
ENGINEERED TRAFFIC STUDY – Revision 1

To Meet Whatcom County Major Project Permit Application
Requirements

Gateway Pacific Terminal

Whatcom County, Washington

Prepared for:

Pacific International Terminals, Inc.

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September 2012

Project No. 0-915-15338-C.08

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PREFACE

Pacific International Terminals, Inc., proposes to develop the Gateway Pacific Terminal (the “Terminal”), a multimodal terminal for transfer of dry bulk commodities, at Cherry Point in Whatcom County, Washington. Construction and operation of the Terminal and associated facilities require the approval of local, state, and federal agencies. Agency decision makers are to be informed of the potential environmental impacts of the proposed project by preparation of an Environmental Impact Statement (EIS). The EIS will be prepared under guidelines of the National Environmental Policy Act and State Environmental Policy Act by a lead federal agency and lead state agency or agencies working in cooperation.

This report is one of several technical reports prepared on behalf of Pacific International Terminals, Inc., that provides scientific technical information about the existing conditions of the proposed project site, and in some cases, the projected effects of project operations. It is provided to the lead federal state and County agencies for their use in preparation of a Draft EIS.

Several of the technical reports have also been prepared to support specific project permit applications submitted to local, state, and federal agencies or as part of the consultation process with resource agencies and affected Indian nations. This *Engineered Traffic Study*, in particular, has been developed to comply with Whatcom County’s Major Project Permit submittal requirements (WCC 20.88.205(5)).

A detailed description of the proposed Terminal, including a complete list of proposed commodities and the phasing plan, is provided in the *Revised Project Information Document* (Pacific International Terminals, Inc., 2012).

Another report titled *BNSF Custer Spur Highway/Railway Grade Crossing Traffic Impact Study* (BNSF Railway Co, 2012) documents the rail and vehicle traffic along the Custer Spur.

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ENGINEER'S DECLARATION/CERTIFICATION

"I, Brad Loomis, a professional engineer registered in the state of Washington as a Civil Engineer, do hereby declare that the engineered traffic study titled Engineered Traffic Study, Gateway Pacific Terminal, and dated March 19, 2012, was prepared by, or under my personal supervision, and that said report was prepared generally consistent with the Institute of Transportation Engineers Guidelines for Traffic Studies. I hereby affirm that, to the best of my knowledge, information, and belief, the subject report was prepared in full compliance with Chapter 12.09 of the Whatcom County Code and in compliance with the Whatcom County development standards and all technical standards adopted thereunder; except as specifically set forth under "exceptions to Whatcom County standards."

ENGINEER'S SEAL

BRAD LOOMIS #44595
DATE SEPTEMBER 26, 2012

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ACRONYMS AND ABBREVIATIONS

CTR	Commute Trip Reduction
EIS	Environmental Impact Statement
HII	Heavy Impact Industrial
I-5	Interstate 5
LOS	Level of Service
Mtpa	metric tons per year
NEPA	National Environmental Policy Act
PHF	peak hour factor
SEPA	State Environmental Policy Act
SOV	single occupancy vehicle
SR	State Route
TDM	Traffic Demand Management
Terminal	Gateway Pacific Terminal
TIP	Transportation Improvement Program
UGA	Urban Growth Area
V/C	volume-to-capacity
VMT	vehicle miles traveled
WCC	Whatcom County Code
WCOG	Whatcom Council of Governments
WDNR	Washington Department of National Resources
WSDOT	Washington State Department of Transportation
WTA	Whatcom County Authority

1.0 INTRODUCTION AND DESCRIPTION

This report presents the results of a traffic analysis performed on behalf of Pacific International Terminals, Inc., for the proposed Gateway Pacific Terminal at Cherry Point in Whatcom County, Washington (Figure 1-1). Designed for export and import of dry bulk commodities, the proposed Gateway Pacific Terminal (Terminal) would include a deep-draft wharf with access trestle, dry bulk materials handling and storage facilities, and rail transportation access. The purpose of this report is to meet the submittal requirements of the Major Project Permit Application.

1.1 PROJECT OVERVIEW AND KEY FEATURES

Gateway Pacific Terminal would serve as a deep-water, multimodal terminal for the export and import of dry bulk commodities¹ between rail and oceangoing vessels. The proposed Terminal project area encompasses 1,200 acres. The proposed Terminal's infrastructure would be developed on approximately 334 acres within a total project area of approximately 1,200 acres (Figure 1-2). The project area is located in the Cherry Point Industrial Urban Growth Area (UGA), which is zoned for heavy-impact industrial land use. Under Whatcom County's Shoreline Management Program, the property is designated as part of the Cherry Point Management Area, where port and water-dependent industrial facilities are permitted.

The proposed Terminal would include the following key facilities:

- Wharf and trestle,
- Materials handling and storage, and
- Rail connection.

The Terminal would be developed to have the capacity to export and import up to 54 million metric tons per year (Mtpa) of dry bulk commodities. The main features of the proposed Terminal are shown in Figure 1-2.

Pacific International Terminals expects to construct the Terminal in two stages. The first stage is planned to commence in 2014 after completion of necessary environmental review under National Environmental Policy Act (NEPA) and State Environmental Policy Act (SEPA), and issuance of required federal, state, and local permits and authorizations. Pacific International Terminals currently anticipates that Stage 1 will be completed by 2016 and Stage 2 by 2018. Additional materials handling

¹ Dry bulk commodities include forest, agricultural, or mining products; are minimally processed, if at all; and are not bagged or wrapped. Dry bulk commodities are mainly transported as shiploads or trainloads, and handled using large-capacity containers or storage pads and dedicated transfer machinery generally incorporating conveyor systems. Dry bulk commodities include, for example, grain, iron ore, salts, coal, and alumina. Bulk commodities are the "raw material" upon which many industrial processes depend.

equipment would be added in subsequent years in response to operational needs. This schedule is an estimate and subject to change based on market demand and other economic factors.

A more detailed description of the proposed Terminal, including a complete list of proposed commodities and the phasing plan, is provided the *Gateway Pacific Terminal Revised Project Information Document* (Pacific International Terminals, 2012)

1.2 PROJECT LOCATION

The project area is located at Cherry Point, a small promontory of land on the eastern shore of the Strait of Georgia on the west coast of Washington State. The project area is located approximately 18 miles northwest of the City of Bellingham, 5 miles west of Ferndale, and 17 miles south of the US-Canada border (see Figure 1-1). Existing major industrial facilities in the Cherry Point Industrial UGA include the BP Cherry Point Refinery, the ConocoPhillips Ferndale Refinery, and the ALCOA-Intalco Works; industrial piers currently serve all three facilities.

1.3 PROJECT DEVELOPER AND PROPERTY OWNERSHIP

The Terminal would be built, owned, and operated by Pacific International Terminals, Inc., who is the project applicant for development of the Terminal. BNSF Railway will be the project applicant for improvements to Custer Spur that would occur only if the Terminal is built.

The upland portions of the Terminal would be built on 334 acres of an approximately 1,200-acre assemblage of private property. The wharf and the major length of the trestle would be located on state-owned tidelands that would be leased from the Washington Department of Natural Resources (WDNR). Pacific International Terminals will petition Whatcom County for vacation of specific County-owned rights-of-way within the project area. Adjacent landowners include BP, WDNR, ALCOA, BNSF Railway, and one other private property owner.

1.4 TRAFFIC ANALYSIS SCOPE AND PURPOSE

The purpose of this engineered traffic study was to meet the submittal requirements of the Major Project Permit application. It documents the existing roadway infrastructure and traffic conditions, identify potential effects of the Terminal on traffic congestion and safety, and provide recommendations for potential improvements that would be needed to address those effects. Traffic models were used to simulate existing traffic conditions and anticipated future traffic conditions at key intersections in the vicinity of the Terminal, both assuming no development and assuming development of the Terminal.

The models used data on existing traffic conditions from traffic counts at selected intersections, combined with anticipated future traffic due to assumed growth in the region and development of the

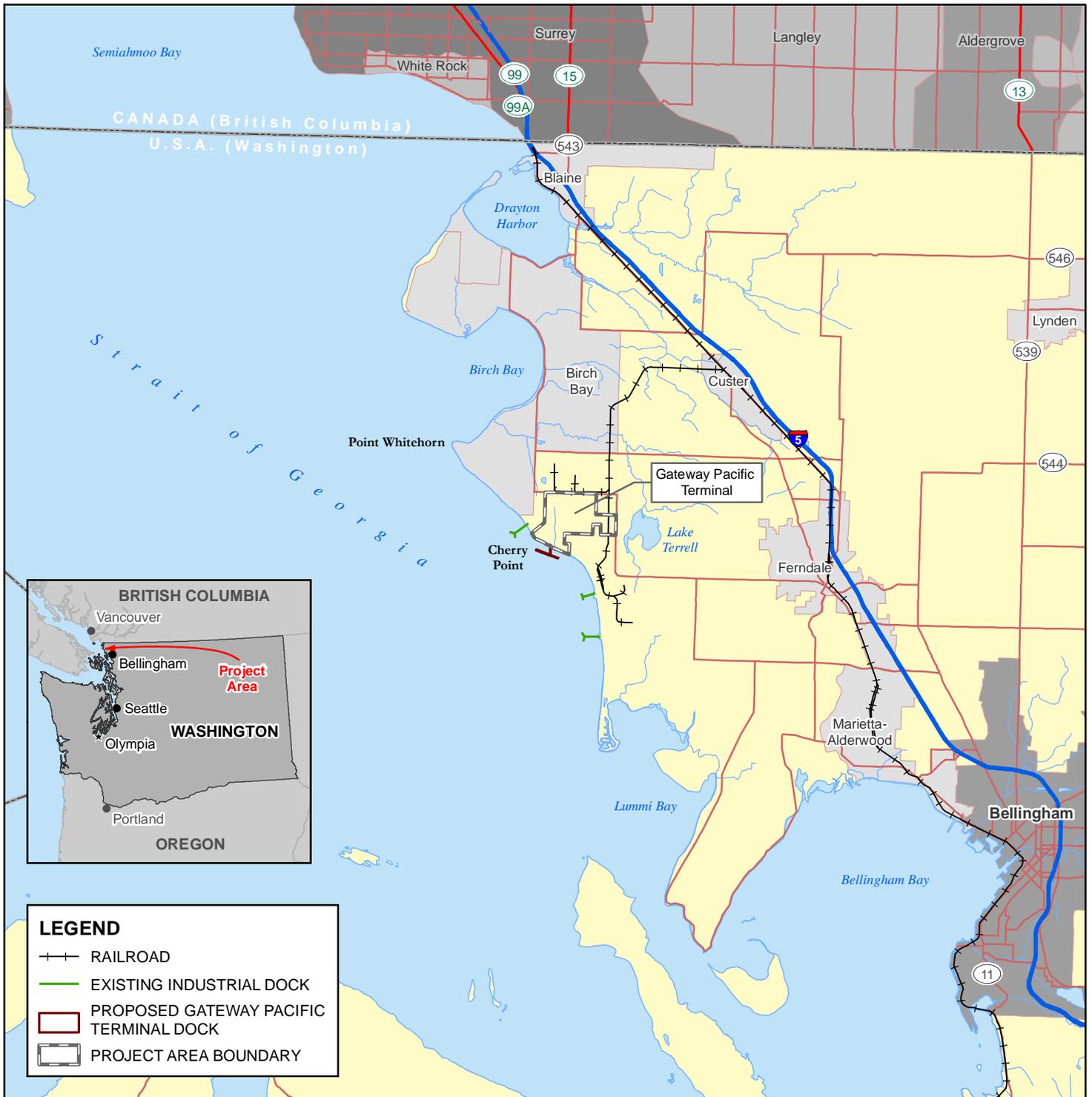
Terminal. The models simulated the number of peak hour vehicle trips that would be associated with development of the Terminal, and these data were used to assess impacts on traffic flow in the project vicinity.

1.5 PROJECT STUDY AREA

The traffic study area (“study area”) was defined in consultation with Whatcom County and includes roads and intersections in the vicinity of the Terminal that could experience increased traffic due to the Terminal, as identified by Whatcom County Public Works, Engineering Section (Whatcom County 2011b).

The study area is bounded by Interstate 5 (I-5) to the east; Birch Bay/Lynden Road to the north; Blaine Road, Kickerville Road, and Lake Terrell Road to the west; and Slater Road to the south. The boundaries of the study area and the locations of the 17 intersections included in the modeling analysis are shown in Figure 1-3.

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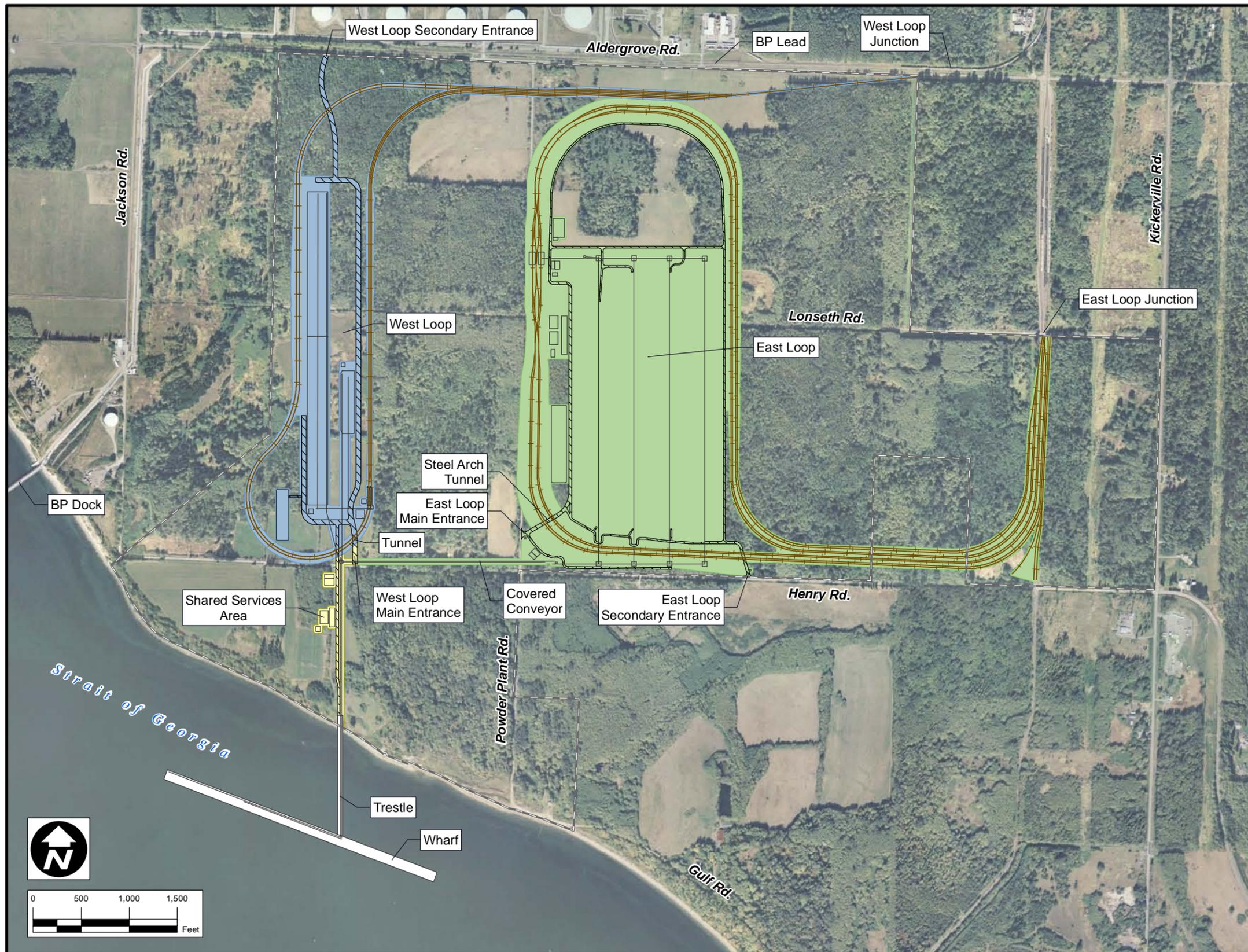
LEGEND

- +—+— RAILROAD
- EXISTING INDUSTRIAL DOCK
- ▭ PROPOSED GATEWAY PACIFIC TERMINAL DOCK
- ▭ PROJECT AREA BOUNDARY



				CLIENT: PACIFIC INTERNATIONAL TERMINALS, INC.	
PROJECT: PROPOSED GATEWAY PACIFIC TERMINAL		DWN BY: SD	DATUM: NAD83	DATE: FEBRUARY 2011	
TITLE: VICINITY MAP		CHK'D BY: TQ	REV. NO.: 1	PROJECT NO.: 091515338C-18-01	
		PROJECTION: WA SP North, Ft.	SCALE: 1 inch=3 miles	FIGURE No.: FIGURE 1-1	

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LEGEND

-  NEW RAILWAY TRACK
-  ROAD
-  EAST LOOP
-  WEST LOOP
-  SHARED SERVICES AREA
-  TRESTLE & WHARF
-  PROJECT AREA BOUNDARY

Source:
Ausenco Sandwell, 154199-A100-42S01.dwg (Rev. J), 12/24/2010.



CLIENT:
PACIFIC INTERNATIONAL TERMINALS, INC.

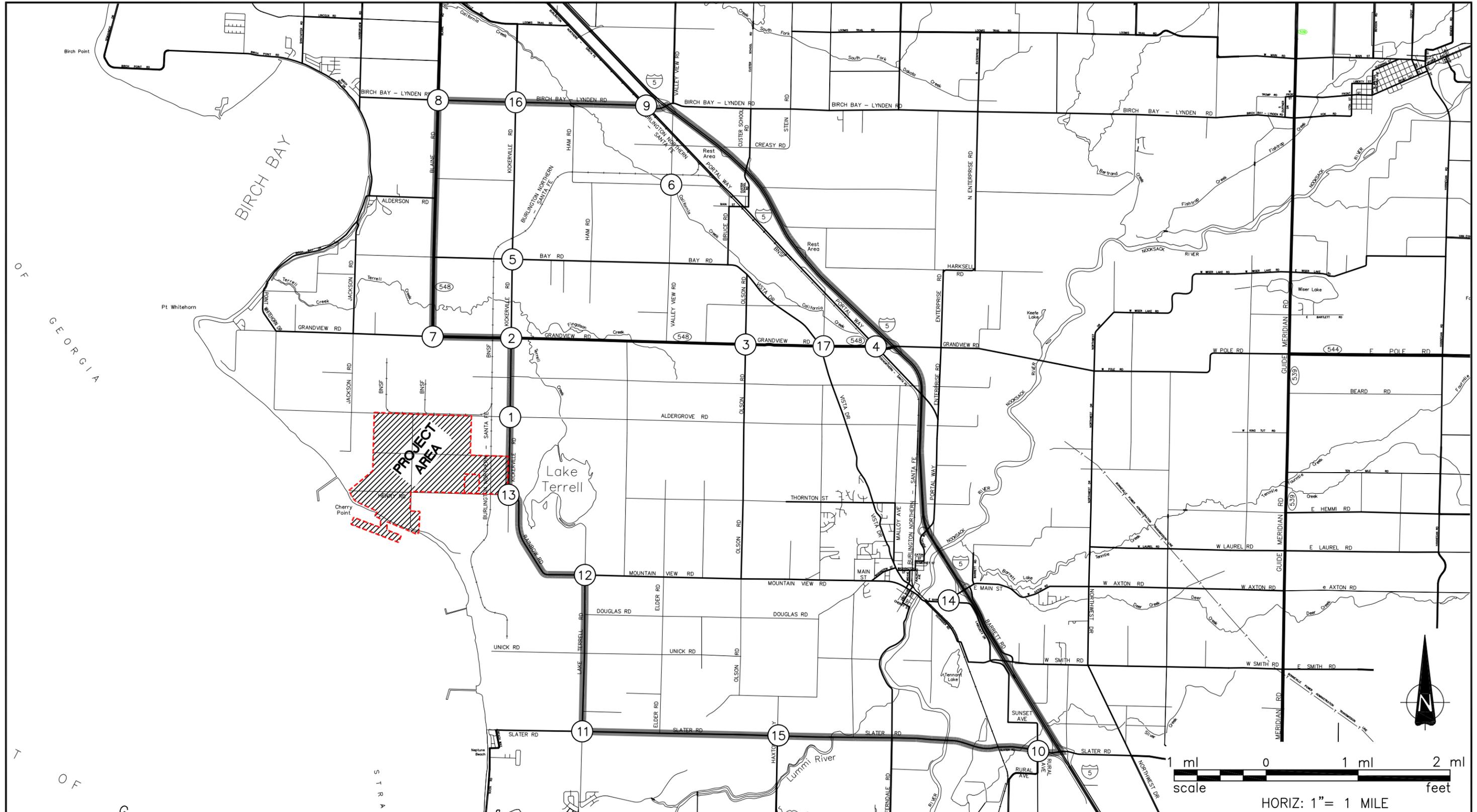
DWN BY: SD
CHK'D BY: KD
DATUM: NAD83
PROJECTION: WA SP North, Ft.
SCALE: 1 inch = 1,100 feet

PROJECT:
PROPOSED GATEWAY PACIFIC TERMINAL

TITLE:
PROPOSED PROJECT LAYOUT

DATE: FEBRUARY 2011
PROJECT NO.: 091515338C-18-01
REV. NO.: 1
FIGURE NO.: FIGURE 1-2

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LEGEND:	
	Study Area Boundary
	Analyzed Intersection

CLIENT LOGO

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CLIENT:
PACIFIC INTERNATIONAL TERMINAL, INC.

AMEC Environment & Infrastructure, Inc.
11810 North Creek Parkway N
Bothell, WA 98011

DWN BY: BMM / MJR
CHK'D BY: BPL
DATUM: -
PROJECTION: -
SCALE: AS SHOWN

PROJECT
PROPOSED GATEWAY PACIFIC TERMINAL

TITLE
BOUNDARY OF STUDY AREA

DATE: SEPTEMBER 2012
PROJECT NO: 5-91M-15338C-08-01
REV. NO.: -
FIGURE No. 1-3

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2.0 EXISTING SITE AND STUDY AREA CONDITIONS

This section describes existing traffic conditions in the project vicinity, beginning with land use and zoning in the study area, followed by existing transportation infrastructure and traffic patterns.

2.1 ZONING AND LAND USE

This section describes existing land uses near the proposed project, plans for future development of the project area as defined by Whatcom County's Comprehensive Plan and zoning code, and the relevance of these land uses to traffic conditions in the project vicinity.

The Terminal would be located in the Cherry Point Industrial Area on undeveloped land zoned for Heavy Impact Industrial (HII) use. Neighboring properties include the BP Cherry Point Refinery immediately north and west, WDNR school lands, and a large, privately held industrial parcel along the southern boundary. The Strait of Georgia forms part of the southern and southwestern boundary.

The BNSF Railway's Custer Spur lies in the easternmost portion of the project area and includes the Elliot Rail Yard. Utility corridors include a buried petroleum pipeline and a high-power electrical transmission line. Other industrial facilities in the vicinity include the ConocoPhillips Ferndale Refinery (approximately 2.5 miles southeast) and the ALCOA-Intalco Works (aluminum processing, approximately 1 mile southeast). Nearby land uses include the Lake Terrell State Wildlife Refuge to the east, and large-lot, single-family residences located approximately 1.5 miles to the east between the project area and the Wildlife Refuge.

Data on existing and future traffic volumes arising from each of these existing land uses have been incorporated into the modeling for this report.

2.1.1 Other Proposed Development

None of the existing land users in the vicinity has known expansion plans that would contribute to traffic volumes, and no other new development projects are known to be proposed in the area.

2.1.2 Whatcom County Comprehensive Plan

Whatcom County's Comprehensive Plan, first adopted in 1996 and last updated in January 2010 is intended to guide growth in unincorporated areas of Whatcom County for the next 20 years. Under Whatcom County's Comprehensive Plan (Whatcom County 2010), the Cherry Point zone is designated as an Urban Growth Area covering approximately 7,000 acres, including the project area.

The goals and policies of the Comprehensive Plan related to traffic that appear to be pertinent to the Gateway Pacific Terminal project, and statements of the Terminal’s consistency with these goals, are shown in Table 2–1.

Table 2–1 Pertinent Comprehensive Plan Goals and Policies

Section	Text	Statement of Consistency
Goal 2BB	Maintain Cherry Point as an unincorporated urban growth area based on its unique location and characteristics and its significant contribution to the overall industrial land supply and Whatcom County's tax base.	
Policy 2BB-10	RCW 36.70A.365 requires the implementation of Traffic Demand Management (TDM) programs for the designating of a Major Industrial UGA. Any employer in the Cherry Point UGA that employs 100 or more full-time employees at a single worksite who begin their regular workday between 6:00 AM and 9:00 AM on weekdays for at least 12 continuous months during the year are required to meet the TDM requirements of Whatcom County Code (WCC) 16.24.	Pacific International Terminals will work with Whatcom County to develop a TDM plan for the Terminal. Pacific International Terminals’ understanding is that guidelines for development of TDMs have not yet been developed.
Policy 6A-3	Establish the following level of service (LOS) for purposes of maintaining transportation concurrency: <ul style="list-style-type: none"> • A volume-to-capacity (V/C) ratio less than 0.75 during weekday afternoon peak hours for county arterials and collectors located outside of urban growth areas, except for specified primary routes as shown on Map 14A in the Comprehensive Plan, which shall have a V/C ratio less than or equal to 0.90 (LOS D). • A V/C ratio less than or equal to 0.90 (LOS D or better) during weekday afternoon peak hours for county arterials and collectors within urban growth areas not associated with cities, which may be reduced for concurrency evaluation purposes in accordance with Policy 6A-4. • A V/C ratio less than or equal to 0.9 during weekday afternoon peak hours (equivalent to LOS D) for county arterials and collectors within city urban growth areas, which may be reduced for concurrency evaluation purposes in accordance with Policy 6A-4. 	Based on the estimates of future traffic, the Terminal project does not cause any roadways in the study area to exceed the LOS levels. Some roadways currently operate, or will operate in the future, above the LOS levels even without the proposed development.
Policy 6A-6	Identify and mitigate safety and other impacts to transportation facilities caused by development during SEPA review, using standards adopted for intersections and other minimum standards established by WCC Development Standards.	It is anticipated that an Environmental Impact Statement will be developed for the Gateway Pacific Terminal, and that it will identify safety and other impacts to transportation facilities and will propose mitigation measures.
Goal 6P	Provide for safe, efficient movement of commercial vehicles in Whatcom County.	
Policy 6P-2	Consider proposals for an east/west rail freight corridor.	An east/west rail freight corridor is not being proposed.
Policy 6P-4	Support commercial and industrial development adjacent to existing transportation corridors, including I-5 and rail and air facilities, as long as such facilities do not reduce safe, efficient movement of vehicles in Whatcom County.	The Terminal would be located close to I-5 and adjacent to existing rail facilities, in an area designated for deep-water port development. Compliance with the County’s transportation policies and regulations will ensure that it would not reduce safe, efficient movement of vehicles in Whatcom County.
Goal 6Q	Support intermodal connections (i.e., truck/rail facilities) that promote use of air, water, and/or rail freight where feasible.	The Terminal would be a multimodal facility connecting (proposed) water to rail freight facilities.

Table 2-1 Pertinent Comprehensive Plan Goals and Policies

Section	Text	Statement of Consistency
Policy 6Q-1	Encourage the location and design of intermodal facilities for efficient freight transfer and access to the state and interstate highway, rail, and ferry systems.	The Terminal would be a multimodal facility connecting (proposed) water to rail freight facilities.
Policy 6Q-2	Support convenient access to ports, airports, other intermodal freight facilities, and international border crossings to enhance freight mobility.	The Terminal would be a multimodal facility connecting (proposed) water to rail freight facilities.
Goal 6R	Emphasize the importance of economically competitive and high quality inland transportation services; foster the preservation, development, and full implementation of freight rail; and plan intermodal linkage for long-distance movement of goods.	
Policy 6R-1	Support efficient movement and access of freight vehicles within and through the county.	The Terminal proposes efficient movement and access of freight vehicles within and through the county.

2.1.3 Zoning

The Whatcom County Comprehensive Plan designates the project area as part of the Major/Port Industrial UGA, and the project area is zoned for HII use in the County's zoning code. The existing industrial developments adjacent to the site are also zoned HII. The Cherry Point HII zone has special characteristics of regional and international significance for the siting of large industrial facilities, including deep water near the shoreline and ready access to rail transportation.

2.2 RAIL TRANSPORTATION

Both freight and passenger rail services are provided in the project study area. The Custer Spur (Cherry Point Line) rail line would provide rail service to the Terminal. The Custer Spur connects to the BNSF Railway Bellingham Subdivision main line at Portal Way, near Intersection 6 (see Figure 1-3), and serves the industrial properties in the Cherry Point Area. The Custer Spur currently provides freight cargo service. The Bellingham Subdivision main line serves both freight cargo and passenger trains.

2.2.1 At-Grade Rail Crossings

At-grade rail crossings occur in the study area along both the Custer Spur and the Bellingham Subdivision main line. Locations of at-grade rail crossings in the transportation study area near the project are shown in Figure 2-1. Intersections 1, 2, 5, 6, and 13 are the closest road intersections evaluated in this study to the Custer Spur at-grade crossings. The at-grade crossings near Intersections 1, 2, 5, 6 and 13 have active warning devices (signals with gates).

At-grade rail crossings along the Bellingham Subdivision main line occur within the study area near intersections 4, 9, and 10. The signalized controls at Intersection 4 are pre-empted by the rail line (the traffic signal is overridden when rail traffic is present). Intersection 9 is stop controlled. Intersection 10

is signalized, but the rail line is far enough from the intersection that there is no traffic signal pre-emption.

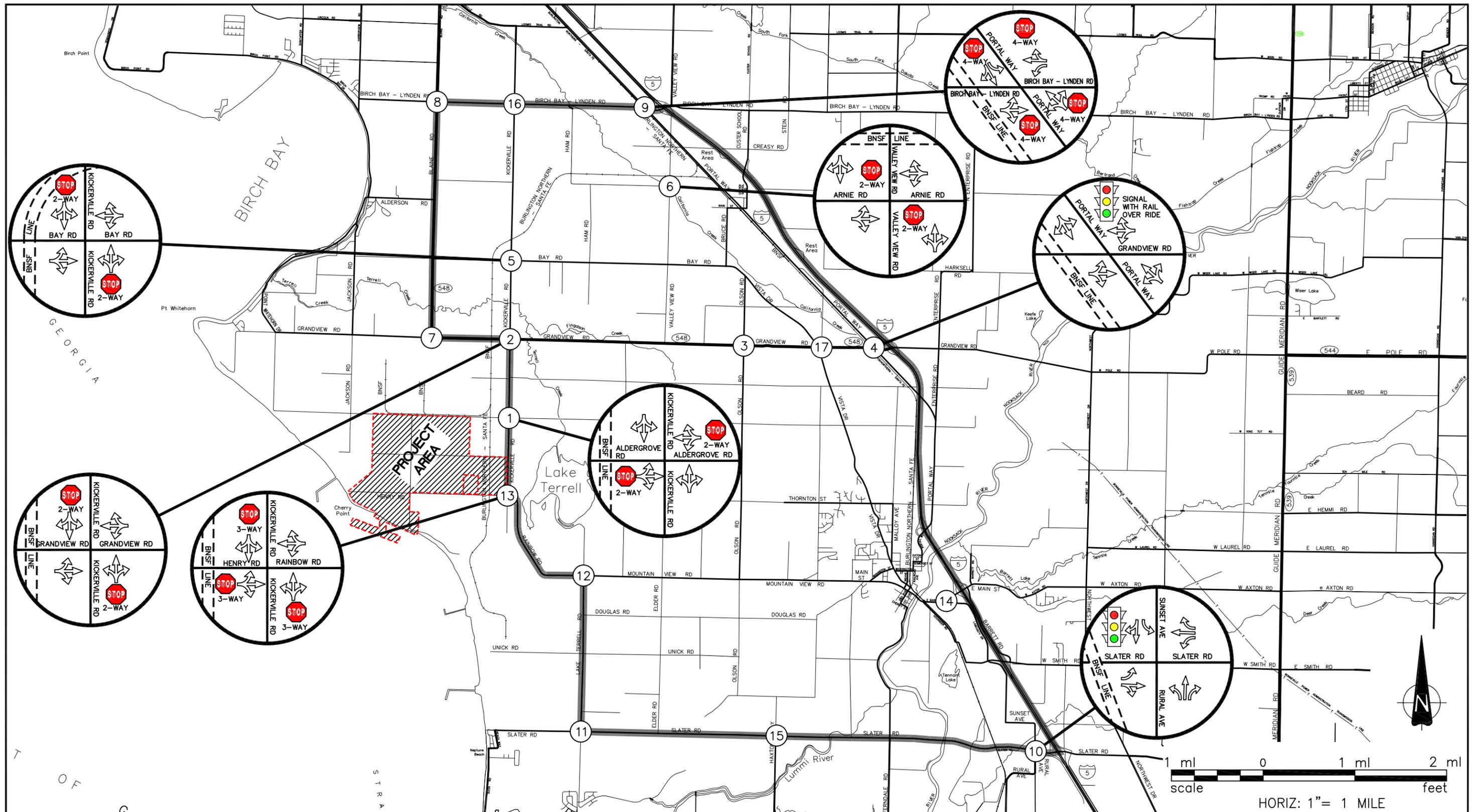
Detailed modeling of at-grade rail crossings and the impacts of rail traffic on vehicle traffic is available in the report *BNSF Custer Spur Highway/Railway Grade Crossing Traffic Impact Study* (BNSF Railway Co, 2012).

2.3 ROADWAY TRANSPORTATION NETWORK AND CONDITIONS

This section describes the existing road transportation network and traffic conditions in the study area. The intersections evaluated in this study were selected in cooperation with the Whatcom County Department of Public Works, Engineering Section.

Because traffic flow is generally limited by flow through intersections, this traffic analysis focused on intersections within the study area that would likely receive increased traffic volume as a result of Terminal development and operation. A total of 17 intersections were identified in the study area in consultation with and based on input from traffic engineers from the Whatcom County Department of Public Works (Whatcom County 2011b). These 17 intersections are shown in Figure 2-2. These intersections serve as throughpoints and access points to the road network in the area. Impacts to these traffic intersections could affect overall road and highway traffic conditions. The 17 intersections are:

- Intersection 1: Aldergrove Road and Kickerville Road
- Intersection 2: Grandview Road and Kickerville Road
- Intersection 3: Grandview Road and Olson Road
- Intersection 4: Grandview Road and Portal Way
- Intersection 5: Bay Road and Kickerville Road
- Intersection 6: Arnie Road and Valley View Road
- Intersection 7: Grandview Road and Blaine Road
- Intersection 8: Birch Bay-Lynden Road and Blaine Road
- Intersection 9: Birch Bay-Lynden Road and Portal Way
- Intersection 10: Slater Road and Sunset Avenue/Rural Avenue
- Intersection 11: Slater Road and Lake Terrell Road
- Intersection 12: Rainbow Road/Mountain View Road and Lake Terrell Road
- Intersection 13: Rainbow Road/Henry Road and Kickerville Road
- Intersection 14: Main Street/West Axton Road and Riverside Drive/Labounty Drive
- Intersection 15: Slater Road and Haxton Way
- Intersection 16: Birch Bay-Lynden Road and Kickerville Road
- Intersection 17: Grandview Road and Vista Drive



LEGEND:	
	Study Area Boundary
	Analyzed Intersection
	Existing Stop-Controlled Intersection
	Existing Signalized Intersection

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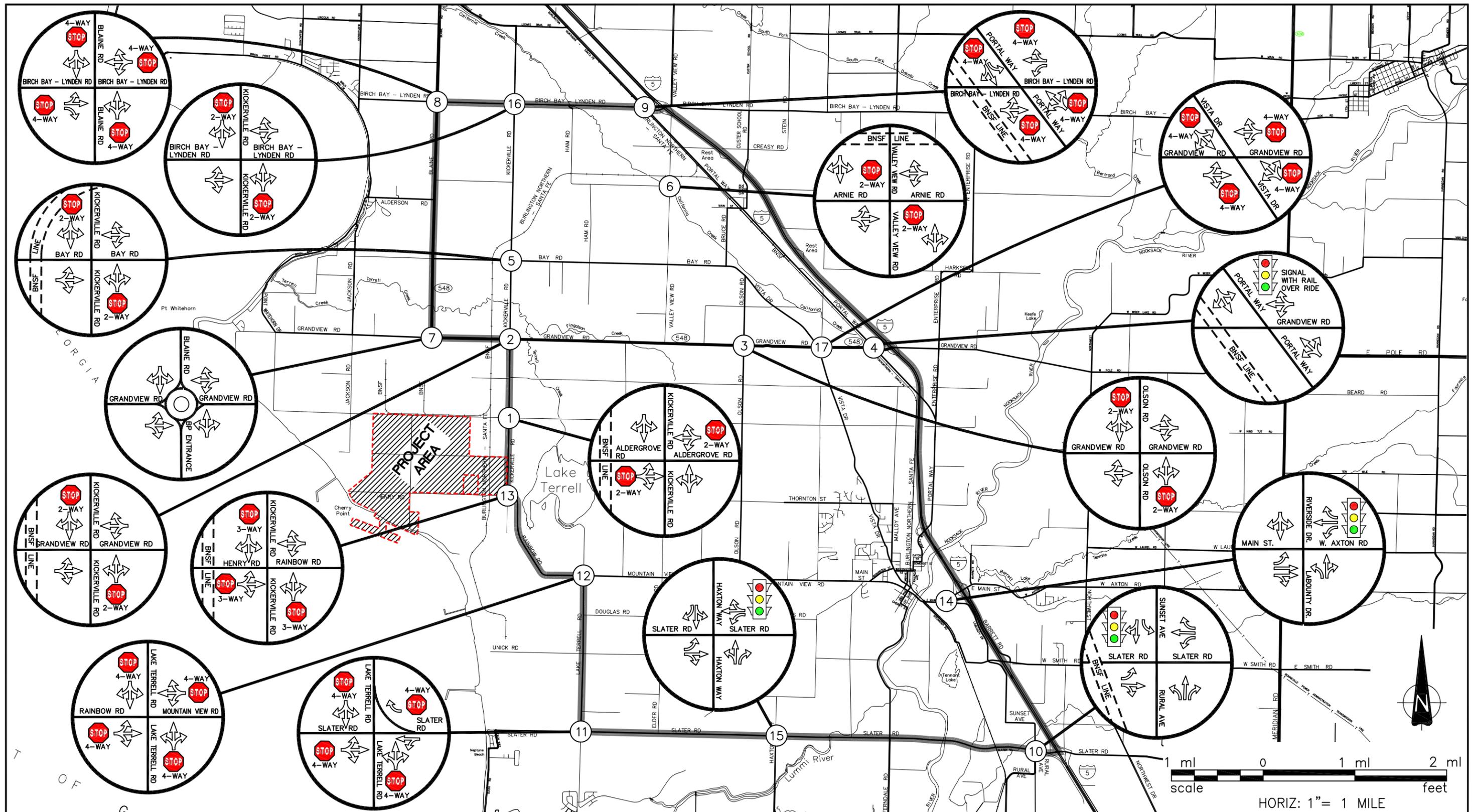
DWN BY: BMM / MJR
CHK'D BY: BPL
DATUM: -
PROJECTION: -
SCALE: AS SHOWN

PROJECT
PROPOSED GATEWAY PACIFIC TERMINAL

TITLE
AT-GRADE RAIL CROSSINGS

DATE: SEPTEMBER 2012
PROJECT NO: 5-91M-15338C-08-01
REV. NO.: -
FIGURE No. 2-1

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LEGEND:	
	Study Area Boundary
	Analyzed Intersection
	Existing Stop-Controlled Intersection
	Existing Signalized Intersection

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Bothell, WA 98011

DWN BY: BMM / MJR
CHK'D BY: BPL
DATUM:
PROJECTION:
SCALE: AS SHOWN

PROJECT
PROPOSED GATEWAY PACIFIC TERMINAL

TITLE
INTERSECTION GEOMETRY- INTERSECTIONS #1 TO #17

DATE: SEPTEMBER 2012
PROJECT NO: 5-91M-15338C-08-01
REV. NO.:
FIGURE No. 2-2

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The Whatcom County volume-to-capacity (V/C) ratio limit for each of these intersections is presented in Table 2–2.

Table 2–2 Volume/Capacity Ratio Limits

Intersection Number	Description	V/C Ratio Limit¹
1	Aldergrove Road and Kickerville Road	.75
2	Grandview Road and Kickerville Road	.75
3	Grandview Road and Olson Road	.75
4	Grandview Road and Portal Way	.75
5	Bay Road and Kickerville Road	.75
6	Arnie Road and Valley View Road	.75
7	Grandview Road and Blaine Road	.75
8	Birch Bay-Lynden Road and Blaine Road	.90
9	Birch Bay-Lynden Road and Portal Way	.90
10	Slater Road and Sunset Avenue/Rural Avenue	.90
11	Slater Road and Lake Terrell Road	.75
12	Rainbow Road/Mountain View Road and Lake Terrell Road	.75
13	Rainbow Road/Henry Road and Kickerville Road	.75
14	Main Street/West Axton Road and Riverside Drive/Labounty Drive	.75
15	Slater Road and Haxton Way	.75
16	Birch Bay-Lynden Road and Kickerville Road	.75
17	Grandview Road and Vista Drive	.75

1 Limit set by Whatcom County Comprehensive Plan (Whatcom County 2010), Map #14A—Level of Service Standards Volume/Capacity Ratio.

2.3.1 Traffic Signals and Controls

The geometry and traffic controls for the 17 intersections are shown in Figure 2-2. At most of the intersections, traffic is controlled through unsignalized methods (such as stop signs and yield signs). Four intersections near the I-5 corridor are signalized (Intersections 4, 10, 14, and 15).

2.3.2 Roadway Classifications and Pavement Widths

The roadway network in the project vicinity is predominantly rural. Most existing roadways have been constructed of bituminous asphalt material and are 24 feet wide or less. Whatcom County has established a hierarchy of streets based on four commonly accepted functional classifications:

- *Principal arterials* are streets that move large volumes of traffic between major traffic generators and destinations.
- *Minor arterials* are streets that move traffic from higher classification arterials to lesser arterials.

- *Collector arterials* are streets that move traffic from arterials to local access streets.
- *Local streets* move traffic from commercial, industrial, or residential areas to collector arterials.

The immediate project area is served by the following existing arterial roadways:

- **Aldergrove Road** is a two-lane local access road running east/west. The lane width is 11 feet and the pavement is in average condition based on a visual inspection. The road has little or no shoulders and a posted speed limit of 35 miles per hour in the project vicinity. A signalized, at-grade rail crossing exists west of the intersection with Kickerville Road.
- **Grandview Road (State Route [SR] 548)** is a two-lane principal arterial running east/west in the project vicinity between Cherry Point and I-5. The lane width varies between 11 and 12 feet and the pavement is in average condition, based on a visual inspection. The road has a combination of paved and gravel shoulders with a posted speed limit of 50 miles per hour in the project vicinity.
- **Henry Road** is a local street running east/west with lanes approximately 10 feet wide. The pavement is in average condition based on a visual inspection. The road does not have shoulders and has a posted speed limit of 35 miles per hour in the project vicinity. A signalized, at-grade rail crossing exists west of the intersection with Kickerville Road.
- **Kickerville Road** is a two-lane rural major collector running north/south with lane widths of 12 feet. The pavement condition is average based on a visual inspection. The road does not have shoulders and has a posted speed limit of 35 to 45 miles per hour in the project vicinity.
- **Mountain View Road** is a two-lane rural major collector running east/west connecting Cherry Point with the City of Ferndale. The lane width is 12 feet and the pavement is in average condition based on a visual inspection. The road does not have shoulders and has a posted speed limit of 35 to 50 miles per hour in the project vicinity.

2.3.3 Existing Traffic Type and Volumes

Traffic in the vicinity is generated primarily by industrial facilities and low-density residential areas, with industrial facilities generating the majority of traffic movements. The highest traffic volume that occurs during the day has the greatest influence on traffic flow. This maximum daily traffic volume typically occurs during morning and/or afternoon commuting times and is known as *peak hour traffic volume*. For the roads in the project vicinity, peak hour traffic volumes occur during shift changes of the major industrial employers near Cherry Point.

Traffic counts were conducted at the 17 intersections identified previously to characterize the existing traffic conditions in the transportation study area. Traffic volume at each intersection was recorded in

time increments of 15 minutes. Intersections with relatively low traffic volumes (Intersections 1, 3, 5, 6, 15, 16, and 17) were counted manually, while video recording systems were used to record traffic volumes at the intersections with relatively high traffic volumes (Intersections 2, 4, 7, 8, 9, 10, 11, 12, 13, and 14). Manual traffic counts or video recording for Intersections 1 through 15 were conducted on Tuesday, June 22, and Wednesday, June 23, 2010. Manual traffic counts for Intersections 16 and 17 were conducted on Thursday, March 20, 2011.

The *peak hour* (the hour during the day with the highest traffic volume) for each intersection is represented by the four consecutive 15-minute periods with the highest cumulative traffic volume for the intersection as a whole. Peak hour volumes for the 17 intersections are presented in Table 2–3. Results of the traffic counts show that the afternoon (PM) peak hour traffic volumes in the study area were higher than the morning (AM) peak hour volumes. The PM peak hour occurred between 4:15 PM and 5:15 PM at a majority of the intersections, though Table 2–3 shows the actual peak hour volume for each intersection, whenever it may fall.

