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July 17, 2014

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1800 Continental Place
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Re: MDNS Comments to PL13-0468 & PL14-0079 – Responses to June 3, 2014, Request for Additional Information

Dear Ms. Forbes,

I would like to thank you and the Skagit County Planning & Development Services staff for your thorough and professional review of our proposal. We appreciate the oversight that assures our refinery continues to operate safely and in full compliance with all applicable regulations.

To briefly summarize the rationale for this project: A significant portion of our refinery's crude now comes from Alaska's North Slope fields, where production is declining. To assure we remain competitive, we need to have access to crude oil from the Bakken fields in North Dakota similar to that which our competitors in the area have or will soon have.

Shell is committed to build and operate the safest possible rail facility for bringing crude oil into our refinery. We are also committed to build and operate the facility in accordance with all applicable federal, state, and local regulations. Our design minimizes the impact of construction on the landscape and protects the nearby natural environment. In the very unlikely event that something should go wrong, we have state-of-the-art spill response and firefighting equipment and highly trained people standing by.

Shell is also committed to working with our partners at the BNSF railroad to ensure that crude oil arrives safely at our refinery. The railroad is aggressively maintaining and upgrading its tracks and investing in other infrastructure to continue hauling crude oil safely as demand grows.

Finally, Shell is committed to providing information, technical assistance and other resources, including specialized training, to local leaders and emergency responders to help in their planning and to reassure the public that we will continue to operate our refinery safely.

We hope the following responses to your June 3, 2014, letter meet your need and expectation. Please do not hesitate to contact me if you need additional information. Thank you for your attention to this matter.

Respectfully,

Tom Rizzo

Tom Rizzo

Enclosed:

- Responses to June 3, 2014, Request for Additional Information
- Exhibit 1: BNSF Response for Shell Puget Sound Refinery
- Exhibit 2: Traffic Study

1. On-site spill response

1.1 Describe how spill prevention is incorporated into the project design.

The project is being designed in accordance with all applicable codes and standards by a consulting engineering firm that specializes in this type of facility design.

The project is designed first to minimize the potential for leaks or spills, and second, to fully contain any inadvertent leaks or spills within the project containment system. The unloading operation is designed as a closed system, meaning that crude oil will be contained within rail cars, piping, and unloading hoses and will not normally have an open path to the atmosphere or environment. The closed system is the initial, primary containment for the crude oil. Secondary containment will be provided via a curbed, continuous concrete containment pad under the rail cars in the unloading area. The concrete pad is bowl constructed, meaning it is sloped in from both ends of the unloading area to allow for collection of crude oil, or any other liquid material, by the plant's sewer system. The sewer system is specifically designed to capture, recover, and transfer these liquids for further treatment in a different unit in the refinery. Tertiary containment will be provided via a high density polyethylene (HDPE) liner under the concrete pad.

The unloading facility will be staffed by trained personnel at all times train cars are present. These personnel will inspect all facilities daily to look for any potential leaks or signs of material corrosion or degradation. In addition, a vapor detection system will be installed to promptly alert operators of any potential leak not detected during routine inspection. In the event a leak is discovered, unloading operations will not commence (or will be immediately stopped, if underway) until the leak is repaired.

1.2 Provide a copy of relevant portions of the oil spill contingency plan per WAC 173-182. Confirm that the oil spill contingency plan accounts for the different types of crude that may arrive via rail.

The Puget Sound Refinery (PSR) currently receives and processes a wide variety of crude oil and other feedstock materials. The Refinery's Oil Spill Response Plan (OSRP) Section 2.5 provides Response Guidelines for different Oil Groups, consistent with applicable regulations. The Oil Groups are defined using the definitions in 33 CFR 154 for Persistent and Non-Persistent Oils.

> *Persistent oil* means a petroleum-based oil that does not meet the distillation criteria for a non-persistent oil. For the purposes of this subpart, persistent oils are further classified based on specific gravity as follows:
>
> (1) Group II — specific gravity of less than 0.85.
> (2) Group III — specific gravity equal to or greater than 0.85 and less than 0.95.
> (3) Group IV — specific gravity equal to or greater than 0.95 and less than or equal to 1.0.

(4) Group V — specific gravity greater than 1.0.

Non-persistent or Group I oil means a petroleum-based oil that, at the time of shipment, consists of hydrocarbon fractions—

(1) At least 50 percent of which by volume, distill at a temperature of 340 degrees C (645 degrees F); and
(2) At least 95 percent of which by volume, distill at a temperature of 370 degrees C (700 degrees F).

Using an existing Bakken assay and Bakken lab data measured at PSR in 2013, as well as the United States Coast Guard (USCG) definitions, Bakken Crude is a Group II Oil. The OSRP addresses Group II Oil, as well as the other Groups. A recent study published by the American Fuels and Petrochemicals Manufacturers (discussed below), concludes that Bakken crude oil is “within the norm with respect to the hazard characteristics of a light crude oil.”

The PSR’s OSRP was approved by Washington State Department of Ecology (Ecology) pursuant to WAC 173-182 and by the USCG to meet the requirements of the Oil Pollution Act of 1990 and 33 CFR 154, Subpart F. Relevant portions of the PSR’s OSRP follow. The figures, appendices, and other sections referenced are not included; however, they can be provided should it be necessary.

<u>Excerpts from PSR’s OSRP:</u>

2.5.2 Response Guidelines – Combustible Oils (Group II-IV and some Group I Oils such as Diesel)

The preferred response is to contain and recover product (such as diesel), since it exhibits low volatility characteristics.

- Identify source and stop discharge, if possible.
- Deploy facility containment boom, and skimmers if available, to attempt to isolate the slick and reduce the spread and potential impact area. Monitor the boom for effectiveness.
- If shorelines may be impacted, consider deploying exclusion boom to reduce the impact to shoreline.
- If there is still boom remaining after reducing the spread of the slick and protecting shorelines, attempt to isolate pockets of oil where possible to facilitate more efficient recovery.
- If product escapes, deploy sorbents along the shoreline to capture product during tidal cycles. Monitor the sorbents periodically for effectiveness and replace as needed.
- Callout response contractors to assist in containment efforts and begin recovery operations.
- Advise neighboring operators of any threat to their property or personnel. List of neighboring facilities is provided in [the OSRP].

- Determine the direction and expected duration of spill movement. Tide charts are available on the NOAA website.
- Request U.S. Coast Guard to establish Vessel Traffic Control in the area.
- Review the location of environmentally and economically sensitive areas in [the OSRP]. Utilize the trajectory analysis . . . to assist in prediction of potentially impacted areas. Determine which of these areas may be threatened by the spill and direct contractors to proceed with boom and skimmers to these specified locations.

2.5.3 Response Guidelines – Flammable Oils (Light Group I Oils such as Gasoline)

These materials float on the water and are extremely flammable. Containment of these materials may allow explosive concentrations to accumulate. The preferred response is to knock down the vapors and protect shorelines from fouling and allow evaporation to occur.

- Identify source and stop discharge if possible.
- Eliminate sources of vapor cloud ignition. Use waterfog to knock down vapors and disperse material, if available.
- Stay upwind and evacuate nonessential personnel.
- Advise neighboring operations of any threat to their property or personnel. List of neighboring facilities is provided in [the OSRP].
- Advise boats operating in the area of potential danger and direct them out of the area.
- Determine the direction and expected duration of spill movement. Tide charts are available on the NOAA website.
- Request U.S. Coast Guard to establish Vessel Traffic Control in the area.
- Review the location of environmentally and economically sensitive areas in [the OSRP]. Utilize the trajectory analysis . . . to assist in prediction of potentially impacted areas. Determine which of these areas may be threatened by the spill and direct contractors to proceed with boom to protect sensitive areas.
- Obtain Explosimeter and other air sampling equipment to assure areas are safe to enter for continued response operations.

2.5.4 Response Guidelines – Group V Oils (such as Heavy Cycle Gas Oil)

Shell Puget Sound Refinery handles Group V oil. Shell's Primary Response Contractor (PRC) for responding to Group V oil spills is the Marine Spill Response Corporation (MSRC). MSRC maintains the resources for locating and recovering oil on the bottom or suspended in the water column. This equipment is capable of being on scene within 12 hours of spill notification. For a detailed list of response equipment and response capabilities refer to MSRC's PRC application.

These materials either float, remain suspended in the water column, or sink to the sea floor. In salt water, Group V oils with specific gravities just over 1.0 will actually float, or sink slowly. If this is the case, see response guidelines in Section 2.5.2 above. Response guidelines for non-floating products are provided below:

- Identify source and stop discharge, if possible.
- Callout response contractors to assist in containment efforts and begin recovery operations. Containment of oil suspended in the water column may be accomplished under low current conditions using silt curtains or fine-mesh nets coupled with surface boom to contain the floating or refloating fraction of the oil.
- Determine the location(s) of the non-floating oil being deposited on the sea floor through aerial observations (in clear water), diver transects, subsurface modeling, and/or side-scan sonar surveys. All remote observations must be verified with diver surveys.
- Recovery of sunken oil that accumulates on the bottom can be attempted using manual removal by divers, removal by pump and vacuum systems, and/or by dredging.
- Advise neighboring operators of any threat to their property or personnel. List of neighboring facilities is provided in [the ORSP].
- Request U.S. Coast Guard to establish Vessel Traffic Control in the area.
- Review the location of environmentally and economically sensitive areas in [the ORSP]. Utilize the trajectory analysis . . . to assist in prediction of potentially impacted areas. Determine which of these areas may be threatened by the spill and direct contractors to proceed with boom and skimmers to these specified locations.

(end excerpt)

2. Off-site spill response

2.1 Describe how Shell is coordinating with BNSF and local emergency service providers in the event of a spill off-site.

If Shell is notified that a railcar with Shell product is leaking, Shell sends members of the Shell Response Action Team (RAT) or approved contractors to respond and/or provide technical support in addressing the situation. The RAT team members and contractors are trained HAZMAT responders and are located throughout the United States and Canada.

In addition, Shell is engaging with BNSF and other local Oil Refiners to discuss the potential for a mutual aid agreement associated with responding to crude railcar incidents off-site of refinery property.

Shell PSR conducts several emergency response drills and exercises annually in which federal, state, and local agencies as well as service providers are invited to participate. These drills and exercises include: oil spill table top exercises and deployment drills as well as fire and medical mutual aid drills. These activities are important components in developing relationships and effective coordination.

2.2 Provide a copy, if available, of relevant BNSF spill response plans in the event of a spill on rail.

See enclosed Exhibit 1 for BNSF off-site spill response discussion.

3. Emergency response

3.1 Describe how Shell is coordinating with BNSF and local emergency service providers in Skagit County in the event of a fire or accident off-site.

Shell is a member of Community Awareness and Emergency Response (CAER), an organization established to enhance awareness of local chemical and petroleum industries. The local CAER is made up of industrial members, Shell, Tesoro, Air Liquide, Linde, and Chemtrade Solutions. Other members of CAER include Skagit County Department of Emergency Management, several local Police and Fire Departments, Swinomish Tribe, Island Hospital, and Anacortes Red Cross.

Annually, CAER conducts an emergency response drill at one of the member facilities. The scenario for the 2014 drill that will be held at Tesoro will include an incident with a railcar containing Bakken crude.

On April 9, 2014, Shell and BNSF as well as other Refiners and Agencies participated in a Skagit County Department of Emergency Management led Bakken Crude Train Derailment Tabletop Exercise.

In May 2014, Shell provided a walkthrough of PSR fire response equipment to the fire chiefs from the cities of Mount Vernon and Anacortes.

On September 27, 2014, BNSF, Skagit County Department of Emergency Management, and local Refiners will be conducting railcar familiarization training with local first responders.

Emergency response would also be a potential part of a mutual aid agreement, mentioned above.

4. Tank car safety

4.1 Confirm that the tank cars meet federal safety standards for the type of product being transported.

Crude oil is classified by the U.S. Department of Transportation (DOT) as a Class 3 Flammable Liquid.[1] This classification determines the type of rail car that must be used

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[1] A recent independent study of Bakken crude oil characteristics was carried out by Dangerous Goods Transport Consulting Inc. on behalf of the American Fuels and Petrochemicals Manufacturers. The author of the study (Frits Wybenga) is a former USCG officer and has over 40 years of experience in the field of hazardous material transportation, including extensive work for DOT. This study concluded that Bakken crude oil does not pose risks significantly different from other crude oils or flammable liquids authorized for rail transport. However, Shell does comply with the latest safety advisory (Safety Advisory 2014-01)

for transporting crude oil by rail. Shell's current rail car fleet used to transport crude oil is comprised of only DOT 111 (both "legacy" and "good faith CPC 1232") rail tank cars. Both of these comply with all current federal standards regarding crude rail car design. New rail cars that will be added to the fleet for this project would be the "good faith CPC 1232" type cars.

The Pipeline and Hazardous Material Safety Administration (PHMSA; part of DOT) is in the process of reviewing the current standards for crude rail car design and crude oil transport in the latest Notice of Probable Rulemaking. Once any new regulations/standards regarding crude rail cars are promulgated, Shell will determine what actions are required to assure its rail car fleet fully complies with the new regulations/standards and take appropriate action. In any case, it is expected that Shell will fully transition out of "legacy" DOT 111 cars for transporting crude oil by the time the PHMSA tank car rule is final.

To the extent Shell accepts crude shipped in rail cars owned by others, Shell will expect that the car owners and the railroad will comply with all applicable DOT regulations with respect to those cars, including any new regulations promulgated by the DOT. Shell will not knowingly accept at its facility any rail cars that do not meet such regulations.

5. Rail safety

5.1 Confirm BNSF compliance with applicable state and federal regulations for rail safety. Provide verification that the tracks and rail bridges located within Skagit County have been and will continue to be inspected as required by FRA standards and that these inspections show that the tracks are adequately maintained to support the proposed increase of one unit train in and out of the Shell refinery per day.

See enclosed Exhibit 1 for BNSF rail safety response.

6. Traffic impacts

6.1 Provide a traffic analysis for the length of the Anacortes Subdivision (Burlington to Anacortes) to show potential wait times and delays at rail crossings, including the cumulative impacts associated with the additional refinery and other rail traffic.

6.2 Provide an analysis of impacts on emergency service provider response times.

Per County request, URS was engaged to complete a vehicular traffic analysis for the Anacortes Subdivision (Burlington to Anacortes). This study is provided as Exhibit 2. Please note that the first section of this study, "PM Peak Hour Intersection Capacity Analysis," provides estimated existing intersection capacities without trains

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and will transport Shell-owned Bakken crude oil in the most robust tank cars that it has available in its current fleet.

present. Because the Shell crude rail project will not result in additional motor vehicle trips, the intersection capacity projections do not change as a result of the project but are presented for background informational purposes. The next two sections of the study consider estimated/potential traffic impacts associated with trains, whether current trains serving another facility or future trains serving Shell.

When considering traffic impacts at intersections along the rail line in Skagit County, it is important to note that trains serving the Shell facility will not increase the delay time at any intersection beyond that which would occur when current unit trains serving Shell's neighbor refinery pass by. Thus, the "cumulative impact" is a matter of frequency of occurrence, not of duration of delay. Shell's project will add, on average, two trains per day through the intersections in question.

Assuming train speed of 10 to 25 mph, per current data, trains will take between 4 and 8 minutes to pass through any given intersection, meaning traffic will be delayed by 4 to 8 minutes (plus queuing time, which would increase over the next 20 years assuming traffic growth and no corresponding road improvements or grade crossing changes) an additional two times per day at the impacted intersections. The potential length of the vehicle queue at each intersection when a train passes through during peak vehicular travel periods is estimated in the URS analysis, assuming a 1.5 percent annual growth rate. Again, note that these delays occur today but will become somewhat more frequent with the additional train traffic.

An analysis of emergency response times was completed for emergency service vehicle access in the City of Burlington. This analysis determined that there is little difference in emergency vehicle accessibility (and response time) with or without a train.

Please see the attached traffic analysis study completed by URS (Exhibit 2).

7. March Point heronry

7.1 Provide a narrative describing how the proposal has been designed, will be constructed, and will be used to avoid and minimize impacts to the March Point heronry.

Several project elements have been designed, selected, or are proposed to avoid and/or minimize impacts to the March Point heronry. These elements include project configuration, wetland avoidance and buffer enhancement, minimization of construction disturbance, lighting design, and noise buffers.

Project Configuration

Two configuration alternatives were considered for the rail project: one longer and narrower two-track option (the proposed layout) and another shorter and broader four-track option. Each was laid out to meet BNSF unit train design requirements. The four-track option would require the BNSF rail line to be modified east of the East March Point Road intersection, resulting in some fill below the ordinary high water mark of Padilla Bay. The four-track option would also require rail cars to park temporarily on the existing rail line east of the intersection with East March Point Road. The construction and prolonged unit train staging activity required for the four-track option would occur approximately 650 feet from the heron colony. The proposed two-track layout is approximately 1,350 feet from the heron colony, avoiding potential disturbance from unit staging and minimizing potential disturbance associated with construction.

Wetland Avoidance and Buffer Enhancement

The project has been designed to avoid and minimize wetlands to the greatest extent possible, per federal Clean Water Act regulations. The project will avoid any direct impacts to Padilla Bay or the adjacent tidal wetlands, which are important great blue heron foraging habitat. A salt marsh on Shell property (at the northwest corner of East March Point Road and the existing rail line) will be avoided. Native trees and shrubs will be installed to further enhance the buffer of the salt marsh. Cattle that could have an adverse impact on wetlands and the salt marsh were removed from the project site in May 2014. The project will also minimize wetland impacts by narrowing the project footprint wherever possible and moving the alignment as much as possible away from forested wetlands.

Minimization of Construction Disturbance

During construction, the boundaries of the project site will be clearly marked ahead of time and maintained throughout construction. These “no work” areas would also be off limits to construction personnel during non-work activities (breaks, walking, etc.). Construction workers will receive “Environmental Awareness Training,” emphasizing the avoidance of adjacent natural areas (no-work areas). This will minimize potential disturbance from pedestrian encroachment in natural areas.

Lighting Design

Construction activities will largely be confined to daylight hours, which will eliminate the need for artificial lighting during the nighttime. The current project schedule anticipates field work commencing in the spring of 2015. If construction activities continue into to mid-winter, activities will extend somewhat beyond daylight hours, due to shortened day length. During the period of the year when the heronry is likely to be occupied (March to August), the need for nighttime illumination will be lower than what may be needed during mid-winter, when the heronry may not be occupied.

Nighttime illumination of the project site during construction and operation will be limited to the minimum needed for safety and reasonable functionality. Under these conditions, the nearest source of new lighting from the project is located approximately 2,000 feet northwest of the March Point heronry. All of the lights that are being designed for the project have been modeled in a lighting photometric study program. The photometric analysis shows that light from the nearest fixture from the heronry would dissipate to zero approximately 50 feet from the source. Therefore, no additional light will result from the project for more than 1,950 feet from the nearest corner of the March Point heronry.

The lights have been designed to meet American Petroleum Institute lighting standards for this type of facility. The fixtures will all be energy efficient International Dark Sky Association Dark Sky compliant light-emitting diode (LED) light fixtures. To be Dark Sky compliant means the light fixture does not emit any luminous output above 90 degrees in the vertical plane and that the light fixture is fully shielded, minimizing the light pollution caused by outdoor lighting. LED light fixtures have the longest life span of any type of fixture, meaning less fixture maintenance. Being energy efficient LED fixtures, the lights consume far less power than traditional induction or high-pressure sodium lights.