2.3.4 Level of Service Standards and Existing Problems and Constraints

Existing traffic operating conditions in the study area were analyzed using Trafficware’s Synchro 7 traffic analysis software and the methodology specified in the *Highway Capacity Manual 2000* (Transportation Research Board 2000). Output from the traffic model for the existing conditions is presented in Appendix A.

Traffic operations are depicted as turning movement volumes, which indicate the number of vehicles turning right, turning left, or proceeding straight for all approaches at a given intersection. The peak hour turning movement volumes for existing conditions based on the traffic counts in Table 2–3 are shown for Intersections 1–12 in Figure 2-3 and for Intersections 13–17 in Figure 2-4.

To assess effects on traffic, traffic conditions are evaluated based on a measure of the *level of service* (LOS). LOS is a qualitative measure to describe operational traffic conditions, and the perception of these conditions by drivers or passengers. These conditions include factors such as speed, delay, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety. The LOS for a given intersection is indicated by letter designations that range from A to F, with LOS A representing the best operating conditions (free flow, little delay) and LOS F, the worst (congestion, long delays). Generally, LOS A and B are considered high levels of service, LOS C and D are considered moderate, and LOS E and F are considered low.

The Washington State Department of Transportation (WSDOT) has adopted LOS standards for highways of statewide significance (WSDOT 2010). The Regional Transportation Planning Organization, in consultation with WSDOT, has adopted levels of service for other state highways. For

state highways in Whatcom County, the standards are LOS D in urban areas and LOS C in rural areas. As stated earlier, Whatcom County also adopts LOS standards for roadways other than state highways. The County generally adopts standards of LOS D in urban areas and LOS C in rural areas. However, the County has adopted a standard of LOS D for some of the rural roads that function as primary routes connecting major activity centers, as designated in the regional *Whatcom Transportation Plan* (Whatcom Council of Governments 2007) to reflect higher peak hour volumes (Whatcom County 2010).

V/C ratio provides another measure of traffic conditions. The V/C ratio is simply traffic volume divided by the design capacity of the roadway. Whatcom County has established a standard to limit the V/C ratio to less than 0.75 during weekday PM peak hours for county arterials and collectors located outside of urban growth areas. The County identifies exceptions for specified primary routes. For these selected routes, the County standard is a V/C ratio of less than or equal to 0.90 (LOS D) (Whatcom County 2010).

Table 2–2 shows the Whatcom County standard for V/C ratio for the 17 intersections in the study area. Table 2–3 shows the PM peak hour LOS, average delay time, actual V/C ratio, and Whatcom County standard for V/C ratio for the 17 intersections. Most of the intersections in the study area generally conform to the Whatcom County standard for V/C ratio during peak traffic hours. Intersections 8 and 9 on the Birch Bay–Lynden Road corridor linking Lynden to I-5 do not meet the Whatcom County standard for westbound traffic during peak hours. In addition, Intersections 4 and 17 on Grandview Road near I-5 exceed the V/C standard slightly during the PM peak traffic hour.

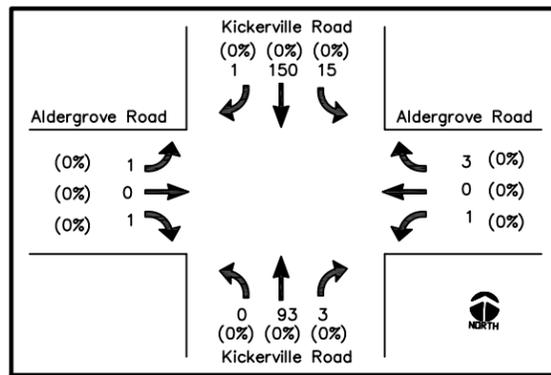
2.3.5 Traffic Safety

This section describes traffic safety, including accident history and sight distance analysis, for intersections in the study area.

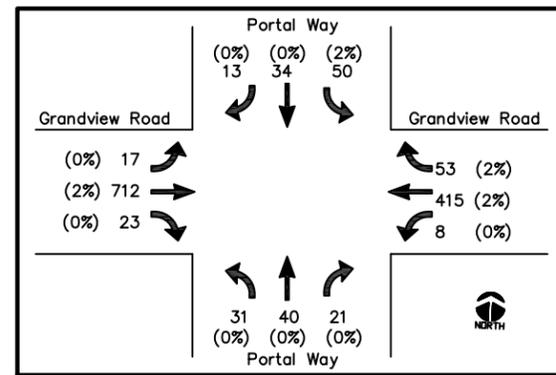
2.3.5.1 Accident History

Whatcom County and WSDOT accident data for the 17 intersections in the transportation study area are summarized in Table 2–4.

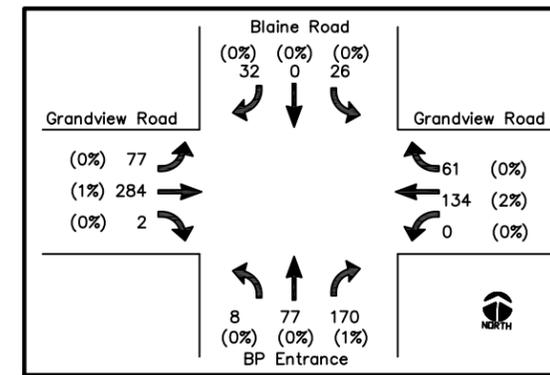
The existing collision rate for Whatcom County is 1.92 accidents per million vehicle miles travelled (WSDOT 2009). For rural principal arterials in the WSDOT Northwest Region, the collision rate is 0.95. As shown in Table 2–4, accident rates for all intersections in the study area (except Intersection 2) are below the average rate for the Northwest Region.



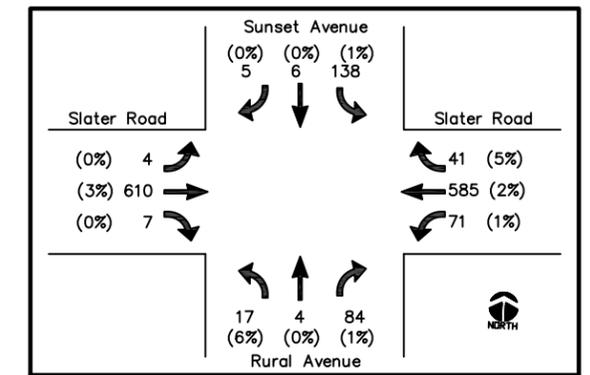
INTERSECTION NO. 1
ALDERGROVE ROAD AND
KICKERVILLE ROAD
N.T.S.



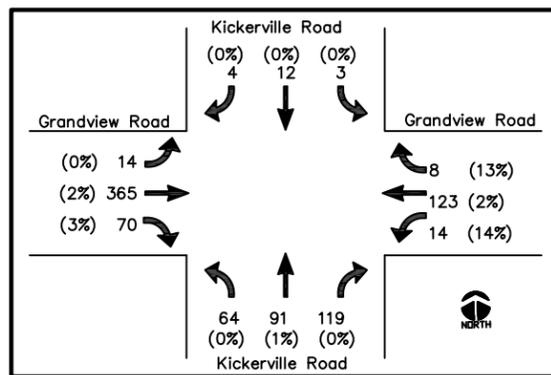
INTERSECTION NO. 4
GRANDVIEW ROAD AND PORTAL WAY
N.T.S.



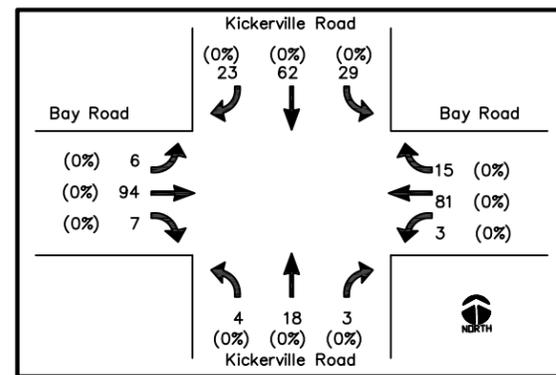
INTERSECTION NO. 7
GRANDVIEW ROAD AND BLAINE ROAD
N.T.S.



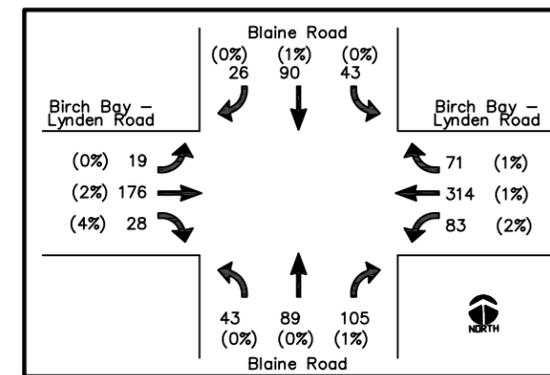
INTERSECTION NO. 10
SLATER ROAD AND SUNSET AVENUE / RURAL AVENUE
N.T.S.



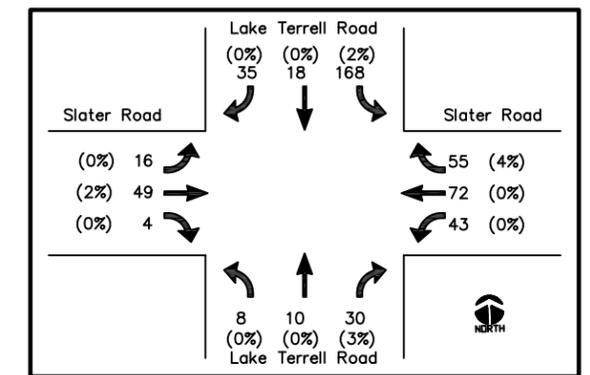
INTERSECTION NO. 2
GRANDVIEW ROAD AND
KICKERVILLE ROAD
N.T.S.



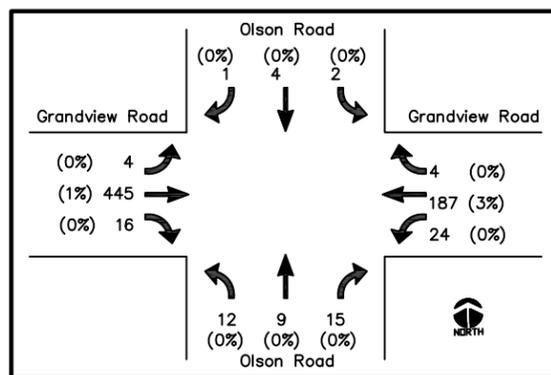
INTERSECTION NO. 5
BAY ROAD AND KICKERVILLE ROAD
N.T.S.



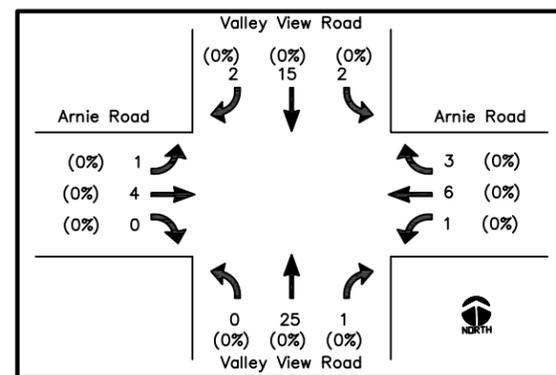
INTERSECTION NO. 8
BIRCH BAY - LYNDEN ROAD AND BLAINE ROAD
N.T.S.



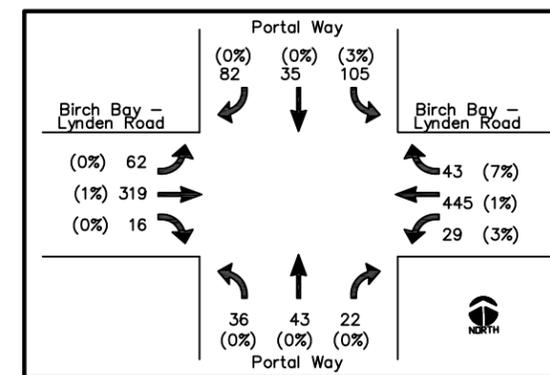
INTERSECTION NO. 11
SLATER ROAD AND LAKE TERRELL ROAD
N.T.S.



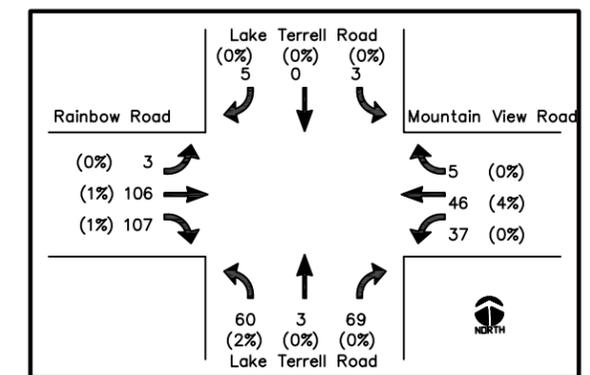
INTERSECTION NO. 3
GRANDVIEW ROAD AND OLSON ROAD
N.T.S.



INTERSECTION NO. 6
ARNIE ROAD AND VALLEY VIEW ROAD
N.T.S.



INTERSECTION NO. 9
BIRCH BAY - LYNDEN ROAD AND PORTAL WAY
N.T.S.



INTERSECTION NO. 12
RAINBOW ROAD / MOUNTAIN VIEW ROAD AND
LAKE TERRELL ROAD
N.T.S.

LEGEND:

- Directional Indicators
- X PM Peak Hour Traffic Count
- (X%) Percent of Heavy Vehicles



CLIENT:
PACIFIC INTERNATIONAL TERMINAL, INC.

AMEC Environment & Infrastructure, Inc.
11810 North Creek Parkway N
Bothell, WA 98011

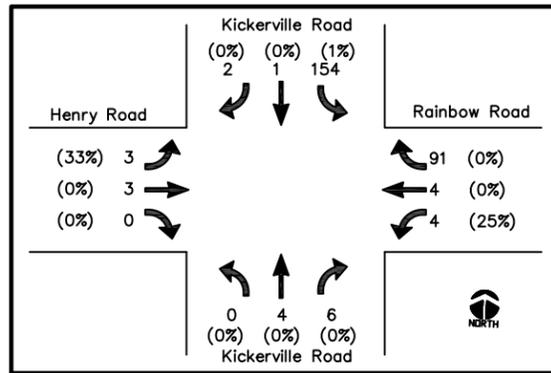
DWN BY: BMM / MJR
CHK'D BY: BPL
DATUM: -
PROJECTION: -
SCALE: AS SHOWN

PROJECT
PROPOSED GATEWAY PACIFIC TERMINAL

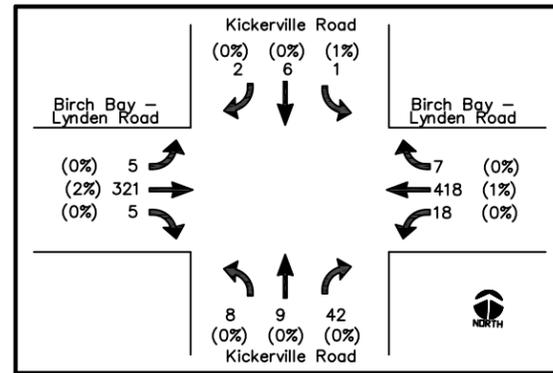
TITLE
**EXISTING VOLUMES 2010 (PM) PEAK HOUR
TURNING MOVEMENT VOLUMES
INTERSECTIONS #1 TO #12**

DATE: SEPTEMBER 2012
PROJECT NO: 5-91M-15338C-08-01
REV. NO.: -
FIGURE No. 2-3

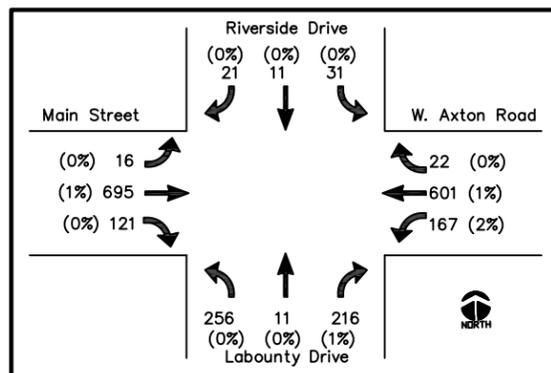
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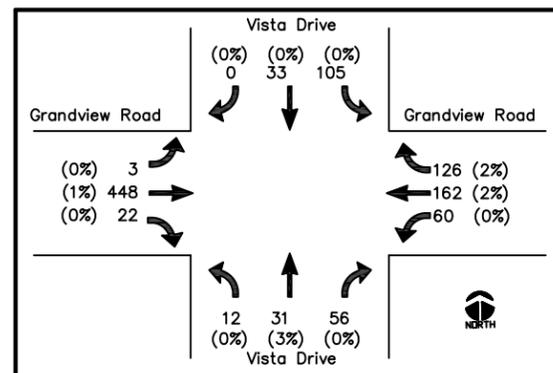
INTERSECTION NO. 13
RAINBOW ROAD / HENRY ROAD AND KICKERVILLE ROAD
N.T.S.



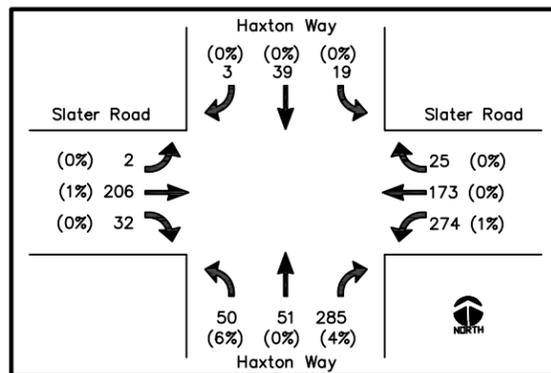
INTERSECTION NO. 16
BIRCH BAY - LYNDEN ROAD AND KICKERVILLE ROAD
N.T.S.



INTERSECTION NO. 14
MAIN STREET / W. AXTON ROAD AND
RIVERSIDE DRIVE / LABOUNTY DRIVE
N.T.S.



INTERSECTION NO. 17
VISTA DRIVE AND GRANDVIEW ROAD
N.T.S.



INTERSECTION NO. 15
SLATER ROAD AND HAXTON WAY
N.T.S.

LEGEND:

- Directional Indicators
- X PM Peak Hour Traffic Count
- (X%) Percent of Heavy Vehicles

CLIENT LOGO



CLIENT:

PACIFIC INTERNATIONAL TERMINAL, INC.

AMEC Environment & Infrastructure, Inc.

11810 North Creek Parkway N
Bothell, WA 98011

DWN BY:

BMM / MJR

CHK'D BY:

BPL

DATUM:

PROJECTION:

SCALE:

AS SHOWN

PROJECT

PROPOSED GATEWAY PACIFIC TERMINAL

TITLE

EXISTING VOLUMES 2010 (PM) PEAK HOUR
TURNING MOVEMENT VOLUMES
INTERSECTIONS #13 TO #17

DATE:

SEPTEMBER 2012

PROJECT NO:

5-91M-15338C-08-01

REV. NO.:

-

FIGURE No.

2-4

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2.3.5.2 Sight Distance

Public access to the Terminal will be gained via Henry Road from its intersection with Kickerville Road (Intersection 13). Some roadside brush adjacent to the southwestern corner of Intersection 13 limits sight distance for vehicles approaching the intersection from the west and south. Sight distance at the new access points will be considered during design of the terminal access roads and intersection controls.

2.3.6 Transit Service

The Whatcom Transportation Authority (WTA) provides transit service near the project area. The nearest transit service for the Terminal site is provided by WTA Route 55, which runs from Cordata Station in Bellingham to Blaine along Portal Way and Birch Bay-Lynden Road.

2.3.7 Pedestrian, Bicycle, and Equestrian Facilities

Few sidewalks or pedestrian crossings are located in the study area. Most roadways in the area consist of rural arterial streets, where pedestrian movements are not encouraged. Surrounding streets have no marked bicycle lanes, and few bicycle movements were observed during traffic studies in 2010 and 2011.

A concept plan for the Coast Millennium Trail is proposed to run to the south and west of the project site. The Terminal will work with Whatcom Council of Governments (WCOG) to incorporate the trail into the project area as appropriate. Pedestrian traffic generated from the Terminal is expected to be minimal.

No equestrian facilities were identified within 5 miles of the Terminal site and no equestrian units were noted during traffic counts.

Table 2-3 2010 PM Peak Hour Level of Service, Delay, and Volume/Capacity Ratio

Intersection Number	Description	Count Method	Count Date	Volume (PM Peak Hour)	LOS	Avg. Delay (sec.)	V/C Ratio Actual ¹	V/C Ratio Limit ²
1	Aldergrove Road and Kickerville Road	Manual	6/23/2010	268	A	0.7	.01	.75
2	Grandview Road and Kickerville Road	Video	6/23/2010	887	B	8.8	.65	.75
3	Grandview Road and Olson Road	Manual	6/23/2010	723	A	1.3	.10	.75
4	Grandview Road and Portal Way	Video	6/23/2010	1,307	B	15.7	<i>.75³ - EB</i>	.75
5	Bay Road and Kickerville Road	Manual	6/23/2010	345	A	4.6	.17	.75
6	Arnie Road and Valley View Road	Manual	6/23/2010	60	A	7.1	.03	.75
7	Grandview Road and Blaine Road	Video	6/23/2010	871	A	N/A ⁴	.35	.75
8	Birch Bay-Lynden Road and Blaine Road	Video	6/23/2010	1,087	C	22.0	<i>1.00³ - WB</i>	.90
9	Birch Bay-Lynden Road and Portal Way	Video	6/23/2010	1,237	E	38.8	<i>1.00³ - WB</i>	.90
10	Slater Road and Sunset Avenue/Rural Avenue	Video	6/23/2010	1,560	B	13.3	.71	.90
11	Slater Road and Lake Terrell Road	Video	6/23/2010	508	A	7.9	.37	.75
12	Rainbow Road/Mountain View Road and Lake Terrell Road	Video	6/23/2010	444	A	8.4	.28	.75
13	Rainbow Road/Henry Road and Kickerville Road	Video	6/23/2010	272	A	8.0	.21	.75
14	Main Street/West Axton Road and Riverside Drive/Labounty Drive	Video	6/23/2010	1,788	C	20.7	.72	.75
15	Slater Road and Haxton Way	Manual	6/23/2010	1,099	A	7.3	.54	.75
16	Birch Bay-Lynden Road and Kickerville Road	Manual	3/20/2011	842	A	1.5	.13	.75
17	Grandview Road and Vista Drive	Manual	3/20/2011	1,058	C	18.4	<i>.77³ - EB</i>	.75

- 1 EB = eastbound traffic; WB = westbound traffic. Values in *italics* exceed the Whatcom County V/C Ratio standard.
- 2 Limit set by Whatcom County Comprehensive Plan (Whatcom County 2010), Map #14A—Level of Service Standards Volume/Capacity Ratio.
- 3 V/C ratio of the indicated approach meets or exceeds the Whatcom County limit with existing traffic without the Terminal. Indicates approach direction that fails.
- 4 Intersection is a roundabout so delay is not calculated in the model.

Table 2-4 Collision Rate and Frequency – January 1, 2007 to December 31, 2010

Intersection Number	Description	4-Year Total	Collision Frequency ¹	ADT ²	Rate (per MVM) ³
1	Aldergrove Road and Kickerville Road	1	0.26	2,680	0.26
2	Grandview Road and Kickerville Road	12	1.25	8,870	1.24
3	Grandview Road and Olson Road	5	0.47	7,230	0.47
4	Grandview Road and Portal Way	10	0.48	14,170	0.48
5	Bay Road and Kickerville Road	4	0.79	3,450	0.79
6	Arnie Road and Valley View Road	0	0.00	600	N/A
7	Grandview Road and Blaine Road	1	0.08	8,710	0.31
8	Birch Bay-Lynden Road and Blaine Road	4	0.25	10,870	0.25
9	Birch Bay-Lynden Road and Portal Way	6	0.33	12,370	0.33
10	Slater Road and Sunset Avenue/Rural Avenue ⁴	-	-	15,720	-
11	Slater Road and Lake Terrell Road	1	0.13	5,080	0.13
12	Rainbow Road/Mountain View Road and Lake Terrell Road	1*	0.15	4,440	0.15
13	Rainbow Road/Henry Road and Kickerville Road	1	0.25	2,720	0.25
14	Main Street/West Axton Road and Riverside Drive/Labounty Drive ⁴	-	-	21,680	-
15	Slater Road and Haxton Way	9	0.53	11,590	0.53
16	Birch Bay-Lynden Road and Kickerville Road ⁵	-	-	8,420	-
17	Grandview Road and Vista Drive ⁵	-	-	10,580	-

1. Collision frequency is expressed per million entering vehicles.

2. ADT = Average daily trips. Estimated from peak hour volumes using a "k value" of 0.10 for rural/urban mixed area.

3. MVM = number of accidents per millions of vehicle entering intersection, given as:
 $\text{Collision Frequency} / [(\text{ADT} \times 365) / 1 \text{ Million}]$.

4. Collision data requested from the City of Ferndale were not available at the time of publication.

5. Collision data were not available

* Fatal collision.

2.3.8 Parking

The proposed Terminal would be located in a rural area, with limited parking demand except for developed facilities. No formal parking facilities currently exist at the project site, but ample parking capacity would be added as part of the Terminal development. Based on the estimated employee numbers, peak parking demand in 2026 is estimated at 160 parking stalls. Ample parking facilities would be provided within the Terminal property to accommodate peak demand surrounding shift changes.

2.3.9 Area Roadway Pavement Conditions

A visual inspection of area roadways showed that the pavements were generally in average to good condition. A detailed pavement inspection was not completed as part of the traffic study.

3.0 PROPOSED IMPROVEMENTS

This section presents a detailed description of proposed improvements needed to construct and operate the Terminal. The layout and main features of the Terminal are shown in Figure 1-2.

3.1 COUNTY 6-YEAR TRANSPORTATION IMPROVEMENT PROGRAM ELEMENTS RELATIVE TO PROJECT

The 2011 Whatcom County Transportation Improvement Program (TIP) (Whatcom Council of Governments 2010) was reviewed to determine if other proposed projects were relevant to the Terminal project. A TIP project to signalize Intersection 9 (Birch Bay – Lynden Road and Portal Way) is compatible with the proposed project. Based on the TIP, it is anticipated that the Whatcom County signalization project will be in place before Stage 1 of the Terminal is completed. Based on this information, it is appropriate to model Intersection 9 as a signalized intersection for the future condition analysis (Section 4).

3.2 ACCESS ROADWAYS

New paved access roads would be constructed to connect the Terminal's East and West Loops to Henry Road. These would be considered the main entrances to the Terminal's East and West Loops. Other roads would be constructed within the rail loops, including roads along the rail tracks and roads to provide access to the commodity storage areas, shared services area, and other facilities. Approximately 7 miles of roads would be built within the Terminal. The new roads would all be paved. All roadways would be 18 feet wide with 4-foot shoulders on both sides.

Near the main entrance, a steel-arch tunnel conveying the access road beneath the embankment of the access rail bed would be provided to allow unobstructed access to the East Loop at all times, including when the rail lines are in use. The structure would have a span of 28 feet, an interior height of 17 feet, and a length of 50 feet from headwall to headwall. To serve as a secondary access point, an at-grade crossing connecting to Henry Road would be located at the southeast corner of the East Loop. This access point would be blocked approximately 50 percent of the time at full build out due to the presence of trains.

A concrete box tunnel would be constructed near the main entrance at Henry Road to convey the access road beneath the rail bed embankment, allowing unobstructed access to the West Loop at all times, including when the rail lines are in use. The structure would have a span of 15 feet, an interior height of 20 feet, and a length of 100 feet from headwall to headwall. To serve as a secondary access point, an at-grade crossing connecting to Aldergrove Road would be located at the northern extent of the West Loop. When the Terminal is in full operation, this secondary access point would be blocked approximately 20 to 30 percent of the time due to the presence of trains.

3.3 RAIL ACCESS

The BNSF Railway would provide the main inland freight access via BNSF Railway's existing rail network. Specifically, the BNSF Railway's existing Bellingham Subdivision main line runs approximately north-south, roughly parallel to I-5, in the project vicinity. This main line feeds the Custer Spur (Cherry Point Subdivision Main Line), the only existing rail line serving the Cherry Point Industrial UGA. The Custer Spur branches west from the Bellingham Subdivision main line at Custer, then travels west, and then south. The Custer Spur then terminates at milepost 8.9 in the Cherry Point rail yard near the ConocoPhillips Refinery, the southernmost industrial facility in the HII zone.

Improvements to approximately 6 miles of the Custer Spur are necessary to accommodate the number, length, and weight of trains estimated to access the Terminal. BNSF Railway would be the permitting applicant for any needed permits and approvals to complete improvements on the Custer Rail Spur and associated facilities. Initially 7,000-foot-long trains are expected, and ultimately longer trains up to 8,500 feet long may eventually service the Terminal. To support the expected tonnages of bulk commodities to be handled at the Terminal, the following improvements would be made to the Custer Spur:

- Up to three receiving and departure tracks (called "R&D" tracks) would be developed on the south side of the BNSF Railway's Custer Spur line starting from the Custer Wye through the Intalco Yard, past Valley View Road, and to Ham Road. Each R&D track would be long enough to provide a holding area for trains up to 8,500 feet long to avoid blockage of at-grade public crossings or blocking of the BNSF Railway's main lines. Construction of the R&D tracks would include a new railbed, trackage, bridge, and drainage structures. The at-grade crossing of Valley View Road would need to be closed to accomplish this development.
- The Custer Spur's rails would be upgraded from the existing jointed light-rail sections to 141-pound, continuous-welded rail. This upgrade is needed to accommodate the expected tonnage of transported commodities and to manage efficiently the required maintenance demands resulting from increased numbers of trains while maintaining current service levels. This rail upgrade would also include any required rehabilitation of the existing rail ties and other existing railbed structural improvements.
- A second track would be added along the length of the Custer Spur from the Custer Wye approximately 6 miles to the new proposed Terminal connection points. The Custer Spur currently serves several existing industries by way of a single track. A second track would protect existing rail service and switching capabilities for all customers along the line and would efficiently accommodate increased rail traffic to and from the Terminal.

- A new terminal lead to connect existing tracks to the proposed Terminal would be installed, and improvements would be made to BNSF Railway's existing Elliot Yard to support the additional rail connectivity.

As a result of the improvements to the Custer Spur and the Intalco Yard, BNSF Railway is proposing to close Valley View Road at the Intalco Yard. The impacts of this road closure on the Terminal project are not expected to be significant because current and future average daily trips are low along this portion of Valley View Road. The BNSF will complete an analysis of the impacts of this proposed change on street traffic and report separately from this report. In addition to the Valley View analysis, detailed modeling of at-grade rail crossings and the impacts of rail traffic on vehicle traffic is being completed by BNSF Railway as part of their permitting documents for the Custer Spur upgrade project.

3.4 PLANNED TERMINAL CONSTRUCTION STAGING

Large infrastructure involves large capital expenditures and large-scale construction activities. To spread the capital expenditures over time and reduce potential environmental effects associated with the large-scale construction, the Terminal would be constructed in two stages. During Stage 1 construction, the East Loop and other infrastructure required for opening the Terminal would be developed, including the trestle and wharf, while the West Loop area would be completed during Stage 2.

3.5 EMPLOYMENT

Operating hours for the Terminal are anticipated to be 24 hours a day, 365 days a year. When fully developed the Terminal is expected to employ 213 people. Table 3–1 shows the anticipated numbers of Terminal shift workers by shift for each operational phase.

Table 3–1 Estimated Number of Terminal Employees by Shift for Each Operational Phase

Phase	Approximate Year (estimated)	Operational Capacity (Mtpa)	Number of Terminal Employees by Shift			
			7 AM–4 PM	3 PM–12 AM	11 PM–8 AM	Total
1	2016	25	39	26	24	89
2	2018	31	67	48	45	160
3	2021	45	83	61	57	201
4	2026	54	88	65	60	213

Note: The timing of implementation of the phases is subject to change based on market demand and other factors.

3.6 MAJOR AND MINOR CIRCULATION ELEMENTS

The terminal parking lot will be designed to accommodate circulation of employee vehicles during shift changes. Commercial, delivery, and repair vehicles will have adequate space to park and conduct their business. Because the major source of traffic generated from the development would be employee traffic, no significant circulation issue was identified, as there are few non-employees visiting the terminal.

4.0 TRAFFIC PROJECTIONS AND DESIGN YEAR ANALYSIS

This section provides results of traffic modeling used to assess potential effects of the Terminal on traffic conditions.

4.1 LEVEL OF ANALYSIS AND METHODOLOGY

Traffic modeling was performed using Trafficware's Synchro 7 traffic analysis software to assess impacts on afternoon peak hour traffic at 17 key intersections in the study area. The methodology was developed in consultation with the Whatcom County Department of Public Works (Whatcom County 2011b). Modeling was based on the traffic counts conducted to assess current traffic conditions, as described in Section 2.3.3. These counts of existing traffic at each of the 17 key intersections were then used to simulate future traffic volumes.

Separate simulations were developed under future conditions assuming that the Terminal is constructed, and assuming that it is not constructed. This approach allows evaluation of the effects of the Terminal on future traffic conditions. Future conditions with the Terminal were based on operations at the completion of Phase 4, when the Terminal reaches its maximum capacity and maximum number of employees, as this represents the greatest potential effect of the Terminal on traffic conditions. Effects during other operational phases would be less.

Modeling of future conditions was conducted using an estimated overall annual growth rate of 2 percent in future traffic volume. As approved by Whatcom County, the analysis was limited to afternoon peak hour traffic volumes, because impacts during this period represent the worst-case effect on traffic. The peak hour traffic volume is the four consecutive 15-minute periods with the highest cumulative traffic volume. The existing peak hour traffic volumes are shown in Table 2–3. The peak traffic hour for most of the intersections occurs between 4:15 PM and 5:15 PM, although Table 2–3 shows the peak hour volume for each intersection, whenever it may fall.

Future peak hour volume was simulated with the model based on the following assumptions:

- For intersections with signals, the signal timing and phasing were estimated from the available video counts.
- A default peak hour factor (PHF) (a measure of fluctuation in traffic volume within the peak traffic hour) of 0.92 was used.
- The percentages of heavy vehicles observed during the traffic counts at each intersection were used for each turning movement.

- Employee trip generation rates are based on the actual number of employees anticipated to be employed at the Terminal.
- The Terminal would produce no increase in the volume of trucks or heavy vehicles as all cargo will use rail facilities.
- Traffic volume in the vicinity is assumed to grow at an annual rate of 2 percent.

4.2 ROADWAY TRANSPORTATION DURING CONSTRUCTION

Traffic volumes attributed to project construction would be temporary and would include construction worker vehicles and construction vehicles typically associated with construction of a Terminal. These impacts would be short term, occurring only during terminal construction. Construction would occur in two stages.

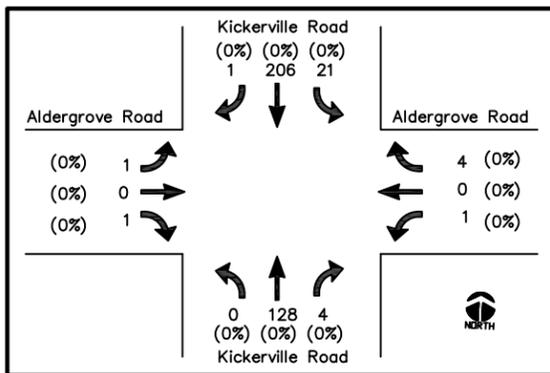
Pacific International Terminals will work with Whatcom County and WSDOT during the permitting process to identify and minimize impacts to existing traffic patterns, including potential roadway closures or lane reductions. Any access interruptions to occupied parcels during construction would be coordinated with the affected businesses or homeowners to minimize impacts. Due to the rural location of the development, lane closures and access interruptions are not expected.

4.3 TRIP GENERATION

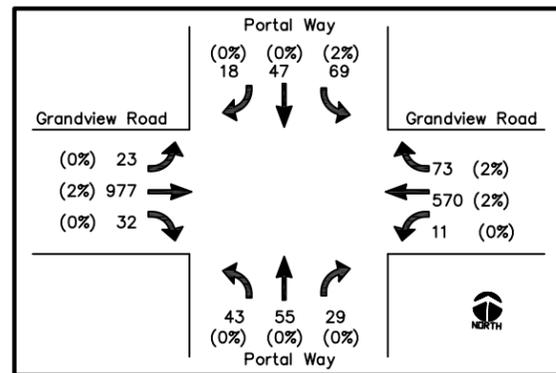
This section describes the number of future vehicle trips anticipated in the vicinity of the Terminal. Changes in vehicle traffic include changes in traffic volume due to general population growth and economic growth in the area, as well as new vehicle trips generated specifically due to development of the Terminal.

4.3.1 Background Growth

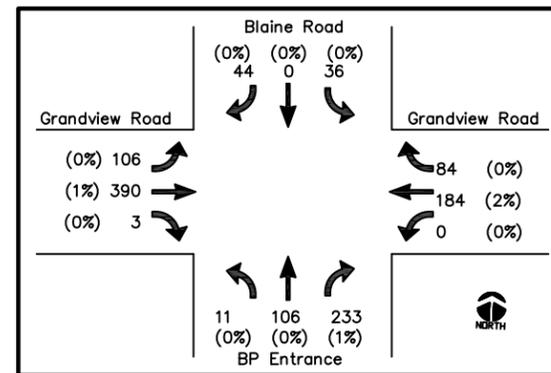
Existing PM peak hour traffic counts were assumed to increase by an annual rate of 2 percent per year to estimate future year 2026 traffic volumes without development of the Terminal. Figure 4-1 and Figure 4-2 show the simulated turning movement volumes for the year 2026 without the effects of trips generated by the Terminal.



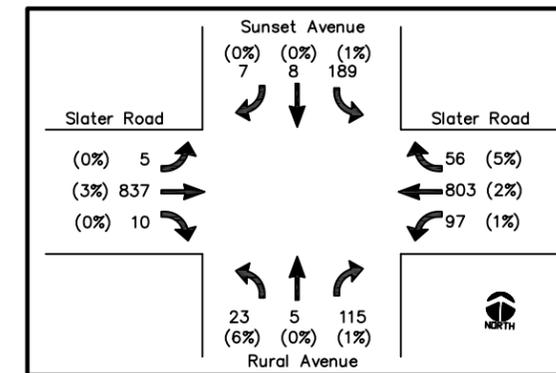
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ALDERGROVE ROAD AND
KICKERVILLE ROAD
N.T.S.



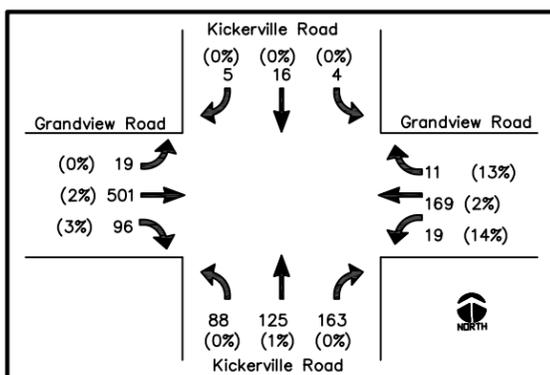
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GRANDVIEW ROAD AND PORTAL WAY
N.T.S.



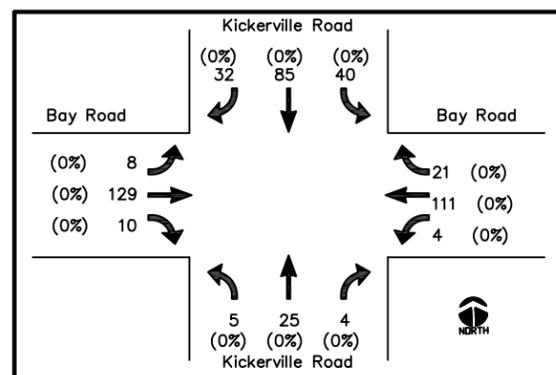
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GRANDVIEW ROAD AND BLAINE ROAD
N.T.S.



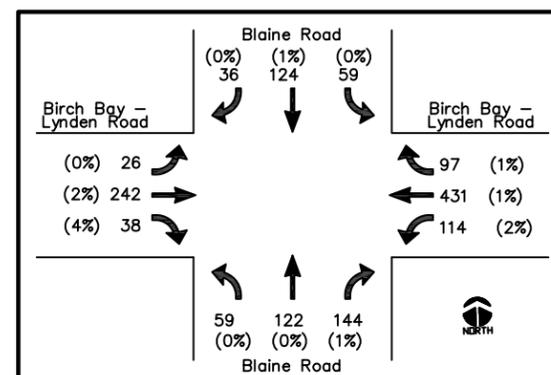
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SLATER ROAD AND SUNSET AVENUE / RURAL AVENUE
N.T.S.



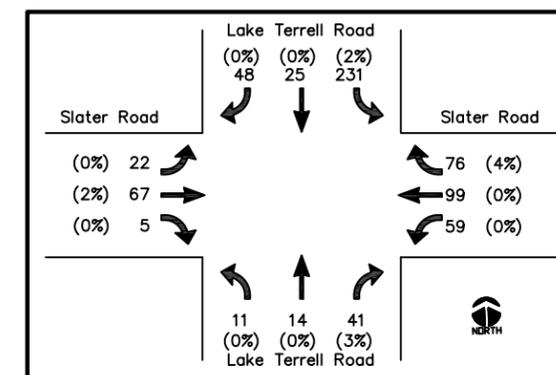
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N.T.S.



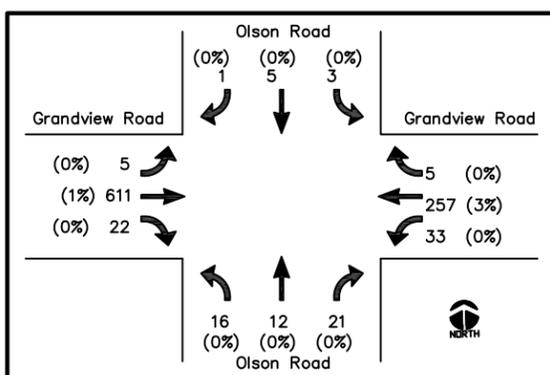
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BAY ROAD AND KICKERVILLE ROAD
N.T.S.



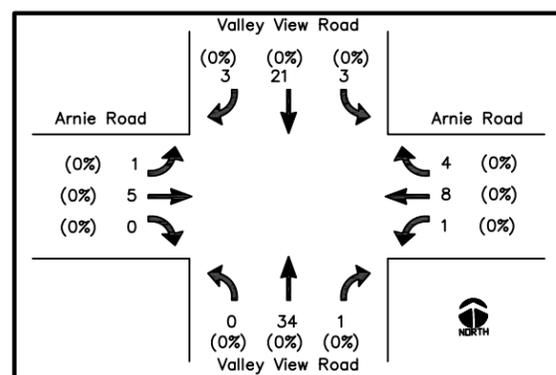
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BIRCH BAY - LYNDEN ROAD AND BLAINE ROAD
N.T.S.



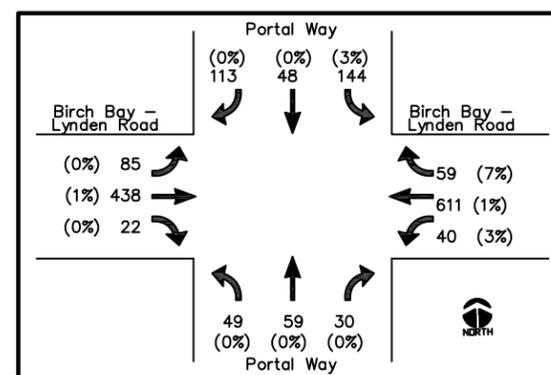
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SLATER ROAD AND LAKE TERRELL ROAD
N.T.S.



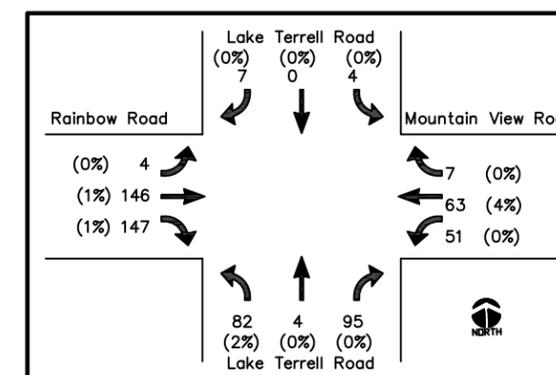
INTERSECTION NO. 3
GRANDVIEW ROAD AND OLSON ROAD
N.T.S.



INTERSECTION NO. 6
ARNIE ROAD AND VALLEY VIEW ROAD
N.T.S.



INTERSECTION NO. 9
BIRCH BAY - LYNDEN ROAD AND PORTAL WAY
N.T.S.



INTERSECTION NO. 12
RAINBOW ROAD / MOUNTAIN VIEW ROAD AND
LAKE TERRELL ROAD
N.T.S.

LEGEND:

- Directional Indicators
- X PM Peak Hour Traffic Count
- (X%) Percent of Heavy Vehicles



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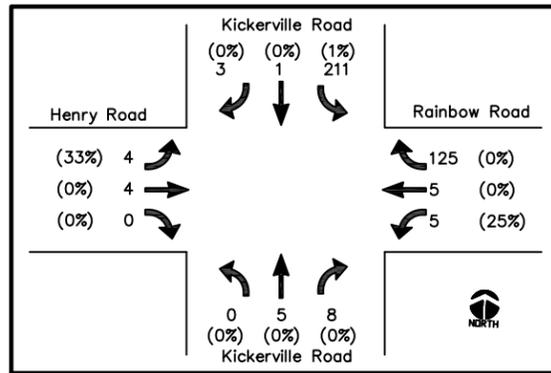
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PROJECTION: -
SCALE: AS SHOWN

PROJECT
PROPOSED GATEWAY PACIFIC TERMINAL

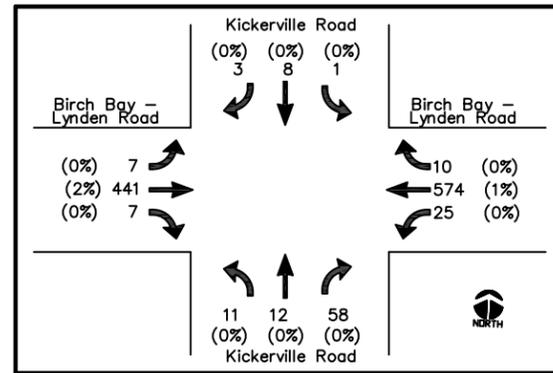
TITLE
FUTURE VOLUMES 2026 (PM) PEAK HOUR
WITHOUT PROJECT
INTERSECTIONS #1 TO #12

DATE: SEPTEMBER 2012
PROJECT NO: 5-91M-15338C-08-01
REV. NO.: -
FIGURE No. 4-1

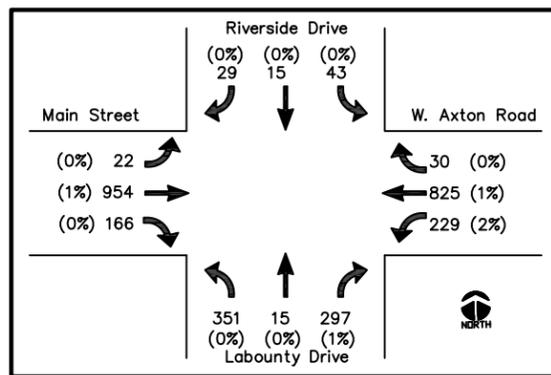
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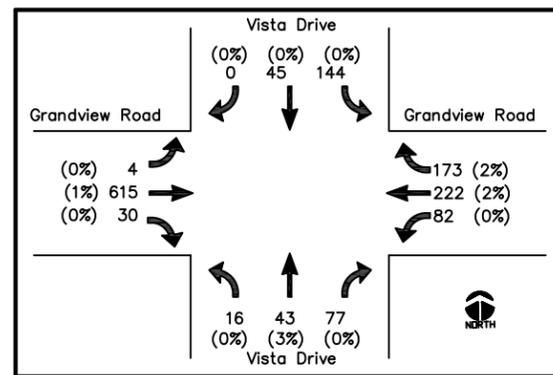
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RAINBOW ROAD / HENRY ROAD AND KICKERVILLE ROAD
N.T.S.



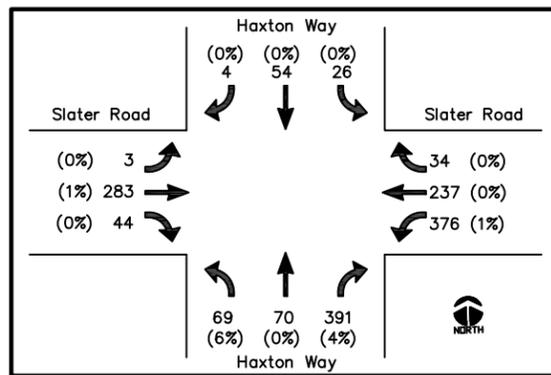
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BIRCH BAY - LYNDEN ROAD AND KICKERVILLE ROAD
N.T.S.



INTERSECTION NO. 14
MAIN STREET / W. AXTON ROAD AND
RIVERSIDE DRIVE / LABOUNTY DRIVE
N.T.S.



INTERSECTION NO. 17
VISTA DRIVE AND GRANDVIEW ROAD
N.T.S.



INTERSECTION NO. 15
SLATER ROAD AND HAXTON WAY
N.T.S.

LEGEND:
 Directional Indicators
 X PM Peak Hour Traffic Count
 (X%) Percent of Heavy Vehicles



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 DATUM: -
 PROJECTION: -
 SCALE: AS SHOWN

PROJECT
PROPOSED GATEWAY PACIFIC TERMINAL

TITLE
FUTURE VOLUMES 2026 (PM) PEAK HOUR
WITHOUT PROJECT
INTERSECTIONS #13 TO #17

DATE: SEPTEMBER 2012
 PROJECT NO: 5-91M-15338C-08-01
 REV. NO.: -
 FIGURE No. 4-2

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4.3.2 Trip Generation—Employees

Estimates of trips generated due to the Terminal are based on the actual number of anticipated employees who would work at the Terminal, as shown in Table 3–1 (Section 0). The Terminal would reach its maximum number of employees during operational phase 4 (Table 3–1). The facility would operate 24 hours per day, and the work force would be divided into three shifts: 7 AM to 4 PM, 3 PM to 12 AM, and 11 PM to 8 AM. The day shift (7 AM to 4 PM) during Phase 4 would comprise 88 employees. It is estimated that each employee would generate 2.25 trips per day. This estimate represents one trip to work, one trip from work, and a round trip (one outbound and one inbound trip) for 1 out of 8 employees for lunch or another errand during their shift.

Trip-generation estimates based on the anticipated number of employees (213 employees at 2.25 trips per day) yield a total of approximately 480 daily trips. The day shift of 88 employees is estimated to generate 198 trips per day.

For the purpose of the analysis, it is assumed that 100 percent of the day-shift employees would leave the Terminal during the peak traffic hour of 4:15 PM to 5:15 PM. The result is that the estimated number of PM peak hour trips would be 88 trips (home from work) for the day shift. This is a conservative estimate, as some employees would leave when their shift ends before 4:15 PM.

These estimated trip generation rates based on the actual number of anticipated employees were compared to trip generation rates developed based on standardized equations used to estimate generic trip generation rates. Equations compiled by the Institute of Transportation Engineers (ITE) were used to predict the daily project-related traffic that would be generated by the Terminal (ITE 2008). ITE provides generic formulas to estimate trip-generation rates for facilities under the land use code Waterport/Marine Terminal (010) based on two different characteristics of the terminal: (1) the physical size of the facility, and (2) number of marine berths.

These two sets of generic trip generation rates were used to evaluate the potential number of trips that would be generated by the Terminal. Based upon trip rates per acre, an estimated 6,017 daily trips would be generated. Based upon trip rates per berth, an estimated 479 daily trips would be generated. The per-acre rates do not account for the large part of the project area devoted to open space, commodity storage, and rail staging areas. In addition, total commodity throughput is limited by the total number of ship berths, not by the acreage of the project area, making the trip-generation rate based on ship berths more realistic. The specific characteristics of the proposed Terminal suggest the appropriateness of generic estimates based on trip rates per ship berth, and these match closely the estimated number of trips based on the actual number of employees expected.

The estimated number of employee trips does not include any trip reduction for carpooling or use of transit, bicycle, or other means. In addition, no employee turnover ratio was used. No other shifts are anticipated to generate PM peak hour trips. Overall, the estimated 88 trips generated during the PM peak hour likely exceeds the actual peak hour traffic volume that would be generated due to the Terminal.

4.4 TRIP GENERATION—NON-EMPLOYEE

All commodities coming into the Terminal would use rail lines, generating no truck trips for commodities shipping. Any commodities off-loaded from ships would also leave the Terminal on rail lines. From time to time, service, repair, and delivery vehicles would access the Terminal. These trips would be few and typically occur during the day and not during the PM peak hour. Therefore, no peak hour trips except for employee trips would be expected.

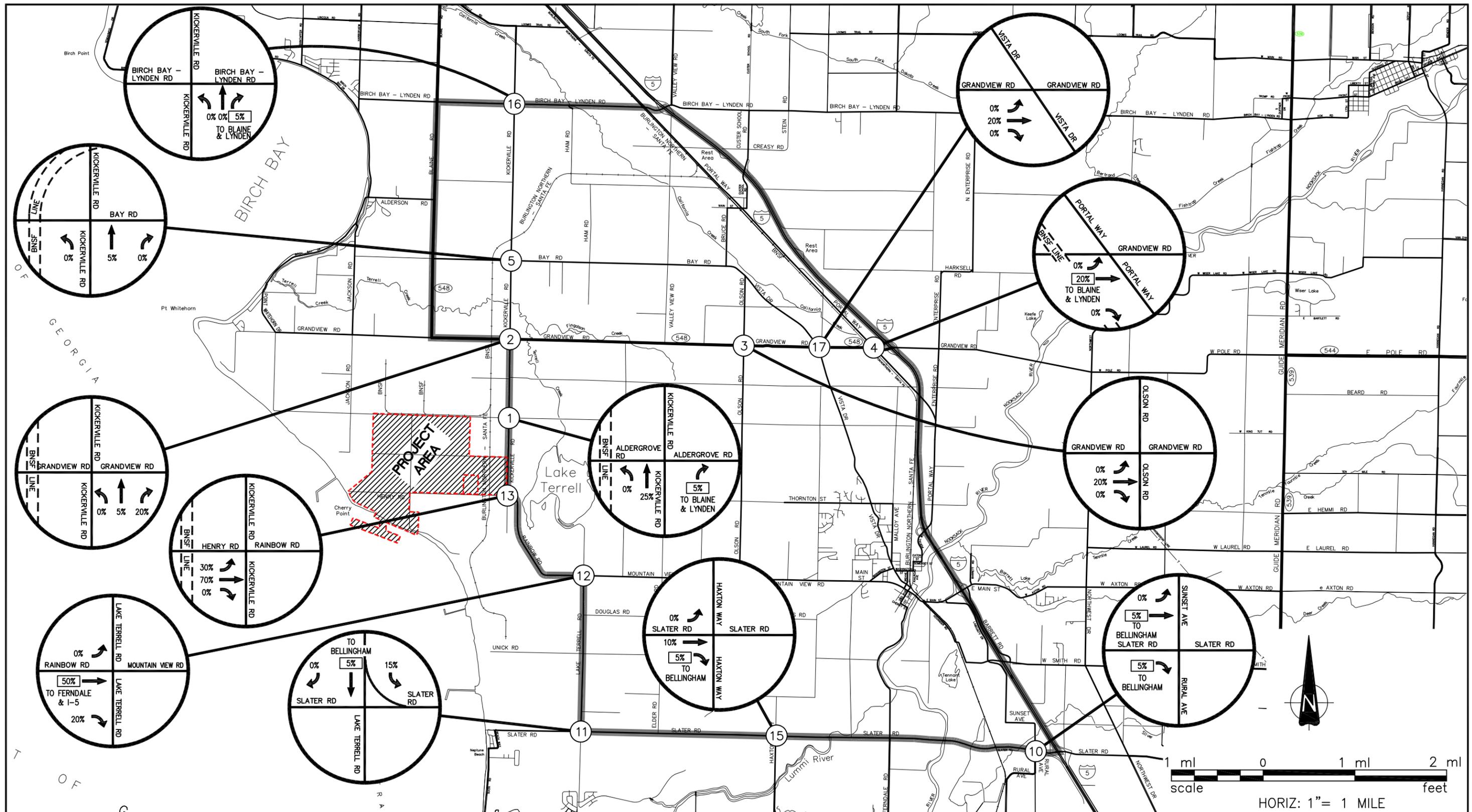
4.5 TRIP DISTRIBUTION

Figure 4-3 illustrates the estimated distribution and assignment of vehicle trips generated from the Terminal. In general, the estimated distribution pattern for outbound trips is 30 percent to the north toward Blaine, Lynden, and I-5; 50 percent to the east toward Ferndale and I-5; and 20 percent to the south and southeast toward Bellingham (KJS Associates, Inc. 1996). The inbound (AM peak) trip distribution would follow the opposite route. This trip distribution is consistent with field observations during the summer of 2010.

4.6 PEAK PERIOD TRAFFIC IMPACTS

Figure 4-4 and Figure 4-5 display the estimated PM peak hour roadway traffic generated by the Terminal when operating at full capacity for Intersections 1 through 12 and Intersections 13 through 17, respectively. Figure 4-6 and Figure 4-7 display the total simulated PM peak hour roadway traffic including both traffic associated with the Terminal and all other background traffic for Intersections 1 through 12 and Intersections 13 through 17, respectively.

Development of the Terminal would not cause any of the studied intersections not to meet the Whatcom County standards for LOS or V/C ratio. The simulated peak hour LOS for each of the 17 key intersections for the year 2026 is shown in Table 4–1 both without the Terminal and with development of the Terminal. The peak hour delay time and V/C ratio for the 17 key intersections for the year 2026 is shown in Table 4–2 both without the Terminal and with development of the Terminal. The data in Table 4–1 and Table 4–2 show the effects of increased, project-related roadway traffic on Intersections 1 through 17 during the PM peak hour.



LEGEND:	
	Employee Trips
	Analyzed Intersection
	Percent of Trips Leaving Study Area

CLIENT LOGO

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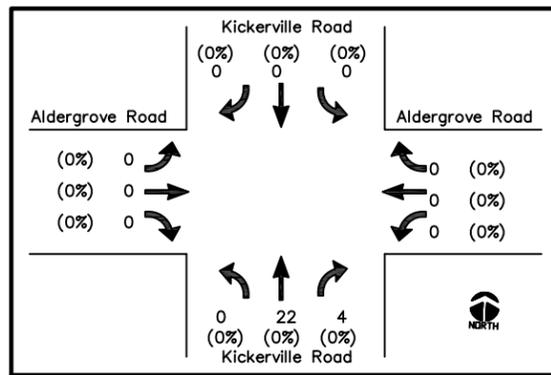
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PROJECT
PROPOSED GATEWAY PACIFIC TERMINAL

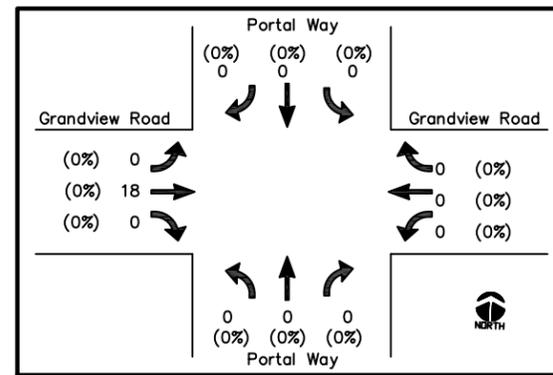
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OUTBOUND EMPLOYEE TRIP DISTRIBUTION

DATE: SEPTEMBER 2012
PROJECT NO: 5-91M-15338C-08-01
REV. NO.: -
FIGURE No. 4-3

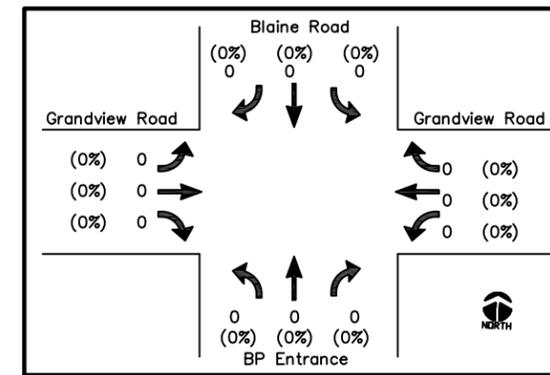
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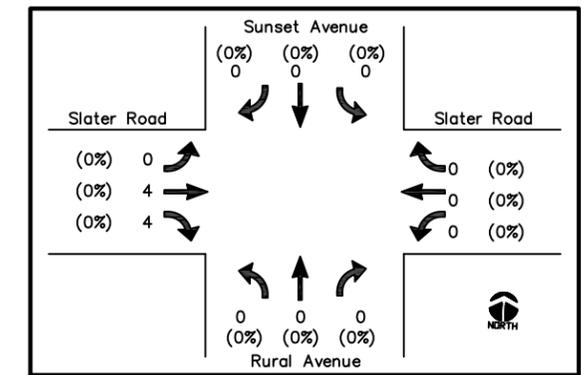
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ALDERGROVE ROAD AND
KICKERVILLE ROAD
N.T.S.



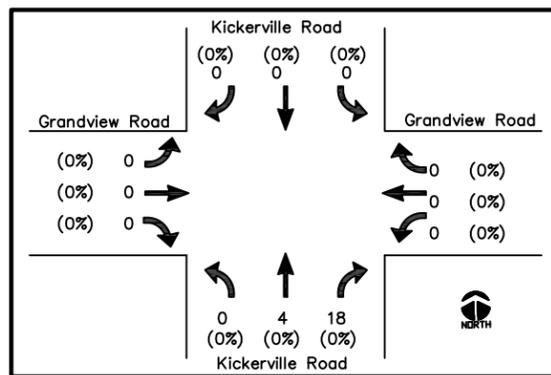
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GRANDVIEW ROAD AND PORTAL WAY
N.T.S.



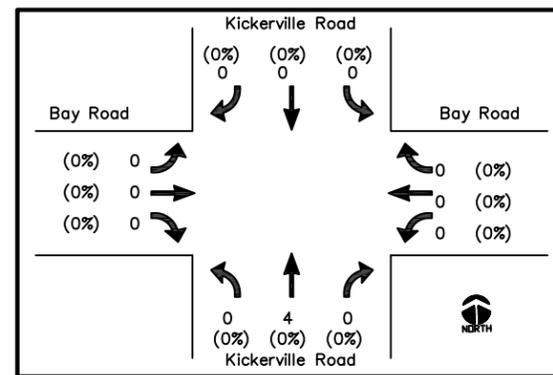
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GRANDVIEW ROAD AND BLAINE ROAD
N.T.S.



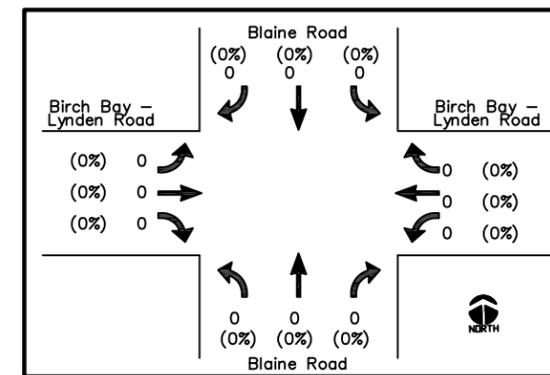
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SLATER ROAD AND SUNSET AVENUE / RURAL AVENUE
N.T.S.



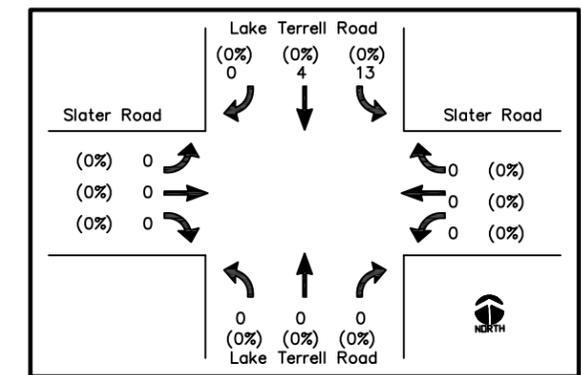
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GRANDVIEW ROAD AND
KICKERVILLE ROAD
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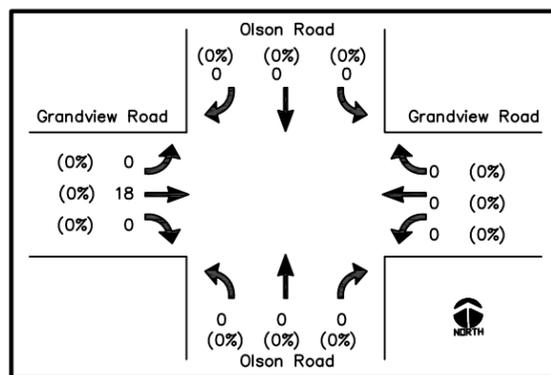
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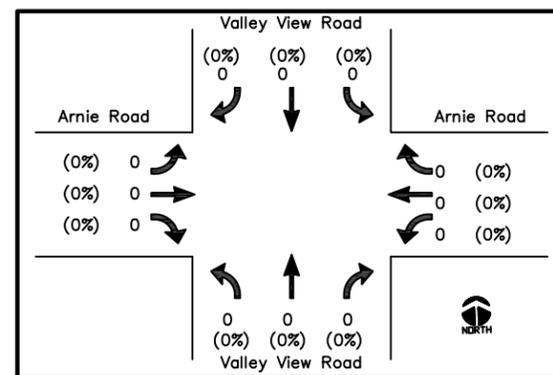
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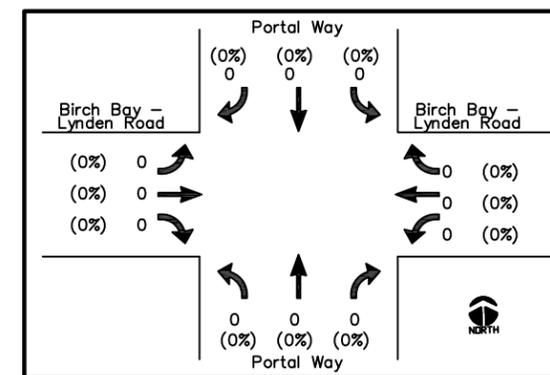
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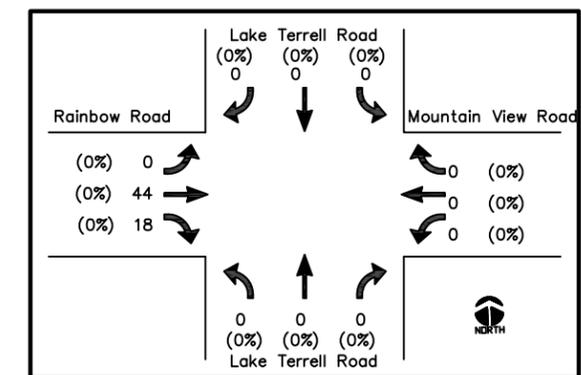
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GRANDVIEW ROAD AND OLSON ROAD
N.T.S.



INTERSECTION NO. 6
ARNIE ROAD AND VALLEY VIEW ROAD
N.T.S.



INTERSECTION NO. 9
BIRCH BAY - LYNDEN ROAD AND PORTAL WAY
N.T.S.



INTERSECTION NO. 12
RAINBOW ROAD / MOUNTAIN VIEW ROAD AND
LAKE TERRELL ROAD
N.T.S.

LEGEND:

- Directional Indicators
- X PM Peak Hour Traffic Count
- (X%) Percent of Heavy Vehicles



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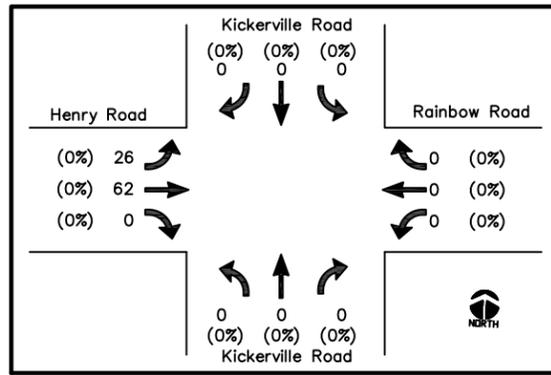
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PROJECTION: -
SCALE: AS SHOWN

PROJECT
PROPOSED GATEWAY PACIFIC TERMINAL

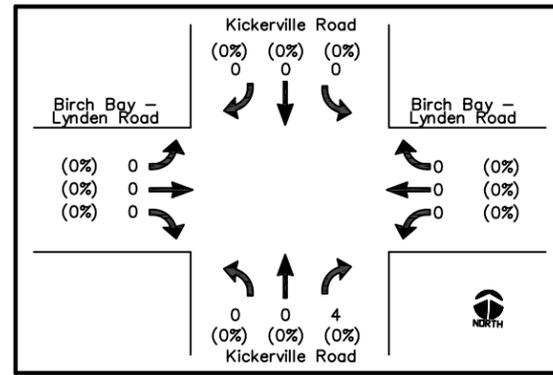
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**FUTURE VOLUMES 2026 (PM) PEAK HOUR
PROJECT RELATED VOLUME
INTERSECTIONS #1 TO #12**

DATE: SEPTEMBER 2012
PROJECT NO: 5-91M-15338C-08-01
REV. NO.: -
FIGURE No. 4-4

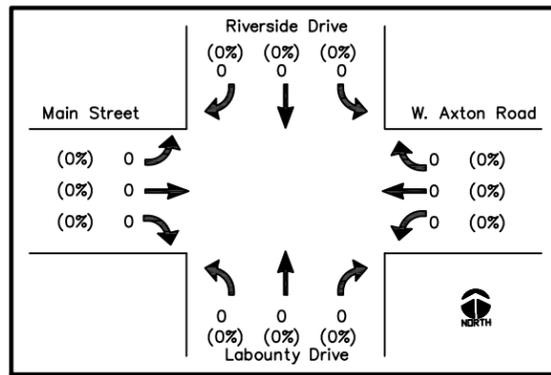
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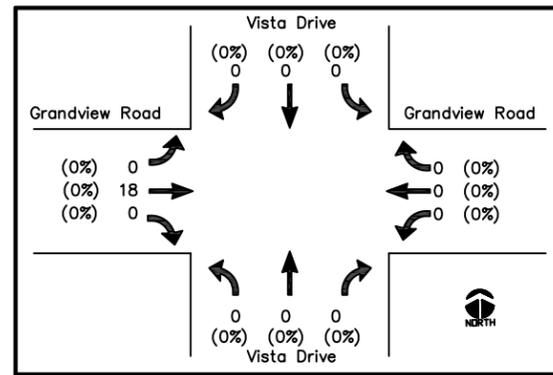
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RAINBOW ROAD / HENRY ROAD AND KICKERVILLE ROAD
N.T.S.



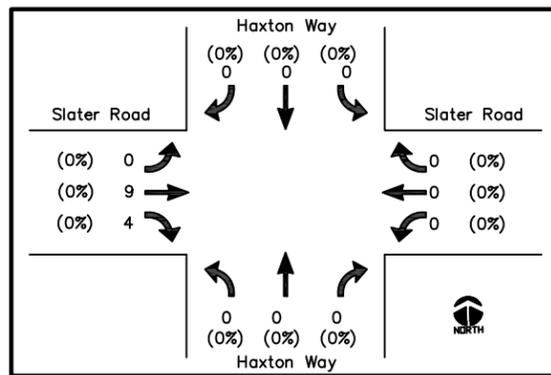
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BIRCH BAY - LYNDEN ROAD AND KICKERVILLE ROAD
N.T.S.



INTERSECTION NO. 14
MAIN STREET / W. AXTON ROAD AND
RIVERSIDE DRIVE / LABOUNTY DRIVE
N.T.S.



INTERSECTION NO. 17
VISTA DRIVE AND GRANDVIEW ROAD
N.T.S.



INTERSECTION NO. 15
SLATER ROAD AND HAXTON WAY
N.T.S.

LEGEND:
 Directional Indicators
 X PM Peak Hour Traffic Count
 (X%) Percent of Heavy Vehicles



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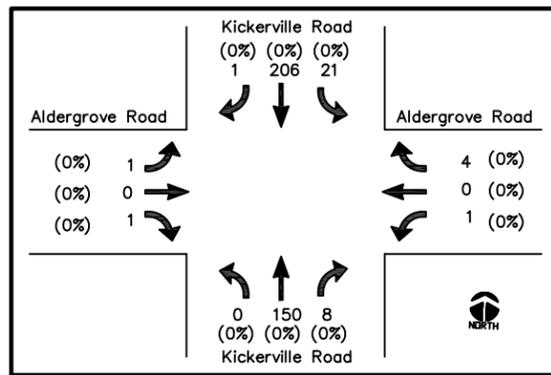
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PROJECT
PROPOSED GATEWAY PACIFIC TERMINAL

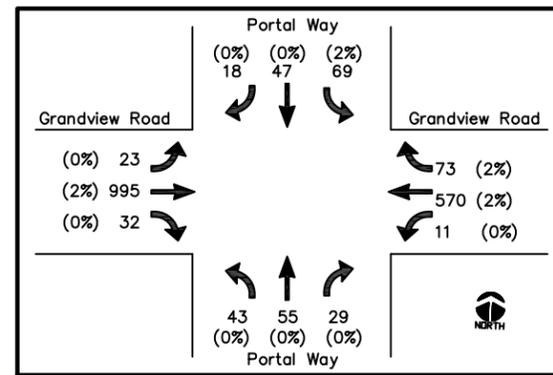
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PROJECT RELATED VOLUME
INTERSECTIONS #13 TO #17

DATE: SEPTEMBER 2012
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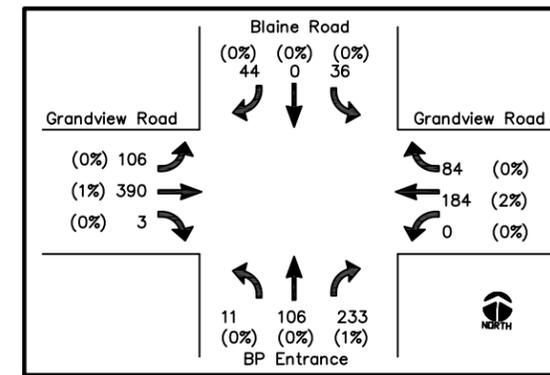
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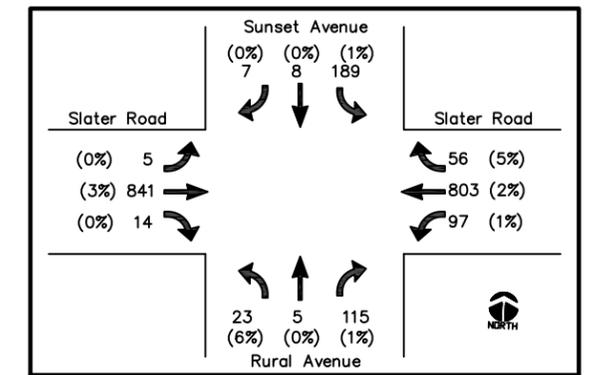
INTERSECTION NO. 1
ALDERGROVE ROAD AND
KICKERVILLE ROAD
N.T.S.



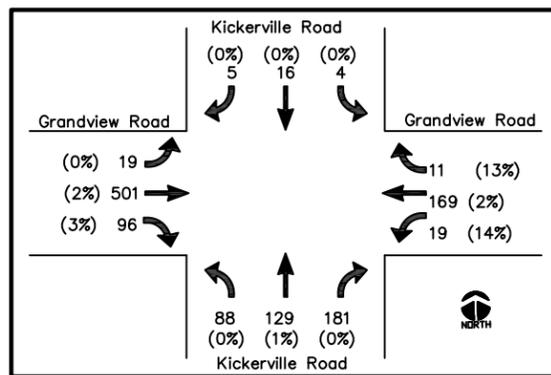
INTERSECTION NO. 4
GRANDVIEW ROAD AND PORTAL WAY
N.T.S.



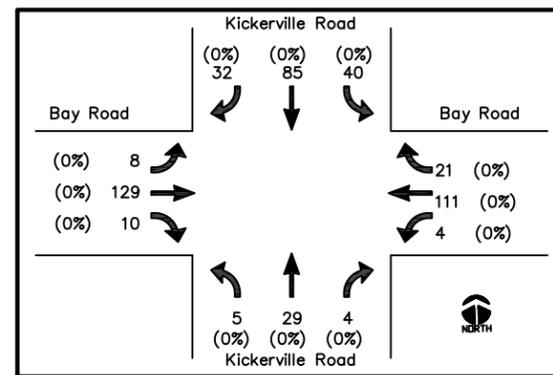
INTERSECTION NO. 7
GRANDVIEW ROAD / BLAINE ROAD
N.T.S.



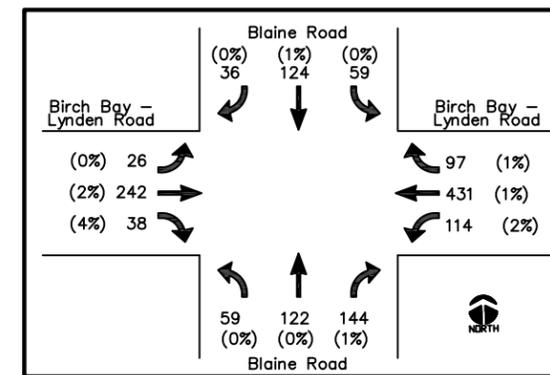
INTERSECTION NO. 10
SLATER ROAD AND SUNSET AVENUE / RURAL AVENUE
N.T.S.



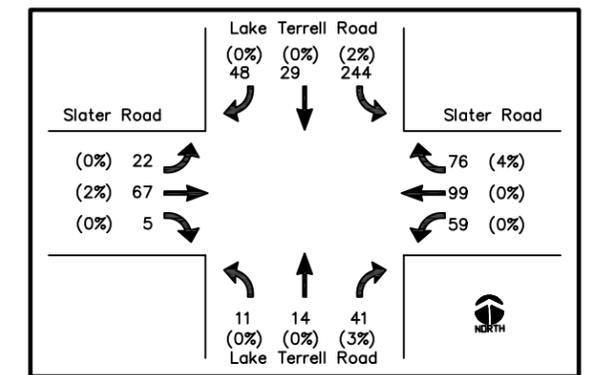
INTERSECTION NO. 2
GRANDVIEW ROAD AND
KICKERVILLE ROAD
N.T.S.



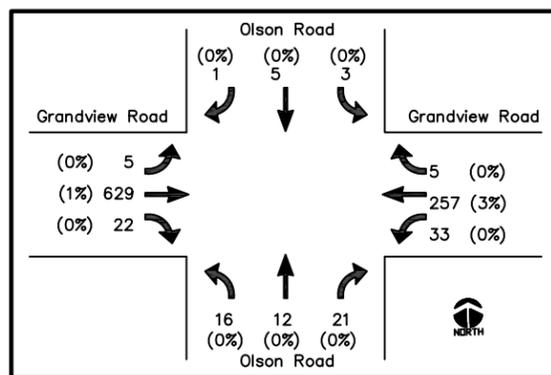
INTERSECTION NO. 5
BAY ROAD AND KICKERVILLE ROAD
N.T.S.



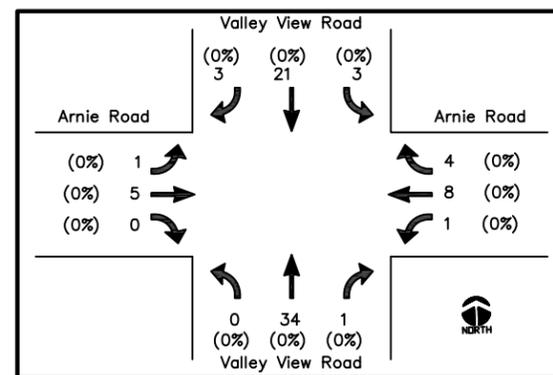
INTERSECTION NO. 8
BIRCH BAY - LYNDEN ROAD AND BLAINE ROAD
N.T.S.



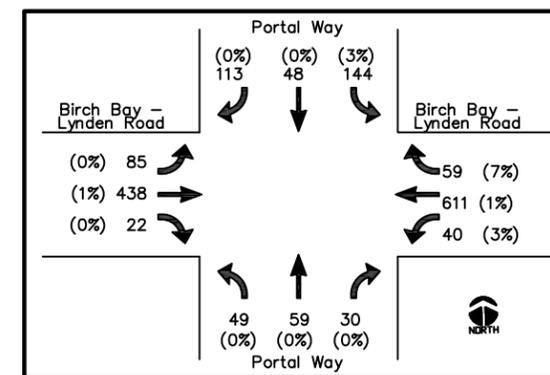
INTERSECTION NO. 11
SLATER ROAD AND LAKE TERRELL ROAD
N.T.S.



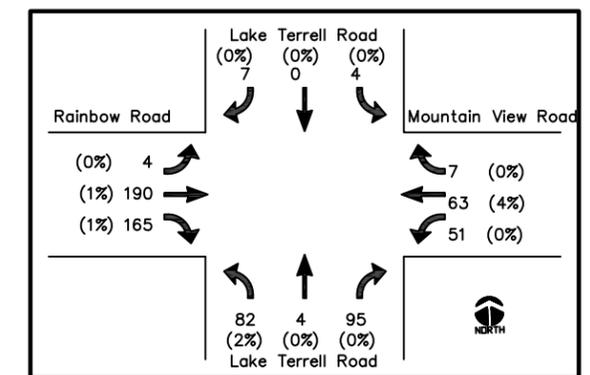
INTERSECTION NO. 3
GRANDVIEW ROAD AND OLSON ROAD
N.T.S.



INTERSECTION NO. 6
ARNIE ROAD AND VALLEY VIEW ROAD
N.T.S.



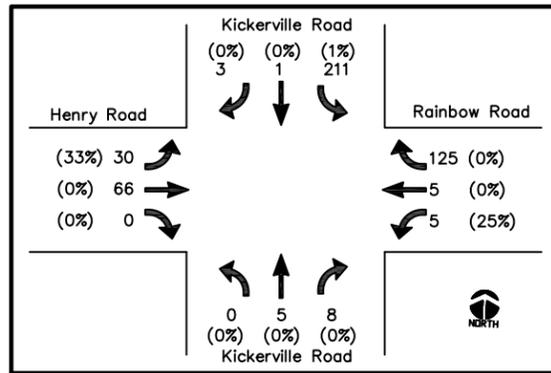
INTERSECTION NO. 9
BIRCH BAY - LYNDEN ROAD AND PORTAL WAY
N.T.S.



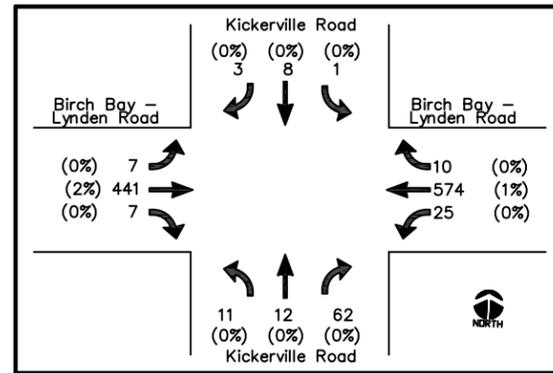
INTERSECTION NO. 12
RAINBOW ROAD / MOUNTAIN VIEW ROAD AND
LAKE TERRELL ROAD
N.T.S.

LEGEND: Directional Indicators PM Peak Hour Traffic Count (X%) Percent of Heavy Vehicles	CLIENT LOGO 	CLIENT: PACIFIC INTERNATIONAL TERMINAL, INC.	DWN BY: BMM / MJR CHK'D BY: BPL DATUM: - PROJECTION: - SCALE: AS SHOWN	PROJECT PROPOSED GATEWAY PACIFIC TERMINAL	DATE: SEPTEMBER 2012 PROJECT NO: 5-91M-15338C-08-01 REV. NO.: - FIGURE No. 4-6	
		AMEC Environment & Infrastructure, Inc. 11810 North Creek Parkway N Bothell, WA 98011	TITLE FUTURE VOLUMES 2026 (PM) PEAK HOUR VOLUME WITH PROJECT INTERSECTIONS #1 TO #12			

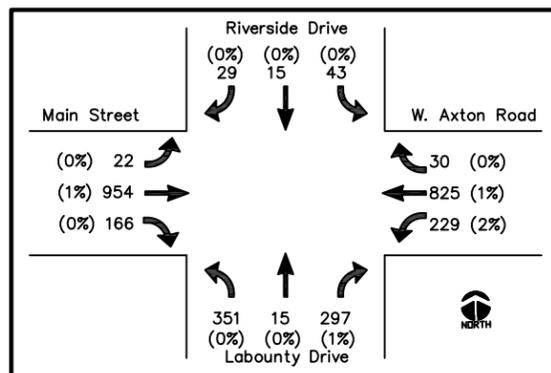
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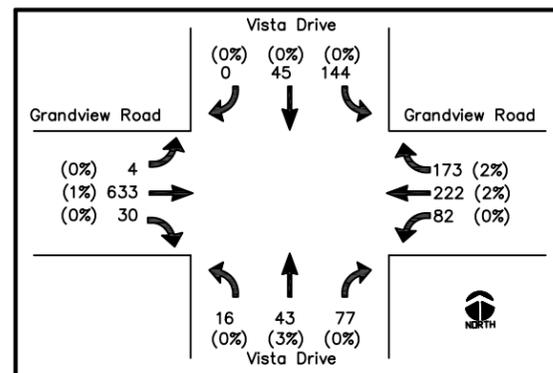
INTERSECTION NO. 13
RAINBOW ROAD / HENRY ROAD AND KICKERVILLE ROAD
N.T.S.



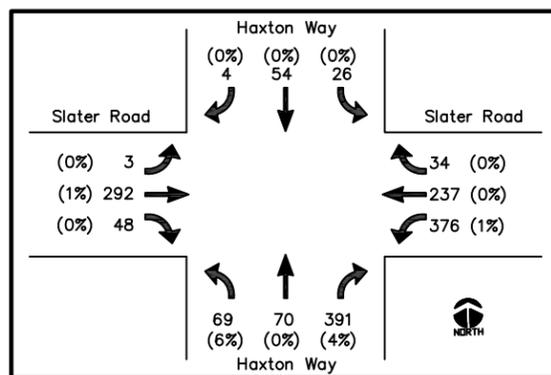
INTERSECTION NO. 16
BIRCH BAY - LYNDEN ROAD AND KICKERVILLE ROAD
N.T.S.



INTERSECTION NO. 14
MAIN STREET / W. AXTON ROAD AND
RIVERSIDE DRIVE / LABOUNTY DRIVE
N.T.S.



INTERSECTION NO. 17
VISTA DRIVE AND GRANDVIEW ROAD
N.T.S.



INTERSECTION NO. 15
SLATER ROAD AND HAXTON WAY
N.T.S.

LEGEND:
 Directional Indicators
 X PM Peak Hour Traffic Count
 (X%) Percent of Heavy Vehicles



CLIENT:
PACIFIC INTERNATIONAL TERMINAL, INC.

AMEC Environment & Infrastructure, Inc.
11810 North Creek Parkway N
Bothell, WA 98011

DWN BY: BMM / MJR
 CHK'D BY: BPL
 DATUM: -
 PROJECTION: -
 SCALE: AS SHOWN

PROJECT
PROPOSED GATEWAY PACIFIC TERMINAL

TITLE
FUTURE VOLUMES 2026 (PM) PEAK HOUR
VOLUME WITH PROJECT
INTERSECTIONS #13 TO #17

DATE: SEPTEMBER 2012
 PROJECT NO: 5-91M-15338C-08-01
 REV. NO.: -
 FIGURE No. 4-7

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Complete model results from the traffic model for the 2026 without-project and with-project conditions are available in Appendix B and Appendix C, respectively.

As shown in Table 4–1, increased road and street traffic from the project would decrease the LOS at only one intersection (Intersection 12), and that intersection would remain at a high LOS of B even with the project impact. Three intersections (Intersections 8, 9, and 17) would operate at LOS F whether or not the Terminal is constructed.

It is important to understand that the LOS and the delay shown in Table 4–1 and Table 4–2 represent the average delay for each vehicle during the PM peak hour. What may seem like an insignificant change in delay can have a larger change to LOS.

Table 4–1 2026 PM Peak Hour Level of Service with and without Project

Intersection Number	Description	Without Project		With Project	
		Volume ¹	LOS	Volume ¹	LOS
1	Aldergrove Road and Kickerville Road	367	A	393	A
2	Grandview Road and Kickerville Road	1,216	C	1,238	C
3	Grandview Road and Olson Road	991	A	1,009	A
4	Grandview Road and Portal Way	1,947	C	1,965	C
5	Bay Road and Kickerville Road	474	A	478	A
6	Arnie Road and Valley View Road	81	A	81	A
7	Grandview Road and Blaine Road	1,197	C	1,197	C
8	Birch Bay-Lynden Road and Blaine Road	1,492	F*	1,492	F
9	Birch Bay-Lynden Road and Portal Way	1,698	F*	1,698	F
10	Slater Road and Sunset Avenue/Rural Avenue	2,155	C	2,163	C
11	Slater Road and Lake Terrell Road	698	A	715	A
12	Rainbow Road/Mountain View Road and Lake Terrell Road	610	A	672	B
13	Rainbow Road/Henry Road and Kickerville Road	371	A	459	A
14	Main Street/West Axton Road and Riverside Drive/Labounty Drive	2,976	C	2,976	C
15	Slater Road and Haxton Way	1,591	B	1,604	B
16	Birch Bay-Lynden Road and Kickerville Road	1,157	B	1,161	B
17	Grandview Road and Vista Drive	1,451	F*	1,499	F

¹ Total entering volume

* LOS exceeds the Whatcom County limit for 2026 traffic volumes without the project improvements.

Table 4-2 2026 PM Peak Hour Delay and V/C Ratio with and without Project

Intersection Number	Description	Without Project		With Project		V/C Ratio Limit ^{1,2}
		Avg. Delay	V/C Ratio ¹	Avg. Delay	V/C Ratio ¹	
1	Aldergrove Road and Kickerville Road	0.7	.02	0.7	.02	.75
2	Grandview Road and Kickerville Road	50.3	1.23* - NB	58.7	1.28	.75
3	Grandview Road and Olson Road	1.8	.20	1.8	.20	.75
4	Grandview Road and Portal Way	25.9	.91* - EB	26.8	.92	.75
5	Bay Road and Kickerville Road	5.2	.26	5.2	.26	.75
6	Arnie Road and Valley View Road	7.2	.04	7.2	.04	.75
7	Grandview Road and Blaine Road	N/A ³	.48	N/A ³	.48	.75
8	Birch Bay-Lynden Road and Blaine Road	111.4	1.43* -WB	111.4	1.43	.90
9	Birch Bay-Lynden Road and Portal Way	154.5	1.49* - WB	154.5	1.49	.90
10	Slater Road and Sunset Avenue/Rural Avenue	20.1	.84	20.3	.85	.90
11	Slater Road and Lake Terrell Road	11.4	.62	12.4	.65	.75
12	Rainbow Road/ Mountain View Road and Lake Terrell Road	9.6	.40	10.4	.47	.75
13	Rainbow Road/Henry Road and Kickerville Road	8.6	.30	8.9	.31	.75
14	Main Street/West Axton Road and Riverside Drive/Labounty Drive	33.3	.95* - EB	33.3	.95	.75
15	Slater Road and Haxton Way	10.3	.69	10.5	.69	.75
16	Birch Bay-Lynden Road and Kickerville Road	2.0	.26	2.1	.26	.75
17	Grandview Road and Vista Drive	86.6	1.26* - EB	94.0	1.30	.75

1. V/C ratio = volume/capacity ratio;

2. Limit as set by Whatcom County Comprehensive Plan (Whatcom County 2010), Map #14A - Level of Service Standards Volume/Capacity Ratio.