Noise Buffer

The disturbance to wildlife from construction noise will vary by the duration and timing of the noise and by the sensitivity of different species and individuals. Impacts from noise may be less during the non-breeding season when an individual can fly or otherwise relocate to a foraging or resting site without noise. Construction noise near a nesting site could potentially cause abandonment of the nesting effort.

To protect great blue heron colonies from construction noise and other disturbance, the Washington Department of Fish and Wildlife (WDFW) has developed noise buffer guidelines and distances. The year-round buffer for nesting colonies is 984 feet in undeveloped areas. There will be no construction within 984 feet of the March Point great blue heron colony. In addition to the standard buffers, WDFW recommends a seasonal buffer to be added to the outer edge of the year-round buffer when project activities occur during the breeding season (approximately March through August). The additional seasonal buffer is 656 feet for unusually loud activities (exceeding 92 decibels) and 1,320 feet for blasting. No blasting is anticipated during construction. Operation and construction noise will be below 92 decibels within the buffer zone of the heron colony.

There is already existing rail traffic (including unit trains going to and from the Tesoro Refinery) and activity from two refineries and other industrial facilities along South March Point Road including the steel fabrication plant adjacent to the heronry. Great blue heron colonies closer to human activity may tolerate more disturbance than colonies in a more undisturbed area.

8. Type of crude

8.1 Please respond to both safety and spill-response concerns regarding the type of crude that will be transported to the proposed facility.

See discussion in Section 1 regarding spill response - PSR's Oil Spill Response Plan (OSRP). In addition, the following is provided.

In the event of a spill to water, Shell and its Oil Spill Response Organization (OSRO) will respond no matter what type of oil has spilled. Initial activities are the same regardless of crude oil type. When a spill occurs and oil spill response vessels are activated, a site safety assessment is conducted. This safety assessment includes review of product material safety data sheets (MSDS), air monitoring for Lower Explosive Limit, and for chemicals such as benzene and hydrogen sulfide, to ensure the area is safe to enter both for personnel and equipment. If any air monitoring limits are exceeded, response activities are adjusted to ensure safety in that area and may be temporarily curtailed if not safe for responders or vessels to make entry. Air monitoring will continue in order to verify when conditions have improved and response activities can continue in that area. This approach ensures that response activities are designed with awareness of actual material characteristics (based on monitoring data), not assumptions based solely on information about product type. In addition, if appropriate, additional air monitoring will be conducted in the vicinity of the spill if there is a potential for emissions from the spill to impact off-site persons or property. Monitoring data are regularly evaluated by trained professionals and the data shared with Incident Command staff and appropriate agencies.

Shell PSR conducts semi-annual oil spill response deployment drills where response equipment is mobilized in the field. During these deployment drills, Shell conducts site safety assessments including air monitoring. These deployment drills are conducted jointly with PSR's OSRO, Marine Spill Response Corporation. In addition, representatives from Ecology and the U.S. Environmental Protection Agency are invited to deployment drills and have observed these deployment drills in the past.

During a response, the Safety Officer is the person responsible for ensuring the appropriate air monitoring is conducted. The responsibilities for the Safety Officer during an oil spill are documented in PSR's OSRP (see excerpt below). Among other responsibilities, the Safety Officer ensures that an appropriate Site Safety Plan is developed and implemented during the oil spill response.

<u>Excerpts from Puget Sound Refinery OSPR:</u>

The Safety Officer, a member of the Command Staff, is responsible for monitoring and assessing hazardous and unsafe situations and developing measures for assuring personnel safety. The Safety Officer will correct unsafe acts or conditions through the regular line of authority, although the Officer may exercise emergency authority to stop or prevent unsafe acts when immediate action is required. The Safety Officer maintains awareness of active and developing situations, ensures the preparation and implementation of the Site Safety Plan, and includes safety messages in each Incident Action Plan.

The Safety Officer should be well versed in safe operation practices, and be familiar with state (Division of Occupational Safety and Health) and federal (Occupational Safety and Health Administration) requirements as they apply to oil spill response operations. He/She will identify potential safety and health problems at the spill site and communicate this information to the field forces. Responsible for providing expertise in safety and health practices to be followed in all operations for oil spill response and clean-up.

SAFETY OFFICER
Scope of Responsibility
Obtain briefing from Incident Commander.
Review Common Responsibilities.
Develop measures for assuring personnel safety.
Identify hazardous or unsafe situations associated with the incident.
Participate in planning meetings.
Review the Incident Action Plan for safety implications.
Exercise emergency authority to stop and prevent unsafe acts.
Investigate accidents that have occurred within the incident areas.
* Ensure the preparation and implementation of the Site Safety Plan in accordance with the Area Contingency Plan (ACP).
Assign assistants and manage the incident safety organization.
Review and approve the medical plan.
Demobilize as ordered.
Stand Down/Continuing
Monitor relevant developments in safety techniques.
Points to Consider
Prohibit smoking at work site.
Prohibit alcohol consumption at work site and living quarters provided by company.
Workers should shower before leaving work site.
Safety showers and eye wash stations are needed at each work site.
At least one vehicle per work site is needed for emergency evacuation of injured personnel.
One portable toilet is needed for every 20 workers.
Encourage food service department not to serve beans or other foods which may cause diarrhea, as diarrhea is a symptom of exposure and/or ingestion of petroleum products.

SAFETY OFFICER
Develop the site safety plan and publish site safety plan summary (ICS-208) as required. Develop the work safety analysis worksheet (ICS-215a) as required.
Brief Command on safety issues and concerns.

(end of excerpt)

The site safety plan (ICS-208) forms are located in PSR's OSRP.

The general strategies and tactics for responding to a spill of Bakken crude oil will be the same as for any other Group II material. The Incident Action Plan will document the specific tactics to be used to respond to the spill based on the objectives identified by the Incident Commander or the Unified Command. These tactics will include deploying Geographic Response Plans as identified in the Northwest Area Contingency Plan or as directed by the Resources as Risk Summary (ICS-232) developed by the Environmental Unit within the Incident Command System. If necessary, adjustments can be made based on visual and monitoring data or other information collected during the response.

9. Wetland, salt marsh, and wildlife impacts:

9.1 Describe the existing wetlands and salt marsh, and summarize how the mitigation proposed will adequately offset any impacts to these wetlands and the salt marsh.

All of the wetlands within the project vicinity are described in the Wetland Delineation Report and Critical Areas Assessment: Crude by Rail East Gate.[2] This report assesses all wetlands, streams, and ditches that may be affected by the project. Details of each wetland are provided in Appendix A of the report, including photographs, location, size, landscape setting, classification, rating, buffer, hydrology, vegetation, soils, and functions. The salt marsh is described under Wetland I1. A summary is provided in Table 4 of the report.

The Wetland Mitigation Bank Use Plan: Crude by Rail East Gate Project provides further descriptions of the wetlands that will be directly or indirectly affected by the project.[3] Chapter 4 of this report describes the type and duration of impacts and the conditions of the specific wetland areas that will be impacted, including size, location, water regime, soils, vegetation, fauna, and rating. Summaries are provided in Tables 2, 3, 5, and 6. An assessment of the wetland functions that are likely to be impacted is provided in Chapter 5, with a summary in Table 9.

[2] URS Corporation. 2013. *Wetland Delineation Report and Critical Areas Assessment: Crude by Rail East Gate*. Prepared for Shell Puget Sound Refinery. October 2013. Seattle, Washington.
[3] URS Corporation. 2013. *Wetland Mitigation Bank Use Plan: Crude by Rail East Gate Project*. Prepared for Shell Puget Sound Refinery. December 2013. Seattle, Washington.

Twenty-one wetlands were identified in the wetland delineation report, covering approximately 67 acres. Approximately one-third of this area will be directly and permanently impacted by the proposed rail project. Impacted wetlands are predominantly low-quality, grazed pasture wetlands. Over three-fourths of the permanent impacts and almost all of the temporary impacts are to emergent (herbaceous) wetlands dominated by pasture species (Table 3). Higher quality forested wetlands that exist on either side of the proposed rail corridor will be largely avoided. There will be no adverse impacts to the salt marsh. Rather, the grazed edge of the salt marsh and a 200-foot buffer will be fenced off and restored to native vegetation.

Wetland impacts from the project that cannot be avoided will be mitigated by the purchase of appropriate credits at Nookachamps Wetland Mitigation Bank in Skagit County. The detailed rationale for selection of the mitigation site, and description of the bank site, is provided in Chapter 6 of the Bank Use Plan. The bank selection process included an extensive search for mitigation opportunities both on site and within the project vicinity. March Point provided very few opportunities for mitigation due to the presence of existing industrial facilities. A property at the south end of Padilla Bay that is currently used as a poplar plantation was identified as a potential wetland mitigation site. However, after extensive planning and negotiations, an agreement with the owner could not be reached to use the site for wetland mitigation.

In the absence of opportunities for viable or extensive mitigation at or in the vicinity of the project site, a mitigation bank was the best available option. A bank avoids the risks and shortcomings of having several smaller, dispersed mitigation sites. A bank also has gone through extensive planning and review in order to be certified by the regulatory agencies, and it must meet extensive monitoring and maintenance requirements. The Nookachamps Bank in particular provides outstanding wetland and riparian habitat for a variety of species in comparison to attempting numerous, small mitigation projects at or near the project site.

Specific wetland functions provided at the Nookachamps Bank are described in Chapter 7 of the Bank Use Plan. Most of the bank area was in farmland previous to the mitigation activities, which have created or restored several types of wetlands, riparian areas, and off-channel fish habitat. The bank provides hydrologic and water quality benefits that extend throughout the lower Skagit River floodplain. Providing habitat for migratory waterfowl, anadromous fish, and other wildlife also benefits the lower Skagit River and Padilla Bay ecosystems. Wetland functions that may only be provided at the project site, such as stormwater treatment, are discussed in Chapter 8 of the Bank Use Plan. The applicant has initiated discussions with the Nookachamps Bank sponsor, the Swinomish Tribe, and state and federal resource agencies regarding the Bank Use Plan.

9.2 Address concerns that the project could impair wildlife habitat both on land and in nearby Padilla Bay.

Potential mechanisms by which a project might impair wildlife habitat include direct loss of habitat, changes that render habitat unsuitable, or fragmentation of the remaining habitat.

Approximately 16.5 acres of forested or shrub habitat and 33.5 acres of pasture or disturbed areas would be removed for the project. Portions of each habitat type are also wetlands. The project has been designed to avoid the highest quality habitats. In particular, the project has been designed to avoid any direct impacts to Padilla Bay or the adjacent tidal wetlands. A salt marsh on Shell property (at the northwest corner of East March Point Road and South March Point Road) has been avoided in the project design and will be fenced to exclude cattle. Native trees and shrubs will be installed to further enhance the salt marsh buffer.

The majority of potential wildlife habitat that will be permanently impacted are pasture fields used for cattle grazing. Some forested areas will be permanently removed as part of the project. The areas of wildlife habitat to be removed are mostly located immediately adjacent to the existing refinery operations. The existing habitat is a patchwork (mosaic) of forest, pasture, and shrubs. Forest removal will occur in two locations at the north end of the rail alignment, but no old growth forest is located on or near the project site.

Those areas of habitat not directly impacted by the project would not be converted to any other type of habitat, with the exception of salt marsh wetland enhancement described above. Indirect effects from operation of the rail facility would have similar levels of noise and human activity to the existing refineries, roads, and businesses in the vicinity of March Point.

Virtually all species of small and medium-sized mammals, with the exception of squirrels, tend to be nocturnal. Potential effects of artificial night light on mammals may include disruption of foraging behavior, increased risk of predation, disruption of biological clocks, and disruption of dispersal movements and corridor use.[4] In response to natural sources of night light, such as the moon, small mammals have been shown to vary their movements and preferences to darker areas or times. Artificial illumination that goes on throughout the night may lead to abandonment of those areas permanently lighted. Lighting may also affect an animal’s willingness to move through an area, such as a corridor. Bats, on the other hand, have been observed feeding on insects attracted to artificial light sources such as streetlamps. Migrating birds may be disoriented by nighttime illumination. Based on photometric calculations for the project (as referenced in the response to great blue herons above), additional nighttime illumination from the

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[4] Rich, C. and T. Longcore, eds. 2006. *Ecological Consequences of Artificial Night Lighting*. Island Press. 458 pages.

project would not travel more than 50 feet from the individual light sources. It would not reach Padilla Bay, the associated salt marshes, or the nearby heron colony.

The new rail facility could potentially be a barrier to wildlife movement through fragmentation of the remaining habitat. Habitat fragmentation would be minimal because there will be little remaining wildlife habitat between the new rail facility and the existing refinery facilities.

10. EFSEC jurisdiction

EFSEC does not have jurisdiction over Shell's proposal to construct a rail siding that would permit bringing crude by rail into the existing Shell refinery. EFSEC's jurisdiction over facilities handling petroleum products involves an assessment of the facility's capacity to receive product that has been or will be shipped over marine waters, and the facility's refining capacity. Under RCW 80.50.060, EFSEC has jurisdiction over the **"new construction of energy facilities"** which is defined in RCW 80.50.020(12) to mean:

> (d) Facilities which will have the capacity to receive more than an average of fifty thousand barrels per day of crude or refined petroleum or liquefied petroleum gas which has been or will be transported over marine waters, except that the provisions of this chapter shall not apply to storage facilities unless occasioned by such new facility construction; … [and]
>
> (f) Facilities capable of processing more than twenty-five thousand barrels per day of petroleum or biofuel into refined products except where such biofuel production is undertaken at existing industrial facilities.

In the case of a project such as Shell's, EFSEC does not have jurisdiction unless the project either adds at least 50,000 bbl/day of capacity to receive product that has been or will be shipped over marine waters, or adds at least 25,000 bbl/day of refining capability (RCW 80.50.060(1)). The new rail siding will add <u>zero</u> capacity to receive products that have been or will be transported over marine waters because the product brought in by rail is not taken out over marine waters; rather it will be taken into the refinery from inland locations. Moreover, the rail siding does not involve any change in refining capacity; instead it merely provides more flexibility in the transportation product to the existing refinery. Shell is not seeking approval to increase its refining capacity or approval to construct facilities that would be necessary to increase the amount of product transported over marine waters.

11. General description of rail transportation system

11.1 There is some confusion about how rail traffic is regulated and how the common carrier system works. Please provide a brief description.

See Exhibit 1 for BNSF discussion of the rail transportation system.

12. Cumulative impacts

Introduction

Cumulative impacts are those impacts that arise directly or indirectly from a proposed project, and impacts from other past, present, and reasonably foreseeable future actions. The cumulative impacts analysis for the Shell proposal focuses on impacts at the project site and the rail line from the City of Burlington to the Shell refinery (sometimes referred to as the Anacortes Subdivision). The Anacortes Subdivision is approximately 15 miles long and serves customers between Burlington and Anacortes, including Shell, another refinery, and several adjacent industrial facilities.

Background Information

Under the State Environmental Protection Act (SEPA), the lead permitting agency must make a "threshold determination" as to whether a project will have a probable, significant, adverse environmental impact.[5] The lead agency must make its threshold determination based upon information reasonably sufficient to evaluate the environmental impact of a proposal.[6] To accomplish an impacts analysis, the SEPA lead agency must "carefully consider the range of probable impacts, including short-term and long-term effects . . . that are likely to arise or exist over the lifetime of a proposal or, depending on the particular proposal, longer."[7]

Effects include direct and indirect, and cumulative impacts.[8] Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."[9] An impact is reasonably foreseeable when there is enough information available to permit meaningful consideration.[10] Meaningful consideration requires more than general statements about possible effect; it requires a hard look at "quantified or detailed information" unless the lead agency provides a "justification regarding why more definitive information could

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[5] RCW 43.21C.031, 033. "Significant" means "a reasonable likelihood of more than a moderate adverse impact on environmental quality" (WAC 197-11-794(1)). "Impacts" are defined as ". . . the effects or consequences of actions" (WAC 197-11-752); and "probable" means likely or reasonably likely to occur (WAC 197-11-794). The term "probable" is used to distinguish between likely impacts and those that merely have a possibility of occurring - i.e., remote or speculative impacts (WAC 197-11-782; *see also* WAC 197-11-060(4)(a)).
[6] WAC 197-11-055(2) and 197-11-060(3)), WAC 197-11-335.
[7] WAC 197-11-060(4)(c).
[8] WAC 197-11-060(4)(d), 060(4)(e), WAC 197-11-792(2)(c).
[9] 40 C.F.R. § 1508.7. Under Washington law, agencies and courts may rely on the National Environmental Policy Act (NEPA) and case law interpreting NEPA to evaluate the meaning of similar terms used in SEPA, including the appropriate scope and nature of a cumulative impacts analysis. *Pub. Utli.Dist. No. 1 of Clark Cnty v. Pollution Control Hearings Bd.*, 137 Wn.App 150, 158 (2007).
[10] *N. Plains Res. Council, Inc. v. Surface Transp. Bd.*, 668 F.3d 1067, 1078 (9th Cir. 2011).

not be provided."[11] A cumulative impacts analysis must be practical and based on available information that can support meaningful consideration. The government is not required "to do the impractical," if not enough information is available to permit meaningful consideration.[12]

Study Area Rationale

An analysis of cumulative impacts related to Shell's proposal to add rail transportation of crude oil shipments to the existing refinery facility should be focused on the project site and the Anacortes Subdivision because that is the broadest scope where direct and indirect impacts that are capable of meaningful consideration are reasonably likely to occur. An attempt to analyze impacts beyond the project site and Anacortes Subdivision, such as rail traffic on the BNSF main line, would not be meaningful because such impacts do not arise directly or indirectly from Shell's proposal, and they are remote and speculative.

The Washington State Department of Transportation (WSDOT) recently finalized its analysis of the *Integrated Freight and Passenger Rail Plan (2013 - 2035)* (the "Rail Plan"). Class I Railroads in Washington State are owned and operated by BNSF Railway Company (BNSF) and Union Pacific Railroad (UP); these Class I lines form the backbone of an interstate and international rail system. In 2010, half of all rail traffic in Washington State came from shipments originating out-of-state, and, as of 2013, WSDOT states the "rail system is working" and is "providing sufficient capacity to meet demand for rail transportation."[13]

The Rail Plan acknowledges that rail traffic is expanding and explains that the key market factors driving freight growth include a growing population, higher per capita income, and increased employment and international trade. How overall growth in railroad volume occurs on and impacts the rail systems is a dynamic process. WSDOT explains that there are factors such as an increase in the transportation of bulk commodities like crude oil that may affect capacity on the state rail system sooner than forecast. WSDOT describes how other factors may also affect the use of the state rail system, including new bulk exports (e.g., coal), volatility of global sourcing of goods, expanded capacity of the Panama Canal to handle larger container ships, shifting modal economic dynamics between the use of rail and truck, and changes in fuel costs and conversion of alternative fuel sources.[14] The Class I Railroads make significant capital investments in the system to

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[11] *Ocean Advocates v. U.S. Army Corps of Eng'rs*, 402 F.3d 846, 868 (9th Cir. 2005); *see* WAC 197-11-080(2) ("When there are gaps in relevant information or scientific uncertainty concerning significant impacts, agencies shall make clear that such information is lacking or that substantial uncertainty exists.").
[12] *Inland Empire Pub. Lands Council v. USFS*, 88 F.3d 754, 764 (9th Cir.1996).
[13] Washington State Department of Transportation. 2014. *Washington State Rail Plan, Integrated Freight and Passenger Rail Plan 2013-2035*. Prepared by Cambridge Systematics, Inc. March 2014.
[14] *Ibid*., 45-47.

maintain and improve capacity over time. All of these factors could significantly impact the state's rail projections in the short and long term.