3. Intersection is a roundabout so delay is not calculated in the model.

* V/C ratio of one of the approaches meets or exceeds the Whatcom County limit with existing traffic without development of the Terminal. Approach direction that fails is indicated as follows: NB = northbound; EB = eastbound; WB = westbound.

Projected traffic volume in 2026 without development of the Terminal would cause six intersections (Intersections 2, 4, 8, 9, 14, and 17) to exceed the established Whatcom County limit for V/C ratio. The impacts of the Terminal development on V/C ratio at these six intersections would be minor (V/C ratio increase of 0.05 at the most). In some cases, no impact is predicted. In general, the existing roadway network has adequate capacity for the project, and most locations have adequate capacity for the projected future growth. Those intersections with LOS or V/C ratio that will not meet County standards in 2026 would not achieve these standards whether or not the Terminal is constructed.

4.7 THROUGH TRAFFIC

Due to the nature of the development, there will be no through traffic. Visitors who enter the site will exit through the same point.

4.8 SITE ACCESS AND CIRCULATION

Access to the Terminal would be provided at the main entrances to the Terminal via new paved access roads that connect at the intersection of Gulf Road and Henry Road. The main access point to the through road network for the Terminal lies at Intersection 13 (Henry Road and Kickerville Road). Other roads within the Terminal would be constructed to access the facilities. Secondary access points would be provided through at-grade rail crossings at the southeast corner of the East Loop and the northern end of the West Loop.

As is evident in Table 4–1 and Table 4–2, additional traffic associated with the Terminal would have no effect on LOS and a negligible effect on V/C ratio at the main access point to the local road network at Intersection 13.

4.9 TERMINAL PARKING AND QUEUING

Based on the anticipated numbers of employees shown in Table 3–1, peak parking demand in 2026 is estimated at 160 parking stalls to accommodate all employees combined from two shifts during shift changes. All parking would be provided within the Terminal property. On-site queuing may increase during the PM peak hour as employees leave work. This queuing is not expected to affect the external roadway system, but may affect the delay experienced by workers leaving the Terminal.

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5.0 IMPACTS AND MITIGATION

Increased road and street traffic from the project would decrease the LOS at only one intersection (Intersection 12), and that intersection would remain at LOS B even with the project impact. Three intersections (Intersections 8, 9, and 17) would operate at LOS F whether or not the Terminal is built.

5.1 FRONTAGE IMPROVEMENTS AND RIGHTS-OF-WAY DEDICATION

No significant impacts that warrant mitigation were identified.

5.2 POSSIBLE IMPROVEMENTS TO RESTORE SYSTEM CAPACITY

Based on the results of the traffic analysis, three intersections (Intersections 8, 9, and 17) will operate at LOS F in the year 2026 whether or not the Terminal is built.

These three locations would benefit from the following recommended improvements:

- **Intersection 8** – Install new traffic signals to replace the existing four-way stop controls, and optimize signal timing and cycle length. Increasing cycle length generally has a negative impact on intersection operations and creates longer queues, so cycle lengths should be minimized. Adequate sight distance is needed, and conflicting left turns need to be checked to avoid potential collisions. Additional geometric improvements may be required to signalize the intersection.
- **Intersection 9** – Install new traffic signals to replace the existing four-way stop controls, and optimize signal timing and cycle length. Increasing cycle length generally has a negative impact on intersection operations and creates longer queues, so cycle lengths should be minimized. Adequate sight distance is needed, and conflicting left turns need to be checked to avoid potential collisions. Additional geometric improvements may be required to signalize the intersection.
- **Intersection 17** – Install new traffic signals to replace the existing four-way stop controls, and optimize signal timing and cycle length. Increasing cycle length generally has a negative impact on intersection operations and creates longer queues, so cycle lengths should be minimized. Adequate sight distance is needed, and conflicting left turns need to be checked to avoid potential collisions. Additional geometric improvements may be required to signalize the intersection.

Signal improvements for Intersection 9 have been designed and will be constructed by Whatcom County in the future, most likely prior to Phase 1 of Terminal development.

5.3 ACCESS IMPROVEMENTS

The Terminal is a new development, so new access points will be constructed. No significant impacts that warrant mitigation were identified.

5.4 SAFETY – CORRECTIVE MEASURES

No significant impacts that warrant mitigation were identified.

5.5 BICYCLE/PEDESTRIAN/EQUESTRIAN IMPROVEMENTS

The Coast Millennium Bicycle Trail is planned to be in the vicinity of the Terminal area. An alternate plan will be developed to maintain the connectivity of the trail and provide for bicyclist safety. Pacific International Terminals, Inc. will work with WCOG and other stakeholders to determine the appropriate configuration of the Bicycle Trail in the project area.

5.6 COMPLIANCE WITH LOS

Increased road and street traffic from the project would decrease the LOS at only one intersection (Intersection 12), and that intersection would remain at LOS B even with the project impact. Three intersections (Intersections 8, 9, and 17) are expected to operate at LOS F whether or not the Terminal is built. Vehicle traffic from the Terminal does not cause LOS to fall below LOS D at any intersection.

5.7 LEVEL OF SERVICE CHANGES AT INTERSECTIONS

No significant impacts that warrant mitigation were identified.

5.8 CAPACITY RESTORATION ON ALTERNATIVE CORRIDORS

No significant impacts that warrant mitigation were identified.

5.9 PRO-RATA SHARE CONTRIBUTION TO ROAD IMPROVEMENT PROJECTS

Pacific International Terminals will work with Whatcom County to determine their fiscal contribution to proposed improvements based on the Terminal's anticipated traffic impacts compared to the existing background traffic flow at those locations. As described in Section 4.6, all intersections except three (Intersections 8, 9 and 17) would operate at LOS D or better during the PM peak hour in year 2026 and the three impaired intersections are expected to operate at LOS F by 2026 whether or not the Terminal is operating.

6.0 CONCLUSIONS AND RECOMMENDATIONS

This section presents conclusions of the engineered traffic study and recommendations to improve traffic conditions in the vicinity of the proposed Terminal.

6.1 SUGGESTED IMPROVEMENTS

Based on the results of the traffic analysis, three intersections (Intersections 8, 9, and 17) will operate at LOS F in the year 2026 whether or not the Terminal is operating. The proposed project would not send any vehicles through these intersections, but these intersections were analyzed due to their proximity to the site, and for Intersection 17, at the request of the County.

Intersection improvements are already under way at Intersection 9 (new traffic signals), the two other intersections would benefit from the following recommended improvements:

- **Intersection 8** – Install new traffic signals to replace the existing four-way stop controls, and optimize signal timing and cycle length. See Section 5.2 for details.
- **Intersection 17** – Install new traffic signals to replace the existing four-way stop controls, and optimize signal timing and cycle length. See Section 5.2 for details.

The traffic analysis was repeated by running the traffic model for 2026 for the without-project and with-project conditions but replacing the four-way stop controls at these intersections with the recommended intersection signalization improvements. Results from the models are presented in Appendix D for without-project and in Appendix E for with-project conditions. At projected build out traffic volumes, the PM peak hour LOS for these intersections would improve substantially by enhancing traffic controls from the existing two-way, stop-controlled to signalized control, as shown in Table 6–1. Traffic signals would improve traffic conditions at these two intersections to high LOS level B.

Table 6–1 2026 PM Peak Hour Level of Service with and without Signalization Improvements

Intersection Number	Description	Without Improvements		With Improvements	
		Delay (sec.)	LOS	Delay (sec.)	LOS
8	Birch Bay-Lynden Road and Blaine Road	111.4	F*	18.2	B
9	Birch Bay-Lynden Road and Portal Way	154.5	F*	17.6	B
17	Grandview Road and Vista Drive	94.0	F*	15.1	B

LOS = level of service

* LOS exceeds the Whatcom County limit with 2026 traffic volumes without the project improvements.

Projected volumes in 2026 without the project cause six intersections (Intersections 2, 4, 8, 9, 14, and 17) to exceed the established Whatcom County limit for V/C ratio. Effects of Terminal traffic on V/C ratio would be minor (0.05 at the most) or in some cases no effect is expected (Table 4–2).

It is suggested that Whatcom County work with WSDOT and other regional users to prioritize improvements that would keep the V/C ratio under the established limits as growth occurs. Pacific International Terminals will work with Whatcom County to determine their fiscal contribution to any proposed improvements based on the Terminal's anticipated traffic impacts to the background traffic flow at these locations. As described in Section 4.6, all intersections except three (Intersections 8, 9, and 17) would operate at LOS D or better during the PM peak hour in year 2026, even with the additional Terminal-related vehicle traffic.

6.2 COMPLIANCE WITH APPLICABLE LOCAL CODES

Refer to Table 2–1 for a detailed description of compliance with local codes.

6.3 SITE ACCESS/CIRCULATION PLAN

The site access and circulation plan will be developed as part of the Terminal design. Due to the nature of the development, no circulation issues are expected, and no through traffic would be allowed.

6.4 ROADWAY IMPROVEMENTS

Roadway improvements at the access points for the Terminal will be developed as part of the Terminal design. No off-site roadway improvements have been identified as necessary for the Terminal to function.

6.5 TRANSPORTATION SYSTEM MANAGEMENT ACTIONS

As a potential employer of more than 100 employees, this project will be subject to the County's Commute Trip Reduction (CTR) Plan. The goals of the CTR for the employer are to develop and implement a CTR program that will:

- Encourage employees to reduce the number of vehicle miles traveled (VMT) per employee and the number of single occupancy vehicle (SOV) commuter trips; and
- Include mandatory elements such as:
 - Designate a Transportation Coordinator;
 - Distribute information to employees at least once per year that provides information on alternatives to driving alone to work;

- Prepare an annual progress report and submit it to the WCOG; and
- Conduct an employee survey of transportation choices at least annually.

Pacific International Terminals will work with Whatcom County staff to develop, implement, and monitor the CTR Plan for the Terminal.

6.6 EXCEPTIONS FROM WHATCOM COUNTY STANDARDS

The following exceptions from Whatcom County Standards were used:

- No analysis of effects of future additional trains on the flow of street traffic due to at-grade crossings was included in this report. The BNSF Railway is the permittee for any improvements to the Custer Spur and associated facilities and BNSF Railway. A separate report titled *BNSF Custer Spur Highway/Railway Grade Crossing Traffic Impact Study* (BNSF Railway Co., 2012) provides that analysis.

6.7 OTHER RECOMMENDATIONS

While no significant traffic impacts are identified in this report, the increased train activity from the Terminal could result in significant short-term delay at intersections near at-grade rail crossings along the Custer Spur.

Additionally, all at-grade rail crossings used by trains that serve the Terminal should have updated crossing gates and signals to enhance the safety of vehicle operators. Advance signing should be installed at approaches to the at-grade rail crossings used by trains that serve the Terminal to alert roadway users that train delays of several minutes may occur. The signs should also provide a description of alternative routes to avoid rail crossings.

Finally, the at-grade crossings along the Custer Spur should be evaluated, and deteriorated crossing surfaces should be replaced with concrete aprons to provide a smooth transition over the railroad, particularly on high-volume roadways.

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APPENDIX A

2010 Traffic Model – Existing Conditions

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Volume

1: Aldergrove Road & Kickerville Road

5/12/2011

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	1	0	1	1	0	3	0	93	3	15	150	1
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	1	0	1	1	0	3	0	101	3	16	163	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	2	0	0	4	0	0	104	0	0	180	0
Intersection Summary												

HCM Unsignalized Intersection Capacity Analysis
 1: Aldergrove Road & Kickerville Road

5/12/2011

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	0	1	1	0	3	0	93	3	15	150	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	1	0	1	1	0	3	0	101	3	16	163	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	302	301	164	300	299	103	164			104		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	302	301	164	300	299	103	164			104		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			99		
cM capacity (veh/h)	646	609	886	650	609	958	1427			1500		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	2	4	104	180								
Volume Left	1	1	0	16								
Volume Right	1	3	3	1								
cSH	748	856	1427	1500								
Volume to Capacity	0.00	0.01	0.00	0.01								
Queue Length 95th (ft)	0	0	0	1								
Control Delay (s)	9.8	9.2	0.0	0.8								
Lane LOS	A	A		A								
Approach Delay (s)	9.8	9.2	0.0	0.8								
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.7									
Intersection Capacity Utilization			25.5%		ICU Level of Service				A			
Analysis Period (min)			15									

Volume

2: Grandview Road & Kickerville Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	14	365	70	14	123	8	64	91	119	3	12	4
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	3%	14%	2%	13%	0%	1%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	15	397	76	15	134	9	70	99	129	3	13	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	488	0	0	158	0	0	298	0	0	20	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

2: Grandview Road & Kickerville Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	14	365	70	14	123	8	64	91	119	3	12	4
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	15	397	76	15	134	9	70	99	129	3	13	4
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		TWLTL			None							
Median storage (veh)		2										
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	142			473			645	638	435	812	672	138
vC1, stage 1 conf vol							465	465		168	168	
vC2, stage 2 conf vol							179	173		644	503	
vCu, unblocked vol	142			473			645	638	435	812	672	138
tC, single (s)	4.1			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			87	81	79	99	97	100
cM capacity (veh/h)	1453			1029			533	521	626	277	496	916

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	488	158	298	21
Volume Left	15	15	70	3
Volume Right	76	9	129	4
cSH	1453	1029	565	482
Volume to Capacity	0.01	0.01	0.53	0.04
Queue Length 95th (ft)	1	1	77	3
Control Delay (s)	0.3	1.0	18.2	12.8
Lane LOS	A	A	C	B
Approach Delay (s)	0.3	1.0	18.2	12.8
Approach LOS			C	B

Intersection Summary

Average Delay		6.2		
Intersection Capacity Utilization		55.4%	ICU Level of Service	B
Analysis Period (min)		15		

Volume

3: Grandview Road & Olson Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	4	445	16	24	187	4	12	9	15	2	4	1
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	0%	3%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	4	484	17	26	203	4	13	10	16	2	4	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	505	0	0	233	0	0	39	0	0	7	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

3: Grandview Road & Olson Road

5/12/2011

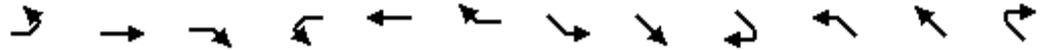


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	4	445	16	24	187	4	12	9	15	2	4	1
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	484	17	26	203	4	13	10	16	2	4	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	208			501			762	761	492	780	767	205
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	208			501			762	761	492	780	767	205
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			98			96	97	97	99	99	100
cM capacity (veh/h)	1375			1074			314	328	581	293	325	840
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	505	234	39	8								
Volume Left	4	26	13	2								
Volume Right	17	4	16	1								
cSH	1375	1074	393	345								
Volume to Capacity	0.00	0.02	0.10	0.02								
Queue Length 95th (ft)	0	2	8	2								
Control Delay (s)	0.1	1.1	15.2	15.7								
Lane LOS	A	A	C	C								
Approach Delay (s)	0.1	1.1	15.2	15.7								
Approach LOS			C	C								
Intersection Summary												
Average Delay			1.3									
Intersection Capacity Utilization			36.5%		ICU Level of Service				A			
Analysis Period (min)			15									

Volume

4: Grandview Road & Portal Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	SEL	SET	NWL	NWT
Volume (vph)	17	712	8	415	50	34	31	40
Confl. Peds. (#/hr)								
Confl. Bikes (#/hr)								
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	2%	2%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0
Parking (#/hr)								
Mid-Block Traffic (%)		0%		0%		0%		0%
Adj. Flow (vph)	18	774	9	451	54	37	34	43
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	817	0	518	0	105	0	100
Intersection Summary								

Timings

4: Grandview Road & Portal Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	SET	NWT
Lane Configurations		↕		↕	↕	↕
Volume (vph)	17	712	8	415	34	40
Turn Type	Perm		Perm			
Protected Phases		3		3	2	1
Permitted Phases	3		3			
Detector Phase	3	3	3	3	2	1
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	100.0	100.0	100.0	100.0	20.0	20.0
Total Split (%)	71.4%	71.4%	71.4%	71.4%	14.3%	14.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag					Lag	Lead
Lead-Lag Optimize?					Yes	Yes
Recall Mode	None	None	None	None	Min	Min
Act Effect Green (s)		47.8		47.8	10.6	10.3
Actuated g/C Ratio		0.58		0.58	0.13	0.13
v/c Ratio		0.76		0.49	0.44	0.43
Control Delay		18.1		11.3	44.3	42.4
Queue Delay		0.0		0.0	0.0	0.0
Total Delay		18.1		11.3	44.3	42.4
LOS		B		B	D	D
Approach Delay		18.1		11.3	44.3	42.4
Approach LOS		B		B	D	D

Intersection Summary

Cycle Length: 140	
Actuated Cycle Length: 81.9	
Natural Cycle: 80	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.76	
Intersection Signal Delay: 19.2	Intersection LOS: B
Intersection Capacity Utilization 63.2%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 4: Grandview Road & Portal Way



Queues

4: Grandview Road & Portal Way

5/12/2011



Lane Group	EBT	WBT	SET	NWT
Lane Group Flow (vph)	817	518	105	100
v/c Ratio	0.76	0.49	0.44	0.43
Control Delay	18.1	11.3	44.3	42.4
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	18.1	11.3	44.3	42.4
Queue Length 50th (ft)	263	127	46	42
Queue Length 95th (ft)	537	263	133	123
Internal Link Dist (ft)	3763	783	22485	3678
Turn Bay Length (ft)				
Base Capacity (vph)	1368	1355	353	358
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.60	0.38	0.30	0.28

Intersection Summary

HCM Signalized Intersection Capacity Analysis

4: Grandview Road & Portal Way

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	17	712	23	8	415	53	50	34	13	31	40	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		1.00			0.98			0.98			0.97	
Flt Protected		1.00			1.00			0.97			0.98	
Satd. Flow (prot)		1855			1834			1801			1810	
Flt Permitted		0.99			0.99			0.97			0.98	
Satd. Flow (perm)		1832			1812			1801			1810	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	18	774	25	9	451	58	54	37	14	34	43	23
RTOR Reduction (vph)	0	1	0	0	4	0	0	3	0	0	8	0
Lane Group Flow (vph)	0	816	0	0	514	0	0	102	0	0	92	0
Heavy Vehicles (%)	0%	2%	0%	0%	2%	2%	2%	0%	0%	0%	0%	0%
Turn Type	Perm			Perm			Split			Split		
Protected Phases		3			3		2	2		1	1	
Permitted Phases	3			3								
Actuated Green, G (s)		47.8			47.8			10.6			10.3	
Effective Green, g (s)		47.8			47.8			10.6			10.3	
Actuated g/C Ratio		0.59			0.59			0.13			0.13	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1085			1073			237			231	
v/s Ratio Prot								c0.06			c0.05	
v/s Ratio Perm		c0.45			0.28							
v/c Ratio		0.75			0.48			0.43			0.40	
Uniform Delay, d1		12.1			9.4			32.3			32.4	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		3.0			0.3			1.2			1.1	
Delay (s)		15.1			9.7			33.5			33.5	
Level of Service		B			A			C			C	
Approach Delay (s)		15.1			9.7			33.5			33.5	
Approach LOS		B			A			C			C	

Intersection Summary

HCM Average Control Delay	15.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	80.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Volume

5: Bay Road & Kickerville Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	6	94	7	3	81	15	4	18	3	29	62	23
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	7	102	8	3	88	16	4	20	3	32	67	25
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	117	0	0	107	0	0	27	0	0	124	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

5: Bay Road & Kickerville Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	6	94	7	3	81	15	4	18	3	29	62	23
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	7	102	8	3	88	16	4	20	3	32	67	25
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	104			110			280	230	106	235	226	96
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	104			110			280	230	106	235	226	96
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			99	97	100	96	90	97
cM capacity (veh/h)	1500			1493			605	669	954	702	673	966
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	116	108	27	124								
Volume Left	7	3	4	32								
Volume Right	8	16	3	25								
cSH	1500	1493	682	725								
Volume to Capacity	0.00	0.00	0.04	0.17								
Queue Length 95th (ft)	0	0	3	15								
Control Delay (s)	0.4	0.2	10.5	11.0								
Lane LOS	A	A	B	B								
Approach Delay (s)	0.4	0.2	10.5	11.0								
Approach LOS			B	B								
Intersection Summary												
Average Delay			4.6									
Intersection Capacity Utilization			24.8%		ICU Level of Service				A			
Analysis Period (min)			15									

Volume

6: Arnie Road & Valley View Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	1	4	0	1	6	3	0	25	1	2	15	2
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	1	4	0	1	7	3	0	27	1	2	16	2
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	5	0	0	11	0	0	28	0	0	20	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

6: Arnie Road & Valley View Road

5/12/2011



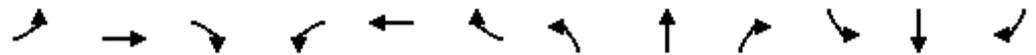
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	1	4	0	1	6	3	0	25	1	2	15	2
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	4	0	1	7	3	0	27	1	2	16	2
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	10			4			27	18	4	32	17	8
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	10			4			27	18	4	32	17	8
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	97	100	100	98	100
cM capacity (veh/h)	1623			1630			971	878	1085	956	880	1080

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	5	11	28	21
Volume Left	1	1	0	2
Volume Right	0	3	1	2
cSH	1623	1630	885	905
Volume to Capacity	0.00	0.00	0.03	0.02
Queue Length 95th (ft)	0	0	2	2
Control Delay (s)	1.4	0.7	9.2	9.1
Lane LOS	A	A	A	A
Approach Delay (s)	1.4	0.7	9.2	9.1
Approach LOS			A	A

Intersection Summary			
Average Delay		7.1	
Intersection Capacity Utilization		13.3%	ICU Level of Service A
Analysis Period (min)		15	

Lanes, Volumes, Timings
7: Grandview Road & Blaine Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕	↗		↕	↗
Volume (vph)	77	284	2	0	134	61	8	77	170	26	0	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		150	0		150
Storage Lanes	0		0	0		0	0		1	0		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. 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
Frt		0.999			0.958				0.850			0.850
Flt Protected		0.989						0.995			0.950	
Satd. Flow (prot)	0	1863	0	0	1795	0	0	1890	1599	0	1805	1615
Flt Permitted		0.989						0.995			0.950	
Satd. Flow (perm)	0	1863	0	0	1795	0	0	1890	1599	0	1805	1615
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		5885			5344			397			4219	
Travel Time (s)		133.8			121.5			9.0			95.9	
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
Heavy Vehicles (%)	0%	1%	0%	0%	2%	0%	0%	0%	1%	0%	0%	0%
Adj. Flow (vph)	84	309	2	0	146	66	9	84	185	28	0	35
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	395	0	0	212	0	0	93	185	0	28	35
Enter Blocked Intersection	No	No	No									
Lane Alignment	Left	Left	Right									
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane					Yes							
Headway 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
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Yield			Yield			Yield			Yield	

Intersection Summary

Area Type:	Other
Control Type:	Roundabout
Intersection Capacity Utilization	50.8%
ICU Level of Service	A
Analysis Period (min)	15

Volume

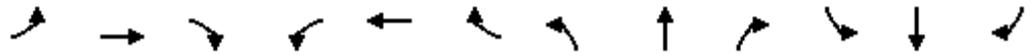
7: Grandview Road & Blaine Road

5/12/2011

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	77	284	2	0	134	61	8	77	170	26	0	32
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	0%	2%	0%	0%	0%	1%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	84	309	2	0	146	66	9	84	185	28	0	35
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	395	0	0	212	0	0	93	185	0	28	35
Intersection Summary												

HCM Unsignalized Intersection Capacity Analysis
 7: Grandview Road & Blaine Road

5/12/2011

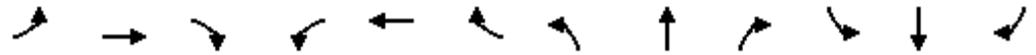


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Right Turn Channelized									Yes			Yes
Volume (veh/h)	77	284	2	0	134	61	8	77	170	26	0	32
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	84	309	2	0	146	66	9	84	185	28	0	35
Approach Volume (veh/h)		395			212			92			28	
Crossing Volume (veh/h)		28			176			421			154	
High Capacity (veh/h)		1354			1207			994			1227	
High v/c (veh/h)		0.29			0.18			0.09			0.02	
Low Capacity (veh/h)		1134			999			809			1018	
Low v/c (veh/h)		0.35			0.21			0.11			0.03	
Intersection Summary												
Maximum v/c High			0.29									
Maximum v/c Low			0.35									
Intersection Capacity Utilization			50.8%			ICU Level of Service					A	

Volume

8: Birch Bay-Lynden Road & Blaine Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	19	176	28	83	314	71	43	89	105	43	90	26
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	4%	2%	1%	1%	0%	0%	1%	0%	1%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	21	191	30	90	341	77	47	97	114	47	98	28
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	212	30	0	508	0	0	258	0	0	173	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 8: Birch Bay-Lynden Road & Blaine Road

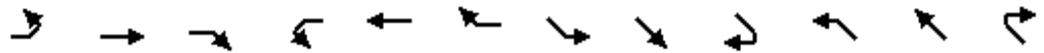
5/12/2011

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	19	176	28	83	314	71	43	89	105	43	90	26
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
Hourly flow rate (vph)	21	191	30	90	341	77	47	97	114	47	98	28
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total (vph)	212	30	509	258	173							
Volume Left (vph)	21	0	90	47	47							
Volume Right (vph)	0	30	77	114	28							
Hadj (s)	0.08	-0.63	-0.04	-0.22	-0.03							
Departure Headway (s)	7.0	6.2	6.0	6.4	6.9							
Degree Utilization, x	0.41	0.05	0.84	0.46	0.33							
Capacity (veh/h)	480	530	509	511	475							
Control Delay (s)	13.5	8.4	33.0	14.8	13.2							
Approach Delay (s)	12.9		33.0	14.8	13.2							
Approach LOS	B		D	B	B							
Intersection Summary												
Delay			22.0									
HCM Level of Service			C									
Intersection Capacity Utilization			61.8%	ICU Level of Service	B							
Analysis Period (min)			15									

Volume

9: Birch Bay-Lynden Road & Portal Way

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Volume (vph)	62	319	16	29	445	43	105	35	82	36	43	22
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	3%	1%	7%	3%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	67	347	17	32	484	47	114	38	89	39	47	24
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	431	0	32	531	0	114	127	0	0	110	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 9: Birch Bay-Lynden Road & Portal Way

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↕		↕	↕		↕	↕			↕	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	62	319	16	29	445	43	105	35	82	36	43	22
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
Hourly flow rate (vph)	67	347	17	32	484	47	114	38	89	39	47	24
Direction, Lane #	EB 1	WB 1	WB 2	SE 1	SE 2	NW 1						
Volume Total (vph)	432	32	530	114	127	110						
Volume Left (vph)	67	32	0	114	0	39						
Volume Right (vph)	17	0	47	0	89	24						
Hadj (s)	0.02	0.55	-0.04	0.55	-0.49	-0.06						
Departure Headway (s)	7.0	7.3	6.7	8.5	7.5	8.4						
Degree Utilization, x	0.84	0.06	0.98	0.27	0.26	0.26						
Capacity (veh/h)	432	480	530	407	464	405						
Control Delay (s)	36.6	9.6	59.3	13.5	11.9	14.3						
Approach Delay (s)	36.6	56.5		12.7		14.3						
Approach LOS	E	F		B		B						
Intersection Summary												
Delay			38.8									
HCM Level of Service			E									
Intersection Capacity Utilization			69.7%	ICU Level of Service								C
Analysis Period (min)			15									

Volume
10: Slater Road & Sunset Avenue

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Volume (vph)	4	610	71	585	41	17	4	84	138	6
Confl. Peds. (#/hr)										
Confl. Bikes (#/hr)										
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	3%	1%	2%	5%	6%	0%	1%	1%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)										
Mid-Block Traffic (%)		0%		0%			0%			0%
Adj. Flow (vph)	4	663	77	636	45	18	4	91	150	7
Shared Lane Traffic (%)										
Lane Group Flow (vph)	4	671	77	636	45	18	4	91	150	12
Intersection Summary										

Timings

10: Slater Road & Sunset Avenue

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↖	↗	↗	↖	↗	↗	↖	↗
Volume (vph)	4	610	71	585	41	17	4	84	138	6
Turn Type	pm+pt		pm+pt		Perm	Perm		Perm	Perm	
Protected Phases	7	4	3	8			2			2
Permitted Phases	4		8		8	2		2	2	
Detector Phase	7	4	3	8	8	2	2	2	2	2
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	20.0	9.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	15.0	70.0	15.0	70.0	70.0	30.0	30.0	30.0	30.0	30.0
Total Split (%)	13.0%	60.9%	13.0%	60.9%	60.9%	26.1%	26.1%	26.1%	26.1%	26.1%
Yellow Time (s)	4.0	3.5	4.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	0.5	1.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	4.0	5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	None	None	None	None	Min	Min	Min	Min	Min
Act Effct Green (s)	32.4	30.0	36.9	37.2	37.2	13.4	13.4	13.4	13.4	13.4
Actuated g/C Ratio	0.46	0.49	0.58	0.61	0.61	0.22	0.22	0.22	0.22	0.22
v/c Ratio	0.01	0.74	0.20	0.56	0.05	0.06	0.01	0.22	0.48	0.03
Control Delay	6.5	19.4	5.9	10.3	2.6	25.5	25.0	8.1	31.7	20.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.5	19.4	5.9	10.3	2.6	25.5	25.0	8.1	31.7	20.4
LOS	A	B	A	B	A	C	C	A	C	C
Approach Delay		19.4		9.4			11.5			30.9
Approach LOS		B		A			B			C

Intersection Summary

Cycle Length: 115	
Actuated Cycle Length: 61.4	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.74	
Intersection Signal Delay: 15.5	Intersection LOS: B
Intersection Capacity Utilization 61.6%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 10: Slater Road & Sunset Avenue



Queues

10: Slater Road & Sunset Avenue

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	4	671	77	636	45	18	4	91	150	12
v/c Ratio	0.01	0.74	0.20	0.56	0.05	0.06	0.01	0.22	0.48	0.03
Control Delay	6.5	19.4	5.9	10.3	2.6	25.5	25.0	8.1	31.7	20.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.5	19.4	5.9	10.3	2.6	25.5	25.0	8.1	31.7	20.4
Queue Length 50th (ft)	1	189	9	97	0	5	1	0	50	2
Queue Length 95th (ft)	4	399	28	342	14	26	10	38	138	17
Internal Link Dist (ft)		5760		6364			1689			1796
Turn Bay Length (ft)										
Base Capacity (vph)	477	1268	437	1386	1156	500	706	652	528	665
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.53	0.18	0.46	0.04	0.04	0.01	0.14	0.28	0.02

Intersection Summary

HCM Signalized Intersection Capacity Analysis

10: Slater Road & Sunset Avenue

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗	↗	↖	↗	↗	↖	↗	
Volume (vph)	4	610	7	71	585	41	17	4	84	138	6	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	4.0		5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1805	1842		1787	1863	1538	1703	1900	1599	1787	1781	
Flt Permitted	0.34	1.00		0.20	1.00	1.00	0.75	1.00	1.00	0.76	1.00	
Satd. Flow (perm)	641	1842		384	1863	1538	1344	1900	1599	1421	1781	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	4	663	8	77	636	45	18	4	91	150	7	5
RTOR Reduction (vph)	0	0	0	0	0	19	0	0	72	0	4	0
Lane Group Flow (vph)	4	671	0	77	636	26	18	4	19	150	8	0
Heavy Vehicles (%)	0%	3%	0%	1%	2%	5%	6%	0%	1%	1%	0%	0%
Turn Type	pm+pt			pm+pt		Perm	Perm		Perm	Perm		
Protected Phases	7	4		3	8			2			2	
Permitted Phases	4			8		8	2		2	2		
Actuated Green, G (s)	34.0	33.2		42.2	37.3	37.3	13.4	13.4	13.4	13.4	13.4	
Effective Green, g (s)	34.0	33.2		42.2	37.3	37.3	13.4	13.4	13.4	13.4	13.4	
Actuated g/C Ratio	0.53	0.51		0.65	0.58	0.58	0.21	0.21	0.21	0.21	0.21	
Clearance Time (s)	5.0	4.0		5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	352	948		358	1077	889	279	395	332	295	370	
v/s Ratio Prot	0.00	c0.36		c0.02	c0.34			0.00			0.00	
v/s Ratio Perm	0.01			0.12		0.02	0.01		0.01	c0.11		
v/c Ratio	0.01	0.71		0.22	0.59	0.03	0.06	0.01	0.06	0.51	0.02	
Uniform Delay, d1	7.6	11.9		7.0	8.7	5.8	20.5	20.3	20.5	22.6	20.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	2.4		0.3	0.9	0.0	0.1	0.0	0.1	1.4	0.0	
Delay (s)	7.6	14.4		7.3	9.6	5.8	20.6	20.3	20.6	24.0	20.4	
Level of Service	A	B		A	A	A	C	C	C	C	C	
Approach Delay (s)		14.3			9.1			20.6			23.7	
Approach LOS		B			A			C			C	

Intersection Summary

HCM Average Control Delay	13.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	64.5	Sum of lost time (s)	17.0
Intersection Capacity Utilization	61.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Volume

11: Slater Road & Lake Terrell Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	16	49	4	43	72	55	8	10	30	168	18	35
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	0%	0%	4%	0%	0%	3%	2%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	17	53	4	47	78	60	9	11	33	183	20	38
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	74	0	0	125	60	0	53	0	0	241	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 11: Slater Road & Lake Terrell Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕	↕		↕			↕	
Volume (veh/h)	16	49	4	43	72	55	8	10	30	168	18	35
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	17	53	4	47	78	60	9	11	33	183	20	38
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	78			58			310	262	55	300	264	78
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	78			58			310	262	55	300	264	78
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			97			99	98	97	70	97	96
cM capacity (veh/h)	1533			1560			588	620	1008	603	618	988

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	75	125	60	52	240
Volume Left	17	47	0	9	183
Volume Right	4	0	60	33	38
cSH	1533	1560	1700	807	644
Volume to Capacity	0.01	0.03	0.04	0.06	0.37
Queue Length 95th (ft)	1	2	0	5	43
Control Delay (s)	1.8	2.9	0.0	9.8	13.9
Lane LOS	A	A		A	B
Approach Delay (s)	1.8	2.0		9.8	13.9
Approach LOS				A	B

Intersection Summary

Average Delay	7.9
Intersection Capacity Utilization	36.1%
ICU Level of Service	A
Analysis Period (min)	15

Volume

12: Mountain View Road & Lake Terrell Road

5/12/2011

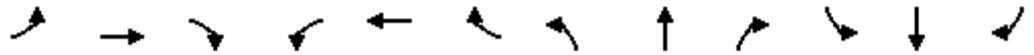


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	3	106	107	37	46	5	60	3	69	3	0	5
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	1%	0%	4%	0%	2%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	3	115	116	40	50	5	65	3	75	3	0	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	234	0	0	95	0	0	143	0	0	8	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 12: Mountain View Road & Lake Terrell Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	3	106	107	37	46	5	60	3	69	3	0	5
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
Hourly flow rate (vph)	3	115	116	40	50	5	65	3	75	3	0	5
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	235	96	143	9								
Volume Left (vph)	3	40	65	3								
Volume Right (vph)	116	5	75	5								
Hadj (s)	-0.28	0.09	-0.21	-0.30								
Departure Headway (s)	4.1	4.6	4.4	4.5								
Degree Utilization, x	0.27	0.12	0.18	0.01								
Capacity (veh/h)	848	742	759	723								
Control Delay (s)	8.6	8.2	8.4	7.6								
Approach Delay (s)	8.6	8.2	8.4	7.6								
Approach LOS	A	A	A	A								
Intersection Summary												
Delay			8.4									
HCM Level of Service			A									
Intersection Capacity Utilization			37.9%	ICU Level of Service	A							
Analysis Period (min)			15									

Volume

13: Henry Road & Kickerville Road

5/12/2011

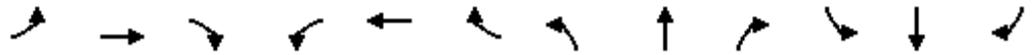


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	3	3	0	4	4	91	0	4	6	154	1	2
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	33%	0%	0%	25%	0%	0%	0%	0%	0%	1%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	3	3	0	4	4	99	0	4	7	167	1	2
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	6	0	0	107	0	0	11	0	0	170	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 13: Henry Road & Kickerville Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	3	3	0	4	4	91	0	4	6	154	1	2
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
Hourly flow rate (vph)	3	3	0	4	4	99	0	4	7	167	1	2

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	7	108	11	171
Volume Left (vph)	3	4	0	167
Volume Right (vph)	0	99	7	2
Hadj (s)	0.38	-0.53	-0.36	0.21
Departure Headway (s)	4.8	3.8	4.0	4.4
Degree Utilization, x	0.01	0.11	0.01	0.21
Capacity (veh/h)	713	904	866	807
Control Delay (s)	7.8	7.3	7.0	8.5
Approach Delay (s)	7.8	7.3	7.0	8.5
Approach LOS	A	A	A	A

Intersection Summary			
Delay		8.0	
HCM Level of Service		A	
Intersection Capacity Utilization	28.1%		ICU Level of Service A
Analysis Period (min)		15	

Volume

14: Main Street & Riverside Dr

5/12/2011



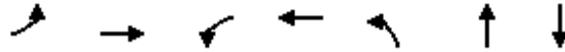
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Volume (vph)	16	695	167	601	256	11	31	11
Confl. Peds. (#/hr)								
Confl. Bikes (#/hr)								
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	2%	1%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0
Parking (#/hr)								
Mid-Block Traffic (%)		0%		0%		0%		0%
Adj. Flow (vph)	17	755	182	653	278	12	34	12
Shared Lane Traffic (%)								
Lane Group Flow (vph)	17	887	182	677	278	247	0	69

Intersection Summary

Timings

14: Main Street & Riverside Dr

5/12/2011

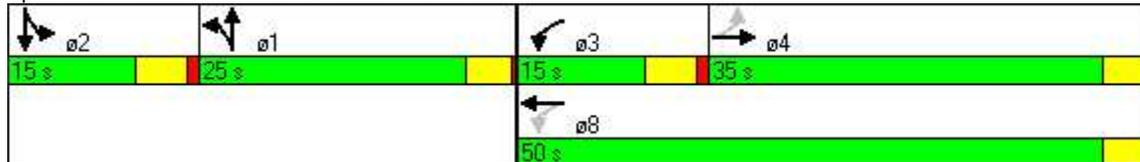


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Configurations	↶	↷	↶	↷	↶	↷	↷
Volume (vph)	16	695	167	601	256	11	11
Turn Type	Perm		pm+pt		Split		
Protected Phases		4	3	8	1	1	2
Permitted Phases	4		8				
Detector Phase	4	4	3	8	1	1	2
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	9.0	20.0	20.0	20.0	9.0
Total Split (s)	35.0	35.0	15.0	50.0	25.0	25.0	15.0
Total Split (%)	38.9%	38.9%	16.7%	55.6%	27.8%	27.8%	16.7%
Yellow Time (s)	3.5	3.5	4.0	3.5	3.5	3.5	4.0
All-Red Time (s)	0.5	0.5	1.0	0.5	0.5	0.5	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	5.0	4.0	4.0	4.0	5.0
Lead/Lag	Lag	Lag	Lead		Lag	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None	None	None	Min	Min	None
Act Effct Green (s)	25.6	25.6	39.0	40.1	16.6	16.6	7.7
Actuated g/C Ratio	0.34	0.34	0.52	0.54	0.22	0.22	0.10
v/c Ratio	0.07	0.73	0.58	0.36	0.69	0.46	0.35
Control Delay	20.4	26.6	21.0	11.9	39.4	8.0	32.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.4	26.6	21.0	11.9	39.4	8.0	32.1
LOS	C	C	C	B	D	A	C
Approach Delay		26.4		13.8		24.6	32.1
Approach LOS		C		B		C	C

Intersection Summary

Cycle Length: 90	
Actuated Cycle Length: 74.9	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.73	
Intersection Signal Delay: 21.6	Intersection LOS: C
Intersection Capacity Utilization 65.1%	ICU Level of Service C
Analysis Period (min) 15	

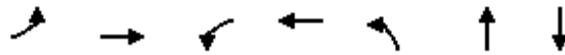
Splits and Phases: 14: Main Street & Riverside Dr



Queues

14: Main Street & Riverside Dr

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	17	887	182	677	278	247	69
v/c Ratio	0.07	0.73	0.58	0.36	0.69	0.46	0.35
Control Delay	20.4	26.6	21.0	11.9	39.4	8.0	32.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.4	26.6	21.0	11.9	39.4	8.0	32.1
Queue Length 50th (ft)	6	204	49	101	133	5	23
Queue Length 95th (ft)	21	294	107	154	229	64	65
Internal Link Dist (ft)		414		818		277	276
Turn Bay Length (ft)							
Base Capacity (vph)	296	1399	337	2048	496	614	249
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.06	0.63	0.54	0.33	0.56	0.40	0.28

Intersection Summary

HCM Signalized Intersection Capacity Analysis

14: Main Street & Riverside Dr

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗			↕	
Volume (vph)	16	695	121	167	601	22	256	11	216	31	11	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		5.0	4.0		4.0	4.0			5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00			1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.86			0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			0.98	
Satd. Flow (prot)	1805	3500		1770	3556		1805	1613			1771	
Flt Permitted	0.39	1.00		0.13	1.00		0.95	1.00			0.98	
Satd. Flow (perm)	749	3500		243	3556		1805	1613			1771	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	17	755	132	182	653	24	278	12	235	34	12	23
RTOR Reduction (vph)	0	16	0	0	3	0	0	183	0	0	20	0
Lane Group Flow (vph)	17	871	0	182	674	0	278	64	0	0	49	0
Heavy Vehicles (%)	0%	1%	0%	2%	1%	0%	0%	0%	1%	0%	0%	0%
Turn Type	Perm		pm+pt				Split		Split			
Protected Phases		4		3	8		1	1		2	2	
Permitted Phases	4			8								
Actuated Green, G (s)	26.0	26.0		40.1	40.1		16.6	16.6			5.9	
Effective Green, g (s)	26.0	26.0		40.1	40.1		16.6	16.6			5.9	
Actuated g/C Ratio	0.34	0.34		0.53	0.53		0.22	0.22			0.08	
Clearance Time (s)	4.0	4.0		5.0	4.0		4.0	4.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	258	1204		313	1886		396	354			138	
v/s Ratio Prot		c0.25		c0.07	0.19		c0.15	0.04			c0.03	
v/s Ratio Perm	0.02			0.24								
v/c Ratio	0.07	0.72		0.58	0.36		0.70	0.18			0.35	
Uniform Delay, d1	16.6	21.7		12.5	10.3		27.2	24.0			33.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.1	2.2		2.7	0.1		5.6	0.2			1.6	
Delay (s)	16.8	23.8		15.2	10.4		32.8	24.2			34.6	
Level of Service	B	C		B	B		C	C			C	
Approach Delay (s)		23.7			11.4			28.7			34.6	
Approach LOS		C			B			C			C	

Intersection Summary

HCM Average Control Delay	20.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	75.6	Sum of lost time (s)	18.0
Intersection Capacity Utilization	65.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Volume

15: Slater Road & Haxton Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Volume (vph)	2	206	274	173	50	51	285	19	39
Confl. Peds. (#/hr)									
Confl. Bikes (#/hr)									
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	1%	0%	6%	0%	4%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0
Parking (#/hr)									
Mid-Block Traffic (%)		0%		0%		0%			0%
Adj. Flow (vph)	2	224	298	188	54	55	310	21	42
Shared Lane Traffic (%)									
Lane Group Flow (vph)	2	259	298	215	0	109	310	21	45

Intersection Summary

Timings

15: Slater Road & Haxton Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations									
Volume (vph)	2	206	274	173	50	51	285	19	39
Turn Type	Perm		Perm		Perm		Perm	Perm	
Protected Phases		1		1		2			2
Permitted Phases	1		1		2		2	2	
Detector Phase	1	1	1	1	2	2	2	2	2
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	80.0	80.0	80.0	80.0	20.0	20.0	20.0	20.0	20.0
Total Split (%)	80.0%	80.0%	80.0%	80.0%	20.0%	20.0%	20.0%	20.0%	20.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lead	Lead	Lead	Lag	Lag	Lag	Lag	Lag
Lead-Lag Optimize?	Yes								
Recall Mode	None	None	None	None	Min	Min	Min	Min	Min
Act Effct Green (s)	16.8	16.8	16.8	16.8		9.2	9.2	9.2	9.2
Actuated g/C Ratio	0.48	0.48	0.48	0.48		0.27	0.27	0.27	0.27
v/c Ratio	0.00	0.29	0.55	0.24		0.26	0.49	0.06	0.09
Control Delay	5.0	5.9	10.8	5.5		13.7	5.1	12.3	11.6
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Total Delay	5.0	5.9	10.8	5.5		13.7	5.1	12.3	11.6
LOS	A	A	B	A		B	A	B	B
Approach Delay		5.8		8.6		7.3			11.8
Approach LOS		A		A		A			B

Intersection Summary

Cycle Length: 100	
Actuated Cycle Length: 34.7	
Natural Cycle: 45	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.55	
Intersection Signal Delay: 7.8	Intersection LOS: A
Intersection Capacity Utilization 50.1%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 15: Slater Road & Haxton Way



Queues

15: Slater Road & Haxton Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	2	259	298	215	109	310	21	45
v/c Ratio	0.00	0.29	0.55	0.24	0.26	0.49	0.06	0.09
Control Delay	5.0	5.9	10.8	5.5	13.7	5.1	12.3	11.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	5.0	5.9	10.8	5.5	13.7	5.1	12.3	11.6
Queue Length 50th (ft)	0	20	30	16	15	0	3	6
Queue Length 95th (ft)	2	66	106	54	55	44	17	27
Internal Link Dist (ft)		13101		11751	4951			2508
Turn Bay Length (ft)								
Base Capacity (vph)	967	1509	919	1524	620	805	519	750
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.00	0.17	0.32	0.14	0.18	0.39	0.04	0.06

Intersection Summary

HCM Signalized Intersection Capacity Analysis

15: Slater Road & Haxton Way

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗			↖	↗	↖	↗	
Volume (vph)	2	206	32	274	173	25	50	51	285	19	39	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Frt	1.00	0.98		1.00	0.98			1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00			0.98	1.00	0.95	1.00	
Satd. Flow (prot)	1805	1846		1787	1864			1801	1553	1805	1881	
Flt Permitted	0.62	1.00		0.60	1.00			0.84	1.00	0.69	1.00	
Satd. Flow (perm)	1185	1846		1127	1864			1558	1553	1305	1881	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	224	35	298	188	27	54	55	310	21	42	3
RTOR Reduction (vph)	0	12	0	0	11	0	0	0	226	0	2	0
Lane Group Flow (vph)	2	247	0	298	204	0	0	109	84	21	43	0
Heavy Vehicles (%)	0%	1%	0%	1%	0%	0%	6%	0%	4%	0%	0%	0%
Turn Type	Perm			Perm			Perm		Perm	Perm		
Protected Phases		1			1			2				2
Permitted Phases	1			1			2		2	2		
Actuated Green, G (s)	16.8	16.8		16.8	16.8			9.2	9.2	9.2	9.2	
Effective Green, g (s)	16.8	16.8		16.8	16.8			9.2	9.2	9.2	9.2	
Actuated g/C Ratio	0.49	0.49		0.49	0.49			0.27	0.27	0.27	0.27	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	586	912		557	921			422	420	353	509	
v/s Ratio Prot		0.13			0.11						0.02	
v/s Ratio Perm	0.00			c0.26				c0.07	0.05	0.02		
v/c Ratio	0.00	0.27		0.54	0.22			0.26	0.20	0.06	0.08	
Uniform Delay, d1	4.4	5.0		5.9	4.9			9.7	9.6	9.2	9.3	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	0.2		1.0	0.1			0.3	0.2	0.1	0.1	
Delay (s)	4.4	5.2		6.9	5.0			10.1	9.8	9.3	9.3	
Level of Service	A	A		A	A			B	A	A	A	
Approach Delay (s)		5.2			6.1			9.9			9.3	
Approach LOS		A			A			A			A	

Intersection Summary

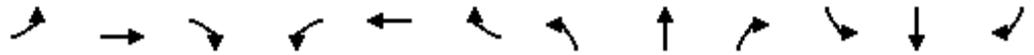
HCM Average Control Delay	7.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	34.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	50.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Volume

16: Birch Bay - Lynden Rd & Kickerville Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	5	321	5	18	418	7	8	9	42	1	6	2
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	0%	1%	0%	0%	0%	0%	1%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	5	349	5	20	454	8	9	10	46	1	7	2
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	359	0	0	482	0	0	65	0	0	10	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 16: Birch Bay - Lynden Rd & Kickerville Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	5	321	5	18	418	7	8	9	42	1	6	2
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	5	349	5	20	454	8	9	10	46	1	7	2
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	462			354			865	864	352	910	862	458
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	462			354			865	864	352	910	862	458
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			98			97	97	93	100	98	100
cM capacity (veh/h)	1110			1216			266	288	696	230	289	607

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	360	482	64	10
Volume Left	5	20	9	1
Volume Right	5	8	46	2
cSH	1110	1216	485	316
Volume to Capacity	0.00	0.02	0.13	0.03
Queue Length 95th (ft)	0	1	11	2
Control Delay (s)	0.2	0.5	13.5	16.7
Lane LOS	A	A	B	C
Approach Delay (s)	0.2	0.5	13.5	16.7
Approach LOS			B	C

Intersection Summary

Average Delay		1.5		
Intersection Capacity Utilization		44.2%	ICU Level of Service	A
Analysis Period (min)		15		

Volume

17: Grandview Road & Vista Drive

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	3	448	22	60	162	126	12	31	56	105	33	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	0%	2%	2%	0%	3%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	3	487	24	65	176	137	13	34	61	114	36	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	514	0	0	378	0	0	108	0	0	150	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 17: Grandview Road & Vista Drive

5/12/2011

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	3	448	22	60	162	126	12	31	56	105	33	0
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
Hourly flow rate (vph)	3	487	24	65	176	137	13	34	61	114	36	0
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	514	378	108	150								
Volume Left (vph)	3	65	13	114								
Volume Right (vph)	24	137	61	0								
Hadj (s)	-0.01	-0.15	-0.30	0.15								
Departure Headway (s)	5.4	5.5	6.4	6.7								
Degree Utilization, x	0.77	0.57	0.19	0.28								
Capacity (veh/h)	650	621	482	477								
Control Delay (s)	24.0	15.5	10.9	12.3								
Approach Delay (s)	24.0	15.5	10.9	12.3								
Approach LOS	C	C	B	B								
Intersection Summary												
Delay			18.4									
HCM Level of Service			C									
Intersection Capacity Utilization			68.8%	ICU Level of Service	C							
Analysis Period (min)			15									

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APPENDIX B

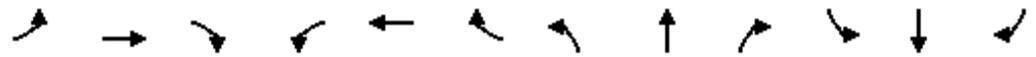
2026 Traffic Model – Without Project

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Volume

1: Aldergrove Road & Kickerville Road

5/12/2011



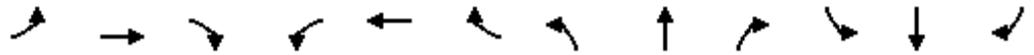
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	1	0	1	1	0	4	0	128	4	21	206	1
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	1	0	1	1	0	4	0	139	4	23	224	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	2	0	0	5	0	0	143	0	0	248	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

1: Aldergrove Road & Kickerville Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	1	0	1	1	0	4	0	128	4	21	206	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	1	0	1	1	0	4	0	139	4	23	224	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	416	414	224	412	412	141	225			143		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	416	414	224	412	412	141	225			143		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			98		
cM capacity (veh/h)	542	524	820	546	525	912	1356			1451		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	2	5	143	248								
Volume Left	1	1	0	23								
Volume Right	1	4	4	1								
cSH	652	804	1356	1451								
Volume to Capacity	0.00	0.01	0.00	0.02								
Queue Length 95th (ft)	0	1	0	1								
Control Delay (s)	10.5	9.5	0.0	0.8								
Lane LOS	B	A		A								
Approach Delay (s)	10.5	9.5	0.0	0.8								
Approach LOS	B	A										
Intersection Summary												
Average Delay			0.7									
Intersection Capacity Utilization			32.4%		ICU Level of Service					A		
Analysis Period (min)			15									

Volume

2: Grandview Road & Kickerville Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	19	501	96	19	169	11	88	125	163	4	16	5
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	3%	14%	2%	13%	0%	1%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	21	545	104	21	184	12	96	136	177	4	17	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	670	0	0	217	0	0	409	0	0	26	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

2: Grandview Road & Kickerville Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	19	501	96	19	169	11	88	125	163	4	16	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	21	545	104	21	184	12	96	136	177	4	17	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	196			649			883	875	597	1114	921	190
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	196			649			883	875	597	1114	921	190
tC, single (s)	4.1			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			98			61	51	65	94	93	99
cM capacity (veh/h)	1389			882			246	278	507	73	262	857
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	670	216	409	27								
Volume Left	21	21	96	4								
Volume Right	104	12	177	5								
cSH	1389	882	333	205								
Volume to Capacity	0.01	0.02	1.23	0.13								
Queue Length 95th (ft)	1	2	450	11								
Control Delay (s)	0.4	1.1	159.6	25.2								
Lane LOS	A	A	F	D								
Approach Delay (s)	0.4	1.1	159.6	25.2								
Approach LOS			F	D								
Intersection Summary												
Average Delay			50.3									
Intersection Capacity Utilization			71.1%		ICU Level of Service				C			
Analysis Period (min)			15									

Volume

3: Grandview Road & Olson Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	5	611	22	33	257	5	16	12	21	3	5	1
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	0%	3%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	5	664	24	36	279	5	17	13	23	3	5	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	693	0	0	320	0	0	53	0	0	9	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

3: Grandview Road & Olson Road

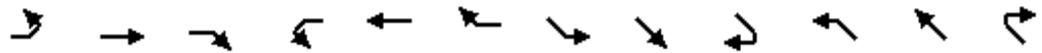
5/12/2011

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	611	22	33	257	5	16	12	21	3	5	1
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	5	664	24	36	279	5	17	13	23	3	5	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	285			688			1045	1043	676	1070	1053	282
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	285			688			1045	1043	676	1070	1053	282
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			96			91	94	95	98	98	100
cM capacity (veh/h)	1289			916			198	221	457	176	218	762
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	693	321	53	10								
Volume Left	5	36	17	3								
Volume Right	24	5	23	1								
cSH	1289	916	270	218								
Volume to Capacity	0.00	0.04	0.20	0.04								
Queue Length 95th (ft)	0	3	18	4								
Control Delay (s)	0.1	1.4	21.5	22.3								
Lane LOS	A	A	C	C								
Approach Delay (s)	0.1	1.4	21.5	22.3								
Approach LOS			C	C								
Intersection Summary												
Average Delay			1.8									
Intersection Capacity Utilization			47.1%		ICU Level of Service				A			
Analysis Period (min)			15									

Volume

4: Grandview Road & Portal Way

5/12/2011



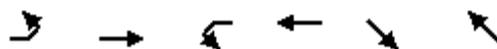
Lane Group	EBL	EBT	WBL	WBT	SEL	SET	NWL	NWT
Volume (vph)	23	977	11	570	69	47	43	55
Confl. Peds. (#/hr)								
Confl. Bikes (#/hr)								
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	2%	2%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0
Parking (#/hr)								
Mid-Block Traffic (%)		0%		0%		0%		0%
Adj. Flow (vph)	25	1062	12	620	75	51	47	60
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	1122	0	711	0	146	0	139

Intersection Summary

Timings

4: Grandview Road & Portal Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	SET	NWT
Lane Configurations		↕		↕	↕	↕
Volume (vph)	23	977	11	570	47	55
Turn Type	Perm		Perm			
Protected Phases		3		3	2	1
Permitted Phases	3		3			
Detector Phase	3	3	3	3	2	1
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	100.0	100.0	100.0	100.0	20.0	20.0
Total Split (%)	71.4%	71.4%	71.4%	71.4%	14.3%	14.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag					Lag	Lead
Lead-Lag Optimize?					Yes	Yes
Recall Mode	None	None	None	None	Min	Min
Act Effect Green (s)		84.0		84.0	14.0	13.4
Actuated g/C Ratio		0.68		0.68	0.11	0.11
v/c Ratio		0.91		0.58	0.71	0.68
Control Delay		29.6		12.9	73.5	70.8
Queue Delay		0.0		0.0	0.0	0.0
Total Delay		29.6		12.9	73.5	70.8
LOS		C		B	E	E
Approach Delay		29.6		12.9	73.5	70.8
Approach LOS		C		B	E	E

Intersection Summary

Cycle Length: 140	
Actuated Cycle Length: 123.9	
Natural Cycle: 110	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.91	
Intersection Signal Delay: 29.7	Intersection LOS: C
Intersection Capacity Utilization 84.2%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 4: Grandview Road & Portal Way



Queues

4: Grandview Road & Portal Way

5/12/2011



Lane Group	EBT	WBT	SET	NWT
Lane Group Flow (vph)	1122	711	146	139
v/c Ratio	0.91	0.58	0.71	0.68
Control Delay	29.6	12.9	73.5	70.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	29.6	12.9	73.5	70.8
Queue Length 50th (ft)	760	300	125	115
Queue Length 95th (ft)	#1137	411	#217	189
Internal Link Dist (ft)	3764	783	22485	3678
Turn Bay Length (ft)				
Base Capacity (vph)	1289	1277	240	244
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.87	0.56	0.61	0.57

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

4: Grandview Road & Portal Way

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	23	977	32	11	570	73	69	47	18	43	55	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		1.00			0.98			0.98			0.97	
Flt Protected		1.00			1.00			0.97			0.98	
Satd. Flow (prot)		1855			1834			1800			1810	
Flt Permitted		0.98			0.98			0.97			0.98	
Satd. Flow (perm)		1814			1795			1800			1810	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	1062	35	12	620	79	75	51	20	47	60	32
RTOR Reduction (vph)	0	1	0	0	3	0	0	4	0	0	8	0
Lane Group Flow (vph)	0	1121	0	0	708	0	0	142	0	0	131	0
Heavy Vehicles (%)	0%	2%	0%	0%	2%	2%	2%	0%	0%	0%	0%	0%
Turn Type	Perm		Perm			Split			Split			
Protected Phases		3			3		2	2		1	1	
Permitted Phases	3			3								
Actuated Green, G (s)		84.0			84.0			14.0			13.4	
Effective Green, g (s)		84.0			84.0			14.0			13.4	
Actuated g/C Ratio		0.68			0.68			0.11			0.11	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1235			1222			204			197	
v/s Ratio Prot								c0.08			c0.07	
v/s Ratio Perm		c0.62			0.39							
v/c Ratio		0.91			0.58			0.69			0.66	
Uniform Delay, d1		16.5			10.4			52.6			52.8	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		9.8			0.7			9.8			8.2	
Delay (s)		26.2			11.1			62.4			61.0	
Level of Service		C			B			E			E	
Approach Delay (s)		26.2			11.1			62.4			61.0	
Approach LOS		C			B			E			E	

Intersection Summary

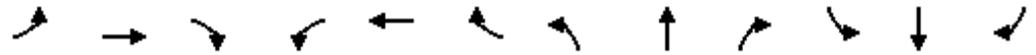
HCM Average Control Delay	25.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	123.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Volume

5: Bay Road & Kickerville Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	8	129	10	4	111	21	5	25	4	40	85	32
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	9	140	11	4	121	23	5	27	4	43	92	35
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	160	0	0	148	0	0	36	0	0	170	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

5: Bay Road & Kickerville Road

5/12/2011

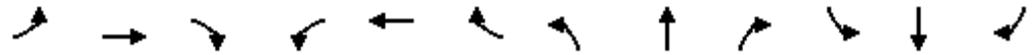


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	8	129	10	4	111	21	5	25	4	40	85	32
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	140	11	4	121	23	5	27	4	43	92	35
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	143			151			385	315	146	322	309	132
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	143			151			385	315	146	322	309	132
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			99	95	100	93	85	96
cM capacity (veh/h)	1451			1442			487	598	907	606	603	923
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	160	148	37	171								
Volume Left	9	4	5	43								
Volume Right	11	23	4	35								
cSH	1451	1442	602	650								
Volume to Capacity	0.01	0.00	0.06	0.26								
Queue Length 95th (ft)	0	0	5	26								
Control Delay (s)	0.5	0.2	11.4	12.5								
Lane LOS	A	A	B	B								
Approach Delay (s)	0.5	0.2	11.4	12.5								
Approach LOS			B	B								
Intersection Summary												
Average Delay			5.2									
Intersection Capacity Utilization			32.1%		ICU Level of Service				A			
Analysis Period (min)			15									

Volume

6: Arnie Road & Valley View Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	1	5	0	1	8	4	0	34	1	3	21	3
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	1	5	0	1	9	4	0	37	1	3	23	3
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	6	0	0	14	0	0	38	0	0	29	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

6: Arnie Road & Valley View Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	1	5	0	1	8	4	0	34	1	3	21	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	1	5	0	1	9	4	0	37	1	3	23	3
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	13			5			35	23	5	40	21	11
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	13			5			35	23	5	40	21	11
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	96	100	100	97	100
cM capacity (veh/h)	1619			1629			953	873	1083	936	876	1076

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	7	14	38	29
Volume Left	1	1	0	3
Volume Right	0	4	1	3
cSH	1619	1629	878	901
Volume to Capacity	0.00	0.00	0.04	0.03
Queue Length 95th (ft)	0	0	3	3
Control Delay (s)	1.2	0.6	9.3	9.1
Lane LOS	A	A	A	A
Approach Delay (s)	1.2	0.6	9.3	9.1
Approach LOS			A	A

Intersection Summary			
Average Delay		7.2	
Intersection Capacity Utilization	13.8%		ICU Level of Service A
Analysis Period (min)	15		

Lanes, Volumes, Timings
7: Grandview Road & Blaine Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕	↕		↕	↕
Volume (vph)	106	390	3	0	184	84	11	106	233	36	0	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. 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
Frt		0.999			0.958				0.850			0.850
Flt Protected		0.990						0.995			0.950	
Satd. Flow (prot)	0	1865	0	0	1796	0	0	1890	1599	0	1805	1615
Flt Permitted		0.990						0.995			0.950	
Satd. Flow (perm)	0	1865	0	0	1796	0	0	1890	1599	0	1805	1615
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		5885			5344			203			4219	
Travel Time (s)		133.8			121.5			4.6			95.9	
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
Heavy Vehicles (%)	0%	1%	0%	0%	2%	0%	0%	0%	1%	0%	0%	0%
Adj. Flow (vph)	115	424	3	0	200	91	12	115	253	39	0	48
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	542	0	0	291	0	0	127	253	0	39	48
Enter Blocked Intersection	No	No	No									
Lane Alignment	Left	Left	Right									
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Yield			Yield			Yield			Yield	

Intersection Summary

Area Type: Other

Control Type: Roundabout

Intersection Capacity Utilization 64.2% ICU Level of Service C

Analysis Period (min) 15

Volume

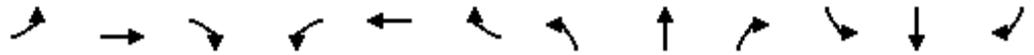
7: Grandview Road & Blaine Road

5/12/2011

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	106	390	3	0	184	84	11	106	233	36	0	44
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	0%	2%	0%	0%	0%	1%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	115	424	3	0	200	91	12	115	253	39	0	48
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	542	0	0	291	0	0	127	253	0	39	48
Intersection Summary												

HCM Unsignalized Intersection Capacity Analysis
 7: Grandview Road & Blaine Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Right Turn Channelized									Yes			Yes
Volume (veh/h)	106	390	3	0	184	84	11	106	233	36	0	44
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
Hourly flow rate (vph)	115	424	3	0	200	91	12	115	253	39	0	48
Approach Volume (veh/h)		542			291			127			39	
Crossing Volume (veh/h)		39			242			578			212	
High Capacity (veh/h)		1343			1145			877			1173	
High v/c (veh/h)		0.40			0.25			0.15			0.03	
Low Capacity (veh/h)		1123			944			704			969	
Low v/c (veh/h)		0.48			0.31			0.18			0.04	
Intersection Summary												
Maximum v/c High			0.40									
Maximum v/c Low			0.48									
Intersection Capacity Utilization			64.2%		ICU Level of Service					C		

Volume

8: Birch Bay-Lynden Road & Blaine Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	26	242	38	114	431	97	59	122	144	59	124	36
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	4%	2%	1%	1%	0%	0%	1%	0%	1%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	28	263	41	124	468	105	64	133	157	64	135	39
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	291	41	0	697	0	0	354	0	0	238	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 8: Birch Bay-Lynden Road & Blaine Road

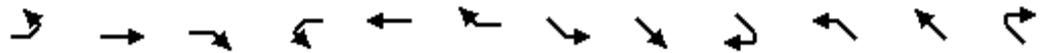
5/12/2011

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	26	242	38	114	431	97	59	122	144	59	124	36
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
Hourly flow rate (vph)	28	263	41	124	468	105	64	133	157	64	135	39
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total (vph)	291	41	698	353	238							
Volume Left (vph)	28	0	124	64	64							
Volume Right (vph)	0	41	105	157	39							
Hadj (s)	0.08	-0.63	-0.04	-0.22	-0.04							
Departure Headway (s)	8.2	7.5	7.4	7.5	8.1							
Degree Utilization, x	0.66	0.09	1.43	0.74	0.54							
Capacity (veh/h)	414	459	489	464	411							
Control Delay (s)	24.5	10.0	226.7	28.6	20.1							
Approach Delay (s)	22.7		226.7	28.6	20.1							
Approach LOS	C		F	D	C							
Intersection Summary												
Delay			111.4									
HCM Level of Service			F									
Intersection Capacity Utilization			81.1%	ICU Level of Service	D							
Analysis Period (min)			15									

Volume

9: Birch Bay-Lynden Road & Portal Way

5/12/2011



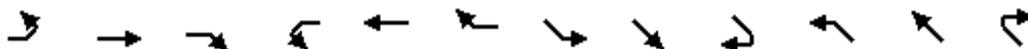
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Volume (vph)	85	438	22	40	611	59	144	48	113	49	59	30
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	3%	1%	7%	3%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	92	476	24	43	664	64	157	52	123	53	64	33
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	592	0	43	728	0	157	175	0	0	150	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

9: Birch Bay-Lynden Road & Portal Way

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↕		↖	↗		↖	↗			↕	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	85	438	22	40	611	59	144	48	113	49	59	30
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
Hourly flow rate (vph)	92	476	24	43	664	64	157	52	123	53	64	33
Direction, Lane #	EB 1	WB 1	WB 2	SE 1	SE 2	NW 1						
Volume Total (vph)	592	43	728	157	175	150						
Volume Left (vph)	92	43	0	157	0	53						
Volume Right (vph)	24	0	64	0	123	33						
Hadj (s)	0.02	0.55	-0.04	0.55	-0.49	-0.06						
Departure Headway (s)	7.6	8.0	7.4	8.9	7.9	9.0						
Degree Utilization, x	1.25	0.10	1.50	0.39	0.38	0.38						
Capacity (veh/h)	462	442	489	396	449	380						
Control Delay (s)	154.1	10.7	254.9	16.2	14.4	17.3						
Approach Delay (s)	154.1	241.2		15.3		17.3						
Approach LOS	F	F		C		C						
Intersection Summary												
Delay			154.5									
HCM Level of Service			F									
Intersection Capacity Utilization			95.3%	ICU Level of Service								F
Analysis Period (min)			15									

Volume
10: Slater Road & Sunset Avenue

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Volume (vph)	5	837	97	803	56	23	5	115	189	8
Confl. Peds. (#/hr)										
Confl. Bikes (#/hr)										
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	3%	1%	2%	5%	6%	0%	1%	1%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)										
Mid-Block Traffic (%)		0%		0%			0%			0%
Adj. Flow (vph)	5	910	105	873	61	25	5	125	205	9
Shared Lane Traffic (%)										
Lane Group Flow (vph)	5	921	105	873	61	25	5	125	205	17

Intersection Summary

Timings

10: Slater Road & Sunset Avenue

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations										
Volume (vph)	5	837	97	803	56	23	5	115	189	8
Turn Type	pm+pt		pm+pt		Perm	Perm		Perm	Perm	
Protected Phases	7	4	3	8			2			2
Permitted Phases	4		8		8	2		2	2	
Detector Phase	7	4	3	8	8	2	2	2	2	2
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	20.0	9.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	15.0	70.0	15.0	70.0	70.0	30.0	30.0	30.0	30.0	30.0
Total Split (%)	13.0%	60.9%	13.0%	60.9%	60.9%	26.1%	26.1%	26.1%	26.1%	26.1%
Yellow Time (s)	4.0	3.5	4.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	0.5	1.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	4.0	5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	None	None	None	None	Min	Min	Min	Min	Min
Act Effct Green (s)	54.9	52.5	59.9	60.1	60.1	19.2	19.2	19.2	19.2	19.2
Actuated g/C Ratio	0.56	0.58	0.65	0.67	0.67	0.21	0.21	0.21	0.21	0.21
v/c Ratio	0.02	0.86	0.40	0.70	0.06	0.09	0.01	0.28	0.68	0.04
Control Delay	7.0	27.0	9.9	14.3	2.6	34.6	33.8	8.6	48.7	24.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.0	27.0	9.9	14.3	2.6	34.6	33.8	8.6	48.7	24.9
LOS	A	C	A	B	A	C	C	A	D	C
Approach Delay		26.9		13.2			13.6			46.9
Approach LOS		C		B			B			D

Intersection Summary

Cycle Length: 115	
Actuated Cycle Length: 89.9	
Natural Cycle: 70	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.86	
Intersection Signal Delay: 21.8	Intersection LOS: C
Intersection Capacity Utilization 78.0%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 10: Slater Road & Sunset Avenue



Queues

10: Slater Road & Sunset Avenue

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	5	921	105	873	61	25	5	125	205	17
v/c Ratio	0.02	0.86	0.40	0.70	0.06	0.09	0.01	0.28	0.68	0.04
Control Delay	7.0	27.0	9.9	14.3	2.6	34.6	33.8	8.6	48.7	24.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.0	27.0	9.9	14.3	2.6	34.6	33.8	8.6	48.7	24.9
Queue Length 50th (ft)	1	438	18	251	1	12	2	0	116	4
Queue Length 95th (ft)	5	#802	40	624	18	38	13	48	220	25
Internal Link Dist (ft)		5760		6364			1689			1796
Turn Bay Length (ft)										
Base Capacity (vph)	364	1187	302	1320	1106	377	536	540	400	503
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.78	0.35	0.66	0.06	0.07	0.01	0.23	0.51	0.03

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

10: Slater Road & Sunset Avenue

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↑	↗	↖	↑	↗	↖	↗	
Volume (vph)	5	837	10	97	803	56	23	5	115	189	8	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	4.0		5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1805	1842		1787	1863	1538	1703	1900	1599	1787	1766	
Flt Permitted	0.20	1.00		0.11	1.00	1.00	0.75	1.00	1.00	0.75	1.00	
Satd. Flow (perm)	384	1842		199	1863	1538	1338	1900	1599	1419	1766	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	910	11	105	873	61	25	5	125	205	9	8
RTOR Reduction (vph)	0	0	0	0	0	20	0	0	99	0	6	0
Lane Group Flow (vph)	5	921	0	105	873	41	25	5	26	205	11	0
Heavy Vehicles (%)	0%	3%	0%	1%	2%	5%	6%	0%	1%	1%	0%	0%
Turn Type	pm+pt			pm+pt		Perm	Perm		Perm	Perm		
Protected Phases	7	4		3	8			2			2	
Permitted Phases	4			8		8	2		2	2		
Actuated Green, G (s)	56.2	55.3		65.8	60.1	60.1	19.2	19.2	19.2	19.2	19.2	
Effective Green, g (s)	56.2	55.3		65.8	60.1	60.1	19.2	19.2	19.2	19.2	19.2	
Actuated g/C Ratio	0.60	0.59		0.71	0.64	0.64	0.21	0.21	0.21	0.21	0.21	
Clearance Time (s)	5.0	4.0		5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	245	1093		238	1201	992	276	391	329	292	364	
v/s Ratio Prot	0.00	c0.50		c0.03	c0.47			0.00			0.01	
v/s Ratio Perm	0.01			0.29		0.03	0.02		0.02	c0.14		
v/c Ratio	0.02	0.84		0.44	0.73	0.04	0.09	0.01	0.08	0.70	0.03	
Uniform Delay, d1	10.1	15.4		14.9	11.1	6.0	29.9	29.5	29.9	34.3	29.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	6.0		1.3	2.2	0.0	0.1	0.0	0.1	7.4	0.0	
Delay (s)	10.1	21.4		16.2	13.3	6.1	30.1	29.5	30.0	41.8	29.6	
Level of Service	B	C		B	B	A	C	C	C	D	C	
Approach Delay (s)		21.4			13.2			30.0			40.8	
Approach LOS		C			B			C			D	

Intersection Summary

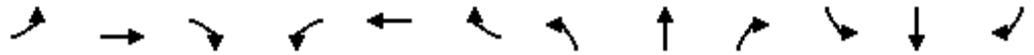
HCM Average Control Delay	20.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	93.2	Sum of lost time (s)	17.0
Intersection Capacity Utilization	78.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Volume

11: Slater Road & Lake Terrell Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	22	67	5	59	99	76	11	14	41	231	25	48
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	0%	0%	4%	0%	0%	3%	2%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	24	73	5	64	108	83	12	15	45	251	27	52
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	102	0	0	172	83	0	72	0	0	330	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 11: Slater Road & Lake Terrell Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕	↕		↕			↕	
Volume (veh/h)	22	67	5	59	99	76	11	14	41	231	25	48
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	24	73	5	64	108	83	12	15	45	251	27	52
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	108			78			425	359	76	411	362	108
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	108			78			425	359	76	411	362	108
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			96			97	97	95	49	95	95
cM capacity (veh/h)	1496			1533			472	538	983	492	536	952

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	102	172	83	72	330
Volume Left	24	64	0	12	251
Volume Right	5	0	83	45	52
cSH	1496	1533	1700	725	537
Volume to Capacity	0.02	0.04	0.05	0.10	0.62
Queue Length 95th (ft)	1	3	0	8	104
Control Delay (s)	1.8	3.0	0.0	10.5	21.9
Lane LOS	A	A		B	C
Approach Delay (s)	1.8	2.0		10.5	21.9
Approach LOS				B	C

Intersection Summary

Average Delay	11.4
Intersection Capacity Utilization	44.2%
ICU Level of Service	A
Analysis Period (min)	15

Volume

12: Mountain View Road & Lake Terrell Road

5/12/2011

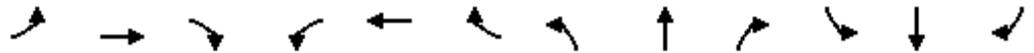


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	4	146	147	51	63	7	82	4	95	4	0	7
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	1%	0%	4%	0%	2%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	4	159	160	55	68	8	89	4	103	4	0	8
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	323	0	0	131	0	0	196	0	0	12	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 12: Mountain View Road & Lake Terrell Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	4	146	147	51	63	7	82	4	95	4	0	7
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
Hourly flow rate (vph)	4	159	160	55	68	8	89	4	103	4	0	8

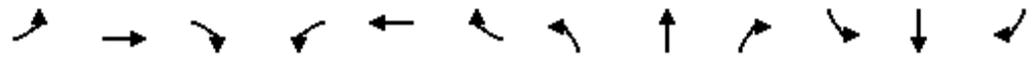
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	323	132	197	12
Volume Left (vph)	4	55	89	4
Volume Right (vph)	160	8	103	8
Hadj (s)	-0.28	0.08	-0.21	-0.31
Departure Headway (s)	4.3	4.9	4.7	4.9
Degree Utilization, x	0.39	0.18	0.26	0.02
Capacity (veh/h)	801	692	701	639
Control Delay (s)	10.0	8.9	9.4	8.0
Approach Delay (s)	10.0	8.9	9.4	8.0
Approach LOS	B	A	A	A

Intersection Summary			
Delay		9.6	
HCM Level of Service		A	
Intersection Capacity Utilization	48.6%		ICU Level of Service A
Analysis Period (min)		15	

Volume

13: Henry Road & Kickerville Road

5/12/2011

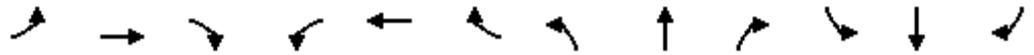


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	4	4	0	5	5	125	0	5	8	211	1	3
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	33%	0%	0%	25%	0%	0%	0%	0%	0%	1%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	4	4	0	5	5	136	0	5	9	229	1	3
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	8	0	0	146	0	0	14	0	0	233	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 13: Henry Road & Kickerville Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	4	4	0	5	5	125	0	5	8	211	1	3
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
Hourly flow rate (vph)	4	4	0	5	5	136	0	5	9	229	1	3

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	9	147	14	234
Volume Left (vph)	4	5	0	229
Volume Right (vph)	0	136	9	3
Hadj (s)	0.38	-0.53	-0.37	0.20
Departure Headway (s)	5.0	4.0	4.1	4.5
Degree Utilization, x	0.01	0.16	0.02	0.29
Capacity (veh/h)	664	849	821	776
Control Delay (s)	8.1	7.7	7.2	9.3
Approach Delay (s)	8.1	7.7	7.2	9.3
Approach LOS	A	A	A	A

Intersection Summary			
Delay		8.6	
HCM Level of Service		A	
Intersection Capacity Utilization	33.5%		ICU Level of Service A
Analysis Period (min)		15	

Volume

14: Main Street & Riverside Dr

5/12/2011



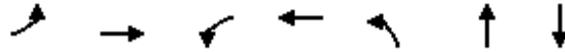
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Volume (vph)	22	954	229	825	351	15	43	15
Confl. Peds. (#/hr)								
Confl. Bikes (#/hr)								
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	2%	1%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0
Parking (#/hr)								
Mid-Block Traffic (%)		0%		0%		0%		0%
Adj. Flow (vph)	24	1037	249	897	382	16	47	16
Shared Lane Traffic (%)								
Lane Group Flow (vph)	24	1217	249	930	382	339	0	95

Intersection Summary

Timings

14: Main Street & Riverside Dr

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Configurations							
Volume (vph)	22	954	229	825	351	15	15
Turn Type	Perm		pm+pt		Split		
Protected Phases		4	3	8	1	1	2
Permitted Phases	4		8				
Detector Phase	4	4	3	8	1	1	2
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	9.0	20.0	20.0	20.0	9.0
Total Split (s)	35.0	35.0	15.0	50.0	25.0	25.0	15.0
Total Split (%)	38.9%	38.9%	16.7%	55.6%	27.8%	27.8%	16.7%
Yellow Time (s)	3.5	3.5	4.0	3.5	3.5	3.5	4.0
All-Red Time (s)	0.5	0.5	1.0	0.5	0.5	0.5	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	5.0	4.0	4.0	4.0	5.0
Lead/Lag	Lag	Lag	Lead		Lag	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None	None	None	Min	Min	None
Act Effct Green (s)	31.3	31.3	45.4	46.4	20.1	20.1	8.3
Actuated g/C Ratio	0.37	0.37	0.53	0.54	0.24	0.24	0.09
v/c Ratio	0.11	0.94	0.85	0.48	0.90	0.54	0.50
Control Delay	22.0	42.0	46.1	14.1	58.8	7.9	38.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.0	42.0	46.1	14.1	58.8	7.9	38.9
LOS	C	D	D	B	E	A	D
Approach Delay		41.6		20.9		34.8	38.9
Approach LOS		D		C		C	D

Intersection Summary

Cycle Length: 90	
Actuated Cycle Length: 85.4	
Natural Cycle: 80	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.94	
Intersection Signal Delay: 32.5	Intersection LOS: C
Intersection Capacity Utilization 83.7%	ICU Level of Service E
Analysis Period (min) 15	

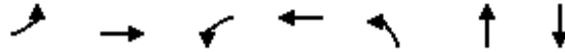
Splits and Phases: 14: Main Street & Riverside Dr



Queues

14: Main Street & Riverside Dr

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	24	1217	249	930	382	339	95
v/c Ratio	0.11	0.94	0.85	0.48	0.90	0.54	0.50
Control Delay	22.0	42.0	46.1	14.1	58.8	7.9	38.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.0	42.0	46.1	14.1	58.8	7.9	38.9
Queue Length 50th (ft)	9	346	89	168	209	7	39
Queue Length 95th (ft)	28	#507	#232	226	#378	77	86
Internal Link Dist (ft)		414		818		277	276
Turn Bay Length (ft)							
Base Capacity (vph)	214	1298	294	1937	441	638	219
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.94	0.85	0.48	0.87	0.53	0.43

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

14: Main Street & Riverside Dr

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	22	954	166	229	825	30	351	15	297	43	15	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		5.0	4.0		4.0	4.0			5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00			1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.86			0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			0.98	
Satd. Flow (prot)	1805	3500		1770	3556		1805	1613			1770	
Flt Permitted	0.31	1.00		0.11	1.00		0.95	1.00			0.98	
Satd. Flow (perm)	584	3500		205	3556		1805	1613			1770	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	24	1037	180	249	897	33	382	16	323	47	16	32
RTOR Reduction (vph)	0	15	0	0	3	0	0	248	0	0	21	0
Lane Group Flow (vph)	24	1202	0	249	927	0	382	91	0	0	74	0
Heavy Vehicles (%)	0%	1%	0%	2%	1%	0%	0%	0%	1%	0%	0%	0%
Turn Type	Perm		pm+pt			Split		Split				
Protected Phases		4		3	8		1	1		2	2	
Permitted Phases	4			8								
Actuated Green, G (s)	31.3	31.3		46.4	46.4		20.1	20.1			7.0	
Effective Green, g (s)	31.3	31.3		46.4	46.4		20.1	20.1			7.0	
Actuated g/C Ratio	0.36	0.36		0.54	0.54		0.23	0.23			0.08	
Clearance Time (s)	4.0	4.0		5.0	4.0		4.0	4.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	211	1266		293	1907		419	375			143	
v/s Ratio Prot		c0.34		c0.10	0.26		c0.21	0.06			c0.04	
v/s Ratio Perm	0.04			0.36								
v/c Ratio	0.11	0.95		0.85	0.49		0.91	0.24			0.52	
Uniform Delay, d1	18.4	26.8		21.1	12.6		32.3	27.0			38.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.2	14.6		20.0	0.2		23.8	0.3			3.1	
Delay (s)	18.6	41.5		41.0	12.8		56.1	27.3			41.3	
Level of Service	B	D		D	B		E	C			D	
Approach Delay (s)		41.0			18.7			42.6			41.3	
Approach LOS		D			B			D			D	

Intersection Summary

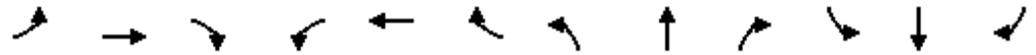
HCM Average Control Delay	33.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	86.5	Sum of lost time (s)	18.0
Intersection Capacity Utilization	83.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Volume

15: Slater Road & Haxton Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Volume (vph)	3	283	376	237	69	70	391	26	54
Confl. Peds. (#/hr)									
Confl. Bikes (#/hr)									
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	1%	0%	6%	0%	4%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0
Parking (#/hr)									
Mid-Block Traffic (%)		0%		0%		0%			0%
Adj. Flow (vph)	3	308	409	258	75	76	425	28	59
Shared Lane Traffic (%)									
Lane Group Flow (vph)	3	356	409	295	0	151	425	28	63

Intersection Summary

Timings

15: Slater Road & Haxton Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations									
Volume (vph)	3	283	376	237	69	70	391	26	54
Turn Type	Perm		Perm		Perm		Perm	Perm	
Protected Phases		1		1		2			2
Permitted Phases	1		1		2		2	2	
Detector Phase	1	1	1	1	2	2	2	2	2
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	80.0	80.0	80.0	80.0	20.0	20.0	20.0	20.0	20.0
Total Split (%)	80.0%	80.0%	80.0%	80.0%	20.0%	20.0%	20.0%	20.0%	20.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lead	Lead	Lead	Lag	Lag	Lag	Lag	Lag
Lead-Lag Optimize?	Yes								
Recall Mode	None	None	None	None	Min	Min	Min	Min	Min
Act Effect Green (s)	29.2	29.2	29.2	29.2		11.8	11.8	11.8	11.8
Actuated g/C Ratio	0.58	0.58	0.58	0.58		0.24	0.24	0.24	0.24
v/c Ratio	0.00	0.33	0.70	0.27		0.42	0.61	0.09	0.14
Control Delay	4.0	5.6	14.5	5.1		24.4	7.3	21.2	19.8
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Total Delay	4.0	5.6	14.5	5.1		24.4	7.3	21.2	19.8
LOS	A	A	B	A		C	A	C	B
Approach Delay		5.6		10.6		11.8			20.2
Approach LOS		A		B		B			C

Intersection Summary

Cycle Length: 100	
Actuated Cycle Length: 50.1	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.70	
Intersection Signal Delay: 10.4	Intersection LOS: B
Intersection Capacity Utilization 62.6%	ICU Level of Service B
Analysis Period (min) 15	

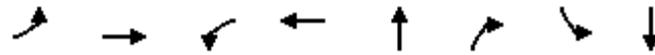
Splits and Phases: 15: Slater Road & Haxton Way



Queues

15: Slater Road & Haxton Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	3	356	409	295	151	425	28	63
v/c Ratio	0.00	0.33	0.70	0.27	0.42	0.61	0.09	0.14
Control Delay	4.0	5.6	14.5	5.1	24.4	7.3	21.2	19.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	4.0	5.6	14.5	5.1	24.4	7.3	21.2	19.8
Queue Length 50th (ft)	0	39	66	31	36	0	6	13
Queue Length 95th (ft)	3	84	168	68	118	73	32	54
Internal Link Dist (ft)		13101		11751	4951			2508
Turn Bay Length (ft)								
Base Capacity (vph)	876	1472	796	1486	476	778	393	590
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.00	0.24	0.51	0.20	0.32	0.55	0.07	0.11

Intersection Summary

HCM Signalized Intersection Capacity Analysis

15: Slater Road & Haxton Way

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	3	283	44	376	237	34	69	70	391	26	54	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Frt	1.00	0.98		1.00	0.98			1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00			0.98	1.00	0.95	1.00	
Satd. Flow (prot)	1805	1846		1787	1864			1800	1553	1805	1882	
Flt Permitted	0.58	1.00		0.53	1.00			0.83	1.00	0.66	1.00	
Satd. Flow (perm)	1101	1846		1000	1864			1523	1553	1256	1882	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	308	48	409	258	37	75	76	425	28	59	4
RTOR Reduction (vph)	0	9	0	0	9	0	0	0	323	0	2	0
Lane Group Flow (vph)	3	347	0	409	286	0	0	151	102	28	61	0
Heavy Vehicles (%)	0%	1%	0%	1%	0%	0%	6%	0%	4%	0%	0%	0%
Turn Type	Perm			Perm			Perm		Perm	Perm		
Protected Phases		1			1			2				2
Permitted Phases	1			1			2		2	2		
Actuated Green, G (s)	29.2	29.2		29.2	29.2			11.8	11.8	11.8	11.8	
Effective Green, g (s)	29.2	29.2		29.2	29.2			11.8	11.8	11.8	11.8	
Actuated g/C Ratio	0.60	0.60		0.60	0.60			0.24	0.24	0.24	0.24	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	656	1100		596	1111			367	374	302	453	
v/s Ratio Prot		0.19			0.15						0.03	
v/s Ratio Perm	0.00			c0.41				c0.10	0.07	0.02		
v/c Ratio	0.00	0.32		0.69	0.26			0.41	0.27	0.09	0.13	
Uniform Delay, d1	4.0	4.9		6.8	4.7			15.7	15.1	14.4	14.6	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	0.2		3.3	0.1			0.8	0.4	0.1	0.1	
Delay (s)	4.0	5.1		10.0	4.8			16.4	15.5	14.6	14.7	
Level of Service	A	A		B	A			B	B	B	B	
Approach Delay (s)		5.1			7.9			15.8			14.7	
Approach LOS		A			A			B			B	

Intersection Summary

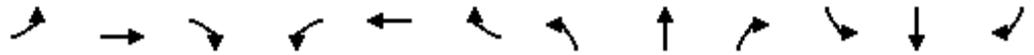
HCM Average Control Delay	10.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	49.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Volume

16: Birch Bay - Lynden Road & Kickerville Road

5/12/2011

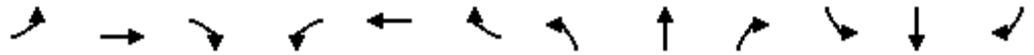


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	7	441	7	25	574	10	11	12	58	1	8	3
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	8	479	8	27	624	11	12	13	63	1	9	3
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	495	0	0	662	0	0	88	0	0	13	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 16: Birch Bay - Lynden Road & Kickerville Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	7	441	7	25	574	10	11	12	58	1	8	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	8	479	8	27	624	11	12	13	63	1	9	3
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	635			487			1190	1188	483	1252	1186	629
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	635			487			1190	1188	483	1252	1186	629
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			97			92	93	89	99	95	99
cM capacity (veh/h)	958			1087			155	184	588	124	184	486
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	495	662	88	13								
Volume Left	8	27	12	1								
Volume Right	8	11	63	3								
cSH	958	1087	345	208								
Volume to Capacity	0.01	0.03	0.26	0.06								
Queue Length 95th (ft)	1	2	25	5								
Control Delay (s)	0.2	0.7	19.0	23.5								
Lane LOS	A	A	C	C								
Approach Delay (s)	0.2	0.7	19.0	23.5								
Approach LOS			C	C								
Intersection Summary												
Average Delay			2.0									
Intersection Capacity Utilization			59.0%		ICU Level of Service				B			
Analysis Period (min)			15									

Volume

17: Grandview Road & Vista Drive

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	4	615	30	82	222	173	16	43	77	144	45	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	0%	2%	2%	0%	3%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	4	668	33	89	241	188	17	47	84	157	49	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	705	0	0	518	0	0	148	0	0	206	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 17: Grandview Road & Vista Drive