Although the overall trend is towards growth, WSDOT states that "in reality, it is anticipated the Class I railroads (BNSF and UP) and other infrastructure owners will likely address key capacity issues as they emerge."[15] For example, since 2012, BNSF's directional running of empty bulk trains on the Stampede Pass route (Auburn-Pasco via Yakima) has vastly enhanced rail capacity over the previous bidirectional rail operation.

Given the dynamic processes that influence capacity on Class I Railroads, it would be speculative and impractical to attempt to evaluate whether Shell's proposal—in the context of all other potential Class I rail freight and the myriad factors that affect freight rail traffic—represents a reasonable likelihood of more than a moderate adverse impact on the capacity of the state rail system. There is sufficient capacity on the state rail system to meet current demand for rail transportation, and BNSF and UP are expected to address capacity issues as they arise on Class I lines. For example, BNSF and the City of Burlington are discussing a track improvement project at the start of the Anacortes Subdivision. Given the micro- and macro-economics involved in day-to-day rail use across the Class I rail system, it is not possible to discern whether Shell's proposal would represent an incremental increase in freight on any given day that would not otherwise occur. As a result, it is impracticable and speculative to attempt to analyze whether Shell's proposal, along with all other Class I rail freight outside of the Anacortes Subdivision, would have an impact on noise, light, vehicular delay, rail infrastructure, rail safety, or any other element.

Shell's proposal would not have likely or reasonably likely direct or indirect impacts on the Class I rail system, and attempting to assess those impacts on a cumulative basis would not provide a meaningful analysis. Shell's proposal may have reasonably likely direct and indirect impacts at and near the project site and along the Anacortes Subdivision, and these impacts are analyzed both individually and in combination with impacts already known to occur at the project site and along the Anacortes Subdivision. The direct, indirect, and cumulative impacts that have been analyzed include wetlands, safety, spill response, noise, light, marine and terrestrial wildlife, air quality, and vehicle traffic including emergency response.

However, depending on the particular impact being analyzed, the scope of direct, indirect, and cumulative effects may be smaller than the geographic scope of the project site and Anacortes Subdivision. For example, impacts on traffic are analyzed within the broader scope of the project site and Anacortes Subdivision because those impacts are reasonably likely to occur in that area; but impacts to water quality are analyzed within a

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[15] *Ibid*., 39.

smaller scope of analysis because those impacts are not reasonably likely to occur along the entire subdivision.

Based on the project design and mitigation measures proposed, none of the impacts discussed in this analysis are likely to have more than a moderate effect on the environment, and therefore, are not “significant” under SEPA.

Baseline Conditions for Cumulative Effects Analysis

The March Point peninsula has accumulated the effects of human use of the land for a long time. The vicinity was traditionally used by Coast Salish peoples. A majority of the project area has been used for pasture since homesteads were established at March Point in the 1860s. The first railroad to Anacortes was built in the 1890s. While roads and highways have existed from the time of homesteading and the establishment of the town of Anacortes, the major east-west highway that parallels the railroad was more recently upgraded to an expressway, with completion to Burlington in 2009. Industries and commercial businesses now occupy much of March Point. Two refineries have been on the peninsula for 50 years or more. The project site has been owned by the Shell refinery (or previous owners) since 1958. The adjacent Tesoro refinery dates from a similar time. The Tesoro refinery has a facility for receiving unit trains of crude oil that has been in operation since 2012. Two pipelines service the refineries. The Kinder Morgan pipeline brings crude oil to them, and the Olympic pipeline carries products from the refineries. Other industries, a casino, and a variety of infrastructure also exist in the vicinity.

Reasonably Foreseeable Future Actions

Reasonably foreseeable future actions include permitted projects that are not yet developed or under construction and existing, active permit applications located on March Point or immediately adjacent represent. Current known applications submitted to Skagit County include three projects at the Tesoro Anacortes Refinery (north of the Shell property): a mobile tower installation located at the north end of the peninsula, a truck rack grading project at the west side of the Tesoro facility, and a parking area expansion on the east side of the Tesoro refinery. The SEPA analysis for the Tesoro parking area resulted in a Mitigated Determination of Non-Significance because the project did not have a probable adverse impact on the environment.[16]

Two permit applications for T-Bailey and Simply Yards are currently under review by the City of Anacortes, both of which are south of the Anacortes Subdivision between South March Point Road and SR-20. The T-Bailey permit application is for construction of a 12,000 square foot office space. An Addendum Mitigated Determination of Non-Significance was issued for the building and future phases of construction in February

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[16] SEPA Mitigated Determination of Nonsignificance available at: http://www.skagitcounty.net/PlanningAndPermit/Documents/notices2014/061914/Tesoro.johnc.pdf

2014.[17] The Simply Yards permit application is for construction of a 10,000 square foot office/warehouse and was determined to be categorically exempt from SEPA review.

Cumulative Impact Analysis for Elements of the Environment

No significant direct or indirect impacts have been identified for the proposed project. Direct impacts anticipated at and near the project site (March Point) and along the Anacortes Subdivision were analyzed both individually and in combination with impacts already known to occur. The area of analysis (March Point vs. Anacortes Subdivision) for each element of the environment differed depending on where the impacts from the project may occur. Elements of the environment that have a potential to be affected include wetlands, safety, noise, light, marine and terrestrial wildlife, air quality, vehicle traffic, and spill response. Based on the project design and mitigation measures proposed, these impacts are not reasonably likely to have more than a moderate effect on the environment.

Mitigation measures, including avoidance and minimization, intended to reduce the project's cumulative effects at March Point and along the Anacortes Subdivision are as follows:

- The project will comply with local, state, and federal regulations, which contribute to a significant slowing of wetland loss by requiring avoidance, minimization, and mitigation for regulated and permitted activities.
- The project was re-designed to:
    - avoid the fish-accessible mid to lower reaches of Stream S and all of its wooded riparian area, which parallels the existing BNSF tracks;
    - avoid the tidal salt marsh portion of Wetland I1;
    - avoid all permanent impacts west of the existing Shell railroad spur, including a large Category II forested wetland (Wetland S) and its buffer;
    - avoid all direct impacts to Padilla Bay or its adjacent wetlands by avoiding rail impacts east of the East March Point Road intersection;
    - optimize both railroad track spacing and use of an overhead platform to reduce the overall width of the unloading area;
    - locate the southern stormwater pond in an upland area of the site and the northern stormwater pond in a mostly upland area;
    - locate the northern stormwater pond away from the eagle nest #2;
    - move planned access roads to serve unloading track operations to coincide with existing access roads wherever possible; and
    - use retaining walls rather than sloped sides for the bridge on 4th Street that would span the tracks to minimize permanent wetland impacts.

[17] SEPA Addendum Mitigated Determination of Nonsignificance available at: http://www.cityofanacortes.org/docs/Planning/MDNS_TBailey.pdf

- During construction, the boundaries of the project site would be clearly marked ahead of time and maintained throughout construction. These “no work” areas would also be off limits to construction personnel during non-work activities (breaks, walking, etc.). Construction workers would receive “Environmental Awareness Training,” emphasizing the avoidance of adjacent natural areas (no-work areas). This would minimize potential disturbance from pedestrian encroachment in natural areas.
- A spill prevention and control plan would be prepared that would avoid the potential for wetlands to be affected if a spill occurs during operation.
- An erosion and sediment control plan would be prepared for the project and would include measures to minimize or eliminate water quality impacts.
- One bald eagle nest tree would be removed for construction of the project. Shell has received a permit from U.S. Fish and Wildlife Service (USFWS) to remove the nest and would mitigate for this impact through the design and development of two new bald eagle nesting platforms.
- Construction activities would largely be confined to daylight hours to avoid the use of artificial lighting during the nighttime, which would pose a potential impact to wildlife.
- Lights would be shielded and directed downward. The photometric analysis shows that light from the nearest fixture from the March Point great blue heron colony would dissipate to zero approximately 50 feet from the source. Therefore, no additional light would result from the project for more than 1,950 feet from the nearest corner of the March Point heronry.

All elements of the environment analyzed were found to have either insignificant or no project effects. The following discussion further explains which elements of the environment may, cumulatively, be subject to impacts that have more than a moderate effect.

Wetlands

Minor wetland cumulative effects are anticipated. The impacts analysis in the Wetland Mitigation Bank Use Plan addresses the potential for both direct and indirect impacts from wetland fill or excavation.[18] No direct impacts are anticipated to occur within Padilla Bay. The new rail cut would be 1,000 to 2,000 feet from Padilla Bay, which is separated from Shell property by East March Point Road. Indirect impacts to Padilla Bay were assessed in terms of the potential to impair water quality, hydrology, and habitat.

Often wetlands can attenuate downstream flooding through storage and gradual release of flood waters. The wetlands in the project area have little opportunity to perform this

[18] URS Corporation. 2013. *Wetland Mitigation Bank Use Plan: Crude by Rail East Gate Project*. Prepared for Shell Puget Sound Refinery. December 2013. Seattle, Washington.

function due to their proximity to the bay, and they all rate low for this function. The small amount of storage that is currently provided by the impacted wetlands would be offset by the new stormwater system, which is designed to detain, treat, and discharge storm flows in a manner that reproduces pre-construction hydrology. The discharge from the stormwater ponds would be conveyed into downslope vegetated buffers and wetlands through the use of flow dissipaters or level spreaders.

Wetlands at the project impact site are not known to provide significant groundwater recharge that would result in freshwater seepage into Padilla Bay. This is an important hydrologic function of some coastal wetlands, but recent and past investigations in the project vicinity indicate it is not for these wetlands because of the presence at depth of a thick, dense clay layer that precludes vertical movement of surface water into deeper water-bearing layers.[19] Delivery of freshwater into the bay by surface flow is still an important function of the wetlands and would continue after completion of the project through discharge from the remaining wetlands and from the new stormwater ponds.

The project site has been used for cattle grazing, and runoff from the wet pastures flows untreated into several ditches or Stream S and then into Padilla Bay. Cattle also have had direct access to many of these drainages. Grazing would be eliminated from the project site, and project-related runoff would be routed through drainage ditches into the stormwater settling ponds. Although grazing would continue outside of the project area, overall water quality impacts from grazing would be reduced due to new fencing and planting around Stream S and the associated estuary in the southern part of the property.

Unavoidable wetland impacts will be compensated through the purchase of credits at the Nookachamps Wetland Mitigation Bank. The Nookachamps Wetland Mitigation Bank provides superior wetland and riparian habitat for a variety of species in comparison to attempting small mitigation projects at or near the project site. Most of the bank area was in farmland previous to the mitigation activities which have created or restored several types of wetlands, riparian areas, and off-channel fish habitat. The bank provides hydrologic and water quality benefits that extend throughout the lower Skagit River floodplain. Habitat for migratory waterfowl, anadromous fish, and other wildlife also benefits the lower Skagit River and Padilla Bay ecosystems.

Even though the proposed mitigation (avoidance, minimization, and compensation) eliminates any significant direct or indirect wetland impacts, there would be a reduction in overall wetland area on the March Point Peninsula. The foreseeable future project for the Tesoro Anacortes Refinery parking area expansion on the east side of the Tesoro property would require filling two low-quality wetlands and would result in buffer

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[19] URS Corporation. 2014. Crude by Rail East Gate Project: Geotechnical Investigation. Prepared for Shell Puget Sound Refinery. March 2014. Seattle, Washington.

reductions for another wetland. These wetland impacts will be mitigated by creating new wetlands and enhancing an existing wetland, which will result in no additional net loss of wetland area.

Safety

No significant direct, indirect, or cumulative safety impacts are reasonably foreseeable as a result of the proposed action. Safe operation of the facility will be ensured by the applicant's compliance with federal and state regulations for oil refinery operations. The project would be designed to minimize the potential for leaks or spills and fully contain any inadvertent leaks or spills within the project containment system. The unloading operation would be designed as a closed system, meaning that crude oil would be contained within rail cars, piping, and unloading hoses and would not normally have an open path to the atmosphere or environment. The unloading facility would be staffed by trained personnel at all times train cars are present, and they would inspect all facilities daily to look for any potential leaks or signs of material corrosion or degradation. A vapor detection system would be installed to promptly alert operators of any potential leak not detected during routine inspection.

The project may result in increased rail traffic within the local vicinity (Anacortes Subdivision) potentially impacting vehicle traffic, including emergency response vehicles. The Shell refinery currently receives an average of three trains per week with an average of 15 cars in each trip for a total of 45 cars on a weekly basis. In addition, three unit trains (with approximately 100 cars per train) travel to Tesoro per week. The facility would be designed to receive a maximum of six unit trains per week, for a total of an additional approximately 612 incoming loaded tank cars and 612 outgoing empty tank cars on a weekly basis. The rail project has been designed to avoid blocking East March Point Road, at the BNSF mainline crossing, during unloading by providing adequate rail track to move the train onto the Shell site, beyond East March Point Road. Power switches may be installed at the BNSF mainline that would eliminate the need for trains to stop and manually switch themselves into the facility.

Safety mechanisms at road crossings (lights, gates, etc.) have been established in accordance with Federal Rail Administration and WSDOT regulations. The operation of these safety mechanisms has been effective in preventing accidents at crossings in the project vicinity and will continue to do so. Washington Administrative Code (WAC) 480-62-220, prohibits trains from blocking a grade crossing for more than ten consecutive minutes, with exceptions for special conditions (equipment malfunction, accidents, etc.). Given the low density of the population in the project vicinity, small increase in rail traffic resulting from the project, infrequency of the trains, and no blocking of East March Point Road, the proposed project would have minor to no impact on emergency vehicle access over existing conditions.

Noise

No significant direct, indirect, or cumulative noise impacts are reasonably foreseeable. Construction noise would be short-term, would adhere to Skagit County Code 9.50 and WAC 173-60 noise level standards, and most project noise from construction would be limited to the project site.

Currently three unit trains travel to Tesoro per week. In addition, a manifest train operates daily on the Anacortes Subdivision (which stops at Shell three times a week). The Shell project would bring an additional six unit trains per week (no more than one round-trip a day). They are anticipated to arrive anytime between the hours of 2:00 a.m. and 4:00 p.m. Operations would likely be performed both day and night. Handling, switching, and operation of the railcars would occur on site at the new train unloading facility, and noise levels are not expected to be greater than existing levels. Current and reasonably foreseeable projects in the project area will be of similar or shorter duration and adhere to noise level standards.

Light

No significant direct, indirect, or cumulative light impacts are anticipated. Construction would require temporary lighting, including equipment lights and portable lighting structures during the fall and winter, when daylight is shorter. New lighting associated with the rail facility would be installed as needed for worker safety and operations. Nighttime illumination of the project site during construction and operation would be limited to the minimum needed for safety and reasonable functionality, and lighting would be downward directed into the site to minimize effects. Platform lighting may be directional but would result in minimal light intrusion to adjacent (industrial) properties. Photometric analysis shows that light from the fixtures would dissipate to zero approximately 50 feet from its source. No light from the project would fall on East March Point Road, Padilla Bay, or to any adjacent residences. Light or glare from the finished project would not be a safety hazard or interfere with views.

Marine and Terrestrial Wildlife

No significant direct, indirect, or cumulative wildlife impacts are reasonably foreseeable. There are no federally threatened or endangered species known to occur on the site. One stream on the project site may provide habitat for listed salmonids. No direct adverse effects are anticipated for Padilla Bay, and Best Management Practices (BMPs) are proposed to reduced or eliminate indirect effects to water quality in the bay.

The majority of potential wildlife habitat that would be permanently impacted is pasture fields used for cattle grazing. The new rail facility could potentially be a barrier to wildlife movement through fragmentation of the remaining habitat. However, habitat fragmentation would be minimal because most of the rail project area is immediately adjacent to the existing refinery.

Due to the necessary wetland fill at the site, Shell will purchase credits at a Skagit County wetland mitigation bank (Nookachamps Wetland Mitigation Bank). This bank provides enhancement and restoration that will also help to enhance or create wildlife habitat.

Bald eagle and great blue heron nesting sites have been identified on and near the project area, respectively. As mentioned above, one bald eagle nest tree would need to be removed for construction of the project. Shell has received a permit to remove the nest from USFWS and has worked with the agency to design two bald eagle nesting platforms to replace the nest that would be removed. The USFWS requires that projects improve the net conditions for eagles, which this proposal does by increasing nesting location opportunities. No cumulative impacts to eagles are expected from the project.

Several project elements have been designed, selected, or are proposed to avoid and/or minimize impacts to the March Point heronry. These elements include project configuration, wetland avoidance and buffer enhancement, minimization of construction disturbance, lighting design, and noise buffers. While the Shell project is not anticipated to impact the heronry, the T-Bailey site expansion is one reasonably foreseeable project that could have an impact. This site is immediately adjacent to the colony, and the construction activity, associated noise, and additional development could potentially impact the herons, at least temporarily. The T-Bailey development proposes several mitigation measures during construction and operation to minimize impacts.

Air Quality

No significant direct, indirect, or cumulative air quality effects are reasonably foreseeable. The project greenhouse gas emissions were quantified to ensure a thorough analysis of the project’s potential air quality impacts. When the decrease in transportation by oil-by-water vessels was combined with the increase in transportation by rail, a minimal increase in greenhouse gas (GHG) emissions was predicted. GHG emissions from transportation by rail would be approximately 8,249 metric tons of CO_2e annually, and 240 metric tons of CO_2e would temporarily result from vehicle trips during construction. Dust during construction would be minimal and temporary, and construction-related heavy machinery emissions and vehicle trips during operation would be negligible. The project’s emissions are not anticipated to reach or come close to the 25,000 metric tons per year of CO_2e identified per Ecology’s Greenhouse Gas Guidance (Section J, page 7) as significant emissions requiring mitigation.

Vehicle Traffic

Minor to moderate cumulative vehicle traffic effects and vehicle queuing are anticipated. Operation of the proposed project would not be expected to result in any new vehicular trips on roadways in the vicinity of the project. Analysis from the Crude by Rail East Gate Project Traffic Study (Exhibit 2) indicates that intersections in the study operate at Skagit County and WSDOT acceptable levels (Level of Service D or better) in 2014. Two intersections are expected to exceed Level of Service D by 2034 with or without the project, assuming a traffic analysis standard 1.5 percent annual growth rate. These intersections are SR-20/La Conner Whitney Road (Level E) and Rio Vista/Burlington Road (Level F). The addition of the project would not substantially contribute to the vehicle traffic cumulative impact.

Vehicle queuing capacity at intersections along the Anacortes Subdivision (rail line) would accommodate the project unit trains (estimated at 3.7 minutes to clear a crossing) for all but two of the intersections in a cumulative condition in the year 2034. The intersections include Rio Vista/Burlington Road and SR-20/Garrett Road. All PM peak hour queuing due to project-related unit train operations would be expected to clear within 5 minutes of the end of the rail crossing event, except at Rio Vista/Burlington Road, where queues were estimated to take between 15 and 20 minutes.

To analyze the potential effects to emergency response times along the Anacortes Subdivision, travel sheds were developed to approximate the area reachable within 5 minutes (based on average county and city emergency vehicle response times). The travel shed compared roadways at rail crossings with and without the project-related unit trains. Distances reachable within the response time were determined assuming no delays due to background traffic on roadways, an emergency vehicle traveling at the posted speed limit, and that emergency vehicles would seek alternate routes to avoid the railway crossing event. There is negligible difference in emergency vehicle response times with and without the project, and a 5-minute response time is anticipated.

Spill Response

No significant direct, indirect, or cumulative spill response impacts are reasonably foreseeable. The Shell PSR emergency response teams are the first responders to all incidents within the refinery boundaries. The teams are trained to respond to spills both on land and on water, fires, medical, rescue, and hazardous material releases. They are trained in accordance with all federal, state, and local rules and regulations. The teams are part of an expanded organization of other professionals who can assist if necessary in emergency situations to protect lives, property, and the public. Shell conducts several emergency response drills and exercises annually in which federal, state, and local agencies as well as service providers are invited to participate. These drills and exercises include oil spill table top exercises, deployment drills, and fire and medical mutual aid drills.

Offsite risks associated with new rail cars on the Anacortes Subdivision would be managed by the operator, BNSF. If Shell is notified that a railcar with Shell product is leaking, Shell sends members of the Shell Response Action Team or approved contractors to respond and/or provide technical support in addressing the situation. BNSF has specialized equipment and hazmat responders staged across its network to deal with hazmat and crude oil incidents, including for firefighting and spill cleanup. In the event of an incident on the Anacortes Subdivision, BNSF crews operating the train would provide their paperwork to the first Responders, the BNSF Hazmat team would contact Skagit County's emergency dispatchers to obtain fire/police contacts, and the BNSF Hazmat team would contact Skagit County's responders to answer any questions and provide resources being mobilized to the site.

Based on the information that is currently available to support a meaningful consideration of spill response, there are no cumulative impacts related to spill response -- or safety (as discussed above) -- that are reasonably foreseeable within the geographic scope of the project site and Anacortes Subdivision. With respect to oil spill response and safety, Ecology states:

> Thanks to a breadth of prevention and planning efforts that have been in place for decades, we have a system in place to respond to spills that affect our state. We also recognize there is always room for improvement and are continually learning lessons and improving our plans. We strive for a rapid, aggressive and well-coordinated response to incidents with a goal of reaching 'zero spills' as stated in our Legislative direction. We now need to strengthen some of our inland planning because of the changes in oil movement and oil type.[20]

To achieve this objective, Ecology is conducting a Marine and Rail Oil Transportation Study to analyze the risks to public health and safety, and the environmental impacts associated with the transport of oil in Washington State.[21] The results of this study will inform state policy makers and agencies about options to consider in addressing statewide oil spill and safety concerns.[22]

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[20] http://www.ecy.wa.gov/programs/spills/OilMovement/FAQs.html
[21] http://www.ecy.wa.gov/programs/spills/oilmovement/2014MRstudy.html
[22] *Ibid*. ("The study will inform the Spills Program, Governor and the Legislature by focusing on the movement of oil in marine and inland areas, by vessel, and rail. The study will compile existing information and determine if there are information gaps in the existing oil transportation system. If gaps exist, the study will identify ways to address the risk and make public health/safety and environmental protection recommendations for appropriate federal, state, local agencies, or the private sector/industry to take appropriate remedial action. . . Based on these findings, the study will inform recommendations for public health, safety and environmental concerns; statement of safety benefits vs. the cost of implementation; recommendation for funding programs; and a risk communication strategy.").

The results of the Marine and Rail Oil Transportation Study may ultimately lead to changes in the state's spill response or the state's recommendations to appropriate federal, state, or local agencies, or to the private sector. However, there is no quantified or detailed information available to suggest that the impact of Shell's proposal -- directly, indirectly or cumulatively -- will have more than a moderate effect on the environment. At this stage, it would be at best speculation to assume that Ecology's study will have a direct bearing or make specific remedial recommendations for the Anacortes Subdivision. Nonetheless, a meaningful analysis of the configuration of the project, along with safety and spill response considerations, demonstrates that it is not reasonably foreseeable for Shell's proposal to significantly impact the environment.

EXHIBIT 1:

BNSF Response for Shell Puget Sound Refinery

BNSF Response for Shell Puget Sound Refinery

1. **Anacortes Subdivision**
   - **a.** The track speeds on the subdivision range between 10 to 25 mph.
   - **b.** The subdivision averages about four trains during a 24-hour period.

2. **Freight Rail Oversight**
   - a. Governing bodies of the rail industry include
     - **i. Department of Transportation (DOT):** Created by an Act of Congress in 1966; formally activated early in 1967. Responsible for developing a national transportation system adequate for economic growth and stability, the welfare of the people, and national security. The Office of the Secretary of Transportation formulates overall policy, allocates resources, and proposes and coordinates legislation concerning private transportation. Nine operating administrations report to the DOT. One is the Federal Railroad Administration (FRA).
     - **ii. Federal Railroad Administration (FRA):** Monitoring and enforcing arm of the DOT, as it relates to the rail industry. Enforces all Federal rail safety regulations including, Hours of Service, mandatory FRA inspection of freight cars and locomotives, and the safe transportation of Hazardous Materials.
     - **iii. The Surface Transportation Board (STB):** Established January 1, 1996, the STB picked up several functions previously handled by the Interstate Commerce Commission (ICC), which was terminated on December 31, 1995. General responsibilities include railroad rate and service issues, mergers, line sales, line construction, line abandonments and labor matters related thereto. Also regulates trucking, ocean shipping, intercity passenger bus and certain pipeline matters. Unlike the ICC, the STB is also more of a watchdog organization, intervening when shippers and carriers cannot resolve an issue.
     - **iv. US Customs**
     - **v. Department of Homeland Security**
     - vi. Various state and municipal agencies to a lesser extent as generally state and local regulations impacting railroad construction or operations are preempted by federal law.
   - **b.** As a common carrier, BNSF is required by federal law to provide reasonable accommodation for all regulated products.

3. **Emergency Response**
   - a. BNSF is in discussions with the local area refineries and first responders to develop a mutual aid agreement.
   - b. BNSF provides free railroad hazmat response training to 3,500 to 4,000 local emergency responders a year in communities across our network, and has provided training to more than 65,000 emergency responders since 1996.
     - i. In 2013, we participated in 20 training sessions for responders in Oregon and Washington, training more than 900 people.
   - c. BNSF has earned the national TRANSCAER (Transportation Community Awareness and Emergency Response) award 13 times since 1998 for our national outreach efforts to assist communities prepare for and respond to possible transportation hazardous material incidents.
   - d. BNSF has specialized equipment and hazmat responders staged across its network to deal with hazmat and crude oil incidents, including for firefighting and spill cleanup.

i. BNSF has more than 200 trained hazmat responders at 60 locations on our network who are supported by a network of contract emergency and environmental responders.

e. BNSF has a geographic information system (GIS) for emergency incidents that enables BNSF to quickly identify and contact the local emergency responders closest to any incident on our network.

f. BNSF was the first railroad in the industry to deploy a fleet (16) of industrial fire-fighting foam trailers on hazmat routes around its network. BNSF also makes the trailers available to other railroads and communities.

   i. BNSF has specialized equipment and hazmat responders staged across our network, which includes several locations in Washington such as Everett, Seattle, Longview, Wishram (Columbia River Gorge), Pasco and Spokane.

   ii. The trailers produce alcohol-resistant foam to extinguish fires involving materials such as ethanol and crude oil by covering the spilled material and depriving it of oxygen.

g. BNSF has developed and shared geographic emergency response plans with state and local emergency response organizations and has also provided a computer-based emergency response training program on hazardous materials to every fire department within 2 miles of our rail lines.

4. Offsite Spill Response in Skagit County

a. In the event of an incident in Skagit County, below is the sequence of events that would occur:

   i. BNSF crews operating the train would provide their paper work to the first responders. This paperwork, also called the "Trainlist" provides the sequence in the train and detailed hazardous materials information. The crew would also help explain the paperwork to the first responders and point out the location of any hazardous materials in the train.

   ii. The BNSF Hazmat team would contact Skagit County's emergency dispatchers to obtain on-site fire/police contacts.

   iii. Then, the BNSF Hazmat team would contact Skagit County's on-site responders to answer any questions and provide resources being mobilized to the site and ETAs.

      1. BNSF Hazmat Responders from Everett and Seattle would be mobilized;

      2. BNSF Hazmat Contractors from Anacortes, Everett and Seattle would be mobilized;

      3. Specialized Air Monitoring Equipment/Personnel would be mobilized from Seattle to provide real time air monitoring to include any on-site and off-site impacts;

      4. Depending in the scale of the response BNSF Hazmat Strike Team would be mobilized from Vancouver, Wash., Fort Worth, Texas, and/or Minneapolis, Minn., using private aircraft;

      5. Depending on the scale and scope of the incident(s), additional contracted resources would be mobilized across the state, the region and throughout the nation.

   iv. BNSF responding personnel and contractors would work within an established Unified Command structure on-site.

      1. The most senior operating officer from BNSF will be the Incident Commander for BNSF within the organization to direct all railroad resources in coordination with the responding agencies.

2. BNSF will mobilize and provide resources necessary to help mitigate the incident.

5. **Engagement with Skagit County First Responders**
    - **a.** In 2013, BNSF provided hands-on “Locomotive Response/Railroad Hazardous Materials Response and Awareness” training for Skagit County first responders in Anacortes. In January 2014, we provided a presentation to the LEPC to discuss BNSF’s transportation of hazardous materials. This was followed up in April with a tabletop drill coordinated by the LEPC and included area first responders, BNSF and other stakeholders. The drill simulated an event while examining what sequence of events would occur regarding the initial phases of a railroad hazardous materials incident.
    - **b.** Numerous members of Skagit County fire agencies have received training from BNSF while attending events such as the Washington State Annual Hazmat Workshop, Washington State Fire Chief’s/Hazmat Special Operations Conference and at the Washington State Firefighters Association Conference.
    - **c.** On Sept. 27, 2014, BNSF will bring the BNSF 99911 Hazmat Training Tank Car to Mount Vernon for a specialized training exercise with area responders on how to respond safely to tank car incidents.
    - **d.** BNSF’s free railroad hazmat training is available to local responding agencies upon their request.
    - **e.** BNSF has provided Skagit County emergency planners with full, recent Hazardous Materials Commodity Reports. These reports provide an historic overview of all hazardous materials that are carried through Skagit County.

6. **Geographic Response Plans (GRP)**
    - **a.** BNSF GRPs for the Bellingham Subdivision and Anacortes Spur are GRPs that we have modified from public documents by overlaying our track on the GRP, which gives us the ability to determine GRP strategies by BNSF mile posts.
    - **b.** BNSF’s GRPs have been provided to Anacortes Fire Chief Richard Curtis and Krista Salinas with the Skagit County Department of Emergency Management.

7. **Track Inspection Program**
    - **a.** BNSF inspects track and bridges more frequently than required by the FRA to ensure they are safe.
    - **b.** Most key routes on BNSF are inspected up to four times per week, more than twice the inspection frequency required by the FRA, and our busiest main lines can be inspected daily.
    - **c.** Depending on the class of track, inspections on tracks in Anacortes and Skagit County are performed two to four days per week.
    - **d.** Track inspections on BNSF main lines occur by hy-rail vehicle. In addition to the normal hy-rail inspections, on-foot inspections of all turn-outs on the main lines and yard tracks are required at least monthly. Supervisors are also required to make regular train rides over their assigned territories.
    - **e.** Track inspectors record track conditions and update data following each inspection. This information is provided to the FRA.
    - f. BNSF employs track inspectors who are chartered by the FRA to comply with FRA regulations.
    - g. For further details on FRA guidelines, visit the Track and Rail and Infrastructure Integrity Compliance Manual http://www.fra.dot.gov/Page/P0051.

8. **Bridge Inspections**

a. Inspections of all bridge structures, including those within Skagit County, are performed a minimum of twice per year and are utilized to identify required maintenance and to ensure there are no structural exceptions. One of those inspections is also performed with the presence of a supervisor.
b. BNSF's bridge inspectors and engineering staff are also supported by consultants and contractors in our efforts to inspect and maintain BNSF bridges.
c. The key to the longevity of any structure is proper maintenance and repair. And railroads, such as BNSF, spend a higher percentage of revenue maintaining, replacing, and expanding its infrastructure than any other industry.
d. In 2013: **54,332 documented inspections** on **12,996 active bridges**
    i. Required Types: Comprehensive & Supervised (by BNSF Officer)
    ii. Special conditions and events - high water, vehicle/boat strikes, fire, etc.
    iii. Additional inspections on periodic basis for underwater components, movable bridge machinery and other specific contract inspections

9. **Automated Track Inspections**
    a. **Rail detectors and track geometry cars.** BNSF's track inspection program also utilizes state-of-the-art technology to help identify defects or problem areas that cannot be detected by the human eye. BNSF has made significant investments in inspection and detection technology to enhance the regular manual inspection process.
    b. **Rail detectors:** BNSF's rail detectors use ultra-sonic rays to detect internal (and external) flaws in the rail. The frequency of inspections are determined by the tonnage moved over a given section of track, however, the main line routes across BNSF's system receive rail detector testing every 30 to 50 days on average.
    c. **Track geometry car:** BNSF's track geometry car measures major main line routes annually and up to three times a year depending on rail volume. The track geometry car is a specially-equipped passenger car that measures the tracks' surface under load for, gauge, cross-level, alignment and vertical acceleration. A computerized print out of the trackage indicates where the measured flaws exist in the track. This information is immediately communicated to field personnel to ensure that the defects are addressed.

10. **Freight Car Defect Technology**
    a. BNSF has special detection technology along key routes on its network to monitor for early signs of potential problems that could cause premature equipment wear or failure. Detecting such defects early has helped improve safety and extend the service life of equipment.
    b. **Wheel Impact Load Detector -** Measures forces applied to the rail to evaluate wheel surface defects. Decreasing the number of high impact wheels can help prevent derailments and also extend the useful life of rail.
    c. **Warm Bearing Detection System -** Monitors for excess heat coming from wheel bearings. Identifying internal bearing defects early prevents potential derailments and helps to extend wheel life.
    d. **Hot / Cold Wheel Detector & Technology Drive Train Inspection -** Measures wheel tread temperature to identify sticking or inoperative brakes; and applied handbrakes.
    e. **Acoustic Bearing Detector -** Utilizes a microphone array to evaluate and identify internal journal bearing flaws.
    f. **Machine Vision System -** Utilizes a camera system to evaluate and identify component wear or damage of wheels, brakes, draft gear and truck components. The early warning this technology provides enables BNSF to repair trucks before safety issues occur and can extend the life of wheels.

g. **Truck Performance Detector -** Measures forces applied to the rail to evaluate each truck's ride performance. Early warning of truck performance issues enable BNSF to perform repairs before safety issues occur and extends the life of the equipment.

###

EXHIBIT 2:

Traffic Study

Traffic Study
Crude by Rail East Gate Project, Skagit County, WA

Prepared By: URS Corporation
Daniel W. Mills, Traffic Engineer

This traffic study was prepared for the Shell Puget Sound Refinery (PSR) Crude by Rail East Gate project, located in Skagit County, Washington. This project will include construction and operation of a new rail spur into the existing Shell refinery to receive crude oil. It is anticipated that the new rail spur would be constructed into the facility from the Anacortes Subdivision (operated by BNSF Railway "BNSF"). The site, as depicted in Figure 1, is expected to receive one 102-car rail train per day (6 days a week).

This analysis includes three components:

- PM peak hour intersection capacity analysis for existing (2014) and future year (2034) conditions;
- Analysis of vehicular queuing due to project-related rail crossing events; and
- Evaluation of the impacts of project-related trains on emergency vehicle access.

The results of this analysis are summarized below:

- Operation of the proposed project would not be expected to result in any new vehicular trips on roadways in the vicinity of the project.
- Analysis of PM peak hour traffic operations indicates that all of the intersections analyzed currently operate at an acceptable level of service.[1]
- Analysis of future year (2034) PM peak hour traffic operations indicates that most of the intersections analyzed would be expected to continue to operate at acceptable levels of service.
- Traffic volumes in the vicinity were estimated to grow at approximately 1.5 percent per year over the next 20 years. This growth could result in unacceptable levels of service at the intersections of SR-20 with LaConner Whitney Road and at Burlington Road with Rio Vista with or without the proposed project.
- Existing PM peak hour vehicular queues due to project unit train operations are expected to fit within existing storage at all but two of the intersections analyzed. Queuing may exceed available storage lengths at the intersections of SR-20 with Garrett Road and at Burlington Road with Rio Vista.

[1] Both Skagit County and the Washington State Department of Transportation (WSDOT) use a peak hour standard of level of service (LOS) D or better at urban intersections as an "acceptable level." WSDOT standards also indicate a LOS C or better standard for rural intersections.

- Under existing conditions, all PM peak hour queuing due to project-related unit train operations can be expected to clear within 5 minutes of the end of the rail crossing event, with the exception of one intersection. At the intersection of Burlington Road with Rio Vista, these queues are estimated to take between 15 and 20 minutes to clear.
- If a 5-minute travel shed is assumed, there is little difference in emergency vehicle accessibility with or without project-related unit trains.

The following sections document the analysis procedures, assumptions, and results.

PM Peak Hour Intersection Capacity Analysis

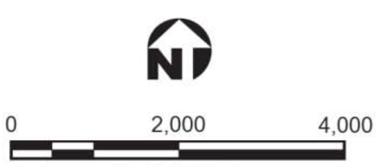
Since there are no additional vehicle trips resulting from construction of this project, this capacity analysis depicts conditions that will occur with or without this project. For purposes of this analysis, operations at the intersections analyzed are described in terms of a Level-of-Service (LOS) grade ranging from LOS A (best) to LOS F (worst). LOS is based on the average delay experienced by drivers using an intersection during the PM peak hour. This delay is estimated empirically based on traffic volumes, lane assignment, traffic signal phasing, and other intersection features. Analysis was conducted using the principles found in the *Highway Capacity Manual* (TRB 2010), and LOS was calculated using Synchro™ software, version 8, by Trafficware.

The delay estimation methodologies and LOS thresholds depend on the type of control (signalized or unsignalized) employed at the intersection. The estimated PM peak hour average delay per vehicle at intersections is calculated based on information provided in the *Highway Capacity Manual* and shown in Table 1. LOS at unsignalized intersections (including driveways without traffic signals) is represented by the PM peak hour calculated delay on the worst stop-controlled approach. At signalized intersections, the delay is a weighted average delay for all approaches to an intersection. As described earlier, both Skagit County [2] and the Washington State Department of Transportation (WSDOT)[3] use a peak hour standard of LOS D or better at urban intersections. WSDOT standards also indicate a LOS C or better standard for rural intersections.

[2] Skagit County Comprehensive Plan, Goal A-2, October 2007. http://www.skagitcounty.net/Departments/PlanningAndPermit/comp_toc.htm.

[3] WSDOT Level of Service Standards for Washington State Highways, January 2010. http://www.wsdot.wa.gov/NR/rdonlyres/6AF72388-2455-47B9-B72D-2BE9A89A0E19/0/LOSStandardsforWAHwys.pdf.