5/12/2011

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	4	615	30	82	222	173	16	43	77	144	45	0
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
Hourly flow rate (vph)	4	668	33	89	241	188	17	47	84	157	49	0
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	705	518	148	205								
Volume Left (vph)	4	89	17	157								
Volume Right (vph)	33	188	84	0								
Hadj (s)	-0.01	-0.16	-0.30	0.15								
Departure Headway (s)	6.4	6.3	7.7	7.8								
Degree Utilization, x	1.26	0.91	0.31	0.44								
Capacity (veh/h)	549	563	432	438								
Control Delay (s)	153.4	44.0	14.1	16.9								
Approach Delay (s)	153.4	44.0	14.1	16.9								
Approach LOS	F	E	B	C								
Intersection Summary												
Delay			86.6									
HCM Level of Service			F									
Intersection Capacity Utilization			88.2%	ICU Level of Service	E							
Analysis Period (min)			15									

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APPENDIX C

2026 Traffic Model – With Project

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Volume

1: Aldergrove Road & Kickerville Road

5/12/2011

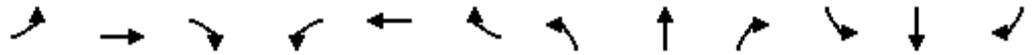


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	1	0	1	1	0	4	0	150	8	21	206	1
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	1	0	1	1	0	4	0	163	9	23	224	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	2	0	0	5	0	0	172	0	0	248	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 1: Aldergrove Road & Kickerville Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	1	0	1	1	0	4	0	150	8	21	206	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	1	0	1	1	0	4	0	163	9	23	224	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	442	442	224	439	438	167	225			172		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	442	442	224	439	438	167	225			172		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			98		
cM capacity (veh/h)	520	505	820	525	507	882	1356			1418		

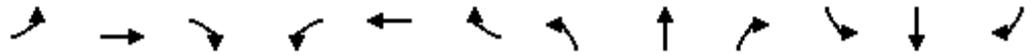
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	2	5	172	248
Volume Left	1	1	0	23
Volume Right	1	4	9	1
cSH	637	776	1356	1418
Volume to Capacity	0.00	0.01	0.00	0.02
Queue Length 95th (ft)	0	1	0	1
Control Delay (s)	10.7	9.7	0.0	0.8
Lane LOS	B	A		A
Approach Delay (s)	10.7	9.7	0.0	0.8
Approach LOS	B	A		

Intersection Summary			
Average Delay		0.7	
Intersection Capacity Utilization		33.8%	ICU Level of Service A
Analysis Period (min)		15	

Volume

2: Grandview Road & Kickerville Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	19	501	96	19	169	11	88	129	181	4	16	5
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	3%	14%	2%	13%	0%	1%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	21	545	104	21	184	12	96	140	197	4	17	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	670	0	0	217	0	0	433	0	0	26	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

2: Grandview Road & Kickerville Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	19	501	96	19	169	11	88	129	181	4	16	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	21	545	104	21	184	12	96	140	197	4	17	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	196			649			883	875	597	1136	921	190
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	196			649			883	875	597	1136	921	190
tC, single (s)	4.1			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			98			61	50	61	93	93	99
cM capacity (veh/h)	1389			882			246	278	507	65	262	857
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	670	216	433	27								
Volume Left	21	21	96	4								
Volume Right	104	12	197	5								
cSH	1389	882	338	195								
Volume to Capacity	0.01	0.02	1.28	0.14								
Queue Length 95th (ft)	1	2	500	12								
Control Delay (s)	0.4	1.1	179.8	26.5								
Lane LOS	A	A	F	D								
Approach Delay (s)	0.4	1.1	179.8	26.5								
Approach LOS			F	D								
Intersection Summary												
Average Delay			58.7									
Intersection Capacity Utilization			72.4%		ICU Level of Service				C			
Analysis Period (min)			15									

Volume

3: Grandview Road & Olson Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	5	629	22	33	257	5	16	12	21	3	5	1
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	0%	3%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	5	684	24	36	279	5	17	13	23	3	5	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	713	0	0	320	0	0	53	0	0	9	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

3: Grandview Road & Olson Road

5/12/2011

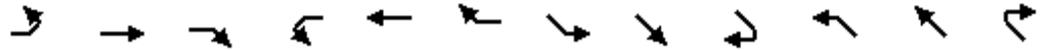


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	5	629	22	33	257	5	16	12	21	3	5	1
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	684	24	36	279	5	17	13	23	3	5	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	285			708			1064	1063	696	1090	1072	282
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	285			708			1064	1063	696	1090	1072	282
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			96			91	94	95	98	97	100
cM capacity (veh/h)	1289			900			192	215	445	170	212	762
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	713	321	53	10								
Volume Left	5	36	17	3								
Volume Right	24	5	23	1								
cSH	1289	900	263	212								
Volume to Capacity	0.00	0.04	0.20	0.05								
Queue Length 95th (ft)	0	3	19	4								
Control Delay (s)	0.1	1.4	22.1	22.8								
Lane LOS	A	A	C	C								
Approach Delay (s)	0.1	1.4	22.1	22.8								
Approach LOS			C	C								
Intersection Summary												
Average Delay			1.8									
Intersection Capacity Utilization			47.2%		ICU Level of Service				A			
Analysis Period (min)			15									

Volume

4: Grandview Road & Portal Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	SEL	SET	NWL	NWT
Volume (vph)	23	995	11	570	69	47	43	55
Confl. Peds. (#/hr)								
Confl. Bikes (#/hr)								
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	2%	2%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0
Parking (#/hr)								
Mid-Block Traffic (%)		0%		0%		0%		0%
Adj. Flow (vph)	25	1082	12	620	75	51	47	60
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	1142	0	711	0	146	0	139
Intersection Summary								

Timings

4: Grandview Road & Portal Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	SET	NWT
Lane Configurations		↕		↕	↕	↕
Volume (vph)	23	995	11	570	47	55
Turn Type	Perm		Perm			
Protected Phases		3		3	2	1
Permitted Phases	3		3			
Detector Phase	3	3	3	3	2	1
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	100.0	100.0	100.0	100.0	20.0	20.0
Total Split (%)	71.4%	71.4%	71.4%	71.4%	14.3%	14.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag					Lag	Lead
Lead-Lag Optimize?					Yes	Yes
Recall Mode	None	None	None	None	Min	Min
Act Effct Green (s)		85.9		85.9	14.0	13.5
Actuated g/C Ratio		0.68		0.68	0.11	0.11
v/c Ratio		0.92		0.58	0.71	0.69
Control Delay		31.0		12.8	74.7	71.8
Queue Delay		0.0		0.0	0.0	0.0
Total Delay		31.0		12.8	74.7	71.8
LOS		C		B	E	E
Approach Delay		31.0		12.8	74.7	71.8
Approach LOS		C		B	E	E

Intersection Summary

Cycle Length: 140	
Actuated Cycle Length: 125.8	
Natural Cycle: 110	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.92	
Intersection Signal Delay: 30.6	Intersection LOS: C
Intersection Capacity Utilization 85.1%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 4: Grandview Road & Portal Way



Queues

4: Grandview Road & Portal Way

5/12/2011



Lane Group	EBT	WBT	SET	NWT
Lane Group Flow (vph)	1142	711	146	139
v/c Ratio	0.92	0.58	0.71	0.69
Control Delay	31.0	12.8	74.7	71.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	31.0	12.8	74.7	71.8
Queue Length 50th (ft)	797	300	125	115
Queue Length 95th (ft)	#1246	412	#217	189
Internal Link Dist (ft)	3727	783	22485	3678
Turn Bay Length (ft)				
Base Capacity (vph)	1286	1273	235	239
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.89	0.56	0.62	0.58

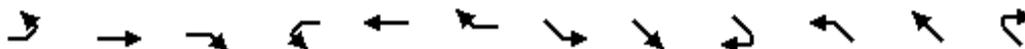
Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

4: Grandview Road & Portal Way

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	23	995	32	11	570	73	69	47	18	43	55	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		1.00			0.98			0.98			0.97	
Flt Protected		1.00			1.00			0.97			0.98	
Satd. Flow (prot)		1855			1834			1800			1810	
Flt Permitted		0.98			0.98			0.97			0.98	
Satd. Flow (perm)		1815			1793			1800			1810	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	1082	35	12	620	79	75	51	20	47	60	32
RTOR Reduction (vph)	0	1	0	0	3	0	0	4	0	0	8	0
Lane Group Flow (vph)	0	1141	0	0	708	0	0	142	0	0	131	0
Heavy Vehicles (%)	0%	2%	0%	0%	2%	2%	2%	0%	0%	0%	0%	0%
Turn Type	Perm			Perm			Split			Split		
Protected Phases		3			3		2	2		1	1	
Permitted Phases	3			3								
Actuated Green, G (s)		85.9			85.9			14.0			13.5	
Effective Green, g (s)		85.9			85.9			14.0			13.5	
Actuated g/C Ratio		0.69			0.69			0.11			0.11	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1243			1228			201			195	
v/s Ratio Prot								c0.08			c0.07	
v/s Ratio Perm		c0.63			0.39							
v/c Ratio		0.92			0.58			0.70			0.67	
Uniform Delay, d1		16.8			10.3			53.7			53.8	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		10.7			0.7			10.7			8.8	
Delay (s)		27.5			10.9			64.4			62.6	
Level of Service		C			B			E			E	
Approach Delay (s)		27.5			10.9			64.4			62.6	
Approach LOS		C			B			E			E	

Intersection Summary

HCM Average Control Delay	26.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	125.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Volume

5: Bay Road & Kickerville Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	8	129	10	4	111	21	5	29	4	40	85	32
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	9	140	11	4	121	23	5	32	4	43	92	35
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	160	0	0	148	0	0	41	0	0	170	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

5: Bay Road & Kickerville Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	8	129	10	4	111	21	5	29	4	40	85	32
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	9	140	11	4	121	23	5	32	4	43	92	35
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	143			151			385	315	146	324	309	132
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	143			151			385	315	146	324	309	132
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			99	95	100	93	85	96
cM capacity (veh/h)	1451			1442			487	598	907	600	603	923
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	160	148	41	171								
Volume Left	9	4	5	43								
Volume Right	11	23	4	35								
cSH	1451	1442	602	648								
Volume to Capacity	0.01	0.00	0.07	0.26								
Queue Length 95th (ft)	0	0	6	26								
Control Delay (s)	0.5	0.2	11.4	12.5								
Lane LOS	A	A	B	B								
Approach Delay (s)	0.5	0.2	11.4	12.5								
Approach LOS			B	B								
Intersection Summary												
Average Delay			5.2									
Intersection Capacity Utilization			32.8%		ICU Level of Service				A			
Analysis Period (min)			15									

Volume

6: Arnie Road & Valley View Road

5/12/2011



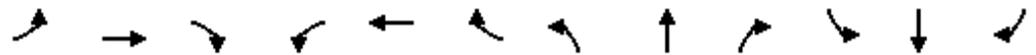
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	1	5	0	1	8	4	0	34	1	3	21	3
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	1	5	0	1	9	4	0	37	1	3	23	3
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	6	0	0	14	0	0	38	0	0	29	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

6: Arnie Road & Valley View Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	1	5	0	1	8	4	0	34	1	3	21	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	1	5	0	1	9	4	0	37	1	3	23	3
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	13			5			35	23	5	40	21	11
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	13			5			35	23	5	40	21	11
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	96	100	100	97	100
cM capacity (veh/h)	1619			1629			953	873	1083	936	876	1076

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	7	14	38	29
Volume Left	1	1	0	3
Volume Right	0	4	1	3
cSH	1619	1629	878	901
Volume to Capacity	0.00	0.00	0.04	0.03
Queue Length 95th (ft)	0	0	3	3
Control Delay (s)	1.2	0.6	9.3	9.1
Lane LOS	A	A	A	A
Approach Delay (s)	1.2	0.6	9.3	9.1
Approach LOS			A	A

Intersection Summary			
Average Delay		7.2	
Intersection Capacity Utilization	13.8%		ICU Level of Service
Analysis Period (min)	15		A

Lanes, Volumes, Timings
7: Grandview Road & Blaine Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕	↗		↕	↗
Volume (vph)	106	390	3	0	184	84	11	106	233	36	0	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		150	0		150
Storage Lanes	0		0	0		0	0		1	0		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. 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
Frt		0.999			0.958				0.850			0.850
Flt Protected		0.990						0.995			0.950	
Satd. Flow (prot)	0	1865	0	0	1796	0	0	1890	1599	0	1805	1615
Flt Permitted		0.990						0.995			0.950	
Satd. Flow (perm)	0	1865	0	0	1796	0	0	1890	1599	0	1805	1615
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		5885			5344			203			4219	
Travel Time (s)		133.8			121.5			4.6			95.9	
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
Heavy Vehicles (%)	0%	1%	0%	0%	2%	0%	0%	0%	1%	0%	0%	0%
Adj. Flow (vph)	115	424	3	0	200	91	12	115	253	39	0	48
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	542	0	0	291	0	0	127	253	0	39	48
Enter Blocked Intersection	No	No	No									
Lane Alignment	Left	Left	Right									
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Yield			Yield			Yield			Yield	

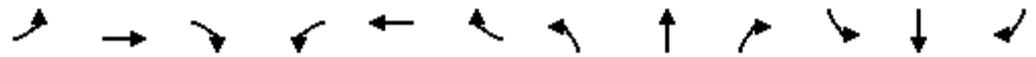
Intersection Summary

Area Type:	Other
Control Type:	Roundabout
Intersection Capacity Utilization	64.2%
ICU Level of Service	C
Analysis Period (min)	15

Volume

7: Grandview Road & Blaine Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	106	390	3	0	184	84	11	106	233	36	0	44
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	0%	2%	0%	0%	0%	1%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	115	424	3	0	200	91	12	115	253	39	0	48
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	542	0	0	291	0	0	127	253	0	39	48

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

7: Grandview Road & Blaine Road

5/12/2011

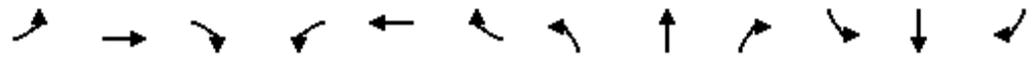


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Right Turn Channelized									Yes			Yes
Volume (veh/h)	106	390	3	0	184	84	11	106	233	36	0	44
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	115	424	3	0	200	91	12	115	253	39	0	48
Approach Volume (veh/h)		542			291			127			39	
Crossing Volume (veh/h)		39			242			578			212	
High Capacity (veh/h)		1343			1145			877			1173	
High v/c (veh/h)		0.40			0.25			0.15			0.03	
Low Capacity (veh/h)		1123			944			704			969	
Low v/c (veh/h)		0.48			0.31			0.18			0.04	
Intersection Summary												
Maximum v/c High			0.40									
Maximum v/c Low			0.48									
Intersection Capacity Utilization			64.2%		ICU Level of Service						C	

Volume

8: Birch Bay-Lynden Road & Blaine Road

5/12/2011



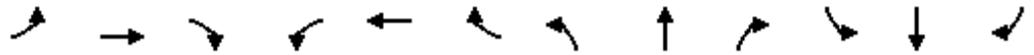
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	26	242	38	114	431	97	59	122	144	59	124	36
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	4%	2%	1%	1%	0%	0%	1%	0%	1%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	28	263	41	124	468	105	64	133	157	64	135	39
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	291	41	0	697	0	0	354	0	0	238	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

8: Birch Bay-Lynden Road & Blaine Road

5/12/2011

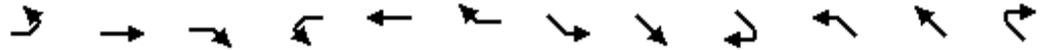


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↔		↔			↔			↔	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	26	242	38	114	431	97	59	122	144	59	124	36
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	28	263	41	124	468	105	64	133	157	64	135	39
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total (vph)	291	41	698	353	238							
Volume Left (vph)	28	0	124	64	64							
Volume Right (vph)	0	41	105	157	39							
Hadj (s)	0.08	-0.63	-0.04	-0.22	-0.04							
Departure Headway (s)	8.2	7.5	7.4	7.5	8.1							
Degree Utilization, x	0.66	0.09	1.43	0.74	0.54							
Capacity (veh/h)	414	459	489	464	411							
Control Delay (s)	24.5	10.0	226.7	28.6	20.1							
Approach Delay (s)	22.7		226.7	28.6	20.1							
Approach LOS	C		F	D	C							
Intersection Summary												
Delay			111.4									
HCM Level of Service			F									
Intersection Capacity Utilization			81.1%	ICU Level of Service	D							
Analysis Period (min)			15									

Volume

9: Birch Bay-Lynden Road & Portal Way

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Volume (vph)	85	438	22	40	611	59	144	48	113	49	59	30
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	3%	1%	7%	3%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	92	476	24	43	664	64	157	52	123	53	64	33
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	592	0	43	728	0	157	175	0	0	150	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

9: Birch Bay-Lynden Road & Portal Way

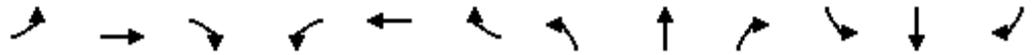
5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR	
Lane Configurations		↕		↕	↕		↕	↕			↕		
Sign Control		Stop			Stop			Stop			Stop		
Volume (vph)	85	438	22	40	611	59	144	48	113	49	59	30	
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	
Hourly flow rate (vph)	92	476	24	43	664	64	157	52	123	53	64	33	
Direction, Lane #	EB 1	WB 1	WB 2	SE 1	SE 2	NW 1							
Volume Total (vph)	592	43	728	157	175	150							
Volume Left (vph)	92	43	0	157	0	53							
Volume Right (vph)	24	0	64	0	123	33							
Hadj (s)	0.02	0.55	-0.04	0.55	-0.49	-0.06							
Departure Headway (s)	7.6	8.0	7.4	8.9	7.9	9.0							
Degree Utilization, x	1.25	0.10	1.50	0.39	0.38	0.38							
Capacity (veh/h)	462	442	489	396	449	380							
Control Delay (s)	154.1	10.7	254.9	16.2	14.4	17.3							
Approach Delay (s)	154.1	241.2		15.3		17.3							
Approach LOS	F	F		C		C							
Intersection Summary													
Delay			154.5										
HCM Level of Service			F										
Intersection Capacity Utilization			95.3%	ICU Level of Service									F
Analysis Period (min)			15										

Volume
10: Slater Road & Sunset Avenue

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Volume (vph)	5	841	97	803	56	23	5	115	189	8
Confl. Peds. (#/hr)										
Confl. Bikes (#/hr)										
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	3%	1%	2%	5%	6%	0%	1%	1%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)										
Mid-Block Traffic (%)		0%		0%			0%			0%
Adj. Flow (vph)	5	914	105	873	61	25	5	125	205	9
Shared Lane Traffic (%)										
Lane Group Flow (vph)	5	929	105	873	61	25	5	125	205	17

Intersection Summary

Timings

10: Slater Road & Sunset Avenue

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↖	↗	↗	↖	↗	↗	↖	↗
Volume (vph)	5	841	97	803	56	23	5	115	189	8
Turn Type	pm+pt		pm+pt		Perm	Perm		Perm	Perm	
Protected Phases	7	4	3	8			2			2
Permitted Phases	4		8		8	2		2	2	
Detector Phase	7	4	3	8	8	2	2	2	2	2
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	20.0	9.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	15.0	70.0	15.0	70.0	70.0	30.0	30.0	30.0	30.0	30.0
Total Split (%)	13.0%	60.9%	13.0%	60.9%	60.9%	26.1%	26.1%	26.1%	26.1%	26.1%
Yellow Time (s)	4.0	3.5	4.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	0.5	1.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	4.0	5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	None	None	None	None	Min	Min	Min	Min	Min
Act Effct Green (s)	55.5	53.0	60.4	60.6	60.6	19.3	19.3	19.3	19.3	19.3
Actuated g/C Ratio	0.56	0.59	0.65	0.67	0.67	0.21	0.21	0.21	0.21	0.21
v/c Ratio	0.02	0.86	0.41	0.70	0.06	0.09	0.01	0.28	0.68	0.04
Control Delay	7.0	27.3	10.2	14.3	2.6	34.7	33.8	8.6	49.0	25.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.0	27.3	10.2	14.3	2.6	34.7	33.8	8.6	49.0	25.0
LOS	A	C	B	B	A	C	C	A	D	C
Approach Delay		27.2		13.2			13.6			47.2
Approach LOS		C		B			B			D

Intersection Summary

Cycle Length: 115	
Actuated Cycle Length: 90.4	
Natural Cycle: 75	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.86	
Intersection Signal Delay: 22.0	Intersection LOS: C
Intersection Capacity Utilization 78.5%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 10: Slater Road & Sunset Avenue



Queues

10: Slater Road & Sunset Avenue

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	5	929	105	873	61	25	5	125	205	17
v/c Ratio	0.02	0.86	0.41	0.70	0.06	0.09	0.01	0.28	0.68	0.04
Control Delay	7.0	27.3	10.2	14.3	2.6	34.7	33.8	8.6	49.0	25.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.0	27.3	10.2	14.3	2.6	34.7	33.8	8.6	49.0	25.0
Queue Length 50th (ft)	1	449	18	253	1	13	3	0	118	4
Queue Length 95th (ft)	5	#854	40	624	18	38	13	48	220	25
Internal Link Dist (ft)		5760		6364			1689			1796
Turn Bay Length (ft)										
Base Capacity (vph)	365	1186	298	1320	1106	375	532	538	397	500
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.78	0.35	0.66	0.06	0.07	0.01	0.23	0.52	0.03

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

10: Slater Road & Sunset Avenue

5/12/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	841	14	97	803	56	23	5	115	189	8	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	4.0		5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1805	1841		1787	1863	1538	1703	1900	1599	1787	1766	
Flt Permitted	0.20	1.00		0.10	1.00	1.00	0.75	1.00	1.00	0.75	1.00	
Satd. Flow (perm)	385	1841		193	1863	1538	1338	1900	1599	1419	1766	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	914	15	105	873	61	25	5	125	205	9	8
RTOR Reduction (vph)	0	0	0	0	0	20	0	0	99	0	6	0
Lane Group Flow (vph)	5	929	0	105	873	41	25	5	26	205	11	0
Heavy Vehicles (%)	0%	3%	0%	1%	2%	5%	6%	0%	1%	1%	0%	0%
Turn Type	pm+pt			pm+pt		Perm	Perm		Perm	Perm		
Protected Phases	7	4		3	8			2			2	
Permitted Phases	4			8		8	2		2	2		
Actuated Green, G (s)	56.7	55.8		66.3	60.6	60.6	19.3	19.3	19.3	19.3	19.3	
Effective Green, g (s)	56.7	55.8		66.3	60.6	60.6	19.3	19.3	19.3	19.3	19.3	
Actuated g/C Ratio	0.60	0.59		0.71	0.65	0.65	0.21	0.21	0.21	0.21	0.21	
Clearance Time (s)	5.0	4.0		5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	246	1095		233	1204	994	275	391	329	292	363	
v/s Ratio Prot	0.00	c0.50		c0.03	c0.47			0.00			0.01	
v/s Ratio Perm	0.01			0.29		0.03	0.02		0.02	c0.14		
v/c Ratio	0.02	0.85		0.45	0.73	0.04	0.09	0.01	0.08	0.70	0.03	
Uniform Delay, d1	10.1	15.5		15.3	11.1	6.0	30.1	29.7	30.1	34.6	29.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	6.3		1.4	2.2	0.0	0.1	0.0	0.1	7.4	0.0	
Delay (s)	10.1	21.8		16.7	13.3	6.1	30.3	29.7	30.2	42.0	29.8	
Level of Service	B	C		B	B	A	C	C	C	D	C	
Approach Delay (s)		21.7			13.2			30.2			41.1	
Approach LOS		C			B			C			D	
Intersection Summary												
HCM Average Control Delay			20.3		HCM Level of Service					C		
HCM Volume to Capacity ratio			0.83									
Actuated Cycle Length (s)			93.8		Sum of lost time (s)					17.0		
Intersection Capacity Utilization			78.5%		ICU Level of Service					D		
Analysis Period (min)			15									

c Critical Lane Group

Volume

11: Slater Road & Lake Terrell Road

5/12/2011

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	22	67	5	59	99	76	11	14	41	244	29	48
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	0%	0%	4%	0%	0%	3%	2%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	24	73	5	64	108	83	12	15	45	265	32	52
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	102	0	0	172	83	0	72	0	0	349	0
Intersection Summary												

HCM Unsignalized Intersection Capacity Analysis

11: Slater Road & Lake Terrell Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕	↕		↕			↕	
Volume (veh/h)	22	67	5	59	99	76	11	14	41	244	29	48
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	24	73	5	64	108	83	12	15	45	265	32	52
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	108			78			427	359	76	411	362	108
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	108			78			427	359	76	411	362	108
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			96			97	97	95	46	94	95
cM capacity (veh/h)	1496			1533			467	538	983	492	536	952
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1							
Volume Total	102	172	83	72	349							
Volume Left	24	64	0	12	265							
Volume Right	5	0	83	45	52							
cSH	1496	1533	1700	723	535							
Volume to Capacity	0.02	0.04	0.05	0.10	0.65							
Queue Length 95th (ft)	1	3	0	8	117							
Control Delay (s)	1.8	3.0	0.0	10.5	23.5							
Lane LOS	A	A		B	C							
Approach Delay (s)	1.8	2.0		10.5	23.5							
Approach LOS				B	C							
Intersection Summary												
Average Delay			12.4									
Intersection Capacity Utilization			45.2%		ICU Level of Service				A			
Analysis Period (min)			15									

Volume

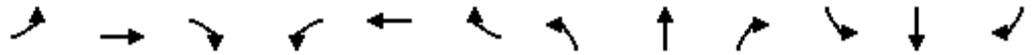
12: Mountain View Road & Lake Terrell Road

5/12/2011

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	4	190	165	51	63	7	82	4	95	4	0	7
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	1%	0%	4%	0%	2%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	4	207	179	55	68	8	89	4	103	4	0	8
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	390	0	0	131	0	0	196	0	0	12	0
Intersection Summary												

HCM Unsignalized Intersection Capacity Analysis
 12: Mountain View Road & Lake Terrell Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	4	190	165	51	63	7	82	4	95	4	0	7
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
Hourly flow rate (vph)	4	207	179	55	68	8	89	4	103	4	0	8
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	390	132	197	12								
Volume Left (vph)	4	55	89	4								
Volume Right (vph)	179	8	103	8								
Hadj (s)	-0.26	0.08	-0.21	-0.31								
Departure Headway (s)	4.4	5.0	4.9	5.1								
Degree Utilization, x	0.47	0.18	0.27	0.02								
Capacity (veh/h)	788	675	674	606								
Control Delay (s)	11.2	9.1	9.7	8.2								
Approach Delay (s)	11.2	9.1	9.7	8.2								
Approach LOS	B	A	A	A								
Intersection Summary												
Delay			10.4									
HCM Level of Service			B									
Intersection Capacity Utilization			52.0%	ICU Level of Service	A							
Analysis Period (min)			15									

Volume

13: Henry Road & Kickerville Road

5/12/2011

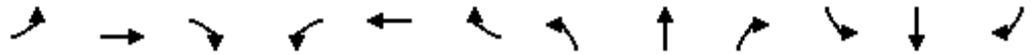


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	30	66	0	5	5	125	0	5	8	211	1	3
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	33%	0%	0%	25%	0%	0%	0%	0%	0%	1%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	33	72	0	5	5	136	0	5	9	229	1	3
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	105	0	0	146	0	0	14	0	0	233	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 13: Henry Road & Kickerville Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	30	66	0	5	5	125	0	5	8	211	1	3
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
Hourly flow rate (vph)	33	72	0	5	5	136	0	5	9	229	1	3
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	104	147	14	234								
Volume Left (vph)	33	5	0	229								
Volume Right (vph)	0	136	9	3								
Hadj (s)	0.24	-0.53	-0.37	0.20								
Departure Headway (s)	4.9	4.1	4.4	4.7								
Degree Utilization, x	0.14	0.17	0.02	0.31								
Capacity (veh/h)	684	814	749	726								
Control Delay (s)	8.7	8.0	7.5	9.8								
Approach Delay (s)	8.7	8.0	7.5	9.8								
Approach LOS	A	A	A	A								
Intersection Summary												
Delay			8.9									
HCM Level of Service			A									
Intersection Capacity Utilization			42.0%	ICU Level of Service	A							
Analysis Period (min)			15									

Volume

14: Main Street & Riverside Dr

5/12/2011



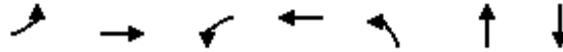
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Volume (vph)	22	954	229	825	351	15	43	15
Confl. Peds. (#/hr)								
Confl. Bikes (#/hr)								
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	2%	1%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0
Parking (#/hr)								
Mid-Block Traffic (%)		0%		0%		0%		0%
Adj. Flow (vph)	24	1037	249	897	382	16	47	16
Shared Lane Traffic (%)								
Lane Group Flow (vph)	24	1217	249	930	382	339	0	95

Intersection Summary

Timings

14: Main Street & Riverside Dr

5/12/2011

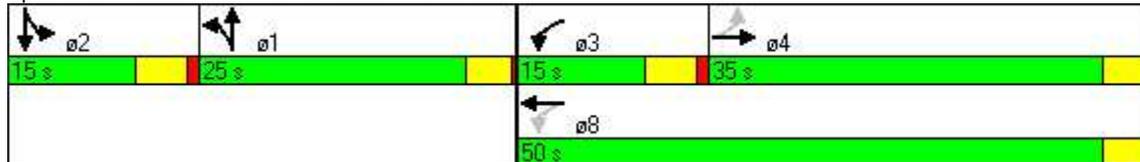


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Configurations	↶	↶↷	↶	↶↷	↶	↷	↷↶
Volume (vph)	22	954	229	825	351	15	15
Turn Type	Perm		pm+pt		Split		
Protected Phases		4	3	8	1	1	2
Permitted Phases	4		8				
Detector Phase	4	4	3	8	1	1	2
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	9.0	20.0	20.0	20.0	9.0
Total Split (s)	35.0	35.0	15.0	50.0	25.0	25.0	15.0
Total Split (%)	38.9%	38.9%	16.7%	55.6%	27.8%	27.8%	16.7%
Yellow Time (s)	3.5	3.5	4.0	3.5	3.5	3.5	4.0
All-Red Time (s)	0.5	0.5	1.0	0.5	0.5	0.5	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	5.0	4.0	4.0	4.0	5.0
Lead/Lag	Lag	Lag	Lead		Lag	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None	None	None	Min	Min	None
Act Effct Green (s)	31.3	31.3	45.4	46.4	20.1	20.1	8.3
Actuated g/C Ratio	0.37	0.37	0.53	0.54	0.24	0.24	0.09
v/c Ratio	0.11	0.94	0.85	0.48	0.90	0.54	0.50
Control Delay	22.0	42.0	46.1	14.1	58.8	7.9	38.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.0	42.0	46.1	14.1	58.8	7.9	38.9
LOS	C	D	D	B	E	A	D
Approach Delay		41.6		20.9		34.8	38.9
Approach LOS		D		C		C	D

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 85.4
 Natural Cycle: 80
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.94
 Intersection Signal Delay: 32.5
 Intersection LOS: C
 Intersection Capacity Utilization 83.7%
 ICU Level of Service E
 Analysis Period (min) 15

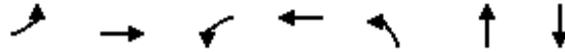
Splits and Phases: 14: Main Street & Riverside Dr



Queues

14: Main Street & Riverside Dr

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	24	1217	249	930	382	339	95
v/c Ratio	0.11	0.94	0.85	0.48	0.90	0.54	0.50
Control Delay	22.0	42.0	46.1	14.1	58.8	7.9	38.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.0	42.0	46.1	14.1	58.8	7.9	38.9
Queue Length 50th (ft)	9	346	89	168	209	7	39
Queue Length 95th (ft)	28	#507	#232	226	#378	77	86
Internal Link Dist (ft)		414		818		277	276
Turn Bay Length (ft)							
Base Capacity (vph)	214	1298	294	1937	441	638	219
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.94	0.85	0.48	0.87	0.53	0.43

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

14: Main Street & Riverside Dr

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	22	954	166	229	825	30	351	15	297	43	15	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		5.0	4.0		4.0	4.0			5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00			1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.86			0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			0.98	
Satd. Flow (prot)	1805	3500		1770	3556		1805	1613			1770	
Flt Permitted	0.31	1.00		0.11	1.00		0.95	1.00			0.98	
Satd. Flow (perm)	584	3500		205	3556		1805	1613			1770	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	24	1037	180	249	897	33	382	16	323	47	16	32
RTOR Reduction (vph)	0	15	0	0	3	0	0	248	0	0	21	0
Lane Group Flow (vph)	24	1202	0	249	927	0	382	91	0	0	74	0
Heavy Vehicles (%)	0%	1%	0%	2%	1%	0%	0%	0%	1%	0%	0%	0%
Turn Type	Perm		pm+pt				Split		Split			
Protected Phases		4		3	8		1	1		2	2	
Permitted Phases	4			8								
Actuated Green, G (s)	31.3	31.3		46.4	46.4		20.1	20.1			7.0	
Effective Green, g (s)	31.3	31.3		46.4	46.4		20.1	20.1			7.0	
Actuated g/C Ratio	0.36	0.36		0.54	0.54		0.23	0.23			0.08	
Clearance Time (s)	4.0	4.0		5.0	4.0		4.0	4.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	211	1266		293	1907		419	375			143	
v/s Ratio Prot		c0.34		c0.10	0.26		c0.21	0.06			c0.04	
v/s Ratio Perm	0.04			0.36								
v/c Ratio	0.11	0.95		0.85	0.49		0.91	0.24			0.52	
Uniform Delay, d1	18.4	26.8		21.1	12.6		32.3	27.0			38.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.2	14.6		20.0	0.2		23.8	0.3			3.1	
Delay (s)	18.6	41.5		41.0	12.8		56.1	27.3			41.3	
Level of Service	B	D		D	B		E	C			D	
Approach Delay (s)		41.0			18.7			42.6			41.3	
Approach LOS		D			B			D			D	

Intersection Summary

HCM Average Control Delay	33.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	86.5	Sum of lost time (s)	18.0
Intersection Capacity Utilization	83.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Volume

15: Slater Road & Haxton Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Volume (vph)	3	292	376	237	69	70	391	26	54
Confl. Peds. (#/hr)									
Confl. Bikes (#/hr)									
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	1%	0%	6%	0%	4%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0
Parking (#/hr)									
Mid-Block Traffic (%)		0%		0%		0%			0%
Adj. Flow (vph)	3	317	409	258	75	76	425	28	59
Shared Lane Traffic (%)									
Lane Group Flow (vph)	3	369	409	295	0	151	425	28	63

Intersection Summary

Timings

15: Slater Road & Haxton Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations									
Volume (vph)	3	292	376	237	69	70	391	26	54
Turn Type	Perm		Perm		Perm		Perm	Perm	
Protected Phases		1		1		2			2
Permitted Phases	1		1		2		2	2	
Detector Phase	1	1	1	1	2	2	2	2	2
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	80.0	80.0	80.0	80.0	20.0	20.0	20.0	20.0	20.0
Total Split (%)	80.0%	80.0%	80.0%	80.0%	20.0%	20.0%	20.0%	20.0%	20.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lead	Lead	Lead	Lag	Lag	Lag	Lag	Lag
Lead-Lag Optimize?	Yes								
Recall Mode	None	None	None	None	Min	Min	Min	Min	Min
Act Effect Green (s)	30.6	30.6	30.6	30.6		11.9	11.9	11.9	11.9
Actuated g/C Ratio	0.59	0.59	0.59	0.59		0.23	0.23	0.23	0.23
v/c Ratio	0.00	0.33	0.70	0.26		0.43	0.62	0.10	0.14
Control Delay	4.0	5.5	14.5	5.0		25.5	7.5	22.0	20.6
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Total Delay	4.0	5.5	14.5	5.0		25.5	7.5	22.0	20.6
LOS	A	A	B	A		C	A	C	C
Approach Delay		5.5		10.5		12.2			21.0
Approach LOS		A		B		B			C

Intersection Summary

Cycle Length: 100	
Actuated Cycle Length: 51.5	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.70	
Intersection Signal Delay: 10.6	Intersection LOS: B
Intersection Capacity Utilization 63.3%	ICU Level of Service B
Analysis Period (min) 15	

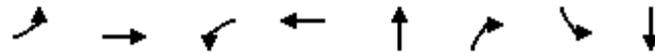
Splits and Phases: 15: Slater Road & Haxton Way



Queues

15: Slater Road & Haxton Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	3	369	409	295	151	425	28	63
v/c Ratio	0.00	0.33	0.70	0.26	0.43	0.62	0.10	0.14
Control Delay	4.0	5.5	14.5	5.0	25.5	7.5	22.0	20.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	4.0	5.5	14.5	5.0	25.5	7.5	22.0	20.6
Queue Length 50th (ft)	0	41	68	31	37	0	6	14
Queue Length 95th (ft)	3	86	171	67	122	76	33	56
Internal Link Dist (ft)		13101		11751	4951			2508
Turn Bay Length (ft)								
Base Capacity (vph)	876	1470	780	1485	465	769	383	576
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.00	0.25	0.52	0.20	0.32	0.55	0.07	0.11

Intersection Summary

HCM Signalized Intersection Capacity Analysis

15: Slater Road & Haxton Way

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	3	292	48	376	237	34	69	70	391	26	54	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Frt	1.00	0.98		1.00	0.98			1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00			0.98	1.00	0.95	1.00	
Satd. Flow (prot)	1805	1844		1787	1864			1800	1553	1805	1882	
Flt Permitted	0.58	1.00		0.52	1.00			0.82	1.00	0.66	1.00	
Satd. Flow (perm)	1101	1844		981	1864			1522	1553	1256	1882	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	317	52	409	258	37	75	76	425	28	59	4
RTOR Reduction (vph)	0	10	0	0	9	0	0	0	325	0	2	0
Lane Group Flow (vph)	3	359	0	409	286	0	0	151	100	28	61	0
Heavy Vehicles (%)	0%	1%	0%	1%	0%	0%	6%	0%	4%	0%	0%	0%
Turn Type	Perm			Perm			Perm		Perm	Perm		
Protected Phases		1			1			2				2
Permitted Phases	1			1			2		2	2		
Actuated Green, G (s)	30.6	30.6		30.6	30.6			11.9	11.9	11.9	11.9	
Effective Green, g (s)	30.6	30.6		30.6	30.6			11.9	11.9	11.9	11.9	
Actuated g/C Ratio	0.61	0.61		0.61	0.61			0.24	0.24	0.24	0.24	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	667	1117		594	1129			359	366	296	443	
v/s Ratio Prot		0.19			0.15						0.03	
v/s Ratio Perm	0.00			c0.42				c0.10	0.06	0.02		
v/c Ratio	0.00	0.32		0.69	0.25			0.42	0.27	0.09	0.14	
Uniform Delay, d1	3.9	4.9		6.7	4.6			16.4	15.8	15.1	15.2	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	0.2		3.3	0.1			0.8	0.4	0.1	0.1	
Delay (s)	3.9	5.0		10.1	4.8			17.2	16.2	15.2	15.4	
Level of Service	A	A		B	A			B	B	B	B	
Approach Delay (s)		5.0			7.8			16.4			15.3	
Approach LOS		A			A			B			B	

Intersection Summary

HCM Average Control Delay	10.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	50.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Volume

16: Birch Bay - Lynden Road & Kickerville Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	7	441	7	25	574	10	11	12	62	1	8	3
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	8	479	8	27	624	11	12	13	67	1	9	3
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	495	0	0	662	0	0	92	0	0	13	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 16: Birch Bay - Lynden Road & Kickerville Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	7	441	7	25	574	10	11	12	62	1	8	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	8	479	8	27	624	11	12	13	67	1	9	3
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	635			487			1190	1188	483	1256	1186	629
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	635			487			1190	1188	483	1256	1186	629
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			97			92	93	89	99	95	99
cM capacity (veh/h)	958			1087			155	184	588	122	184	486

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	495	662	92	13
Volume Left	8	27	12	1
Volume Right	8	11	67	3
cSH	958	1087	352	208
Volume to Capacity	0.01	0.03	0.26	0.06
Queue Length 95th (ft)	1	2	26	5
Control Delay (s)	0.2	0.7	18.9	23.5
Lane LOS	A	A	C	C
Approach Delay (s)	0.2	0.7	18.9	23.5
Approach LOS			C	C

Intersection Summary			
Average Delay		2.1	
Intersection Capacity Utilization		59.2%	ICU Level of Service
Analysis Period (min)		15	B

Volume

17: Grandview Road & Vista Drive

5/12/2011

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	4	633	30	82	222	173	16	43	77	144	45	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	0%	2%	2%	0%	3%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	4	688	33	89	241	188	17	47	84	157	49	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	725	0	0	518	0	0	148	0	0	206	0
Intersection Summary												

HCM Unsignalized Intersection Capacity Analysis
 17: Grandview Road & Vista Drive

5/12/2011

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	4	633	30	82	222	173	16	43	77	144	45	0
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
Hourly flow rate (vph)	4	688	33	89	241	188	17	47	84	157	49	0
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	725	518	148	205								
Volume Left (vph)	4	89	17	157								
Volume Right (vph)	33	188	84	0								
Hadj (s)	-0.01	-0.16	-0.30	0.15								
Departure Headway (s)	6.5	6.3	7.7	7.8								
Degree Utilization, x	1.30	0.91	0.31	0.44								
Capacity (veh/h)	550	563	432	438								
Control Delay (s)	167.8	44.0	14.2	16.9								
Approach Delay (s)	167.8	44.0	14.2	16.9								
Approach LOS	F	E	B	C								
Intersection Summary												
Delay			94.0									
HCM Level of Service			F									
Intersection Capacity Utilization			89.1%	ICU Level of Service	E							
Analysis Period (min)			15									

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APPENDIX D

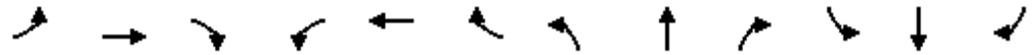
2026 Traffic Model – Without Project and with Recommended Improvements

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Volume

1: Aldergrove Road & Kickerville Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	1	0	1	1	0	4	0	128	4	21	206	1
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	1	0	1	1	0	4	0	139	4	23	224	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	2	0	0	5	0	0	143	0	0	248	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 1: Aldergrove Road & Kickerville Road

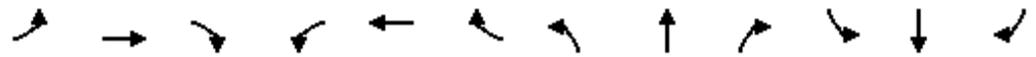
5/12/2011

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	0	1	1	0	4	0	128	4	21	206	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	1	0	1	1	0	4	0	139	4	23	224	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	416	414	224	412	412	141	225			143		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	416	414	224	412	412	141	225			143		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			98		
cM capacity (veh/h)	542	524	820	546	525	912	1356			1451		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	2	5	143	248								
Volume Left	1	1	0	23								
Volume Right	1	4	4	1								
cSH	652	804	1356	1451								
Volume to Capacity	0.00	0.01	0.00	0.02								
Queue Length 95th (ft)	0	1	0	1								
Control Delay (s)	10.5	9.5	0.0	0.8								
Lane LOS	B	A		A								
Approach Delay (s)	10.5	9.5	0.0	0.8								
Approach LOS	B	A										
Intersection Summary												
Average Delay			0.7									
Intersection Capacity Utilization			32.4%		ICU Level of Service					A		
Analysis Period (min)			15									

Volume

2: Grandview Road & Kickerville Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	19	501	96	19	169	11	88	125	163	4	16	5
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	3%	14%	2%	13%	0%	1%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	21	545	104	21	184	12	96	136	177	4	17	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	670	0	0	217	0	0	409	0	0	26	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

2: Grandview Road & Kickerville Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	19	501	96	19	169	11	88	125	163	4	16	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	21	545	104	21	184	12	96	136	177	4	17	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	196			649			883	875	597	1114	921	190
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	196			649			883	875	597	1114	921	190
tC, single (s)	4.1			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			98			61	51	65	94	93	99
cM capacity (veh/h)	1389			882			246	278	507	73	262	857

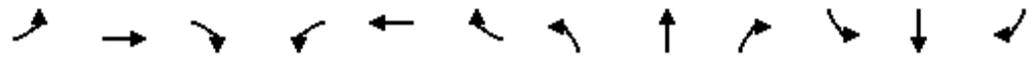
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	670	216	409	27
Volume Left	21	21	96	4
Volume Right	104	12	177	5
cSH	1389	882	333	205
Volume to Capacity	0.01	0.02	1.23	0.13
Queue Length 95th (ft)	1	2	450	11
Control Delay (s)	0.4	1.1	159.6	25.2
Lane LOS	A	A	F	D
Approach Delay (s)	0.4	1.1	159.6	25.2
Approach LOS			F	D

Intersection Summary			
Average Delay		50.3	
Intersection Capacity Utilization		71.1%	ICU Level of Service C
Analysis Period (min)		15	

Volume

3: Grandview Road & Olson Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	5	611	22	33	257	5	16	12	21	3	5	1
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	0%	3%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	5	664	24	36	279	5	17	13	23	3	5	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	693	0	0	320	0	0	53	0	0	9	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