Source: Google Earth Pro



Job No. 33764101

Figure 1
Project Site Location

Table 1
LOS Delay Ranges for Signalized Intersections

LOS	Delay Range (seconds per vehicle)	
	Unsignalized Intersections	**Signalized Intersections**
A	0 to 10.0	0 to 10.0
B	10.1 to 15.0	10.1 to 20.0
C	15.1 to 25.0	20.1 to 35.0
D	25.1 to 35.0	35.1 to 55.0
E	35.1 to 50.0	55.1 to 80.0
F	50.1 or more	80.1 or more

Source: TRB 2010

Intersection capacity analysis was conducted for the existing PM peak hour and a future year (2034) PM peak hour. The estimate of future year traffic is based on information from WSDOT's Automated Traffic Recorder (ATR) stations on SR-20. Average Daily Traffic (ADT) volume information from these ATR stations is shown in Table 2.

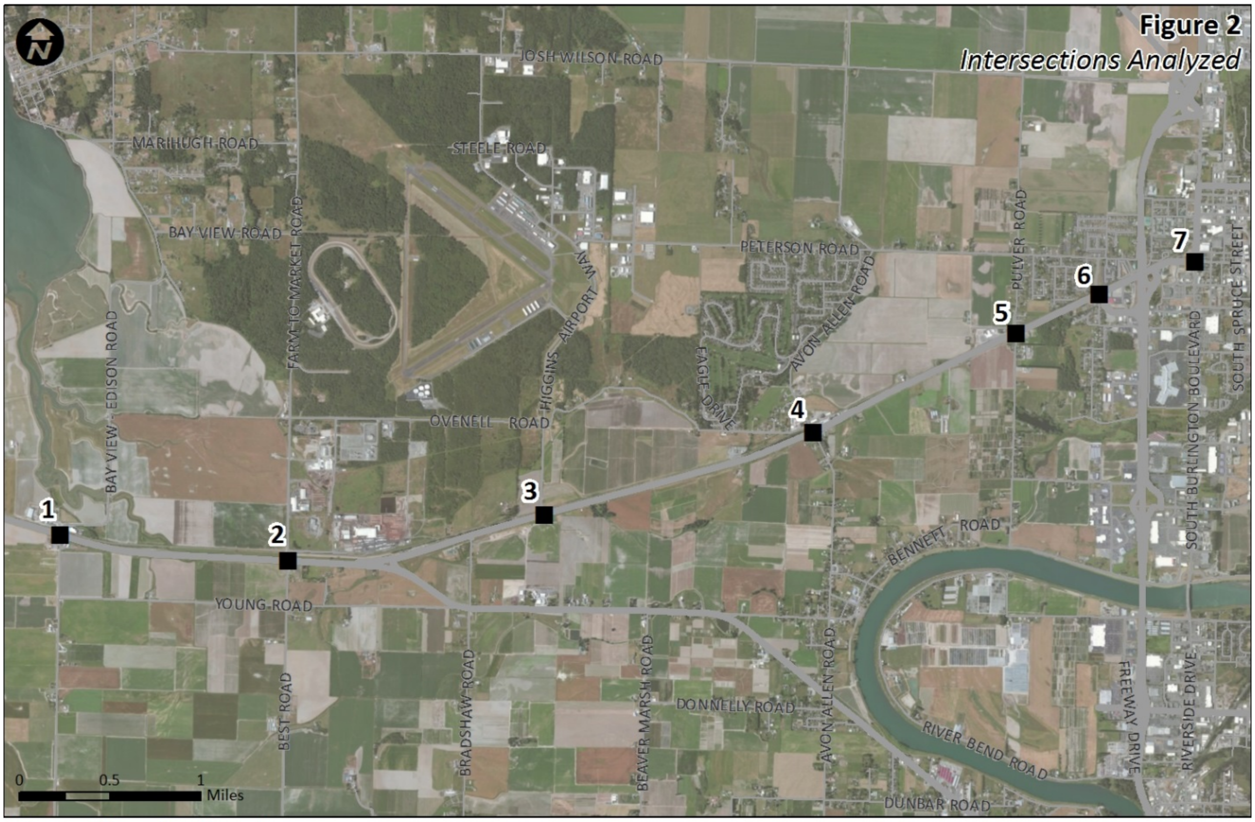
Table 2
SR-20 ATR Locations

ATR Location	Mile Post	ADT Year		Annual Growth Rate
		2002	2012	
SR-20 East of Avon Allen Rd	57.52	20,000	21,000	0.5%
SR-20 West of LaConner Whitney Rd	53.26	23,000	29,000	2.5%

Source: URS Corporation

As indicated in Table 2, historical traffic growth on SR-20 in the vicinity of the Anacortes Subdivision varies by location. In order to estimate an area-wide traffic growth rate, growth rates for these two ATR locations were averaged and calculated at approximately 1.5 percent per year. This area-wide growth rate was added to the existing PM peak hour traffic volumes to estimate future year (2034) PM peak hour traffic volumes. Analysis was then conducted assuming these increased traffic volumes.

Figure 2 depicts the location of the intersections analyzed for this report. Capacity analysis results for the 2014 and 2034 PM peak hour are summarized in Table 3.



Intersections Analyzed:

1. Hwy 20 at La Conner-Whitney Rd
2. Hwy 20 at Farm to Market Rd
3. Hwy 20 at Higgins Airport Way
4. Hwy 20 at Avon Allen Rd
5. Hwy 20 at Pulver Rd
6. Hwy 20 at Garrett Rd
7. E Rio Vista Ave at Burlington Blvd

As indicated in Table 3, during the existing PM peak hour, all of the intersections analyzed operate at acceptable LOS with or without the proposed project. The most congested intersections are SR-20 at LaConner Whitney Road which currently operates at LOS C and Rio Vista at Burlington Road which operates at LOS D during the PM peak hour.

Table 3
Intersection Capacity Analysis Results

Intersection	**2014 PM Peak Hour (Average Delay/LOS)**	**2034 PM Peak Hour (Average Delay/LOS)**
SR-20 at LaConner Whitney Rd	27.4/C	72.0/E
SR-20 at Farm to Market Rd	18.1/B	49.7/D
SR-20 at Higgins Airport Way	5.4/A	7.2/A
SR-20 at Avon Allen Rd	9.1/A	12.5/B
SR-20 at Pulver Rd	8.0/A	10.9/B
SR-20 at Garrett Rd	19.2/B	30.0/C
Rio Vista at Burlington Rd	38.3/D	90.2/F

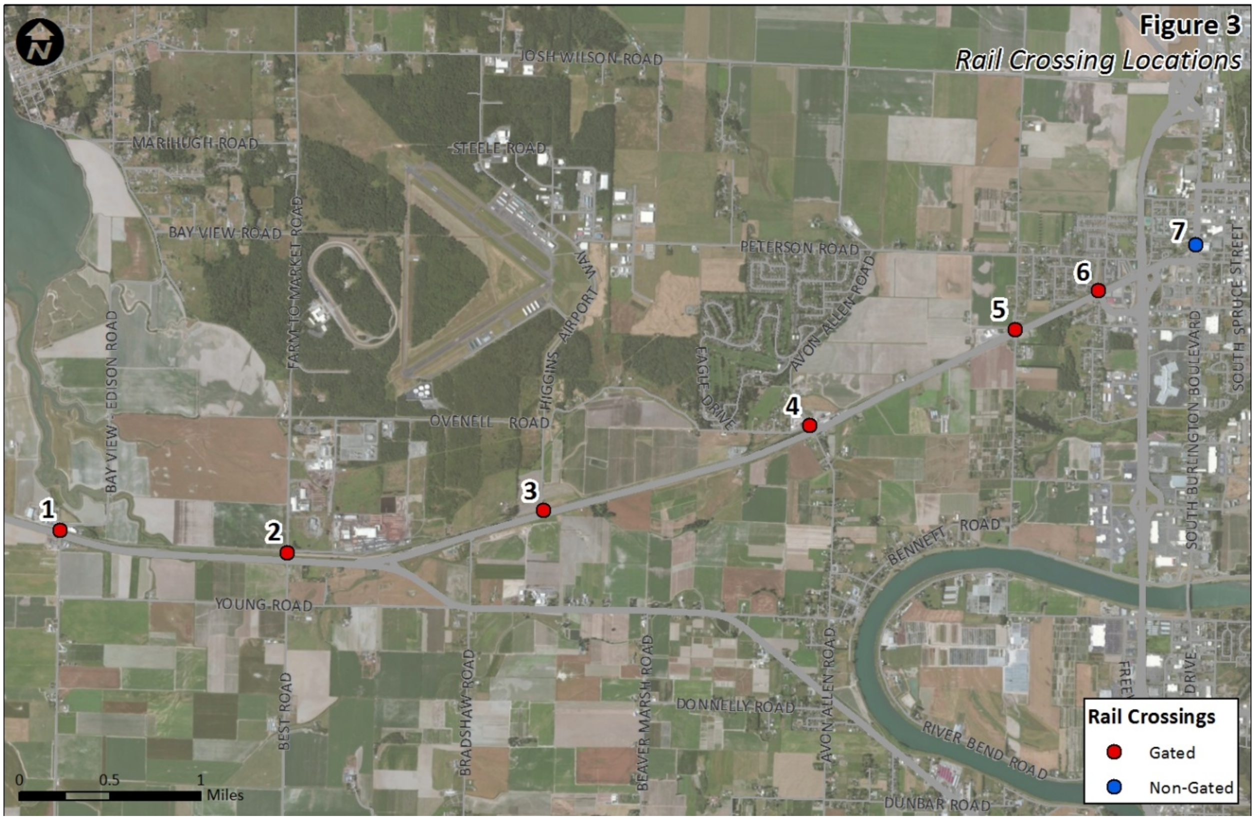
Source: URS Corporation

Assuming that future year traffic growth in this area is similar to the historical information provided via the ATR stations and assuming that WSDOT, Skagit County, the City of Burlington, and BNSF make no road or crossing improvements, PM peak hour delays at all of the intersections analyzed can be expected to increase with area growth in traffic. However, most of the intersections analyzed can be expected to operate in an acceptable manner (LOS D or better) through 2034. Two intersections would be expected to operate at unacceptable LOS by 2034: SR-20 at LaConner Whitney Road, which is expected to operate at LOS E, and Rio Vista at Burlington Road, which is expected to operate at LOS F with or without the project. Figures depicting existing and projected future year (2034) PM peak hour traffic volumes are included as Attachment A. Intersection capacity analysis worksheets are included as Attachment B.

Vehicular Queuing at Intersections due to Unit Train Service

Existing and future year (2034) PM peak hour traffic volumes were also used as a basis for estimation of vehicular queuing due to rail operations. Vehicular queuing was estimated at the rail crossings shown in Figure 3.

Conversations with BNSF staff indicate that the Anacortes Subdivision is classified by the Federal Railway Administration as a Class 2 track, which would allow for maximum freight train speeds of 25 miles per hour (MPH). At 25 MPH, a 102-car rail train with four locomotives would be about 6,250 feet in length and would require approximately 220 seconds (3.7 minutes) to clear a crossing (including time for gate operations). There is also a track curve where the Anacortes spur leaves the BNSF mainline in the City of Burlington. Because of this curve, train speeds were assumed to be 10 MPH until the train is completely clear of the curve. This reduced speed would result in extended train crossing times (approximately 478 seconds or 8 minutes) at the intersections of SR-20 with Garrett Road and Burlington Road with Rio Vista.



Using this information and the existing and future year (2034) PM peak hour traffic volumes, average and 95th percentile queues can be estimated for traffic movements at the intersections that are impacted by adding unit train service to the Shell PSR. As noted above, the traffic volumes, average, and 95th percentile queues assume an average growth rate of 1.5 percent per year for the next 20 years and that no roadway or rail crossing improvements are constructed by WSDOT, the County, the City, or BNSF through 2034. The following sections document queuing analysis results at each of the intersections analyzed.

SR-20 at LaConner Whitney Road

The intersection of LaConner Whitney Road with SR-20 has eastbound left- and westbound right-turn lanes that provide approximately 150 feet of vehicular storage (enough for about six vehicles). The railroad crossing is located on the north side of the intersection and railroad gates are present. There appears to be a part-time restriction sign, which would prevent a westbound right turn from SR-20 to LaConner Whitney road during the rail crossing event.

Queuing analysis results due to project-related train operations at the intersection are summarized in Table 4.

As indicated in Table 4, existing and year 2034 average queues for the eastbound left- and westbound right-turn lanes are expected to fit within the existing available storage. However, if the 95th percentile queues are considered, there is potential for queued vehicles attempting to make an eastbound left-turn movement to occasionally block one of the eastbound through lanes.

The longest queues at this intersection resulting from project-related train activity would be in the northbound direction. It is estimated that the average northbound queue would clear within about 2.5 minutes from the end of the crossing event, and the 95th percentile queue would require approximately 4.5 minutes to clear. Note that these queues will not impact traffic on SR-20.

Table 4
Estimated Queuing, LaConner Whitney Road at SR-20

Traffic Movement	Existing PM Peak Hour		2034 PM Peak Hour	
	Average Queue (Vehicles/Length)	95th Percentile (Vehicles/Length)	Average Queue (Vehicles/Length)	95th Percentile (Vehicles/Length)
Eastbound Left Turn	3/75 feet	8/200 feet	4/100 feet	10/250 feet
Westbound Right Turn	1/25 feet	6/150 feet	1/25 feet	6/150 feet
Northbound Thru/Left Turn	7/175 feet	14/350 feet	10/250 feet	18/450 feet

Source: URS Corporation

SR-20 at Farm to Market Road

The intersection of Farm to Market Road with SR-20 has eastbound left- and westbound right-turn lanes that provide approximately 150 feet of vehicular storage (enough for about six vehicles). The railroad crossing is located on the north side of the intersection, and railroad gates are present. There appears to be a part-time restriction sign, which would prevent a westbound right turn from SR-20 to Farm to Market Road during the rail crossing event.

Queuing analysis results for the SR-20 intersection with Farm to Market Road are summarized in Table 5.

As indicated in Table 5, PM peak hour queuing of eastbound left-turning traffic due to project-related train operations is expected to exceed available storage under all of the conditions analyzed (including existing conditions).

Average vehicular queues for the westbound right-turn movement are expected to fit within existing storage through 2034. However, the existing and future year 95th percentile queues for eastbound left-turning vehicles are expected to exceed the available storage under either alternative. It is estimated that the average eastbound left-turn queue would clear within about 2.5 minutes from the end of the rail crossing event, and the 95th percentile queue would clear within about 5.0 minutes from the end of the rail crossing event.

Table 5
Estimated Queuing, Farm to Market Road at SR-20

Traffic Movement	Existing PM Peak Hour		2034 PM Peak Hour	
	Average Queue (Vehicles/Length)	95th Percentile (Vehicles/Length)	Average Queue (Vehicles/Length)	95th Percentile (Vehicles/Length)
Eastbound Left Turn	8/200 feet	16/400 feet	10/250 feet	18/450 feet
Westbound Right Turn	3/75 feet	8/200 feet	4/100 feet	10/250 feet
Northbound All	5/125 feet	12/300 feet	7/175 feet	14/350 feet

Source: URS Corporation

SR-20 at Higgins Airport Way

The intersection of Higgins Airport Way with SR-20 is a "T" intersection that provides about 300 feet of storage (enough for about 12 vehicles) for westbound right-turning vehicles and about 250 feet of storage (enough for about 10 vehicles) for eastbound left-turning vehicles. The railroad crossing is located on the north side of the intersection and railroad gates are present. There appears to be a part-time restriction sign, which would prevent a westbound right turn from SR-20 to Higgins Airport Way during the rail crossing event.

Analysis of queuing at the intersection of SR-20 with Higgins Airport Way is summarized in Table 6.

As indicated in Table 6, PM peak hour queuing of westbound right-turning vehicles is expected to fit within available storage through 2034. Queuing of eastbound left-turning vehicles is expected to fit within available storage for all scenarios except the 95th percentile queue in 2034. The average eastbound left-turn queue would be expected to clear in less than 90 seconds, while the 95th percentile queue would be expected to clear within about 2.5 minutes from the end of the rail crossing event.

Table 6
Estimated Queuing, Higgins Airport Way at SR-20

Traffic Movement	Existing PM Peak Hour		2034 PM Peak Hour	
	Average Queue (Vehicles/Length)	95th Percentile (Vehicles/Length)	Average Queue (Vehicles/Length)	95th Percentile (Vehicles/Length)
Eastbound Left Turn	3/75 feet	8/200 feet	5/125 feet	12/300 feet
Westbound Right Turn	3/75 feet	8/200 feet	3/75 feet	8/200 feet

Source: URS Corporation

SR-20 at Avon Allen Road

The intersection of Avon Allen Road with SR-20 provides approximately 450 feet of storage for westbound right-turning vehicles (enough for about 18 vehicles) and about 350 feet of storage for eastbound left-turning vehicles (enough for about 14 vehicles). The railroad crossing is located on the north side approximately 100 feet north of the intersection, and railroad gates are present. There appears to be a part-time restriction sign, which would prevent a westbound right turn from SR-20 to Avon Allen Road during the rail crossing event.

Queuing analysis results at the intersection of SR-20 with Avon Allen Road are summarized in Table 7.

As indicated in Table 7, queues for eastbound left-turning and westbound right-turning vehicles due to project-related train operations are expected to fit within existing storage during the PM peak hour through 2034. Analysis indicates that the longest average and 95th percentile queues will be the westbound right-turn movement. Both the existing and 95th percentile queues are expected to clear in less than 90 seconds.

Table 7
Estimated Queuing, Avon Allen Road at SR-20

Traffic Movement	Existing PM Peak Hour		2034 PM Peak Hour	
	Average Queue (Vehicles/Length)	95th Percentile (Vehicles/Length)	Average Queue (Vehicles/Length)	95th Percentile (Vehicles/Length)
Eastbound Left Turn	2/50 feet	7/175 feet	2/50 feet	7/175 feet
Westbound Right Turn	6/150 feet	13/325 feet	7/175 feet	14/350 feet
Northbound Thru	3/75 feet	8/200 feet	5/125 feet	12/300 feet

Source: URS Corporation

SR-20 at Pulver Road

The intersection of Pulver Road with SR-20 provides approximately 400 feet of storage for westbound right-turning vehicles (enough for about 16 vehicles) and about 500 feet of storage for eastbound left-turning vehicles (enough for about 20 vehicles). The railroad crossing is located on the north side, and railroad gates are present. There appears to be a part-time restriction sign, which would prevent a westbound right turn from SR-20 to Pulver Road during the rail crossing event.

Queuing analysis results at the intersection of SR-20 with Avon Allen Road are summarized in Table 8.

As indicated in Table 8, queues for eastbound left-turning and westbound right-turning vehicles due to project-related train operations are expected to fit within existing storage during the PM peak hour through 2034. Analysis indicates that the longest average and 95th percentile queues will be the eastbound left-turn movement. Both the existing and 95th percentile queues are expected to clear in less than 90 seconds.

Table 8
Estimated Queuing, Pulver Road at SR-20

Traffic Movement	Existing PM Peak Hour		2034 PM Peak Hour	
	Average Queue (Vehicles/Length)	95th Percentile (Vehicles/Length)	Average Queue (Vehicles/Length)	95th Percentile (Vehicles/Length)
Eastbound Left Turn	2/50 feet	7/175 feet	2/50 feet	7/175 feet
Westbound Right Turn	1/25 feet	6/150 feet	1/25 feet	6/150 feet
Northbound Thru	3/75 feet	8/200 feet	4/100 feet	10/250 feet

Source: URS Corporation

SR-20 at Garrett Road

The intersection of Garrett Road with SR-20 has eastbound left- and westbound right-turn lanes that provide approximately 250 feet of vehicular storage (enough for about eight vehicles). The railroad crossing is located on the north side of the intersection and railroad gates are present. There appears to be a part-time restriction sign preventing a westbound right turn from SR-20 to Garrett Road during the train crossing event.

Queuing analysis results at the intersection of SR-20 with Garrett Road are summarized in Table 9.

As indicated in Table 9, existing and future PM peak hour average queues for eastbound left-turning vehicles are expected to fit within available storage through 2034. However, the existing and future PM peak hour 95th percentile queues are not expected to fit within existing storage lengths. The westbound right-turning queue is expected to exceed available storage.

Due to the lengths of the projected queues for westbound right-turning vehicles, the time to clear this queue was estimated assuming the existing PM peak hour. Analysis results indicate that an average queue would clear within approximately 3.5 minutes, and the 95th percentile queue would clear within approximately 5.0 minutes of the end of the rail crossing event.

Table 9
Estimated Queuing, Garrett Road at SR-20

Traffic Movement	Existing PM Peak Hour		2034 PM Peak Hour	
	Average Queue (Vehicles/Length)	95th Percentile (Vehicles/Length)	Average Queue (Vehicles/Length)	95th Percentile (Vehicles/Length)
Eastbound Left Turn	7/175 feet	14/350 feet	9/225 feet	17/425 feet
Westbound Right Turn	33/825 feet	46/1150 feet	45/1125 feet	60/1500 feet
Northbound Thru	3/75 feet	8/200 feet	5/125 feet	11/275 feet

Source: URS Corporation

Rio Vista at Burlington Road

The intersection of Rio Vista with Burlington Road is located approximately 275 feet south of the Anacortes Subdivision crossing. Burlington Road, between the crossing location and the intersection with Rio Vista, provides two northbound travel lanes, and there is room for approximately 22 vehicles to queue on this link. The crossing has flashers, but gates are not present. It is anticipated that once the distance between the crossing and the intersection is fully queued, the queues will extend past the intersection.

Table 10 summarizes the queuing analysis assuming that the aforementioned northbound Burlington Road roadway link is already fully queued.

As indicated in Table 10, average existing PM peak hour vehicular queues for the eastbound thru-left traffic movement and the northbound thru-right traffic movement are expected to reach approximately 1,925 to 1,975 feet past the Burlington Road intersection with Rio Vista. Additional analysis was conducted to estimate the time to clear these average queues. Results indicate that:

- The time to clear the northbound thru-right movement would be approximately 18.5 minutes; and
- The time to clear the eastbound thru-left movement would be approximately 15.5 minutes.

If the existing 95th percentile PM peak hour queue is assumed, these queues are expected to reach approximately 1,100 feet past the intersection. The time for queue clearance was also estimated for this traffic movement. Analysis indicates that:

- The time to clear the estimated 95th percentile queue for the northbound thru-right movement would be approximately 22.5 minutes; and
- The time to clear the estimated 95th percentile queue for the eastbound thru-left movement would be approximately 19.5 minutes.

Future year (2034) queuing analysis indicates that average queues for both the eastbound thru-left and northbound thru-right movements can be expected to reach to about 2,700 feet, and the 95th percentile queues can be expected to reach approximately 3,300 past the intersection. State or local governments can use the federal Railway-Highway Crossing Program to request railroad crossing improvements when they feel such improvements are necessary (see 23 U.S.C.130).

Table 10
Estimated Queuing, Rio Vista at Burlington Road

Traffic Movement	Existing PM Peak Hour		2034 PM Peak Hour	
	Average Queue (Vehicles/Length)	95th Percentile (Vehicles/Length)	Average Queue (Vehicles/Length)	95th Percentile (Vehicles/Length)
Eastbound Thru Left	77/1925 feet	96/2400 feet	108/2700 feet	130/3250 feet
Westbound Right Turn	2/50 feet	7/175 feet	2/50 feet	7/175 feet
Northbound Thru Right	79/1975 feet	98/2450 feet	110/2750 feet	132/3300 feet

Source: URS Corporation

Table 11 presents a summary of estimated clearance times under existing conditions for critical movements at the intersections analyzed. As previously indicated, most of the queues analyzed can be expected to clear within 5 minutes of the end of the rail crossing event. However, queuing at the intersection of Rio Vista with Burlington Road is expected to take between 15 and 20 minutes to clear.

Table 11
Estimated Queuing, Rio Vista at Burlington Road

Intersection	Traffic Movement	Estimated Queue Clearance Time	
		Average	95th Percentile
SR-20 at LaConner Whitney Road	NBT/L	2.5 min	4.5 min
SR-20 at Farm to Market Road	EBL	2.5 min	5.0 min
SR-20 at Higgins Airport Way	EBL	>1.5 min	>1.5 min
SR-20 at Avon Allen Road	WBR	>1.5 min	>1.5 min
SR-20 at Pulver Road	EBL	>1.5 min	>1.5 min
SR-20 at Garrett Road	WBR	3.5 min	5.0 min
Burlington Road at Rio Vista	NBT/R	18.5 min	22.5 min
	EBL/T	15.5 min	19.5 min

Source: URS Corporation

Emergency Vehicle Access

In order to analyze the potential impacts of project-related train operations on the response times of emergency services in the City of Burlington, modeled travel sheds were developed in ArcGIS. These travel sheds approximate the range of places reachable within a given time frame from the City of Burlington Police and Fire Departments (located on Spruce Street and Sharon Avenue). The emergency service travel sheds were modeled in ArcGIS 10.1 – Network Analyst Extension.

The basis of the analysis, a road network dataset of roadway segments and intersection nodes, was compiled from WSDOT and Skagit County GIS shape files. Distances reachable within a given time frame were determined assuming no traffic delay and a vehicle traveling at the posted speed limit on each roadway segment. It is further assumed that emergency vehicles would seek alternate routes to avoid the railway crossing event. Those routes would depend on where the train is located on the track relative to the crossing, the direction the train is heading, and where the emergency is located. The travel time calculations described in the next paragraph include time for alternative routing of emergency vehicles.

A travel shed for a 5-minute time frame was modelled assuming no train blocking roadways at crossings and with a project-related train blocking the crossings. The 5-minute travel shed was assumed based on average fire response time information provided by the Skagit County and City of Burlington fire departments. Skagit County fire department has indicated that their average response time in 2014 (YTD) is approximately 7 minutes, and the latest information available from the City of Burlington fire department indicates that their average response time in 2012 was approximately 4 minutes. To analyze the potential impacts of a project-related unit train in the area, the travel shed was developed assuming a westbound unit train had just cleared the track curve from the mainline to the Anacortes Subdivision in Burlington, just north of Greenleaf Avenue and east of Spruce Street. Under this scenario, the train blocks crossings at Garret Road, Burlington Boulevard, Walnut Street, and Spruce Street.

The results of the emergency vehicle access analysis are shown in Figure 4. As shown in Figure 4, if a 5-minute travel shed is assumed, there is little difference in emergency vehicle accessibility with or without the train. The only differences in the 5-minute travel shed with and without the train blockages would be found in the outlying areas northeast of the City of Burlington (see dashed line).

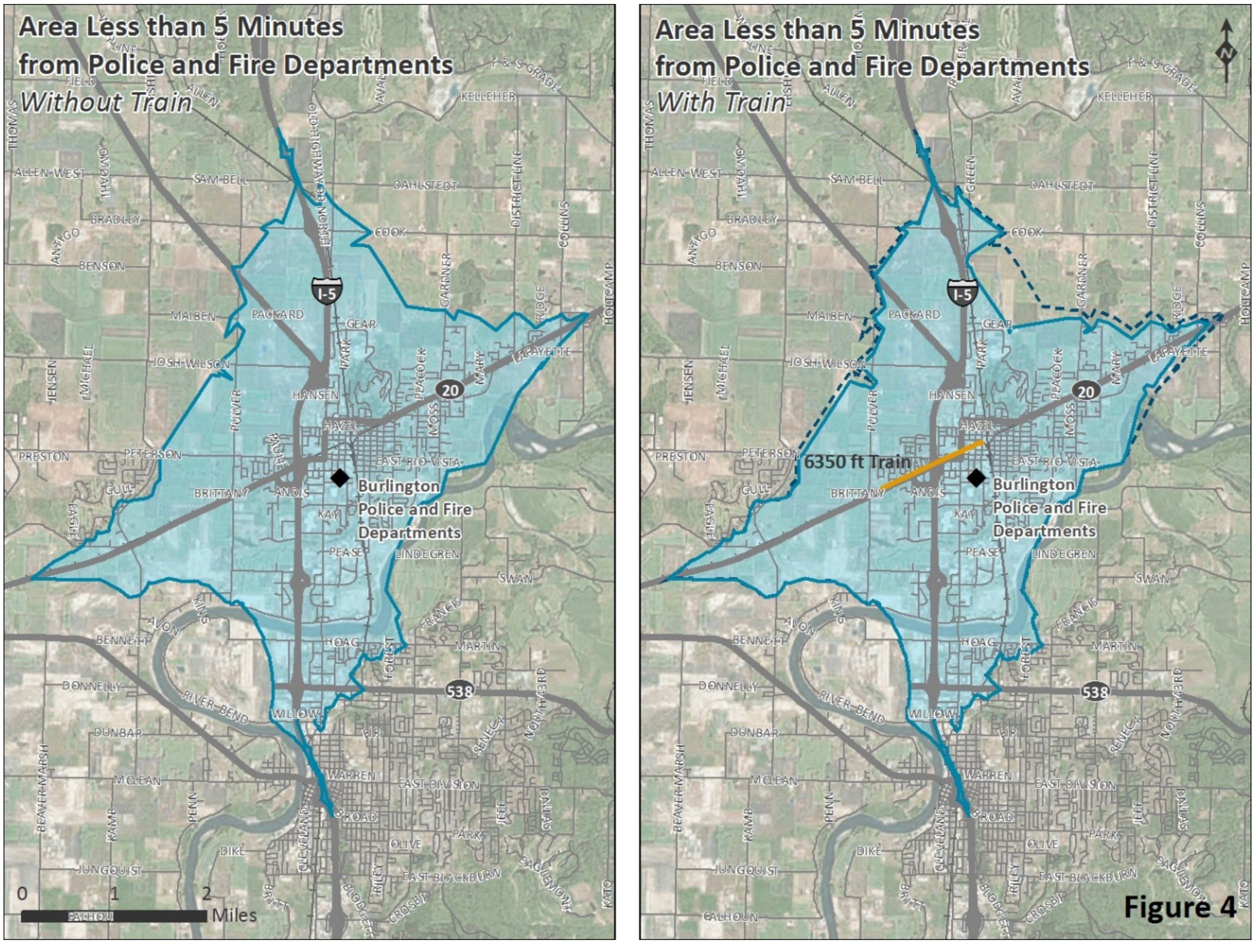
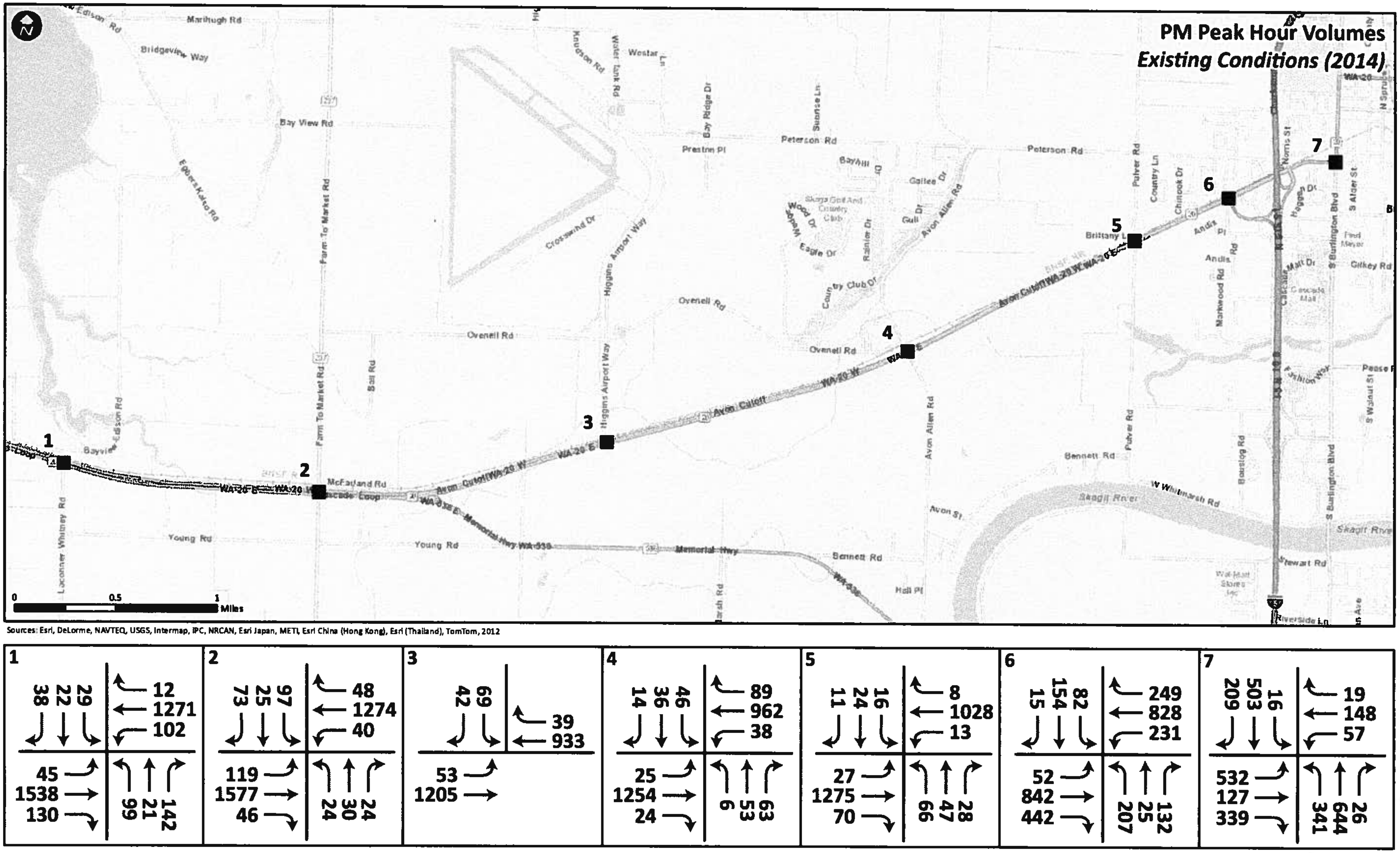


Figure 4

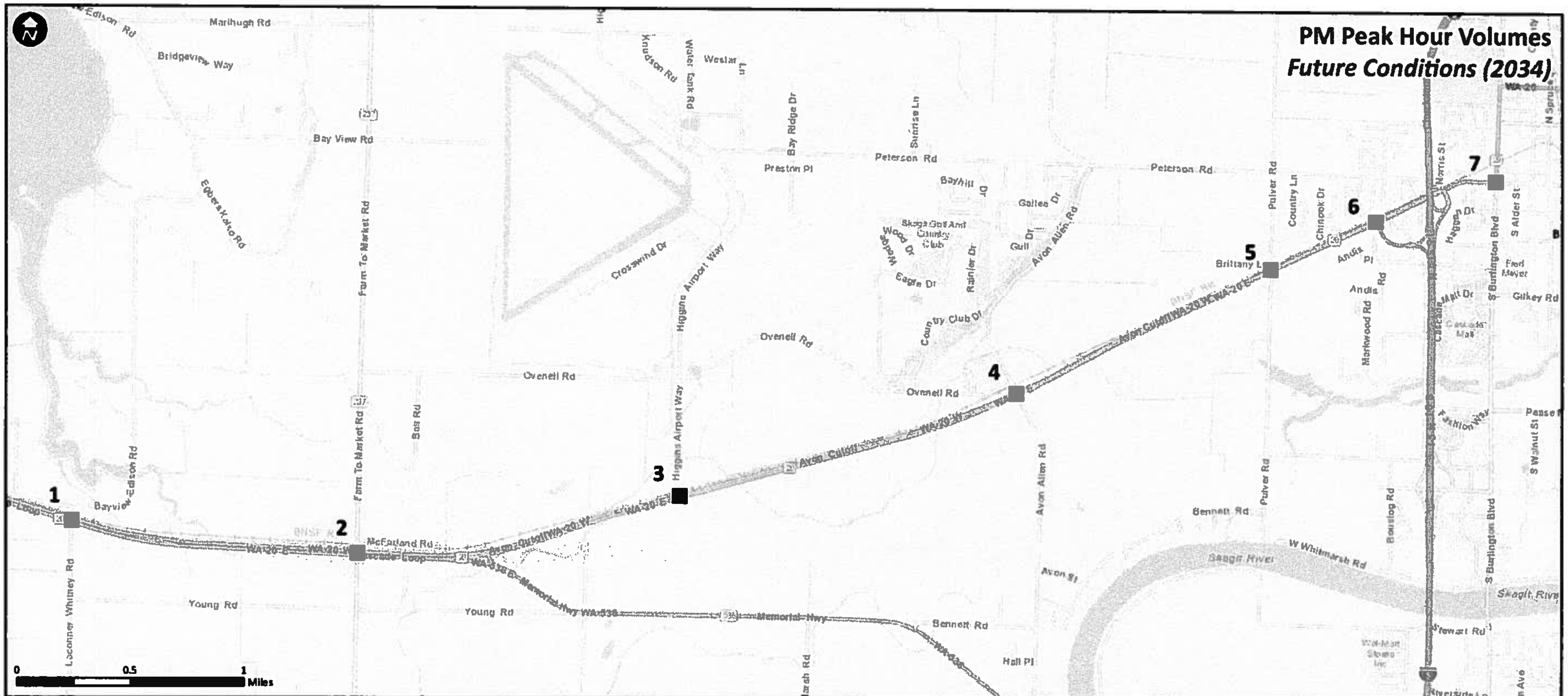
Reference:

Transportation Research Board. 2010. *Highway Capacity Manual 2010*. Washington, DC.