3: Grandview Road & Olson Road

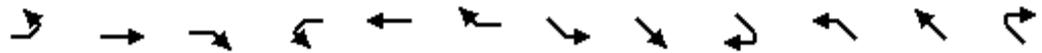
5/12/2011

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	611	22	33	257	5	16	12	21	3	5	1
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	5	664	24	36	279	5	17	13	23	3	5	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	285			688			1045	1043	676	1070	1053	282
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	285			688			1045	1043	676	1070	1053	282
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			96			91	94	95	98	98	100
cM capacity (veh/h)	1289			916			198	221	457	176	218	762
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	693	321	53	10								
Volume Left	5	36	17	3								
Volume Right	24	5	23	1								
cSH	1289	916	270	218								
Volume to Capacity	0.00	0.04	0.20	0.04								
Queue Length 95th (ft)	0	3	18	4								
Control Delay (s)	0.1	1.4	21.5	22.3								
Lane LOS	A	A	C	C								
Approach Delay (s)	0.1	1.4	21.5	22.3								
Approach LOS			C	C								
Intersection Summary												
Average Delay			1.8									
Intersection Capacity Utilization			47.1%		ICU Level of Service				A			
Analysis Period (min)			15									

Volume

4: Grandview Road & Portal Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	SEL	SET	NWL	NWT
Volume (vph)	23	977	11	570	69	47	43	55
Confl. Peds. (#/hr)								
Confl. Bikes (#/hr)								
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	2%	2%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0
Parking (#/hr)								
Mid-Block Traffic (%)		0%		0%		0%		0%
Adj. Flow (vph)	25	1062	12	620	75	51	47	60
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	1122	0	711	0	146	0	139
Intersection Summary								

Timings

4: Grandview Road & Portal Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	SET	NWT
Lane Configurations		↕		↕	↕	↕
Volume (vph)	23	977	11	570	47	55
Turn Type	Perm		Perm			
Protected Phases		3		3	2	1
Permitted Phases	3		3			
Detector Phase	3	3	3	3	2	1
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	100.0	100.0	100.0	100.0	20.0	20.0
Total Split (%)	71.4%	71.4%	71.4%	71.4%	14.3%	14.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag					Lag	Lead
Lead-Lag Optimize?					Yes	Yes
Recall Mode	None	None	None	None	Min	Min
Act Effect Green (s)		84.0		84.0	14.0	13.4
Actuated g/C Ratio		0.68		0.68	0.11	0.11
v/c Ratio		0.91		0.58	0.71	0.68
Control Delay		29.6		12.9	73.5	70.8
Queue Delay		0.0		0.0	0.0	0.0
Total Delay		29.6		12.9	73.5	70.8
LOS		C		B	E	E
Approach Delay		29.6		12.9	73.5	70.8
Approach LOS		C		B	E	E

Intersection Summary

Cycle Length: 140	
Actuated Cycle Length: 123.9	
Natural Cycle: 110	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.91	
Intersection Signal Delay: 29.7	Intersection LOS: C
Intersection Capacity Utilization 84.2%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 4: Grandview Road & Portal Way



Queues

4: Grandview Road & Portal Way

5/12/2011



Lane Group	EBT	WBT	SET	NWT
Lane Group Flow (vph)	1122	711	146	139
v/c Ratio	0.91	0.58	0.71	0.68
Control Delay	29.6	12.9	73.5	70.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	29.6	12.9	73.5	70.8
Queue Length 50th (ft)	760	300	125	115
Queue Length 95th (ft)	#1137	411	#217	189
Internal Link Dist (ft)	3772	783	22485	3678
Turn Bay Length (ft)				
Base Capacity (vph)	1289	1277	240	244
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.87	0.56	0.61	0.57

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

4: Grandview Road & Portal Way

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	23	977	32	11	570	73	69	47	18	43	55	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		1.00			0.98			0.98			0.97	
Flt Protected		1.00			1.00			0.97			0.98	
Satd. Flow (prot)		1855			1834			1800			1810	
Flt Permitted		0.98			0.98			0.97			0.98	
Satd. Flow (perm)		1814			1795			1800			1810	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	1062	35	12	620	79	75	51	20	47	60	32
RTOR Reduction (vph)	0	1	0	0	3	0	0	4	0	0	8	0
Lane Group Flow (vph)	0	1121	0	0	708	0	0	142	0	0	131	0
Heavy Vehicles (%)	0%	2%	0%	0%	2%	2%	2%	0%	0%	0%	0%	0%
Turn Type	Perm		Perm		Split		Split					
Protected Phases		3			3		2	2		1	1	
Permitted Phases	3			3								
Actuated Green, G (s)		84.0			84.0			14.0			13.4	
Effective Green, g (s)		84.0			84.0			14.0			13.4	
Actuated g/C Ratio		0.68			0.68			0.11			0.11	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1235			1222			204			197	
v/s Ratio Prot								c0.08			c0.07	
v/s Ratio Perm		c0.62			0.39							
v/c Ratio		0.91			0.58			0.69			0.66	
Uniform Delay, d1		16.5			10.4			52.6			52.8	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		9.8			0.7			9.8			8.2	
Delay (s)		26.2			11.1			62.4			61.0	
Level of Service		C			B			E			E	
Approach Delay (s)		26.2			11.1			62.4			61.0	
Approach LOS		C			B			E			E	

Intersection Summary

HCM Average Control Delay	25.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	123.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Volume

5: Bay Road & Kickerville Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	8	129	10	4	111	21	5	25	4	40	85	32
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	9	140	11	4	121	23	5	27	4	43	92	35
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	160	0	0	148	0	0	36	0	0	170	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

5: Bay Road & Kickerville Road

5/12/2011

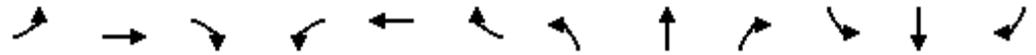


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	8	129	10	4	111	21	5	25	4	40	85	32
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	140	11	4	121	23	5	27	4	43	92	35
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	143			151			385	315	146	322	309	132
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	143			151			385	315	146	322	309	132
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			99	95	100	93	85	96
cM capacity (veh/h)	1451			1442			487	598	907	606	603	923
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	160	148	37	171								
Volume Left	9	4	5	43								
Volume Right	11	23	4	35								
cSH	1451	1442	602	650								
Volume to Capacity	0.01	0.00	0.06	0.26								
Queue Length 95th (ft)	0	0	5	26								
Control Delay (s)	0.5	0.2	11.4	12.5								
Lane LOS	A	A	B	B								
Approach Delay (s)	0.5	0.2	11.4	12.5								
Approach LOS			B	B								
Intersection Summary												
Average Delay			5.2									
Intersection Capacity Utilization			32.1%		ICU Level of Service				A			
Analysis Period (min)			15									

Volume

6: Arnie Road & Valley View Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	1	5	0	1	8	4	0	34	1	3	21	3
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	1	5	0	1	9	4	0	37	1	3	23	3
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	6	0	0	14	0	0	38	0	0	29	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

6: Arnie Road & Valley View Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Volume (veh/h)	1	5	0	1	8	4	0	34	1	3	21	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	1	5	0	1	9	4	0	37	1	3	23	3
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	13			5			35	23	5	40	21	11
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	13			5			35	23	5	40	21	11
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	96	100	100	97	100
cM capacity (veh/h)	1619			1629			953	873	1083	936	876	1076

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	7	14	38	29
Volume Left	1	1	0	3
Volume Right	0	4	1	3
cSH	1619	1629	878	901
Volume to Capacity	0.00	0.00	0.04	0.03
Queue Length 95th (ft)	0	0	3	3
Control Delay (s)	1.2	0.6	9.3	9.1
Lane LOS	A	A	A	A
Approach Delay (s)	1.2	0.6	9.3	9.1
Approach LOS			A	A

Intersection Summary			
Average Delay		7.2	
Intersection Capacity Utilization	13.8%		ICU Level of Service
Analysis Period (min)		15	

Lanes, Volumes, Timings
7: Grandview Road & Blaine Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕	↕		↕	↕
Volume (vph)	106	390	3	0	184	84	11	106	233	36	0	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		150	0		150
Storage Lanes	0		0	0		0	0		1	0		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. 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
Frt		0.999			0.958				0.850			0.850
Flt Protected		0.990						0.995			0.950	
Satd. Flow (prot)	0	1865	0	0	1796	0	0	1890	1599	0	1805	1615
Flt Permitted		0.990						0.995			0.950	
Satd. Flow (perm)	0	1865	0	0	1796	0	0	1890	1599	0	1805	1615
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		5885			5344			203			4219	
Travel Time (s)		133.8			121.5			4.6			95.9	
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
Heavy Vehicles (%)	0%	1%	0%	0%	2%	0%	0%	0%	1%	0%	0%	0%
Adj. Flow (vph)	115	424	3	0	200	91	12	115	253	39	0	48
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	542	0	0	291	0	0	127	253	0	39	48
Enter Blocked Intersection	No	No	No									
Lane Alignment	Left	Left	Right									
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Yield			Yield			Yield			Yield	

Intersection Summary

Area Type: Other

Control Type: Roundabout

Intersection Capacity Utilization 64.2% ICU Level of Service C

Analysis Period (min) 15

Volume

7: Grandview Road & Blaine Road

5/12/2011

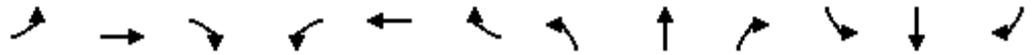


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	106	390	3	0	184	84	11	106	233	36	0	44
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	0%	2%	0%	0%	0%	1%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	115	424	3	0	200	91	12	115	253	39	0	48
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	542	0	0	291	0	0	127	253	0	39	48

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 7: Grandview Road & Blaine Road

5/12/2011

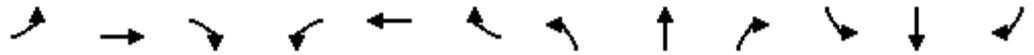


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Right Turn Channelized									Yes			Yes
Volume (veh/h)	106	390	3	0	184	84	11	106	233	36	0	44
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	115	424	3	0	200	91	12	115	253	39	0	48
Approach Volume (veh/h)		542			291			127			39	
Crossing Volume (veh/h)		39			242			578			212	
High Capacity (veh/h)		1343			1145			877			1173	
High v/c (veh/h)		0.40			0.25			0.15			0.03	
Low Capacity (veh/h)		1123			944			704			969	
Low v/c (veh/h)		0.48			0.31			0.18			0.04	
Intersection Summary												
Maximum v/c High			0.40									
Maximum v/c Low			0.48									
Intersection Capacity Utilization			64.2%		ICU Level of Service					C		

Volume

8: Birch Bay-Lynden Road & Blaine Road

5/12/2011



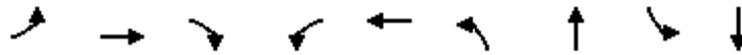
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	26	242	38	114	431	97	59	122	144	59	124	36
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	4%	2%	1%	1%	0%	0%	1%	0%	1%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	28	263	41	124	468	105	64	133	157	64	135	39
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	291	41	0	697	0	0	354	0	0	238	0

Intersection Summary

Timings

8: Birch Bay-Lynden Road & Blaine Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕	↕		↕		↕		↕
Volume (vph)	26	242	38	114	431	59	122	59	124
Turn Type	Perm		Perm	Perm		Perm		Perm	
Protected Phases		4			8		2		6
Permitted Phases	4		4	8		2		6	
Detector Phase	4	4	4	8	8	2	2	6	6
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	38.0	38.0	38.0	38.0	38.0	22.0	22.0	22.0	22.0
Total Split (%)	63.3%	63.3%	63.3%	63.3%	63.3%	36.7%	36.7%	36.7%	36.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	Max								
Act Effct Green (s)		33.0	33.0		33.0		17.0		17.0
Actuated g/C Ratio		0.55	0.55		0.55		0.28		0.28
v/c Ratio		0.31	0.05		0.77		0.71		0.57
Control Delay		8.5	2.6		17.9		24.9		23.4
Queue Delay		0.0	0.0		0.0		0.0		0.0
Total Delay		8.5	2.6		17.9		24.9		23.4
LOS		A	A		B		C		C
Approach Delay		7.7			17.9		24.9		23.4
Approach LOS		A			B		C		C

Intersection Summary

Cycle Length: 60
 Actuated Cycle Length: 60
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 60
 Control Type: Pretimed
 Maximum v/c Ratio: 0.77
 Intersection Signal Delay: 18.2
 Intersection LOS: B
 Intersection Capacity Utilization 83.6%
 ICU Level of Service E
 Analysis Period (min) 15

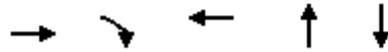
Splits and Phases: 8: Birch Bay-Lynden Road & Blaine Road



Queues

8: Birch Bay-Lynden Road & Blaine Road

5/12/2011



Lane Group	EBT	EBR	WBT	NBT	SBT
Lane Group Flow (vph)	291	41	697	354	238
v/c Ratio	0.31	0.05	0.77	0.71	0.57
Control Delay	8.5	2.6	17.9	24.9	23.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	8.5	2.6	17.9	24.9	23.4
Queue Length 50th (ft)	51	0	170	91	68
Queue Length 95th (ft)	91	11	#335	#202	132
Internal Link Dist (ft)	4694		3734	2504	6889
Turn Bay Length (ft)					
Base Capacity (vph)	941	873	902	502	419
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.31	0.05	0.77	0.71	0.57

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

8: Birch Bay-Lynden Road & Blaine Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗		↕			↕			↕	
Volume (vph)	26	242	38	114	431	97	59	122	144	59	124	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0			5.0			5.0	
Lane Util. Factor		1.00	1.00		1.00			1.00			1.00	
Frt		1.00	0.85		0.98			0.94			0.98	
Flt Protected		1.00	1.00		0.99			0.99			0.99	
Satd. Flow (prot)		1857	1553		1823			1762			1823	
Flt Permitted		0.92	1.00		0.88			0.90			0.78	
Satd. Flow (perm)		1712	1553		1620			1604			1437	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	28	263	41	124	468	105	64	133	157	64	135	39
RTOR Reduction (vph)	0	0	18	0	11	0	0	48	0	0	11	0
Lane Group Flow (vph)	0	291	23	0	686	0	0	306	0	0	227	0
Heavy Vehicles (%)	0%	2%	4%	2%	1%	1%	0%	0%	1%	0%	1%	0%
Turn Type	Perm		Perm	Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		33.0	33.0		33.0			17.0			17.0	
Effective Green, g (s)		33.0	33.0		33.0			17.0			17.0	
Actuated g/C Ratio		0.55	0.55		0.55			0.28			0.28	
Clearance Time (s)		5.0	5.0		5.0			5.0			5.0	
Lane Grp Cap (vph)		942	854		891			454			407	
v/s Ratio Prot												
v/s Ratio Perm		0.17	0.01		0.42			0.19			0.16	
v/c Ratio		0.31	0.03		0.77			0.67			0.56	
Uniform Delay, d1		7.3	6.2		10.5			19.0			18.3	
Progression Factor		1.00	1.00		1.00			1.00			1.00	
Incremental Delay, d2		0.9	0.1		6.4			7.8			5.4	
Delay (s)		8.2	6.2		16.9			26.8			23.7	
Level of Service		A	A		B			C			C	
Approach Delay (s)		7.9			16.9			26.8			23.7	
Approach LOS		A			B			C			C	

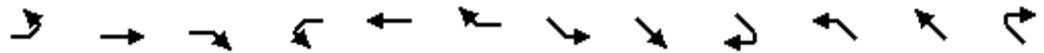
Intersection Summary

HCM Average Control Delay	18.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	83.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Volume

9: Birch Bay-Lynden Road & Portal Way

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Volume (vph)	85	438	22	40	611	59	144	48	113	49	59	30
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	3%	1%	7%	3%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	92	476	24	43	664	64	157	52	123	53	64	33
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	592	0	43	728	0	157	175	0	0	150	0

Intersection Summary

Timings

9: Birch Bay-Lynden Road & Portal Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	SEL	SET	NWL	NWT
Lane Configurations		↕	↕	↕	↕	↕		↕
Volume (vph)	85	438	40	611	144	48	49	59
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		6		2
Permitted Phases	4		8		6		2	
Detector Phase	4	4	8	8	6	6	2	2
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	39.0	39.0	39.0	39.0	21.0	21.0	21.0	21.0
Total Split (%)	65.0%	65.0%	65.0%	65.0%	35.0%	35.0%	35.0%	35.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max							
Act Effect Green (s)		34.0	34.0	34.0	16.0	16.0		16.0
Actuated g/C Ratio		0.57	0.57	0.57	0.27	0.27		0.27
v/c Ratio		0.84	0.10	0.69	0.46	0.32		0.35
Control Delay		24.3	6.7	13.5	23.5	8.5		17.8
Queue Delay		0.0	0.0	0.0	0.0	0.0		0.0
Total Delay		24.3	6.7	13.5	23.5	8.5		17.8
LOS		C	A	B	C	A		B
Approach Delay		24.3		13.1		15.6		17.8
Approach LOS		C		B		B		B

Intersection Summary

Cycle Length: 60
 Actuated Cycle Length: 60
 Offset: 0 (0%), Referenced to phase 2:NWTL and 6:SETL, Start of Green
 Natural Cycle: 60
 Control Type: Pretimed
 Maximum v/c Ratio: 0.84
 Intersection Signal Delay: 17.5
 Intersection LOS: B
 Intersection Capacity Utilization 98.6%
 ICU Level of Service F
 Analysis Period (min) 15

Splits and Phases: 9: Birch Bay-Lynden Road & Portal Way



Queues

9: Birch Bay-Lynden Road & Portal Way

5/12/2011



Lane Group	EBT	WBL	WBT	SEL	SET	NWT
Lane Group Flow (vph)	592	43	728	157	175	150
v/c Ratio	0.84	0.10	0.69	0.46	0.32	0.35
Control Delay	24.3	6.7	13.5	23.5	8.5	17.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.3	6.7	13.5	23.5	8.5	17.8
Queue Length 50th (ft)	155	6	164	47	14	37
Queue Length 95th (ft)	#358	19	276	96	56	80
Internal Link Dist (ft)	3472		1137		18415	22485
Turn Bay Length (ft)						
Base Capacity (vph)	708	445	1052	344	544	429
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.84	0.10	0.69	0.46	0.32	0.35

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
 9: Birch Bay-Lynden Road & Portal Way

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↕		↕	↕		↕	↕			↕	
Volume (vph)	85	438	22	40	611	59	144	48	113	49	59	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0		5.0	5.0			5.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	1.00			1.00	
Frt		0.99		1.00	0.99		1.00	0.89			0.97	
Flt Protected		0.99		0.95	1.00		0.95	1.00			0.98	
Satd. Flow (prot)		1860		1752	1847		1752	1700			1812	
Flt Permitted		0.66		0.43	1.00		0.70	1.00			0.84	
Satd. Flow (perm)		1244		785	1847		1291	1700			1545	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	92	476	24	43	664	64	157	52	123	53	64	33
RTOR Reduction (vph)	0	3	0	0	6	0	0	90	0	0	17	0
Lane Group Flow (vph)	0	589	0	43	722	0	157	85	0	0	133	0
Heavy Vehicles (%)	0%	1%	0%	3%	1%	7%	3%	0%	0%	0%	0%	0%
Turn Type	Perm			Perm			Perm				Perm	
Protected Phases		4			8			6				2
Permitted Phases	4			8			6			2		
Actuated Green, G (s)		34.0		34.0	34.0		16.0	16.0			16.0	
Effective Green, g (s)		34.0		34.0	34.0		16.0	16.0			16.0	
Actuated g/C Ratio		0.57		0.57	0.57		0.27	0.27			0.27	
Clearance Time (s)		5.0		5.0	5.0		5.0	5.0			5.0	
Lane Grp Cap (vph)		705		445	1047		344	453			412	
v/s Ratio Prot					0.39			0.05				
v/s Ratio Perm		c0.47		0.05			c0.12				0.09	
v/c Ratio		0.84		0.10	0.69		0.46	0.19			0.32	
Uniform Delay, d1		10.7		6.0	9.2		18.4	17.0			17.7	
Progression Factor		1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2		11.3		0.4	3.7		4.3	0.9			2.1	
Delay (s)		22.0		6.4	13.0		22.7	17.9			19.7	
Level of Service		C		A	B		C	B			B	
Approach Delay (s)		22.0			12.6			20.2			19.7	
Approach LOS		C			B			C			B	

Intersection Summary

HCM Average Control Delay	17.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	98.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Volume
10: Slater Road & Sunset Avenue

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Volume (vph)	5	837	97	803	56	23	5	115	189	8
Confl. Peds. (#/hr)										
Confl. Bikes (#/hr)										
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	3%	1%	2%	5%	6%	0%	1%	1%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)										
Mid-Block Traffic (%)		0%		0%			0%			0%
Adj. Flow (vph)	5	910	105	873	61	25	5	125	205	9
Shared Lane Traffic (%)										
Lane Group Flow (vph)	5	921	105	873	61	25	5	125	205	17

Intersection Summary

Timings

10: Slater Road & Sunset Avenue

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↖	↗	↗	↖	↗	↗	↖	↗
Volume (vph)	5	837	97	803	56	23	5	115	189	8
Turn Type	pm+pt		pm+pt		Perm	Perm		Perm	Perm	
Protected Phases	7	4	3	8			2			2
Permitted Phases	4		8		8	2		2	2	
Detector Phase	7	4	3	8	8	2	2	2	2	2
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	20.0	9.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	15.0	70.0	15.0	70.0	70.0	30.0	30.0	30.0	30.0	30.0
Total Split (%)	13.0%	60.9%	13.0%	60.9%	60.9%	26.1%	26.1%	26.1%	26.1%	26.1%
Yellow Time (s)	4.0	3.5	4.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	0.5	1.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	4.0	5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	None	None	None	None	Min	Min	Min	Min	Min
Act Effct Green (s)	54.9	52.5	59.9	60.1	60.1	19.2	19.2	19.2	19.2	19.2
Actuated g/C Ratio	0.56	0.58	0.65	0.67	0.67	0.21	0.21	0.21	0.21	0.21
v/c Ratio	0.02	0.86	0.40	0.70	0.06	0.09	0.01	0.28	0.68	0.04
Control Delay	7.0	27.0	9.9	14.3	2.6	34.6	33.8	8.6	48.7	24.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.0	27.0	9.9	14.3	2.6	34.6	33.8	8.6	48.7	24.9
LOS	A	C	A	B	A	C	C	A	D	C
Approach Delay		26.9		13.2			13.6			46.9
Approach LOS		C		B			B			D

Intersection Summary

Cycle Length: 115	
Actuated Cycle Length: 89.9	
Natural Cycle: 70	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.86	
Intersection Signal Delay: 21.8	Intersection LOS: C
Intersection Capacity Utilization 78.0%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 10: Slater Road & Sunset Avenue



Queues

10: Slater Road & Sunset Avenue

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	5	921	105	873	61	25	5	125	205	17
v/c Ratio	0.02	0.86	0.40	0.70	0.06	0.09	0.01	0.28	0.68	0.04
Control Delay	7.0	27.0	9.9	14.3	2.6	34.6	33.8	8.6	48.7	24.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.0	27.0	9.9	14.3	2.6	34.6	33.8	8.6	48.7	24.9
Queue Length 50th (ft)	1	438	18	251	1	12	2	0	116	4
Queue Length 95th (ft)	5	#802	40	624	18	38	13	48	220	25
Internal Link Dist (ft)		5760		6364			1689			1796
Turn Bay Length (ft)										
Base Capacity (vph)	364	1187	302	1320	1106	377	536	540	400	503
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.78	0.35	0.66	0.06	0.07	0.01	0.23	0.51	0.03

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

10: Slater Road & Sunset Avenue

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↑	↗	↖	↑	↗	↖	↗	
Volume (vph)	5	837	10	97	803	56	23	5	115	189	8	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	4.0		5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1805	1842		1787	1863	1538	1703	1900	1599	1787	1766	
Flt Permitted	0.20	1.00		0.11	1.00	1.00	0.75	1.00	1.00	0.75	1.00	
Satd. Flow (perm)	384	1842		199	1863	1538	1338	1900	1599	1419	1766	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	910	11	105	873	61	25	5	125	205	9	8
RTOR Reduction (vph)	0	0	0	0	0	20	0	0	99	0	6	0
Lane Group Flow (vph)	5	921	0	105	873	41	25	5	26	205	11	0
Heavy Vehicles (%)	0%	3%	0%	1%	2%	5%	6%	0%	1%	1%	0%	0%
Turn Type	pm+pt			pm+pt		Perm	Perm		Perm	Perm		
Protected Phases	7	4		3	8			2			2	
Permitted Phases	4			8		8	2		2	2		
Actuated Green, G (s)	56.2	55.3		65.8	60.1	60.1	19.2	19.2	19.2	19.2	19.2	
Effective Green, g (s)	56.2	55.3		65.8	60.1	60.1	19.2	19.2	19.2	19.2	19.2	
Actuated g/C Ratio	0.60	0.59		0.71	0.64	0.64	0.21	0.21	0.21	0.21	0.21	
Clearance Time (s)	5.0	4.0		5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	245	1093		238	1201	992	276	391	329	292	364	
v/s Ratio Prot	0.00	c0.50		c0.03	c0.47			0.00			0.01	
v/s Ratio Perm	0.01			0.29		0.03	0.02		0.02	c0.14		
v/c Ratio	0.02	0.84		0.44	0.73	0.04	0.09	0.01	0.08	0.70	0.03	
Uniform Delay, d1	10.1	15.4		14.9	11.1	6.0	29.9	29.5	29.9	34.3	29.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	6.0		1.3	2.2	0.0	0.1	0.0	0.1	7.4	0.0	
Delay (s)	10.1	21.4		16.2	13.3	6.1	30.1	29.5	30.0	41.8	29.6	
Level of Service	B	C		B	B	A	C	C	C	D	C	
Approach Delay (s)		21.4			13.2			30.0			40.8	
Approach LOS		C			B			C			D	

Intersection Summary

HCM Average Control Delay	20.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	93.2	Sum of lost time (s)	17.0
Intersection Capacity Utilization	78.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Volume

11: Slater Road & Lake Terrell Road

5/12/2011

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	22	67	5	59	99	76	11	14	41	231	25	48
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	0%	0%	4%	0%	0%	3%	2%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	24	73	5	64	108	83	12	15	45	251	27	52
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	102	0	0	172	83	0	72	0	0	330	0
Intersection Summary												

HCM Unsignalized Intersection Capacity Analysis
 11: Slater Road & Lake Terrell Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕	↕		↕			↕	
Volume (veh/h)	22	67	5	59	99	76	11	14	41	231	25	48
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	24	73	5	64	108	83	12	15	45	251	27	52
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	108			78			425	359	76	411	362	108
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	108			78			425	359	76	411	362	108
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			96			97	97	95	49	95	95
cM capacity (veh/h)	1496			1533			472	538	983	492	536	952

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	102	172	83	72	330
Volume Left	24	64	0	12	251
Volume Right	5	0	83	45	52
cSH	1496	1533	1700	725	537
Volume to Capacity	0.02	0.04	0.05	0.10	0.62
Queue Length 95th (ft)	1	3	0	8	104
Control Delay (s)	1.8	3.0	0.0	10.5	21.9
Lane LOS	A	A		B	C
Approach Delay (s)	1.8	2.0		10.5	21.9
Approach LOS				B	C

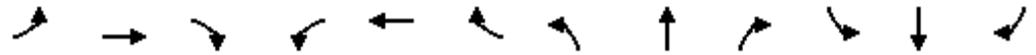
Intersection Summary

Average Delay	11.4
Intersection Capacity Utilization	44.2%
ICU Level of Service	A
Analysis Period (min)	15

Volume

12: Mountain View Road & Lake Terrell Road

5/12/2011

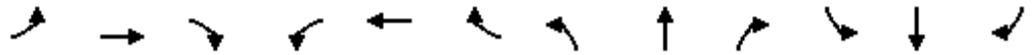


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	4	146	147	51	63	7	82	4	95	4	0	7
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	1%	0%	4%	0%	2%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	4	159	160	55	68	8	89	4	103	4	0	8
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	323	0	0	131	0	0	196	0	0	12	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 12: Mountain View Road & Lake Terrell Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	4	146	147	51	63	7	82	4	95	4	0	7
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
Hourly flow rate (vph)	4	159	160	55	68	8	89	4	103	4	0	8

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	323	132	197	12
Volume Left (vph)	4	55	89	4
Volume Right (vph)	160	8	103	8
Hadj (s)	-0.28	0.08	-0.21	-0.31
Departure Headway (s)	4.3	4.9	4.7	4.9
Degree Utilization, x	0.39	0.18	0.26	0.02
Capacity (veh/h)	801	692	701	639
Control Delay (s)	10.0	8.9	9.4	8.0
Approach Delay (s)	10.0	8.9	9.4	8.0
Approach LOS	B	A	A	A

Intersection Summary			
Delay		9.6	
HCM Level of Service		A	
Intersection Capacity Utilization	48.6%		ICU Level of Service A
Analysis Period (min)		15	

Volume

13: Henry Road & Kickerville Road

5/12/2011

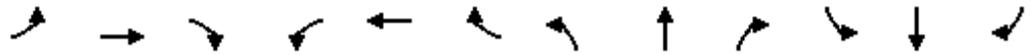


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	4	4	0	5	5	125	0	5	8	211	1	3
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	33%	0%	0%	25%	0%	0%	0%	0%	0%	1%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	4	4	0	5	5	136	0	5	9	229	1	3
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	8	0	0	146	0	0	14	0	0	233	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 13: Henry Road & Kickerville Road

5/12/2011

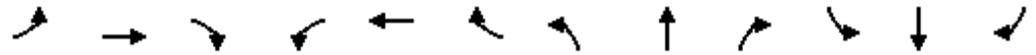


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	4	4	0	5	5	125	0	5	8	211	1	3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	4	0	5	5	136	0	5	9	229	1	3
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	9	147	14	234								
Volume Left (vph)	4	5	0	229								
Volume Right (vph)	0	136	9	3								
Hadj (s)	0.38	-0.53	-0.37	0.20								
Departure Headway (s)	5.0	4.0	4.1	4.5								
Degree Utilization, x	0.01	0.16	0.02	0.29								
Capacity (veh/h)	664	849	821	776								
Control Delay (s)	8.1	7.7	7.2	9.3								
Approach Delay (s)	8.1	7.7	7.2	9.3								
Approach LOS	A	A	A	A								
Intersection Summary												
Delay			8.6									
HCM Level of Service			A									
Intersection Capacity Utilization			33.5%	ICU Level of Service	A							
Analysis Period (min)			15									

Volume

14: Main Street & Riverside Dr

5/12/2011



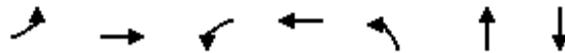
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Volume (vph)	22	954	229	825	351	15	43	15
Confl. Peds. (#/hr)								
Confl. Bikes (#/hr)								
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	2%	1%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0
Parking (#/hr)								
Mid-Block Traffic (%)		0%		0%		0%		0%
Adj. Flow (vph)	24	1037	249	897	382	16	47	16
Shared Lane Traffic (%)								
Lane Group Flow (vph)	24	1217	249	930	382	339	0	95

Intersection Summary

Timings

14: Main Street & Riverside Dr

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Configurations	↶	↶↷	↶	↶↷	↶	↷	↷
Volume (vph)	22	954	229	825	351	15	15
Turn Type	Perm		pm+pt		Split		
Protected Phases		4	3	8	1	1	2
Permitted Phases	4		8				
Detector Phase	4	4	3	8	1	1	2
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	9.0	20.0	20.0	20.0	9.0
Total Split (s)	35.0	35.0	15.0	50.0	25.0	25.0	15.0
Total Split (%)	38.9%	38.9%	16.7%	55.6%	27.8%	27.8%	16.7%
Yellow Time (s)	3.5	3.5	4.0	3.5	3.5	3.5	4.0
All-Red Time (s)	0.5	0.5	1.0	0.5	0.5	0.5	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	5.0	4.0	4.0	4.0	5.0
Lead/Lag	Lag	Lag	Lead		Lag	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None	None	None	Min	Min	None
Act Effct Green (s)	31.3	31.3	45.4	46.4	20.1	20.1	8.3
Actuated g/C Ratio	0.37	0.37	0.53	0.54	0.24	0.24	0.09
v/c Ratio	0.11	0.94	0.85	0.48	0.90	0.54	0.50
Control Delay	22.0	42.0	46.1	14.1	58.8	7.9	38.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.0	42.0	46.1	14.1	58.8	7.9	38.9
LOS	C	D	D	B	E	A	D
Approach Delay		41.6		20.9		34.8	38.9
Approach LOS		D		C		C	D

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 85.4

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.94

Intersection Signal Delay: 32.5

Intersection LOS: C

Intersection Capacity Utilization 83.7%

ICU Level of Service E

Analysis Period (min) 15

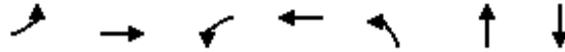
Splits and Phases: 14: Main Street & Riverside Dr



Queues

14: Main Street & Riverside Dr

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	24	1217	249	930	382	339	95
v/c Ratio	0.11	0.94	0.85	0.48	0.90	0.54	0.50
Control Delay	22.0	42.0	46.1	14.1	58.8	7.9	38.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.0	42.0	46.1	14.1	58.8	7.9	38.9
Queue Length 50th (ft)	9	346	89	168	209	7	39
Queue Length 95th (ft)	28	#507	#232	226	#378	77	86
Internal Link Dist (ft)		414		818		277	276
Turn Bay Length (ft)							
Base Capacity (vph)	214	1298	294	1937	441	638	219
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.94	0.85	0.48	0.87	0.53	0.43

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

14: Main Street & Riverside Dr

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	22	954	166	229	825	30	351	15	297	43	15	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		5.0	4.0		4.0	4.0			5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00			1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.86			0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			0.98	
Satd. Flow (prot)	1805	3500		1770	3556		1805	1613			1770	
Flt Permitted	0.31	1.00		0.11	1.00		0.95	1.00			0.98	
Satd. Flow (perm)	584	3500		205	3556		1805	1613			1770	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	24	1037	180	249	897	33	382	16	323	47	16	32
RTOR Reduction (vph)	0	15	0	0	3	0	0	248	0	0	21	0
Lane Group Flow (vph)	24	1202	0	249	927	0	382	91	0	0	74	0
Heavy Vehicles (%)	0%	1%	0%	2%	1%	0%	0%	0%	1%	0%	0%	0%
Turn Type	Perm			pm+pt			Split			Split		
Protected Phases		4		3	8		1	1		2	2	
Permitted Phases	4			8								
Actuated Green, G (s)	31.3	31.3		46.4	46.4		20.1	20.1			7.0	
Effective Green, g (s)	31.3	31.3		46.4	46.4		20.1	20.1			7.0	
Actuated g/C Ratio	0.36	0.36		0.54	0.54		0.23	0.23			0.08	
Clearance Time (s)	4.0	4.0		5.0	4.0		4.0	4.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	211	1266		293	1907		419	375			143	
v/s Ratio Prot		c0.34		c0.10	0.26		c0.21	0.06			c0.04	
v/s Ratio Perm	0.04			0.36								
v/c Ratio	0.11	0.95		0.85	0.49		0.91	0.24			0.52	
Uniform Delay, d1	18.4	26.8		21.1	12.6		32.3	27.0			38.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.2	14.6		20.0	0.2		23.8	0.3			3.1	
Delay (s)	18.6	41.5		41.0	12.8		56.1	27.3			41.3	
Level of Service	B	D		D	B		E	C			D	
Approach Delay (s)		41.0			18.7			42.6			41.3	
Approach LOS		D			B			D			D	

Intersection Summary

HCM Average Control Delay	33.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	86.5	Sum of lost time (s)	18.0
Intersection Capacity Utilization	83.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Volume

15: Slater Road & Haxton Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Volume (vph)	3	283	376	237	69	70	391	26	54
Confl. Peds. (#/hr)									
Confl. Bikes (#/hr)									
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	1%	0%	6%	0%	4%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0
Parking (#/hr)									
Mid-Block Traffic (%)		0%		0%		0%			0%
Adj. Flow (vph)	3	308	409	258	75	76	425	28	59
Shared Lane Traffic (%)									
Lane Group Flow (vph)	3	356	409	295	0	151	425	28	63

Intersection Summary

Timings

15: Slater Road & Haxton Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations	↔	↔	↔	↔		↕	↕	↕	↕
Volume (vph)	3	283	376	237	69	70	391	26	54
Turn Type	Perm		Perm		Perm		Perm	Perm	
Protected Phases		1		1		2			2
Permitted Phases	1		1		2		2	2	
Detector Phase	1	1	1	1	2	2	2	2	2
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	80.0	80.0	80.0	80.0	20.0	20.0	20.0	20.0	20.0
Total Split (%)	80.0%	80.0%	80.0%	80.0%	20.0%	20.0%	20.0%	20.0%	20.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lead	Lead	Lead	Lag	Lag	Lag	Lag	Lag
Lead-Lag Optimize?	Yes								
Recall Mode	None	None	None	None	Min	Min	Min	Min	Min
Act Effect Green (s)	29.2	29.2	29.2	29.2		11.8	11.8	11.8	11.8
Actuated g/C Ratio	0.58	0.58	0.58	0.58		0.24	0.24	0.24	0.24
v/c Ratio	0.00	0.33	0.70	0.27		0.42	0.61	0.09	0.14
Control Delay	4.0	5.6	14.5	5.1		24.4	7.3	21.2	19.8
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Total Delay	4.0	5.6	14.5	5.1		24.4	7.3	21.2	19.8
LOS	A	A	B	A		C	A	C	B
Approach Delay		5.6		10.6		11.8			20.2
Approach LOS		A		B		B			C

Intersection Summary

Cycle Length: 100	
Actuated Cycle Length: 50.1	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.70	
Intersection Signal Delay: 10.4	Intersection LOS: B
Intersection Capacity Utilization 62.6%	ICU Level of Service B
Analysis Period (min) 15	

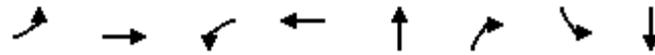
Splits and Phases: 15: Slater Road & Haxton Way



Queues

15: Slater Road & Haxton Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	3	356	409	295	151	425	28	63
v/c Ratio	0.00	0.33	0.70	0.27	0.42	0.61	0.09	0.14
Control Delay	4.0	5.6	14.5	5.1	24.4	7.3	21.2	19.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	4.0	5.6	14.5	5.1	24.4	7.3	21.2	19.8
Queue Length 50th (ft)	0	39	66	31	36	0	6	13
Queue Length 95th (ft)	3	84	168	68	118	73	32	54
Internal Link Dist (ft)		13101		11751	4951			2508
Turn Bay Length (ft)								
Base Capacity (vph)	876	1472	796	1486	476	778	393	590
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.00	0.24	0.51	0.20	0.32	0.55	0.07	0.11

Intersection Summary

HCM Signalized Intersection Capacity Analysis

15: Slater Road & Haxton Way

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	3	283	44	376	237	34	69	70	391	26	54	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Frt	1.00	0.98		1.00	0.98			1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00			0.98	1.00	0.95	1.00	
Satd. Flow (prot)	1805	1846		1787	1864			1800	1553	1805	1882	
Flt Permitted	0.58	1.00		0.53	1.00			0.83	1.00	0.66	1.00	
Satd. Flow (perm)	1101	1846		1000	1864			1523	1553	1256	1882	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	308	48	409	258	37	75	76	425	28	59	4
RTOR Reduction (vph)	0	9	0	0	9	0	0	0	323	0	2	0
Lane Group Flow (vph)	3	347	0	409	286	0	0	151	102	28	61	0
Heavy Vehicles (%)	0%	1%	0%	1%	0%	0%	6%	0%	4%	0%	0%	0%
Turn Type	Perm			Perm			Perm		Perm	Perm		
Protected Phases		1			1			2				2
Permitted Phases	1			1			2		2	2		
Actuated Green, G (s)	29.2	29.2		29.2	29.2			11.8	11.8	11.8	11.8	
Effective Green, g (s)	29.2	29.2		29.2	29.2			11.8	11.8	11.8	11.8	
Actuated g/C Ratio	0.60	0.60		0.60	0.60			0.24	0.24	0.24	0.24	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	656	1100		596	1111			367	374	302	453	
v/s Ratio Prot		0.19			0.15						0.03	
v/s Ratio Perm	0.00			c0.41				c0.10	0.07	0.02		
v/c Ratio	0.00	0.32		0.69	0.26			0.41	0.27	0.09	0.13	
Uniform Delay, d1	4.0	4.9		6.8	4.7			15.7	15.1	14.4	14.6	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	0.2		3.3	0.1			0.8	0.4	0.1	0.1	
Delay (s)	4.0	5.1		10.0	4.8			16.4	15.5	14.6	14.7	
Level of Service	A	A		B	A			B	B	B	B	
Approach Delay (s)		5.1			7.9			15.8			14.7	
Approach LOS		A			A			B			B	

Intersection Summary

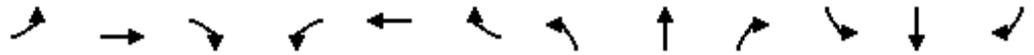
HCM Average Control Delay	10.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	49.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Volume

16: Birch Bay - Lynden Road & Kickerville Road

5/12/2011

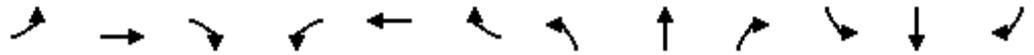


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	7	441	7	25	574	10	11	12	58	1	8	3
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	8	479	8	27	624	11	12	13	63	1	9	3
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	495	0	0	662	0	0	88	0	0	13	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 16: Birch Bay - Lynden Road & Kickerville Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	7	441	7	25	574	10	11	12	58	1	8	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	8	479	8	27	624	11	12	13	63	1	9	3
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	635			487			1190	1188	483	1252	1186	629
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	635			487			1190	1188	483	1252	1186	629
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			97			92	93	89	99	95	99
cM capacity (veh/h)	958			1087			155	184	588	124	184	486

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	495	662	88	13
Volume Left	8	27	12	1
Volume Right	8	11	63	3
cSH	958	1087	345	208
Volume to Capacity	0.01	0.03	0.26	0.06
Queue Length 95th (ft)	1	2	25	5
Control Delay (s)	0.2	0.7	19.0	23.5
Lane LOS	A	A	C	C
Approach Delay (s)	0.2	0.7	19.0	23.5
Approach LOS			C	C

Intersection Summary			
Average Delay		2.0	
Intersection Capacity Utilization		59.0%	ICU Level of Service
Analysis Period (min)		15	B

Volume

17: Grandview Road & Vista Drive

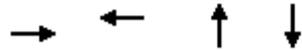
5/12/2011

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	4	615	30	82	222	173	16	43	77	144	45	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	0%	2%	2%	0%	3%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	4	668	33	89	241	188	17	47	84	157	49	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	705	0	0	518	0	0	148	0	0	206	0
Intersection Summary												

Queues

17: Grandview Road & Vista Drive

5/12/2011



Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	705	518	148	206
v/c Ratio	0.71	0.64	0.27	0.51
Control Delay	14.8	12.3	9.1	21.5
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	14.8	12.3	9.1	21.5
Queue Length 50th (ft)	156	90	15	55
Queue Length 95th (ft)	268	180	51	110
Internal Link Dist (ft)	4845	3772	786	702
Turn Bay Length (ft)				
Base Capacity (vph)	988	807	541	406
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.71	0.64	0.27	0.51

Intersection Summary

HCM Signalized Intersection Capacity Analysis

17: Grandview Road & Vista Drive

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	4	615	30	82	222	173	16	43	77	144	45	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.99			0.95			0.92			1.00	
Flt Protected		1.00			0.99			0.99			0.96	
Satd. Flow (prot)		1870			1762			1728			1830	
Flt Permitted		1.00			0.82			0.95			0.74	
Satd. Flow (perm)		1866			1458			1657			1397	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	4	668	33	89	241	188	17	47	84	157	49	0
RTOR Reduction (vph)	0	3	0	0	37	0	0	60	0	0	0	0
Lane Group Flow (vph)	0	702	0	0	481	0	0	88	0	0	206	0
Heavy Vehicles (%)	0%	1%	0%	0%	2%	2%	0%	3%	0%	0%	0%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		29.0			29.0			16.0			16.0	
Effective Green, g (s)		29.0			29.0			16.0			16.0	
Actuated g/C Ratio		0.53			0.53			0.29			0.29	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Lane Grp Cap (vph)		984			769			482			406	
v/s Ratio Prot												
v/s Ratio Perm		c0.38			0.33			0.05			c0.15	
v/c Ratio		0.71			0.63			0.18			0.51	
Uniform Delay, d1		9.8			9.2			14.6			16.2	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		4.4			3.8			0.8			4.5	
Delay (s)		14.2			13.0			15.4			20.7	
Level of Service		B			B			B			C	
Approach Delay (s)		14.2			13.0			15.4			20.7	
Approach LOS		B			B			B			C	

Intersection Summary

HCM Average Control Delay	14.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	90.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

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APPENDIX E

2026 Traffic Model – With Project and with Recommended Improvements

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Volume

1: Aldergrove Road & Kickerville Road

5/12/2011

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	1	0	1	1	0	4	0	150	8	21	206	1
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	1	0	1	1	0	4	0	163	9	23	224	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	2	0	0	5	0	0	172	0	0	248	0
Intersection Summary												

HCM Unsignalized Intersection Capacity Analysis

1: Aldergrove Road & Kickerville Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	1	0	1	1	0	4	0	150	8	21	206	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	1	0	1	1	0	4	0	163	9	23	224	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	442	442	224	439	438	167	225			172		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	442	442	224	439	438	167	225			172		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			98		
cM capacity (veh/h)	520	505	820	525	507	882	1356			1418		

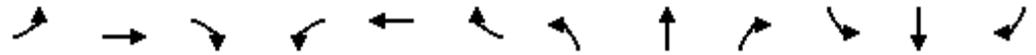
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	2	5	172	248
Volume Left	1	1	0	23
Volume Right	1	4	9	1
cSH	637	776	1356	1418
Volume to Capacity	0.00	0.01	0.00	0.02
Queue Length 95th (ft)	0	1	0	1
Control Delay (s)	10.7	9.7	0.0	0.8
Lane LOS	B	A		A
Approach Delay (s)	10.7	9.7	0.0	0.8
Approach LOS	B	A		