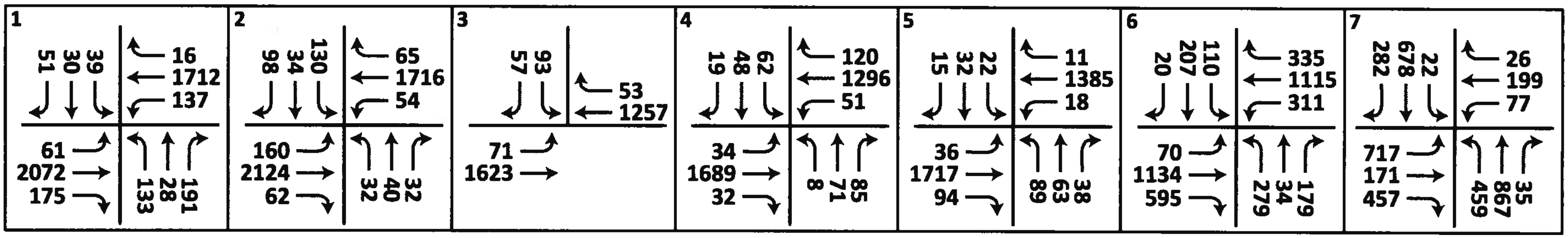
Attachment A



Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, IPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2012



Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, IPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2012



Attachment B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↑	↱		↰↑	↱		↰↑	↱
Volume (veh/h)	45	1538	130	102	1271	12	99	21	142	29	22	38
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863
Adj Flow Rate, veh/h	50	1709	144	113	1412	13	110	23	158	32	24	42
Adj No. of Lanes	1	2	1	1	2	1	0	1	1	0	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	63	2091	936	143	2250	1007	77	9	425	66	33	297
Arrive On Green	0.04	0.59	0.59	0.08	0.64	0.64	0.19	0.19	0.19	0.19	0.19	0.19
Sat Flow, veh/h	1774	3539	1583	1774	3539	1583	0	49	1583	0	174	1583
Grp Volume(v), veh/h	50	1709	144	113	1412	13	133	0	158	56	0	42
Grp Sat Flow(s),veh/h/ln	1774	1770	1583	1774	1770	1583	49	0	1583	174	0	1583
Q Serve(g_s), s	2.4	32.6	3.5	5.3	20.6	0.3	0.0	0.0	6.9	0.0	0.0	1.9
Cycle Q Clear(g_c), s	2.4	32.6	3.5	5.3	20.6	0.3	16.0	0.0	6.9	16.0	0.0	1.9
Prop In Lane	1.00		1.00	1.00		1.00	0.83		1.00	0.57		1.00
Lane Grp Cap(c), veh/h	63	2091	936	143	2250	1007	86	0	425	99	0	297
V/C Ratio(X)	0.79	0.82	0.15	0.79	0.63	0.01	1.54	0.00	0.37	0.57	0.00	0.14
Avail Cap(c_a), veh/h	125	2158	966	208	2324	1040	86	0	425	99	0	297
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	40.8	13.8	7.8	38.5	9.4	5.7	41.0	0.0	25.4	33.7	0.0	28.9
Incr Delay (d2), s/veh	19.0	2.5	0.1	11.9	0.5	0.0	293.1	0.0	2.5	21.3	0.0	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	16.4	1.5	3.1	10.2	0.1	9.0	0.0	3.3	1.9	0.0	0.9
LnGrp Delay(d),s/veh	59.8	16.3	7.9	50.4	9.9	5.7	334.0	0.0	27.8	55.0	0.0	29.9
LnGrp LOS	E	B	A	D	A	A	F		C	E		C
Approach Vol, veh/h		1903			1538			291			98	
Approach Delay, s/veh		16.8			12.9			167.8			44.3	
Approach LOS		B			B			F			D	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.9	54.4		20.0	7.0	58.2		20.0				
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0				
Max Green Setting (Gmax), s	10.0	52.0		16.0	6.0	56.0		16.0				
Max Q Clear Time (g_c+I1), s	7.3	34.6		18.0	4.4	22.6		18.0				
Green Ext Time (p_c), s	0.1	15.8		0.0	0.0	28.2		0.0				
Intersection Summary												
HCM 2010 Ctrl Delay			27.4									
HCM 2010 LOS			C									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↑	↱		✥			↰↑	↱
Volume (veh/h)	119	1577	46	40	1274	48	24	30	24	97	25	73
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1792	1827	1827	1900	1845	1792	1900	1845	1900	1900	1759	1759
Adj Flow Rate, veh/h	129	1714	50	43	1385	52	26	33	26	105	27	79
Adj No. of Lanes	1	2	1	1	2	1	0	1	0	0	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	6	4	4	0	3	6	3	3	3	12	12	8
Cap, veh/h	161	2143	959	54	1939	843	68	79	40	195	41	316
Arrive On Green	0.09	0.62	0.62	0.03	0.55	0.55	0.21	0.21	0.21	0.21	0.21	0.21
Sat Flow, veh/h	1707	3471	1553	1810	3505	1524	61	373	191	562	195	1495
Grp Volume(v), veh/h	129	1714	50	43	1385	52	85	0	0	132	0	79
Grp Sat Flow(s),veh/h/ln	1707	1736	1553	1810	1752	1524	626	0	0	756	0	1495
Q Serve(g_s), s	6.3	31.8	1.1	2.0	24.8	1.3	0.7	0.0	0.0	0.0	0.0	3.7
Cycle Q Clear(g_c), s	6.3	31.8	1.1	2.0	24.8	1.3	16.3	0.0	0.0	15.7	0.0	3.7
Prop In Lane	1.00		1.00	1.00		1.00	0.31		0.31	0.80		1.00
Lane Grp Cap(c), veh/h	161	2143	959	54	1939	843	188	0	0	236	0	316
V/C Ratio(X)	0.80	0.80	0.05	0.79	0.71	0.06	0.45	0.00	0.00	0.56	0.00	0.25
Avail Cap(c_a), veh/h	261	2244	1004	106	1939	843	188	0	0	236	0	316
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	37.8	12.3	6.4	41.0	14.0	8.8	28.6	0.0	0.0	32.2	0.0	27.9
Incr Delay (d2), s/veh	8.9	2.1	0.0	21.8	1.3	0.0	7.7	0.0	0.0	9.3	0.0	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.4	15.6	0.5	1.3	12.3	0.6	2.1	0.0	0.0	3.6	0.0	1.7
LnGrp Delay(d),s/veh	46.7	14.4	6.5	62.8	15.3	8.8	36.3	0.0	0.0	41.5	0.0	29.8
LnGrp LOS	D	B	A	E	B	A	D			D		C
Approach Vol, veh/h		1893			1480			85			211	
Approach Delay, s/veh		16.4			16.5			36.3			37.1	
Approach LOS		B			B			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.6	56.5		22.0	12.0	51.1		22.0
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	5.0	55.0		18.0	13.0	47.0		18.0
Max Q Clear Time (g_c+I1), s	4.0	33.8		17.7	8.3	26.8		18.3
Green Ext Time (p_c), s	0.0	18.8		0.1	0.1	17.9		0.0

Intersection Summary		
HCM 2010 Ctrl Delay		18.1
HCM 2010 LOS		B

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑↑	↑↑	↱	↰	↱
Volume (veh/h)	53	1205	933	39	69	42
Number	5	2	6	16	7	14
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1712	1827	1827	1827	1598	1723
Adj Flow Rate, veh/h	58	1324	1025	43	76	46
Adj No. of Lanes	1	2	2	1	1	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	11	4	4	4	10	2
Cap, veh/h	71	2669	2248	1006	116	111
Arrive On Green	0.04	0.77	0.65	0.65	0.08	0.08
Sat Flow, veh/h	1630	3563	3563	1553	1522	1465
Grp Volume(v), veh/h	58	1324	1025	43	76	46
Grp Sat Flow(s),veh/h/ln	1630	1736	1736	1553	1522	1465
Q Serve(g_s), s	1.8	7.4	7.6	0.5	2.5	1.5
Cycle Q Clear(g_c), s	1.8	7.4	7.6	0.5	2.5	1.5
Prop In Lane	1.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	71	2669	2248	1006	116	111
V/C Ratio(X)	0.81	0.50	0.46	0.04	0.66	0.41
Avail Cap(c_a), veh/h	284	4305	3431	1535	531	511
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	24.5	2.2	4.5	3.3	23.2	22.7
Incr Delay (d2), s/veh	19.3	0.1	0.1	0.0	6.2	2.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	3.4	3.6	0.8	1.3	1.3
LnGrp Delay(d),s/veh	43.7	2.4	4.7	3.3	29.4	25.2
LnGrp LOS	D	A	A	A	C	C
Approach Vol, veh/h		1382	1068		122	
Approach Delay, s/veh		4.1	4.6		27.8	
Approach LOS		A	A		C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		43.7		7.9	6.3	37.4		
Change Period (Y+Rc), s		4.0		4.0	4.0	4.0		
Max Green Setting (Gmax), s		64.0		18.0	9.0	51.0		
Max Q Clear Time (g_c+I1), s		9.4		4.5	3.8	9.6		
Green Ext Time (p_c), s		27.4		0.2	0.0	23.8		

Intersection Summary	
HCM 2010 Ctrl Delay	5.4
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↑	↱	↰	↑	↱	↰	↑	↱
Volume (veh/h)	25	1254	24	38	962	89	6	53	63	46	36	14
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	28	1393	27	42	1069	99	7	59	70	51	40	16
Adj No. of Lanes	1	2	1	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	41	2534	1134	54	2560	1145	201	189	160	182	189	160
Arrive On Green	0.02	0.72	0.72	0.03	0.72	0.72	0.10	0.10	0.10	0.10	0.10	0.10
Sat Flow, veh/h	1774	3539	1583	1774	3539	1583	1342	1863	1583	1256	1863	1583
Grp Volume(v), veh/h	28	1393	27	42	1069	99	7	59	70	51	40	16
Grp Sat Flow(s),veh/h/ln	1774	1770	1583	1774	1770	1583	1342	1863	1583	1256	1863	1583
Q Serve(g_s), s	1.2	14.5	0.4	1.9	9.4	1.5	0.4	2.3	3.3	3.1	1.6	0.7
Cycle Q Clear(g_c), s	1.2	14.5	0.4	1.9	9.4	1.5	1.9	2.3	3.3	5.4	1.6	0.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	41	2534	1134	54	2560	1145	201	189	160	182	189	160
V/C Ratio(X)	0.68	0.55	0.02	0.78	0.42	0.09	0.03	0.31	0.44	0.28	0.21	0.10
Avail Cap(c_a), veh/h	113	2534	1134	135	2560	1145	337	378	321	309	378	321
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	38.2	5.2	3.2	37.9	4.3	3.2	33.4	32.9	33.3	35.4	32.5	32.2
Incr Delay (d2), s/veh	17.7	0.9	0.0	20.6	0.5	0.1	0.1	0.9	1.9	0.8	0.6	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	7.3	0.2	1.2	4.6	0.7	0.1	1.2	1.5	1.1	0.8	0.3
LnGrp Delay(d),s/veh	55.9	6.1	3.3	58.6	4.8	3.4	33.5	33.8	35.2	36.2	33.1	32.4
LnGrp LOS	E	A	A	E	A	A	C	C	D	D	C	C
Approach Vol, veh/h		1448			1210			136			107	
Approach Delay, s/veh		7.0			6.6			34.5			34.5	
Approach LOS		A			A			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.4	60.4		12.0	5.8	61.0		12.0
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	6.0	56.0		16.0	5.0	57.0		16.0
Max Q Clear Time (g_c+I1), s	3.9	16.5		7.4	3.2	11.4		5.3
Green Ext Time (p_c), s	0.0	25.2		0.6	0.0	27.4		0.7

Intersection Summary	
HCM 2010 Ctrl Delay	9.1
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↑	↱	↰	↑	↱	↰	↑↱	
Volume (veh/h)	27	1275	70	13	1028	8	66	47	28	16	24	11
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1792	1652	1827	1900	1845	1696	1827	1792	1849	1900
Adj Flow Rate, veh/h	28	1328	73	14	1071	8	69	49	29	17	25	11
Adj No. of Lanes	1	2	1	1	2	1	1	1	1	1	1	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	4	6	15	4	0	3	12	4	6	0	0
Cap, veh/h	41	2535	1112	21	2500	1163	204	170	155	186	122	54
Arrive On Green	0.02	0.73	0.73	0.01	0.72	0.72	0.10	0.10	0.10	0.10	0.10	0.10
Sat Flow, veh/h	1740	3471	1524	1573	3471	1615	1353	1696	1553	1266	1218	536
Grp Volume(v), veh/h	28	1328	73	14	1071	8	69	49	29	17	0	36
Grp Sat Flow(s),veh/h/ln	1740	1736	1524	1573	1736	1615	1353	1696	1553	1266	0	1755
Q Serve(g_s), s	1.2	12.8	1.0	0.7	9.6	0.1	3.8	2.1	1.3	1.0	0.0	1.4
Cycle Q Clear(g_c), s	1.2	12.8	1.0	0.7	9.6	0.1	5.2	2.1	1.3	3.0	0.0	1.4
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.31
Lane Grp Cap(c), veh/h	41	2535	1112	21	2500	1163	204	170	155	186	0	175
V/C Ratio(X)	0.69	0.52	0.07	0.66	0.43	0.01	0.34	0.29	0.19	0.09	0.00	0.21
Avail Cap(c_a), veh/h	136	2535	1112	82	2500	1163	386	398	364	357	0	412
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	37.2	4.5	2.9	37.7	4.3	3.0	34.1	32.0	31.7	33.4	0.0	31.7
Incr Delay (d2), s/veh	18.5	0.8	0.1	30.0	0.5	0.0	1.0	0.9	0.6	0.2	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	6.2	0.5	0.5	4.6	0.1	1.5	1.0	0.6	0.4	0.0	0.7
LnGrp Delay(d),s/veh	55.7	5.3	3.0	67.7	4.9	3.0	35.1	32.9	32.2	33.6	0.0	32.3
LnGrp LOS	E	A	A	E	A	A	D	C	C	C		C
Approach Vol, veh/h		1429			1093			147			53	
Approach Delay, s/veh		6.2			5.7			33.8			32.7	
Approach LOS		A			A			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	5.0	60.0		11.7	5.8	59.2		11.7
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	4.0	56.0		18.0	6.0	54.0		18.0
Max Q Clear Time (g_c+I1), s	2.7	14.8		5.0	3.2	11.6		7.2
Green Ext Time (p_c), s	0.0	24.7		0.6	0.0	25.1		0.5

Intersection Summary			
HCM 2010 Ctrl Delay			8.0
HCM 2010 LOS			A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰↰	↑↑	↱	↰	↑	↱	↰	↑↱	
Volume (veh/h)	52	842	442	231	828	249	207	25	132	82	154	15
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1792	1827	1810	1863	1863	1900	1863	1900	1871	1900
Adj Flow Rate, veh/h	52	842	442	231	828	249	207	25	132	82	154	15
Adj No. of Lanes	1	2	1	2	2	1	1	1	1	1	1	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	0	3	6	4	5	2	2	0	2	0	1	1
Cap, veh/h	66	1650	717	319	1817	837	347	539	449	433	477	46
Arrive On Green	0.04	0.47	0.47	0.09	0.53	0.53	0.28	0.28	0.28	0.28	0.28	0.28
Sat Flow, veh/h	1810	3505	1524	3375	3438	1583	1211	1900	1583	1249	1679	164
Grp Volume(v), veh/h	52	842	442	231	828	249	207	25	132	82	0	169
Grp Sat Flow(s),veh/h/ln	1810	1752	1524	1688	1719	1583	1211	1900	1583	1249	0	1842
Q Serve(g_s), s	2.3	13.3	17.2	5.3	11.9	7.0	12.9	0.8	5.2	4.1	0.0	5.7
Cycle Q Clear(g_c), s	2.3	13.3	17.2	5.3	11.9	7.0	18.7	0.8	5.2	4.8	0.0	5.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.09
Lane Grp Cap(c), veh/h	66	1650	717	319	1817	837	347	539	449	433	0	523
V/C Ratio(X)	0.78	0.51	0.62	0.72	0.46	0.30	0.60	0.05	0.29	0.19	0.00	0.32
Avail Cap(c_a), veh/h	137	1650	717	467	1817	837	460	717	598	550	0	695
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	38.0	14.7	15.7	35.0	11.6	10.5	29.8	20.7	22.2	22.4	0.0	22.4
Incr Delay (d2), s/veh	17.8	1.1	3.9	3.1	0.8	0.9	1.6	0.0	0.4	0.2	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	6.7	7.9	2.6	5.8	3.3	4.5	0.4	2.3	1.4	0.0	3.0
LnGrp Delay(d),s/veh	55.8	15.8	19.6	38.1	12.5	11.4	31.4	20.7	22.6	22.6	0.0	22.8
LnGrp LOS	E	B	B	D	B	B	C	C	C	C		C
Approach Vol, veh/h		1336			1308			364			251	
Approach Delay, s/veh		18.6			16.8			27.5			22.7	
Approach LOS		B			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	11.5	41.4		26.6	6.9	46.0		26.6
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	11.0	37.0		30.0	6.0	42.0		30.0
Max Q Clear Time (g_c+I1), s	7.3	19.2		7.7	4.3	13.9		20.7
Green Ext Time (p_c), s	0.3	13.1		2.6	0.0	18.2		1.9

Intersection Summary	
HCM 2010 Ctrl Delay	19.2
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱		↰↑↑↱		↰	↑↑↱		↰	↑↑↱	
Volume (veh/h)	532	127	339	57	148	19	341	644	26	16	503	209
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	2451	1238	1863	1900	1842	1900	1845	1879	1900	1900	1842	1900
Adj Flow Rate, veh/h	532	127	339	57	148	19	341	644	26	16	503	209
Adj No. of Lanes	1	1	1	0	2	0	1	2	0	1	2	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	5	2	3	3	3	3	1	1	0	2	2
Cap, veh/h	809	429	549	84	231	31	330	1203	49	27	568	235
Arrive On Green	0.35	0.35	0.35	0.10	0.10	0.10	0.12	0.34	0.34	0.01	0.24	0.24
Sat Flow, veh/h	2334	1238	1583	873	2392	318	1757	3498	141	1810	2416	999
Grp Volume(v), veh/h	532	127	339	117	0	107	341	328	342	16	364	348
Grp Sat Flow(s),veh/h/ln	2334	1238	1583	1798	0	1785	1757	1785	1854	1810	1749	1665
Q Serve(g_s), s	15.6	6.0	14.4	5.1	0.0	4.6	10.0	12.0	12.0	0.7	16.2	16.4
Cycle Q Clear(g_c), s	15.6	6.0	14.4	5.1	0.0	4.6	10.0	12.0	12.0	0.7	16.2	16.4
Prop In Lane	1.00		1.00	0.49		0.18	1.00		0.08	1.00		0.60
Lane Grp Cap(c), veh/h	809	429	549	174	0	172	330	614	638	27	411	391
V/C Ratio(X)	0.66	0.30	0.62	0.68	0.00	0.62	1.03	0.54	0.54	0.59	0.88	0.89
Avail Cap(c_a), veh/h	809	429	549	356	0	354	330	614	638	90	433	412
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	22.3	19.2	21.9	35.3	0.0	35.1	23.2	21.3	21.3	39.5	29.8	29.9
Incr Delay (d2), s/veh	4.2	1.8	5.1	4.5	0.0	3.6	58.1	0.9	0.9	18.9	18.5	20.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.0	2.3	7.1	2.8	0.0	2.5	5.3	6.0	6.2	0.5	9.9	9.7
LnGrp Delay(d),s/veh	26.5	21.0	27.1	39.8	0.0	38.6	81.3	22.2	22.2	58.5	48.3	50.0
LnGrp LOS	C	C	C	D		D	F	C	C	E	D	D
Approach Vol, veh/h		998			224			1011			728	
Approach Delay, s/veh		26.0			39.2			42.2			49.3	
Approach LOS		C			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		32.0	14.0	23.0		11.8	5.2	31.8
Change Period (Y+Rc), s		4.0	4.0	4.0		4.0	4.0	4.0
Max Green Setting (Gmax), s		28.0	10.0	20.0		16.0	4.0	26.0
Max Q Clear Time (g_c+I1), s		17.6	12.0	18.4		7.1	2.7	14.0
Green Ext Time (p_c), s		3.0	0.0	0.6		0.8	0.0	6.7

Intersection Summary	
HCM 2010 Ctrl Delay	38.3
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↑	↱		↰↑	↱		↰↑	↱
Volume (veh/h)	61	2072	175	137	1712	16	133	28	191	39	30	51
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863
Adj Flow Rate, veh/h	68	2302	194	152	1902	18	148	31	212	43	33	57
Adj No. of Lanes	1	2	1	1	2	1	0	1	1	0	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	87	2061	922	185	2255	1009	74	0	449	63	32	284
Arrive On Green	0.05	0.58	0.58	0.10	0.64	0.64	0.18	0.18	0.18	0.18	0.18	0.18
Sat Flow, veh/h	1774	3539	1583	1774	3539	1583	0	0	1583	0	178	1583
Grp Volume(v), veh/h	68	2302	194	152	1902	18	179	0	212	76	0	57
Grp Sat Flow(s),veh/h/ln	1774	1770	1583	1774	1770	1583	0	0	1583	178	0	1583
Q Serve(g_s), s	3.4	52.0	5.2	7.5	37.6	0.4	0.0	0.0	9.9	0.0	0.0	2.7
Cycle Q Clear(g_c), s	3.4	52.0	5.2	7.5	37.6	0.4	16.0	0.0	9.9	16.0	0.0	2.7
Prop In Lane	1.00		1.00	1.00		1.00	0.83		1.00	0.57		1.00
Lane Grp Cap(c), veh/h	87	2061	922	185	2255	1009	74	0	449	95	0	284
V/C Ratio(X)	0.78	1.12	0.21	0.82	0.84	0.02	2.43	0.00	0.47	0.80	0.00	0.20
Avail Cap(c_a), veh/h	119	2061	922	199	2255	1009	74	0	449	95	0	284
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	42.0	18.6	8.9	39.2	12.7	5.9	44.6	0.0	26.5	38.2	0.0	31.2
Incr Delay (d2), s/veh	19.8	59.9	0.1	22.4	3.1	0.0	682.8	0.0	3.5	48.9	0.0	1.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.1	42.1	2.3	4.8	18.9	0.2	15.8	0.0	4.7	3.1	0.0	1.3
LnGrp Delay(d),s/veh	61.8	78.6	9.0	61.6	15.8	5.9	727.5	0.0	30.0	87.1	0.0	32.8
LnGrp LOS	E	F	A	E	B	A	F		C	F		C
Approach Vol, veh/h		2564			2072			391			133	
Approach Delay, s/veh		72.9			19.1			349.3			63.8	
Approach LOS		E			B			F			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	13.3	56.0		20.0	8.4	60.9		20.0
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	10.0	52.0		16.0	6.0	56.0		16.0
Max Q Clear Time (g_c+I1), s	9.5	54.0		18.0	5.4	39.6		18.0
Green Ext Time (p_c), s	0.0	0.0		0.0	0.0	16.1		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	72.0
HCM 2010 LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↑	↱		✥			↰	↱
Volume (veh/h)	160	2124	62	54	1716	65	32	40	32	130	34	98
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1792	1827	1827	1900	1845	1792	1900	1845	1900	1900	1759	1759
Adj Flow Rate, veh/h	174	2309	67	59	1865	71	35	43	35	141	37	107
Adj No. of Lanes	1	2	1	1	2	1	0	1	0	0	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	6	4	4	0	3	6	3	3	3	12	12	8
Cap, veh/h	207	2152	963	76	1894	823	53	58	26	178	29	303
Arrive On Green	0.12	0.62	0.62	0.04	0.54	0.54	0.20	0.20	0.20	0.20	0.20	0.20
Sat Flow, veh/h	1707	3471	1553	1810	3505	1524	0	288	129	519	145	1495
Grp Volume(v), veh/h	174	2309	67	59	1865	71	113	0	0	178	0	107
Grp Sat Flow(s),veh/h/ln	1707	1736	1553	1810	1752	1524	418	0	0	663	0	1495
Q Serve(g_s), s	8.8	55.0	1.5	2.9	46.4	2.0	0.0	0.0	0.0	0.0	0.0	5.5
Cycle Q Clear(g_c), s	8.8	55.0	1.5	2.9	46.4	2.0	18.0	0.0	0.0	18.0	0.0	5.5
Prop In Lane	1.00		1.00	1.00		1.00	0.31		0.31	0.79		1.00
Lane Grp Cap(c), veh/h	207	2152	963	76	1894	823	138	0	0	207	0	303
V/C Ratio(X)	0.84	1.07	0.07	0.78	0.98	0.09	0.82	0.00	0.00	0.86	0.00	0.35
Avail Cap(c_a), veh/h	250	2152	963	102	1894	823	138	0	0	207	0	303
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	38.1	16.9	6.7	42.1	20.0	9.8	32.5	0.0	0.0	37.5	0.0	30.4
Incr Delay (d2), s/veh	18.7	42.4	0.0	22.7	17.1	0.0	39.8	0.0	0.0	34.3	0.0	3.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.2	38.7	0.7	1.9	26.8	0.8	4.3	0.0	0.0	6.3	0.0	2.5
LnGrp Delay(d),s/veh	56.9	59.3	6.7	64.8	37.2	9.9	72.3	0.0	0.0	71.8	0.0	33.6
LnGrp LOS	E	F	A	E	D	A	E			E		C
Approach Vol, veh/h		2550			1995			113			285	
Approach Delay, s/veh		57.7			37.0			72.3			57.4	
Approach LOS		E			D			E			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	7.7	59.0		22.0	14.8	51.9		22.0
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	5.0	55.0		18.0	13.0	47.0		18.0
Max Q Clear Time (g_c+I1), s	4.9	57.0		20.0	10.8	48.4		20.0
Green Ext Time (p_c), s	0.0	0.0		0.0	0.1	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	49.7
HCM 2010 LOS	D

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑↑	↑↑	↱	↰	↱
Volume (veh/h)	71	1623	1257	53	93	57
Number	5	2	6	16	7	14
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1712	1827	1827	1827	1598	1723
Adj Flow Rate, veh/h	78	1784	1381	58	102	63
Adj No. of Lanes	1	2	2	1	1	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	11	4	4	4	10	2
Cap, veh/h	97	2751	2347	1050	143	137
Arrive On Green	0.06	0.79	0.68	0.68	0.09	0.09
Sat Flow, veh/h	1630	3563	3563	1553	1522	1465
Grp Volume(v), veh/h	78	1784	1381	58	102	63
Grp Sat Flow(s),veh/h/ln	1630	1736	1736	1553	1522	1465
Q Serve(g_s), s	3.3	15.4	15.1	0.9	4.6	2.9
Cycle Q Clear(g_c), s	3.3	15.4	15.1	0.9	4.6	2.9
Prop In Lane	1.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	97	2751	2347	1050	143	137
V/C Ratio(X)	0.80	0.65	0.59	0.06	0.71	0.46
Avail Cap(c_a), veh/h	231	3252	2562	1146	346	333
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	32.7	3.1	6.1	3.8	31.0	30.2
Incr Delay (d2), s/veh	13.9	0.4	0.3	0.0	6.5	2.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.9	7.3	7.2	1.5	2.2	2.4
LnGrp Delay(d),s/veh	46.6	3.5	6.4	3.9	37.5	32.6
LnGrp LOS	D	A	A	A	D	C
Approach Vol, veh/h		1862	1439		165	
Approach Delay, s/veh		5.3	6.3		35.6	
Approach LOS		A	A		D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		59.8		10.6	8.2	51.6		
Change Period (Y+Rc), s		4.0		4.0	4.0	4.0		
Max Green Setting (Gmax), s		66.0		16.0	10.0	52.0		
Max Q Clear Time (g_c+I1), s		17.4		6.6	5.3	17.1		
Green Ext Time (p_c), s		38.4		0.3	0.1	29.3		

Intersection Summary			
HCM 2010 Ctrl Delay			7.2
HCM 2010 LOS			A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↑	↱	↰	↑	↱	↰	↑	↱
Volume (veh/h)	34	1689	32	51	1296	120	8	71	85	62	48	19
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	38	1877	36	57	1440	133	9	79	94	69	53	21
Adj No. of Lanes	1	2	1	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	50	2425	1085	73	2470	1105	222	237	201	195	237	201
Arrive On Green	0.03	0.69	0.69	0.04	0.70	0.70	0.13	0.13	0.13	0.13	0.13	0.13
Sat Flow, veh/h	1774	3539	1583	1774	3539	1583	1320	1863	1583	1207	1863	1583
Grp Volume(v), veh/h	38	1877	36	57	1440	133	9	79	94	69	53	21
Grp Sat Flow(s),veh/h/ln	1774	1770	1583	1774	1770	1583	1320	1863	1583	1207	1863	1583
Q Serve(g_s), s	1.7	29.1	0.6	2.6	16.9	2.3	0.5	3.2	4.5	4.5	2.1	1.0
Cycle Q Clear(g_c), s	1.7	29.1	0.6	2.6	16.9	2.3	2.6	3.2	4.5	7.7	2.1	1.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	50	2425	1085	73	2470	1105	222	237	201	195	237	201
V/C Ratio(X)	0.76	0.77	0.03	0.78	0.58	0.12	0.04	0.33	0.47	0.35	0.22	0.10
Avail Cap(c_a), veh/h	109	2425	1085	130	2470	1105	313	365	310	278	365	310
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	39.4	8.6	4.1	38.8	6.3	4.1	33.2	32.5	33.1	36.0	32.1	31.6
Incr Delay (d2), s/veh	20.4	2.5	0.1	16.6	1.0	0.2	0.1	0.8	1.7	1.1	0.5	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	14.7	0.3	1.6	8.5	1.0	0.2	1.7	2.1	1.6	1.1	0.4
LnGrp Delay(d),s/veh	59.8	11.1	4.2	55.5	7.3	4.3	33.3	33.3	34.8	37.1	32.5	31.8
LnGrp LOS	E	B	A	E	A	A	C	C	C	D	C	C
Approach Vol, veh/h		1951			1630			182			143	
Approach Delay, s/veh		11.9			8.7			34.1			34.6	
Approach LOS		B			A			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	7.3	60.0		14.4	6.3	61.0		14.4
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	6.0	56.0		16.0	5.0	57.0		16.0
Max Q Clear Time (g_c+I1), s	4.6	31.1		9.7	3.7	18.9		6.5
Green Ext Time (p_c), s	0.0	22.6		0.7	0.0	33.0		0.9

Intersection Summary	
HCM 2010 Ctrl Delay	12.5
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↑	↱	↰	↑	↱	↰	↱	
Volume (veh/h)	36	1717	94	18	1385	11	89	63	38	22	32	15
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1792	1652	1827	1900	1845	1696	1827	1792	1846	1900
Adj Flow Rate, veh/h	38	1789	98	19	1443	11	93	66	40	23	33	16
Adj No. of Lanes	1	2	1	1	2	1	1	1	1	1	1	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	4	4	6	15	4	0	3	12	4	6	0	0
Cap, veh/h	50	2449	1075	27	2409	1121	226	214	196	203	148	72
Arrive On Green	0.03	0.71	0.71	0.02	0.69	0.69	0.13	0.13	0.13	0.13	0.13	0.13
Sat Flow, veh/h	1740	3471	1524	1573	3471	1615	1337	1696	1553	1234	1175	570
Grp Volume(v), veh/h	38	1789	98	19	1443	11	93	66	40	23	0	49
Grp Sat Flow(s),veh/h/ln	1740	1736	1524	1573	1736	1615	1337	1696	1553	1234	0	1745
Q Serve(g_s), s	1.7	24.9	1.6	1.0	17.3	0.2	5.3	2.8	1.8	1.4	0.0	2.0
Cycle Q Clear(g_c), s	1.7	24.9	1.6	1.0	17.3	0.2	7.3	2.8	1.8	4.2	0.0	2.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.33
Lane Grp Cap(c), veh/h	50	2449	1075	27	2409	1121	226	214	196	203	0	220
V/C Ratio(X)	0.76	0.73	0.09	0.70	0.60	0.01	0.41	0.31	0.20	0.11	0.00	0.22
Avail Cap(c_a), veh/h	132	2449	1075	79	2409	1121	360	385	352	327	0	396
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	38.3	7.1	3.7	38.8	6.4	3.7	34.5	31.5	31.1	33.4	0.0	31.2
Incr Delay (d2), s/veh	21.1	2.0	0.2	27.8	1.1	0.0	1.2	0.8	0.5	0.2	0.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	12.3	0.7	0.6	8.4	0.1	2.0	1.4	0.8	0.5	0.0	1.0
LnGrp Delay(d),s/veh	59.4	9.1	3.8	66.6	7.5	3.8	35.7	32.3	31.6	33.7	0.0	31.7
LnGrp LOS	E	A	A	E	A	A	D	C	C	C		C
Approach Vol, veh/h		1925			1473			199			72	
Approach Delay, s/veh		9.8			8.2			33.8			32.3	
Approach LOS		A			A			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	5.4	60.0		14.0	6.3	59.1		14.0
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	4.0	56.0		18.0	6.0	54.0		18.0
Max Q Clear Time (g_c+I1), s	3.0	26.9		6.2	3.7	19.3		9.3
Green Ext Time (p_c), s	0.0	25.5		0.8	0.0	29.8		0.7

Intersection Summary	
HCM 2010 Ctrl Delay	10.9
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	70	1134	595	311	1115	335	279	34	179	110	207	20
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1792	1827	1810	1863	1863	1900	1863	1900	1871	1900
Adj Flow Rate, veh/h	70	1134	595	311	1115	335	279	34	179	110	207	20
Adj No. of Lanes	1	2	1	2	2	1	1	1	1	1	1	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	0	3	6	4	5	2	2	0	2	0	1	1
Cap, veh/h	90	1455	632	384	1646	758	360	639	533	466	566	55
Arrive On Green	0.05	0.42	0.42	0.11	0.48	0.48	0.34	0.34	0.34	0.34	0.34	0.34
Sat Flow, veh/h	1810	3505	1524	3375	3438	1583	1149	1900	1583	1187	1680	162
Grp Volume(v), veh/h	70	1134	595	311	1115	335	279	34	179	110	0	227
Grp Sat Flow(s),veh/h/ln	1810	1752	1524	1688	1719	1583	1149	1900	1583	1187	0	1843
Q Serve(g_s), s	3.4	24.9	33.4	8.0	22.3	12.5	21.6	1.1	7.5	6.1	0.0	8.3
Cycle Q Clear(g_c), s	3.4	24.9	33.4	8.0	22.3	12.5	29.9	1.1	7.5	7.2	0.0	8.3
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.09
Lane Grp Cap(c), veh/h	90	1455	632	384	1646	758	360	639	533	466	0	620
V/C Ratio(X)	0.77	0.78	0.94	0.81	0.68	0.44	0.77	0.05	0.34	0.24	0.00	0.37
Avail Cap(c_a), veh/h	122	1455	632	417	1646	758	360	639	533	466	0	620
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	41.8	22.5	25.0	38.6	17.9	15.4	33.7	20.0	22.1	22.4	0.0	22.4
Incr Delay (d2), s/veh	19.1	4.2	23.9	10.7	2.3	1.9	10.1	0.0	0.4	0.3	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.2	12.8	18.2	4.3	11.0	5.8	7.8	0.6	3.3	2.1	0.0	4.3
LnGrp Delay(d),s/veh	60.9	26.7	48.9	49.3	20.2	17.2	43.8	20.0	22.5	22.7	0.0	22.7
LnGrp LOS	E	C	D	D	C	B	D	C	C	C		C
Approach Vol, veh/h		1799			1761			492			337	
Approach Delay, s/veh		35.4			24.8			34.4			22.7	
Approach LOS		D			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	14.1	41.0		34.0	8.5	46.7		34.0
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	11.0	37.0		30.0	6.0	42.0		30.0
Max Q Clear Time (g_c+I1), s	10.0	35.4		10.3	5.4	24.3		31.9
Green Ext Time (p_c), s	0.1	1.6		3.7	0.0	15.8		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	30.0
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱		↰↑↱		↰	↑↑↱		↰	↑↑↱	
Volume (veh/h)	717	171	457	77	199	26	459	867	35	22	678	282
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	2451	1238	1863	1900	1842	1900	1845	1879	1900	1900	1842	1900
Adj Flow Rate, veh/h	717	171	457	77	199	26	459	867	35	22	678	282
Adj No. of Lanes	1	1	1	0	2	0	1	2	0	1	2	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	5	2	3	3	3	3	1	1	0	2	2
Cap, veh/h	778	412	527	105	286	39	295	1181	48	35	574	239
Arrive On Green	0.33	0.33	0.33	0.12	0.12	0.12	0.12	0.34	0.34	0.02	0.24	0.24
Sat Flow, veh/h	2334	1238	1583	874	2385	323	1757	3498	141	1810	2411	1003
Grp Volume(v), veh/h	717	171	457	158	0	144	459	442	460	22	492	468
Grp Sat Flow(s),veh/h/ln	2334	1238	1583	1798	0	1785	1757	1785	1854	1810	1749	1665
Q Serve(g_s), s	24.9	9.0	22.7	7.2	0.0	6.5	10.0	18.3	18.3	1.0	20.0	20.0
Cycle Q Clear(g_c), s	24.9	9.0	22.7	7.2	0.0	6.5	10.0	18.3	18.3	1.0	20.0	20.0
Prop In Lane	1.00		1.00	0.49		0.18	1.00		0.08	1.00		0.60
Lane Grp Cap(c), veh/h	778	412	527	215	0	214	295	603	626	35	416	396
V/C Ratio(X)	0.92	0.41	0.87	0.74	0.00	0.67	1.56	0.73	0.73	0.64	1.18	1.18
Avail Cap(c_a), veh/h	778	412	527	342	0	340	295	603	626	86	416	396
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	27.0	21.7	26.3	35.7	0.0	35.4	22.9	24.5	24.5	40.9	32.0	32.0
Incr Delay (d2), s/veh	18.1	3.1	17.2	4.8	0.0	3.6	267.1	4.6	4.5	17.7	104.0	104.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	19.8	3.4	12.4	3.9	0.0	3.4	23.9	9.7	10.1	0.7	21.6	20.7
LnGrp Delay(d),s/veh	45.1	24.7	43.5	40.6	0.0	39.1	289.9	29.1	29.0	58.7	136.0	136.9
LnGrp LOS	D	C	D	D		D	F	C	C	E	F	F
Approach Vol, veh/h		1345			302			1361			982	
Approach Delay, s/veh		42.0			39.8			117.0			134.7	
Approach LOS		D			D			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		32.0	14.0	24.0		14.1	5.6	32.4
Change Period (Y+Rc), s		4.0	4.0	4.0		4.0	4.0	4.0
Max Green Setting (Gmax), s		28.0	10.0	20.0		16.0	4.0	26.0
Max Q Clear Time (g_c+I1), s		26.9	12.0	22.0		9.2	3.0	20.3
Green Ext Time (p_c), s		0.7	0.0	0.0		0.9	0.0	4.5

Intersection Summary	
HCM 2010 Ctrl Delay	90.2
HCM 2010 LOS	F