Intersection Summary			
Average Delay		0.7	
Intersection Capacity Utilization		33.8%	ICU Level of Service A
Analysis Period (min)		15	

Volume

2: Grandview Road & Kickerville Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	19	501	96	19	169	11	88	129	181	4	16	5
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	3%	14%	2%	13%	0%	1%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	21	545	104	21	184	12	96	140	197	4	17	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	670	0	0	217	0	0	433	0	0	26	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

2: Grandview Road & Kickerville Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	19	501	96	19	169	11	88	129	181	4	16	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	21	545	104	21	184	12	96	140	197	4	17	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	196			649			883	875	597	1136	921	190
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	196			649			883	875	597	1136	921	190
tC, single (s)	4.1			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			98			61	50	61	93	93	99
cM capacity (veh/h)	1389			882			246	278	507	65	262	857

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	670	216	433	27
Volume Left	21	21	96	4
Volume Right	104	12	197	5
cSH	1389	882	338	195
Volume to Capacity	0.01	0.02	1.28	0.14
Queue Length 95th (ft)	1	2	500	12
Control Delay (s)	0.4	1.1	179.8	26.5
Lane LOS	A	A	F	D
Approach Delay (s)	0.4	1.1	179.8	26.5
Approach LOS			F	D

Intersection Summary

Average Delay		58.7		
Intersection Capacity Utilization		72.4%	ICU Level of Service	C
Analysis Period (min)		15		

Volume

3: Grandview Road & Olson Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	5	629	22	33	257	5	16	12	21	3	5	1
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	0%	3%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	5	684	24	36	279	5	17	13	23	3	5	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	713	0	0	320	0	0	53	0	0	9	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

3: Grandview Road & Olson Road

5/12/2011

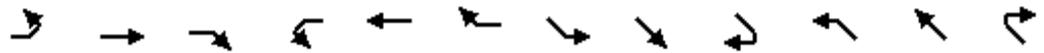


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	5	629	22	33	257	5	16	12	21	3	5	1
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	684	24	36	279	5	17	13	23	3	5	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	285			708			1064	1063	696	1090	1072	282
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	285			708			1064	1063	696	1090	1072	282
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			96			91	94	95	98	97	100
cM capacity (veh/h)	1289			900			192	215	445	170	212	762
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	713	321	53	10								
Volume Left	5	36	17	3								
Volume Right	24	5	23	1								
cSH	1289	900	263	212								
Volume to Capacity	0.00	0.04	0.20	0.05								
Queue Length 95th (ft)	0	3	19	4								
Control Delay (s)	0.1	1.4	22.1	22.8								
Lane LOS	A	A	C	C								
Approach Delay (s)	0.1	1.4	22.1	22.8								
Approach LOS			C	C								
Intersection Summary												
Average Delay			1.8									
Intersection Capacity Utilization			47.2%		ICU Level of Service				A			
Analysis Period (min)			15									

Volume

4: Grandview Road & Portal Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	SEL	SET	NWL	NWT
Volume (vph)	23	995	11	570	69	47	43	55
Confl. Peds. (#/hr)								
Confl. Bikes (#/hr)								
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	2%	2%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0
Parking (#/hr)								
Mid-Block Traffic (%)		0%		0%		0%		0%
Adj. Flow (vph)	25	1082	12	620	75	51	47	60
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	1142	0	711	0	146	0	139
Intersection Summary								

Timings

4: Grandview Road & Portal Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	SET	NWT
Lane Configurations		↕		↕	↕	↕
Volume (vph)	23	995	11	570	47	55
Turn Type	Perm		Perm			
Protected Phases		3		3	2	1
Permitted Phases	3		3			
Detector Phase	3	3	3	3	2	1
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	100.0	100.0	100.0	100.0	20.0	20.0
Total Split (%)	71.4%	71.4%	71.4%	71.4%	14.3%	14.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag					Lag	Lead
Lead-Lag Optimize?					Yes	Yes
Recall Mode	None	None	None	None	Min	Min
Act Effct Green (s)		85.9		85.9	14.0	13.5
Actuated g/C Ratio		0.68		0.68	0.11	0.11
v/c Ratio		0.92		0.58	0.71	0.69
Control Delay		31.0		12.8	74.7	71.8
Queue Delay		0.0		0.0	0.0	0.0
Total Delay		31.0		12.8	74.7	71.8
LOS		C		B	E	E
Approach Delay		31.0		12.8	74.7	71.8
Approach LOS		C		B	E	E

Intersection Summary

Cycle Length: 140	
Actuated Cycle Length: 125.8	
Natural Cycle: 110	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.92	
Intersection Signal Delay: 30.6	Intersection LOS: C
Intersection Capacity Utilization 85.1%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 4: Grandview Road & Portal Way



Queues

4: Grandview Road & Portal Way

5/12/2011



Lane Group	EBT	WBT	SET	NWT
Lane Group Flow (vph)	1142	711	146	139
v/c Ratio	0.92	0.58	0.71	0.69
Control Delay	31.0	12.8	74.7	71.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	31.0	12.8	74.7	71.8
Queue Length 50th (ft)	797	300	125	115
Queue Length 95th (ft)	#1246	412	#217	189
Internal Link Dist (ft)	3862	783	22485	3678
Turn Bay Length (ft)				
Base Capacity (vph)	1286	1273	235	239
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.89	0.56	0.62	0.58

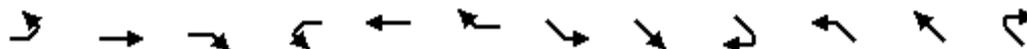
Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

4: Grandview Road & Portal Way

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	23	995	32	11	570	73	69	47	18	43	55	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		1.00			0.98			0.98			0.97	
Flt Protected		1.00			1.00			0.97			0.98	
Satd. Flow (prot)		1855			1834			1800			1810	
Flt Permitted		0.98			0.98			0.97			0.98	
Satd. Flow (perm)		1815			1793			1800			1810	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	1082	35	12	620	79	75	51	20	47	60	32
RTOR Reduction (vph)	0	1	0	0	3	0	0	4	0	0	8	0
Lane Group Flow (vph)	0	1141	0	0	708	0	0	142	0	0	131	0
Heavy Vehicles (%)	0%	2%	0%	0%	2%	2%	2%	0%	0%	0%	0%	0%
Turn Type	Perm		Perm			Split			Split			
Protected Phases		3			3		2	2		1	1	
Permitted Phases	3			3								
Actuated Green, G (s)		85.9			85.9			14.0			13.5	
Effective Green, g (s)		85.9			85.9			14.0			13.5	
Actuated g/C Ratio		0.69			0.69			0.11			0.11	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1243			1228			201			195	
v/s Ratio Prot								c0.08			c0.07	
v/s Ratio Perm		c0.63			0.39							
v/c Ratio		0.92			0.58			0.70			0.67	
Uniform Delay, d1		16.8			10.3			53.7			53.8	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		10.7			0.7			10.7			8.8	
Delay (s)		27.5			10.9			64.4			62.6	
Level of Service		C			B			E			E	
Approach Delay (s)		27.5			10.9			64.4			62.6	
Approach LOS		C			B			E			E	

Intersection Summary

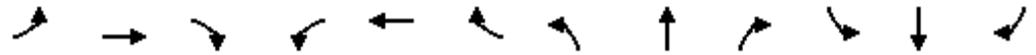
HCM Average Control Delay	26.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	125.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Volume

5: Bay Road & Kickerville Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	8	129	10	4	111	21	5	29	4	40	85	32
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	9	140	11	4	121	23	5	32	4	43	92	35
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	160	0	0	148	0	0	41	0	0	170	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

5: Bay Road & Kickerville Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	8	129	10	4	111	21	5	29	4	40	85	32
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	9	140	11	4	121	23	5	32	4	43	92	35
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	143			151			385	315	146	324	309	132
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	143			151			385	315	146	324	309	132
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			99	95	100	93	85	96
cM capacity (veh/h)	1451			1442			487	598	907	600	603	923

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	160	148	41	171
Volume Left	9	4	5	43
Volume Right	11	23	4	35
cSH	1451	1442	602	648
Volume to Capacity	0.01	0.00	0.07	0.26
Queue Length 95th (ft)	0	0	6	26
Control Delay (s)	0.5	0.2	11.4	12.5
Lane LOS	A	A	B	B
Approach Delay (s)	0.5	0.2	11.4	12.5
Approach LOS			B	B

Intersection Summary

Average Delay		5.2		
Intersection Capacity Utilization		32.8%	ICU Level of Service	A
Analysis Period (min)		15		

Volume

6: Arnie Road & Valley View Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	1	5	0	1	8	4	0	34	1	3	21	3
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	1	5	0	1	9	4	0	37	1	3	23	3
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	6	0	0	14	0	0	38	0	0	29	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis

6: Arnie Road & Valley View Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	1	5	0	1	8	4	0	34	1	3	21	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	1	5	0	1	9	4	0	37	1	3	23	3
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	13			5			35	23	5	40	21	11
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	13			5			35	23	5	40	21	11
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	96	100	100	97	100
cM capacity (veh/h)	1619			1629			953	873	1083	936	876	1076
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	7	14	38	29								
Volume Left	1	1	0	3								
Volume Right	0	4	1	3								
cSH	1619	1629	878	901								
Volume to Capacity	0.00	0.00	0.04	0.03								
Queue Length 95th (ft)	0	0	3	3								
Control Delay (s)	1.2	0.6	9.3	9.1								
Lane LOS	A	A	A	A								
Approach Delay (s)	1.2	0.6	9.3	9.1								
Approach LOS			A	A								
Intersection Summary												
Average Delay			7.2									
Intersection Capacity Utilization			13.8%		ICU Level of Service				A			
Analysis Period (min)			15									

Lanes, Volumes, Timings
7: Grandview Road & Blaine Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕	↗		↕	↗
Volume (vph)	106	390	3	0	184	84	11	106	233	36	0	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		150	0		150
Storage Lanes	0		0	0		0	0		1	0		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. 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
Frt		0.999			0.958				0.850			0.850
Flt Protected		0.990						0.995			0.950	
Satd. Flow (prot)	0	1865	0	0	1796	0	0	1890	1599	0	1805	1615
Flt Permitted		0.990						0.995			0.950	
Satd. Flow (perm)	0	1865	0	0	1796	0	0	1890	1599	0	1805	1615
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		5885			5344			203			4219	
Travel Time (s)		133.8			121.5			4.6			95.9	
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
Heavy Vehicles (%)	0%	1%	0%	0%	2%	0%	0%	0%	1%	0%	0%	0%
Adj. Flow (vph)	115	424	3	0	200	91	12	115	253	39	0	48
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	542	0	0	291	0	0	127	253	0	39	48
Enter Blocked Intersection	No	No	No									
Lane Alignment	Left	Left	Right									
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Yield			Yield			Yield			Yield	

Intersection Summary

Area Type:	Other
Control Type:	Roundabout
Intersection Capacity Utilization	64.2%
ICU Level of Service	C
Analysis Period (min)	15

Volume

7: Grandview Road & Blaine Road

5/12/2011

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	106	390	3	0	184	84	11	106	233	36	0	44
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	0%	2%	0%	0%	0%	1%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	115	424	3	0	200	91	12	115	253	39	0	48
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	542	0	0	291	0	0	127	253	0	39	48
Intersection Summary												

HCM Unsignalized Intersection Capacity Analysis
 7: Grandview Road & Blaine Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Right Turn Channelized									Yes			Yes
Volume (veh/h)	106	390	3	0	184	84	11	106	233	36	0	44
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
Hourly flow rate (vph)	115	424	3	0	200	91	12	115	253	39	0	48
Approach Volume (veh/h)		542			291			127			39	
Crossing Volume (veh/h)		39			242			578			212	
High Capacity (veh/h)		1343			1145			877			1173	
High v/c (veh/h)		0.40			0.25			0.15			0.03	
Low Capacity (veh/h)		1123			944			704			969	
Low v/c (veh/h)		0.48			0.31			0.18			0.04	
Intersection Summary												
Maximum v/c High			0.40									
Maximum v/c Low			0.48									
Intersection Capacity Utilization			64.2%		ICU Level of Service						C	

Volume

8: Birch Bay-Lynden Road & Blaine Road

5/12/2011



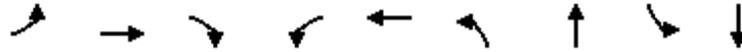
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	26	242	38	114	431	97	59	122	144	59	124	36
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	4%	2%	1%	1%	0%	0%	1%	0%	1%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	28	263	41	124	468	105	64	133	157	64	135	39
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	291	41	0	697	0	0	354	0	0	238	0

Intersection Summary

Timings

8: Birch Bay-Lynden Road & Blaine Road

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕	↗		↕		↕		↕
Volume (vph)	26	242	38	114	431	59	122	59	124
Turn Type	Perm		Perm	Perm		Perm		Perm	
Protected Phases		4			8		2		6
Permitted Phases	4		4	8		2		6	
Detector Phase	4	4	4	8	8	2	2	6	6
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	38.0	38.0	38.0	38.0	38.0	22.0	22.0	22.0	22.0
Total Split (%)	63.3%	63.3%	63.3%	63.3%	63.3%	36.7%	36.7%	36.7%	36.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	Max								
Act Effct Green (s)		33.0	33.0		33.0		17.0		17.0
Actuated g/C Ratio		0.55	0.55		0.55		0.28		0.28
v/c Ratio		0.31	0.05		0.77		0.71		0.57
Control Delay		8.5	2.6		17.9		24.9		23.4
Queue Delay		0.0	0.0		0.0		0.0		0.0
Total Delay		8.5	2.6		17.9		24.9		23.4
LOS		A	A		B		C		C
Approach Delay		7.7			17.9		24.9		23.4
Approach LOS		A			B		C		C

Intersection Summary

Cycle Length: 60

Actuated Cycle Length: 60

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 60

Control Type: Pretimed

Maximum v/c Ratio: 0.77

Intersection Signal Delay: 18.2

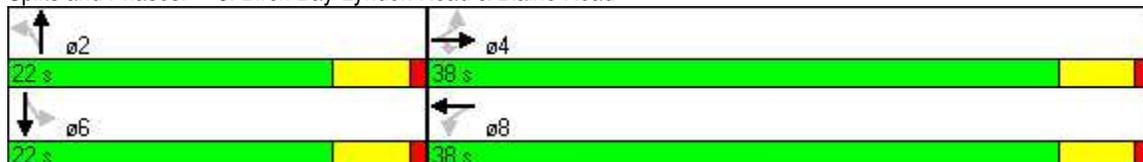
Intersection LOS: B

Intersection Capacity Utilization 83.6%

ICU Level of Service E

Analysis Period (min) 15

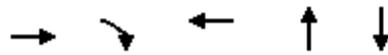
Splits and Phases: 8: Birch Bay-Lynden Road & Blaine Road



Queues

8: Birch Bay-Lynden Road & Blaine Road

5/12/2011



Lane Group	EBT	EBR	WBT	NBT	SBT
Lane Group Flow (vph)	291	41	697	354	238
v/c Ratio	0.31	0.05	0.77	0.71	0.57
Control Delay	8.5	2.6	17.9	24.9	23.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	8.5	2.6	17.9	24.9	23.4
Queue Length 50th (ft)	51	0	170	91	68
Queue Length 95th (ft)	91	11	#335	#202	132
Internal Link Dist (ft)	4694		3734	2504	6889
Turn Bay Length (ft)					
Base Capacity (vph)	941	873	902	502	419
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.31	0.05	0.77	0.71	0.57

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

8: Birch Bay-Lynden Road & Blaine Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗		↕			↕			↕	
Volume (vph)	26	242	38	114	431	97	59	122	144	59	124	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0			5.0			5.0	
Lane Util. Factor		1.00	1.00		1.00			1.00			1.00	
Frt		1.00	0.85		0.98			0.94			0.98	
Flt Protected		1.00	1.00		0.99			0.99			0.99	
Satd. Flow (prot)		1857	1553		1823			1762			1823	
Flt Permitted		0.92	1.00		0.88			0.90			0.78	
Satd. Flow (perm)		1712	1553		1620			1604			1437	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	28	263	41	124	468	105	64	133	157	64	135	39
RTOR Reduction (vph)	0	0	18	0	11	0	0	48	0	0	11	0
Lane Group Flow (vph)	0	291	23	0	686	0	0	306	0	0	227	0
Heavy Vehicles (%)	0%	2%	4%	2%	1%	1%	0%	0%	1%	0%	1%	0%
Turn Type	Perm		Perm	Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		33.0	33.0		33.0			17.0			17.0	
Effective Green, g (s)		33.0	33.0		33.0			17.0			17.0	
Actuated g/C Ratio		0.55	0.55		0.55			0.28			0.28	
Clearance Time (s)		5.0	5.0		5.0			5.0			5.0	
Lane Grp Cap (vph)		942	854		891			454			407	
v/s Ratio Prot												
v/s Ratio Perm		0.17	0.01		0.42			0.19			0.16	
v/c Ratio		0.31	0.03		0.77			0.67			0.56	
Uniform Delay, d1		7.3	6.2		10.5			19.0			18.3	
Progression Factor		1.00	1.00		1.00			1.00			1.00	
Incremental Delay, d2		0.9	0.1		6.4			7.8			5.4	
Delay (s)		8.2	6.2		16.9			26.8			23.7	
Level of Service		A	A		B			C			C	
Approach Delay (s)		7.9			16.9			26.8			23.7	
Approach LOS		A			B			C			C	

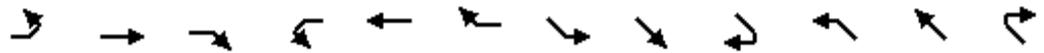
Intersection Summary

HCM Average Control Delay	18.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	83.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Volume

9: Birch Bay-Lynden Road & Portal Way

5/12/2011



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Volume (vph)	85	438	22	40	611	59	144	48	113	49	59	30
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	3%	1%	7%	3%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	92	476	24	43	664	64	157	52	123	53	64	33
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	592	0	43	728	0	157	175	0	0	150	0

Intersection Summary

Timings

9: Birch Bay-Lynden Road & Portal Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	SEL	SET	NWL	NWT
Lane Configurations		↕	↗	↘	↘	↘		↕
Volume (vph)	85	438	40	611	144	48	49	59
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		6		2
Permitted Phases	4		8		6		2	
Detector Phase	4	4	8	8	6	6	2	2
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	39.0	39.0	39.0	39.0	21.0	21.0	21.0	21.0
Total Split (%)	65.0%	65.0%	65.0%	65.0%	35.0%	35.0%	35.0%	35.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max							
Act Effect Green (s)		34.0	34.0	34.0	16.0	16.0		16.0
Actuated g/C Ratio		0.57	0.57	0.57	0.27	0.27		0.27
v/c Ratio		0.84	0.10	0.69	0.46	0.32		0.35
Control Delay		24.3	6.7	13.5	23.5	8.5		17.8
Queue Delay		0.0	0.0	0.0	0.0	0.0		0.0
Total Delay		24.3	6.7	13.5	23.5	8.5		17.8
LOS		C	A	B	C	A		B
Approach Delay		24.3		13.1		15.6		17.8
Approach LOS		C		B		B		B

Intersection Summary

Cycle Length: 60
 Actuated Cycle Length: 60
 Offset: 0 (0%), Referenced to phase 2:NWTL and 6:SETL, Start of Green
 Natural Cycle: 60
 Control Type: Pretimed
 Maximum v/c Ratio: 0.84
 Intersection Signal Delay: 17.5
 Intersection LOS: B
 Intersection Capacity Utilization 98.6%
 ICU Level of Service F
 Analysis Period (min) 15

Splits and Phases: 9: Birch Bay-Lynden Road & Portal Way



Queues

9: Birch Bay-Lynden Road & Portal Way

5/12/2011



Lane Group	EBT	WBL	WBT	SEL	SET	NWT
Lane Group Flow (vph)	592	43	728	157	175	150
v/c Ratio	0.84	0.10	0.69	0.46	0.32	0.35
Control Delay	24.3	6.7	13.5	23.5	8.5	17.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.3	6.7	13.5	23.5	8.5	17.8
Queue Length 50th (ft)	155	6	164	47	14	37
Queue Length 95th (ft)	#358	19	276	96	56	80
Internal Link Dist (ft)	3472		1137		18415	22485
Turn Bay Length (ft)						
Base Capacity (vph)	708	445	1052	344	544	429
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.84	0.10	0.69	0.46	0.32	0.35

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

9: Birch Bay-Lynden Road & Portal Way

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↕		↕	↕		↕	↕			↕	
Volume (vph)	85	438	22	40	611	59	144	48	113	49	59	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0		5.0	5.0			5.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	1.00			1.00	
Frt		0.99		1.00	0.99		1.00	0.89			0.97	
Flt Protected		0.99		0.95	1.00		0.95	1.00			0.98	
Satd. Flow (prot)		1860		1752	1847		1752	1700			1812	
Flt Permitted		0.66		0.43	1.00		0.70	1.00			0.84	
Satd. Flow (perm)		1244		785	1847		1291	1700			1545	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	92	476	24	43	664	64	157	52	123	53	64	33
RTOR Reduction (vph)	0	3	0	0	6	0	0	90	0	0	17	0
Lane Group Flow (vph)	0	589	0	43	722	0	157	85	0	0	133	0
Heavy Vehicles (%)	0%	1%	0%	3%	1%	7%	3%	0%	0%	0%	0%	0%
Turn Type	Perm			Perm			Perm				Perm	
Protected Phases		4			8			6				2
Permitted Phases	4			8			6			2		
Actuated Green, G (s)		34.0		34.0	34.0		16.0	16.0			16.0	
Effective Green, g (s)		34.0		34.0	34.0		16.0	16.0			16.0	
Actuated g/C Ratio		0.57		0.57	0.57		0.27	0.27			0.27	
Clearance Time (s)		5.0		5.0	5.0		5.0	5.0			5.0	
Lane Grp Cap (vph)		705		445	1047		344	453			412	
v/s Ratio Prot					0.39			0.05				
v/s Ratio Perm		c0.47		0.05			c0.12				0.09	
v/c Ratio		0.84		0.10	0.69		0.46	0.19			0.32	
Uniform Delay, d1		10.7		6.0	9.2		18.4	17.0			17.7	
Progression Factor		1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2		11.3		0.4	3.7		4.3	0.9			2.1	
Delay (s)		22.0		6.4	13.0		22.7	17.9			19.7	
Level of Service		C		A	B		C	B			B	
Approach Delay (s)		22.0			12.6			20.2			19.7	
Approach LOS		C			B			C			B	

Intersection Summary

HCM Average Control Delay	17.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	98.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Volume
10: Slater Road & Sunset Avenue

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Volume (vph)	5	841	97	803	56	23	5	115	189	8
Confl. Peds. (#/hr)										
Confl. Bikes (#/hr)										
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	3%	1%	2%	5%	6%	0%	1%	1%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)										
Mid-Block Traffic (%)		0%		0%			0%			0%
Adj. Flow (vph)	5	914	105	873	61	25	5	125	205	9
Shared Lane Traffic (%)										
Lane Group Flow (vph)	5	929	105	873	61	25	5	125	205	17

Intersection Summary

Timings

10: Slater Road & Sunset Avenue

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↖	↗	↗	↖	↗	↗	↖	↗
Volume (vph)	5	841	97	803	56	23	5	115	189	8
Turn Type	pm+pt		pm+pt		Perm	Perm		Perm	Perm	
Protected Phases	7	4	3	8			2			2
Permitted Phases	4		8		8	2		2	2	
Detector Phase	7	4	3	8	8	2	2	2	2	2
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	20.0	9.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	15.0	70.0	15.0	70.0	70.0	30.0	30.0	30.0	30.0	30.0
Total Split (%)	13.0%	60.9%	13.0%	60.9%	60.9%	26.1%	26.1%	26.1%	26.1%	26.1%
Yellow Time (s)	4.0	3.5	4.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	0.5	1.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	4.0	5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	None	None	None	None	Min	Min	Min	Min	Min
Act Effect Green (s)	55.5	53.0	60.4	60.6	60.6	19.3	19.3	19.3	19.3	19.3
Actuated g/C Ratio	0.56	0.59	0.65	0.67	0.67	0.21	0.21	0.21	0.21	0.21
v/c Ratio	0.02	0.86	0.41	0.70	0.06	0.09	0.01	0.28	0.68	0.04
Control Delay	7.0	27.3	10.2	14.3	2.6	34.7	33.8	8.6	49.0	25.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.0	27.3	10.2	14.3	2.6	34.7	33.8	8.6	49.0	25.0
LOS	A	C	B	B	A	C	C	A	D	C
Approach Delay		27.2		13.2			13.6			47.2
Approach LOS		C		B			B			D

Intersection Summary

Cycle Length: 115	
Actuated Cycle Length: 90.4	
Natural Cycle: 75	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.86	
Intersection Signal Delay: 22.0	Intersection LOS: C
Intersection Capacity Utilization 78.5%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 10: Slater Road & Sunset Avenue



Queues

10: Slater Road & Sunset Avenue

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	5	929	105	873	61	25	5	125	205	17
v/c Ratio	0.02	0.86	0.41	0.70	0.06	0.09	0.01	0.28	0.68	0.04
Control Delay	7.0	27.3	10.2	14.3	2.6	34.7	33.8	8.6	49.0	25.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.0	27.3	10.2	14.3	2.6	34.7	33.8	8.6	49.0	25.0
Queue Length 50th (ft)	1	449	18	253	1	13	3	0	118	4
Queue Length 95th (ft)	5	#854	40	624	18	38	13	48	220	25
Internal Link Dist (ft)		5760		6364			1689			1796
Turn Bay Length (ft)										
Base Capacity (vph)	365	1186	298	1320	1106	375	532	538	397	500
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.78	0.35	0.66	0.06	0.07	0.01	0.23	0.52	0.03

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

10: Slater Road & Sunset Avenue

5/12/2011

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	841	14	97	803	56	23	5	115	189	8	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	4.0		5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1805	1841		1787	1863	1538	1703	1900	1599	1787	1766	
Flt Permitted	0.20	1.00		0.10	1.00	1.00	0.75	1.00	1.00	0.75	1.00	
Satd. Flow (perm)	385	1841		193	1863	1538	1338	1900	1599	1419	1766	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	914	15	105	873	61	25	5	125	205	9	8
RTOR Reduction (vph)	0	0	0	0	0	20	0	0	99	0	6	0
Lane Group Flow (vph)	5	929	0	105	873	41	25	5	26	205	11	0
Heavy Vehicles (%)	0%	3%	0%	1%	2%	5%	6%	0%	1%	1%	0%	0%
Turn Type	pm+pt			pm+pt		Perm	Perm		Perm	Perm		
Protected Phases	7	4		3	8			2			2	
Permitted Phases	4			8		8	2		2	2		
Actuated Green, G (s)	56.7	55.8		66.3	60.6	60.6	19.3	19.3	19.3	19.3	19.3	
Effective Green, g (s)	56.7	55.8		66.3	60.6	60.6	19.3	19.3	19.3	19.3	19.3	
Actuated g/C Ratio	0.60	0.59		0.71	0.65	0.65	0.21	0.21	0.21	0.21	0.21	
Clearance Time (s)	5.0	4.0		5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	246	1095		233	1204	994	275	391	329	292	363	
v/s Ratio Prot	0.00	c0.50		c0.03	c0.47			0.00			0.01	
v/s Ratio Perm	0.01			0.29		0.03	0.02		0.02	c0.14		
v/c Ratio	0.02	0.85		0.45	0.73	0.04	0.09	0.01	0.08	0.70	0.03	
Uniform Delay, d1	10.1	15.5		15.3	11.1	6.0	30.1	29.7	30.1	34.6	29.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	6.3		1.4	2.2	0.0	0.1	0.0	0.1	7.4	0.0	
Delay (s)	10.1	21.8		16.7	13.3	6.1	30.3	29.7	30.2	42.0	29.8	
Level of Service	B	C		B	B	A	C	C	C	D	C	
Approach Delay (s)		21.7			13.2			30.2			41.1	
Approach LOS		C			B			C			D	
Intersection Summary												
HCM Average Control Delay			20.3			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.83									
Actuated Cycle Length (s)			93.8			Sum of lost time (s)				17.0		
Intersection Capacity Utilization			78.5%			ICU Level of Service				D		
Analysis Period (min)			15									

c Critical Lane Group

Volume

11: Slater Road & Lake Terrell Road

5/12/2011

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	22	67	5	59	99	76	11	14	41	244	29	48
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	0%	0%	4%	0%	0%	3%	2%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	24	73	5	64	108	83	12	15	45	265	32	52
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	102	0	0	172	83	0	72	0	0	349	0
Intersection Summary												

HCM Unsignalized Intersection Capacity Analysis
 11: Slater Road & Lake Terrell Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔	↔		↔			↔	
Volume (veh/h)	22	67	5	59	99	76	11	14	41	244	29	48
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	24	73	5	64	108	83	12	15	45	265	32	52
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	108			78			427	359	76	411	362	108
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	108			78			427	359	76	411	362	108
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			96			97	97	95	46	94	95
cM capacity (veh/h)	1496			1533			467	538	983	492	536	952

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	102	172	83	72	349
Volume Left	24	64	0	12	265
Volume Right	5	0	83	45	52
cSH	1496	1533	1700	723	535
Volume to Capacity	0.02	0.04	0.05	0.10	0.65
Queue Length 95th (ft)	1	3	0	8	117
Control Delay (s)	1.8	3.0	0.0	10.5	23.5
Lane LOS	A	A		B	C
Approach Delay (s)	1.8	2.0		10.5	23.5
Approach LOS				B	C

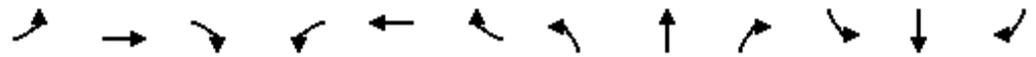
Intersection Summary

Average Delay	12.4
Intersection Capacity Utilization	45.2%
ICU Level of Service	A
Analysis Period (min)	15

Volume

12: Mountain View Road & Lake Terrell Road

5/12/2011

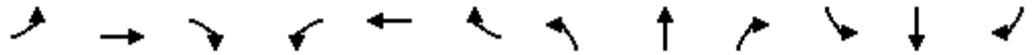


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	4	190	165	51	63	7	82	4	95	4	0	7
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	1%	0%	4%	0%	2%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	4	207	179	55	68	8	89	4	103	4	0	8
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	390	0	0	131	0	0	196	0	0	12	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 12: Mountain View Road & Lake Terrell Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	4	190	165	51	63	7	82	4	95	4	0	7
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
Hourly flow rate (vph)	4	207	179	55	68	8	89	4	103	4	0	8

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	390	132	197	12
Volume Left (vph)	4	55	89	4
Volume Right (vph)	179	8	103	8
Hadj (s)	-0.26	0.08	-0.21	-0.31
Departure Headway (s)	4.4	5.0	4.9	5.1
Degree Utilization, x	0.47	0.18	0.27	0.02
Capacity (veh/h)	788	675	674	606
Control Delay (s)	11.2	9.1	9.7	8.2
Approach Delay (s)	11.2	9.1	9.7	8.2
Approach LOS	B	A	A	A

Intersection Summary			
Delay		10.4	
HCM Level of Service		B	
Intersection Capacity Utilization	52.0%		ICU Level of Service A
Analysis Period (min)		15	

Volume

13: Henry Road & Kickerville Road

5/12/2011

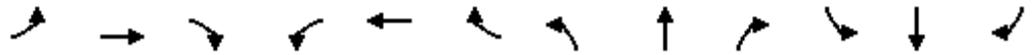


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	30	66	0	5	5	125	0	5	8	211	1	3
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	33%	0%	0%	25%	0%	0%	0%	0%	0%	1%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	33	72	0	5	5	136	0	5	9	229	1	3
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	105	0	0	146	0	0	14	0	0	233	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 13: Henry Road & Kickerville Road

5/12/2011

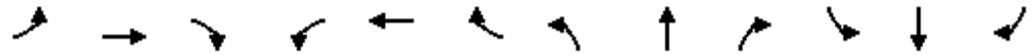


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	30	66	0	5	5	125	0	5	8	211	1	3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	72	0	5	5	136	0	5	9	229	1	3
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	104	147	14	234								
Volume Left (vph)	33	5	0	229								
Volume Right (vph)	0	136	9	3								
Hadj (s)	0.24	-0.53	-0.37	0.20								
Departure Headway (s)	4.9	4.1	4.4	4.7								
Degree Utilization, x	0.14	0.17	0.02	0.31								
Capacity (veh/h)	684	814	749	726								
Control Delay (s)	8.7	8.0	7.5	9.8								
Approach Delay (s)	8.7	8.0	7.5	9.8								
Approach LOS	A	A	A	A								
Intersection Summary												
Delay			8.9									
HCM Level of Service			A									
Intersection Capacity Utilization			42.0%	ICU Level of Service	A							
Analysis Period (min)			15									

Volume

14: Main Street & Riverside Dr

5/12/2011



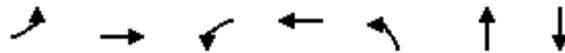
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Volume (vph)	22	954	229	825	351	15	43	15
Confl. Peds. (#/hr)								
Confl. Bikes (#/hr)								
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	2%	1%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0
Parking (#/hr)								
Mid-Block Traffic (%)		0%		0%		0%		0%
Adj. Flow (vph)	24	1037	249	897	382	16	47	16
Shared Lane Traffic (%)								
Lane Group Flow (vph)	24	1217	249	930	382	339	0	95

Intersection Summary

Timings

14: Main Street & Riverside Dr

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Configurations	↶	↷	↶	↷	↶	↷	↷
Volume (vph)	22	954	229	825	351	15	15
Turn Type	Perm		pm+pt		Split		
Protected Phases		4	3	8	1	1	2
Permitted Phases	4		8				
Detector Phase	4	4	3	8	1	1	2
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	9.0	20.0	20.0	20.0	9.0
Total Split (s)	35.0	35.0	15.0	50.0	25.0	25.0	15.0
Total Split (%)	38.9%	38.9%	16.7%	55.6%	27.8%	27.8%	16.7%
Yellow Time (s)	3.5	3.5	4.0	3.5	3.5	3.5	4.0
All-Red Time (s)	0.5	0.5	1.0	0.5	0.5	0.5	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	5.0	4.0	4.0	4.0	5.0
Lead/Lag	Lag	Lag	Lead		Lag	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None	None	None	Min	Min	None
Act Effct Green (s)	31.3	31.3	45.4	46.4	20.1	20.1	8.3
Actuated g/C Ratio	0.37	0.37	0.53	0.54	0.24	0.24	0.09
v/c Ratio	0.11	0.94	0.85	0.48	0.90	0.54	0.50
Control Delay	22.0	42.0	46.1	14.1	58.8	7.9	38.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.0	42.0	46.1	14.1	58.8	7.9	38.9
LOS	C	D	D	B	E	A	D
Approach Delay		41.6		20.9		34.8	38.9
Approach LOS		D		C		C	D

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 85.4

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.94

Intersection Signal Delay: 32.5

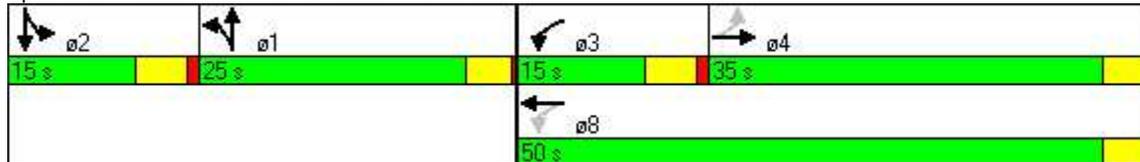
Intersection LOS: C

Intersection Capacity Utilization 83.7%

ICU Level of Service E

Analysis Period (min) 15

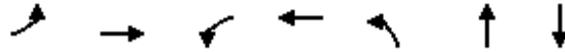
Splits and Phases: 14: Main Street & Riverside Dr



Queues

14: Main Street & Riverside Dr

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	24	1217	249	930	382	339	95
v/c Ratio	0.11	0.94	0.85	0.48	0.90	0.54	0.50
Control Delay	22.0	42.0	46.1	14.1	58.8	7.9	38.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.0	42.0	46.1	14.1	58.8	7.9	38.9
Queue Length 50th (ft)	9	346	89	168	209	7	39
Queue Length 95th (ft)	28	#507	#232	226	#378	77	86
Internal Link Dist (ft)		414		818		277	276
Turn Bay Length (ft)							
Base Capacity (vph)	214	1298	294	1937	441	638	219
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.94	0.85	0.48	0.87	0.53	0.43

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

14: Main Street & Riverside Dr

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	22	954	166	229	825	30	351	15	297	43	15	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		5.0	4.0		4.0	4.0			5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00			1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.86			0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			0.98	
Satd. Flow (prot)	1805	3500		1770	3556		1805	1613			1770	
Flt Permitted	0.31	1.00		0.11	1.00		0.95	1.00			0.98	
Satd. Flow (perm)	584	3500		205	3556		1805	1613			1770	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	24	1037	180	249	897	33	382	16	323	47	16	32
RTOR Reduction (vph)	0	15	0	0	3	0	0	248	0	0	21	0
Lane Group Flow (vph)	24	1202	0	249	927	0	382	91	0	0	74	0
Heavy Vehicles (%)	0%	1%	0%	2%	1%	0%	0%	0%	1%	0%	0%	0%
Turn Type	Perm			pm+pt			Split				Split	
Protected Phases		4		3	8		1	1			2	2
Permitted Phases	4			8								
Actuated Green, G (s)	31.3	31.3		46.4	46.4		20.1	20.1			7.0	
Effective Green, g (s)	31.3	31.3		46.4	46.4		20.1	20.1			7.0	
Actuated g/C Ratio	0.36	0.36		0.54	0.54		0.23	0.23			0.08	
Clearance Time (s)	4.0	4.0		5.0	4.0		4.0	4.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	211	1266		293	1907		419	375			143	
v/s Ratio Prot		c0.34		c0.10	0.26		c0.21	0.06			c0.04	
v/s Ratio Perm	0.04			0.36								
v/c Ratio	0.11	0.95		0.85	0.49		0.91	0.24			0.52	
Uniform Delay, d1	18.4	26.8		21.1	12.6		32.3	27.0			38.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.2	14.6		20.0	0.2		23.8	0.3			3.1	
Delay (s)	18.6	41.5		41.0	12.8		56.1	27.3			41.3	
Level of Service	B	D		D	B		E	C			D	
Approach Delay (s)		41.0			18.7			42.6			41.3	
Approach LOS		D			B			D			D	

Intersection Summary

HCM Average Control Delay	33.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	86.5	Sum of lost time (s)	18.0
Intersection Capacity Utilization	83.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Volume

15: Slater Road & Haxton Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Volume (vph)	3	292	376	237	69	70	391	26	54
Confl. Peds. (#/hr)									
Confl. Bikes (#/hr)									
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	1%	0%	6%	0%	4%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0
Parking (#/hr)									
Mid-Block Traffic (%)		0%		0%		0%			0%
Adj. Flow (vph)	3	317	409	258	75	76	425	28	59
Shared Lane Traffic (%)									
Lane Group Flow (vph)	3	369	409	295	0	151	425	28	63

Intersection Summary

Timings

15: Slater Road & Haxton Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations									
Volume (vph)	3	292	376	237	69	70	391	26	54
Turn Type	Perm		Perm		Perm		Perm	Perm	
Protected Phases		1		1		2			2
Permitted Phases	1		1		2		2	2	
Detector Phase	1	1	1	1	2	2	2	2	2
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	80.0	80.0	80.0	80.0	20.0	20.0	20.0	20.0	20.0
Total Split (%)	80.0%	80.0%	80.0%	80.0%	20.0%	20.0%	20.0%	20.0%	20.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lead	Lead	Lead	Lag	Lag	Lag	Lag	Lag
Lead-Lag Optimize?	Yes								
Recall Mode	None	None	None	None	Min	Min	Min	Min	Min
Act Effect Green (s)	30.6	30.6	30.6	30.6		11.9	11.9	11.9	11.9
Actuated g/C Ratio	0.59	0.59	0.59	0.59		0.23	0.23	0.23	0.23
v/c Ratio	0.00	0.33	0.70	0.26		0.43	0.62	0.10	0.14
Control Delay	4.0	5.5	14.5	5.0		25.5	7.5	22.0	20.6
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Total Delay	4.0	5.5	14.5	5.0		25.5	7.5	22.0	20.6
LOS	A	A	B	A		C	A	C	C
Approach Delay		5.5		10.5		12.2			21.0
Approach LOS		A		B		B			C

Intersection Summary

Cycle Length: 100	
Actuated Cycle Length: 51.5	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.70	
Intersection Signal Delay: 10.6	Intersection LOS: B
Intersection Capacity Utilization 63.3%	ICU Level of Service B
Analysis Period (min) 15	

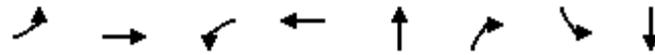
Splits and Phases: 15: Slater Road & Haxton Way



Queues

15: Slater Road & Haxton Way

5/12/2011



Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	3	369	409	295	151	425	28	63
v/c Ratio	0.00	0.33	0.70	0.26	0.43	0.62	0.10	0.14
Control Delay	4.0	5.5	14.5	5.0	25.5	7.5	22.0	20.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	4.0	5.5	14.5	5.0	25.5	7.5	22.0	20.6
Queue Length 50th (ft)	0	41	68	31	37	0	6	14
Queue Length 95th (ft)	3	86	171	67	122	76	33	56
Internal Link Dist (ft)		13101		11751	4951			2508
Turn Bay Length (ft)								
Base Capacity (vph)	876	1470	780	1485	465	769	383	576
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.00	0.25	0.52	0.20	0.32	0.55	0.07	0.11

Intersection Summary

HCM Signalized Intersection Capacity Analysis

15: Slater Road & Haxton Way

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	3	292	48	376	237	34	69	70	391	26	54	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Frt	1.00	0.98		1.00	0.98			1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00			0.98	1.00	0.95	1.00	
Satd. Flow (prot)	1805	1844		1787	1864			1800	1553	1805	1882	
Flt Permitted	0.58	1.00		0.52	1.00			0.82	1.00	0.66	1.00	
Satd. Flow (perm)	1101	1844		981	1864			1522	1553	1256	1882	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	317	52	409	258	37	75	76	425	28	59	4
RTOR Reduction (vph)	0	10	0	0	9	0	0	0	325	0	2	0
Lane Group Flow (vph)	3	359	0	409	286	0	0	151	100	28	61	0
Heavy Vehicles (%)	0%	1%	0%	1%	0%	0%	6%	0%	4%	0%	0%	0%
Turn Type	Perm			Perm			Perm		Perm	Perm		
Protected Phases		1			1			2				2
Permitted Phases	1			1			2		2	2		
Actuated Green, G (s)	30.6	30.6		30.6	30.6			11.9	11.9	11.9	11.9	
Effective Green, g (s)	30.6	30.6		30.6	30.6			11.9	11.9	11.9	11.9	
Actuated g/C Ratio	0.61	0.61		0.61	0.61			0.24	0.24	0.24	0.24	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	667	1117		594	1129			359	366	296	443	
v/s Ratio Prot		0.19			0.15						0.03	
v/s Ratio Perm	0.00			c0.42				c0.10	0.06	0.02		
v/c Ratio	0.00	0.32		0.69	0.25			0.42	0.27	0.09	0.14	
Uniform Delay, d1	3.9	4.9		6.7	4.6			16.4	15.8	15.1	15.2	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	0.2		3.3	0.1			0.8	0.4	0.1	0.1	
Delay (s)	3.9	5.0		10.1	4.8			17.2	16.2	15.2	15.4	
Level of Service	A	A		B	A			B	B	B	B	
Approach Delay (s)		5.0			7.8			16.4			15.3	
Approach LOS		A			A			B			B	

Intersection Summary

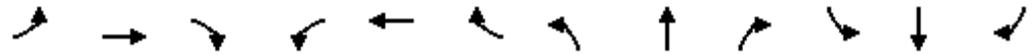
HCM Average Control Delay	10.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	50.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Volume

16: Birch Bay - Lynden Road & Kickerville Road

5/12/2011

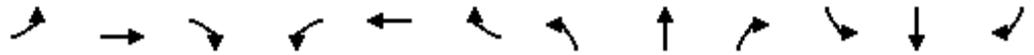


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	7	441	7	25	574	10	11	12	62	1	8	3
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	8	479	8	27	624	11	12	13	67	1	9	3
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	495	0	0	662	0	0	92	0	0	13	0

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
 16: Birch Bay - Lynden Road & Kickerville Road

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	7	441	7	25	574	10	11	12	62	1	8	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	8	479	8	27	624	11	12	13	67	1	9	3
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	635			487			1190	1188	483	1256	1186	629
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	635			487			1190	1188	483	1256	1186	629
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			97			92	93	89	99	95	99
cM capacity (veh/h)	958			1087			155	184	588	122	184	486

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	495	662	92	13
Volume Left	8	27	12	1
Volume Right	8	11	67	3
cSH	958	1087	352	208
Volume to Capacity	0.01	0.03	0.26	0.06
Queue Length 95th (ft)	1	2	26	5
Control Delay (s)	0.2	0.7	18.9	23.5
Lane LOS	A	A	C	C
Approach Delay (s)	0.2	0.7	18.9	23.5
Approach LOS			C	C

Intersection Summary			
Average Delay		2.1	
Intersection Capacity Utilization		59.2%	ICU Level of Service B
Analysis Period (min)		15	

Volume

17: Grandview Road & Vista Drive

5/12/2011

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	4	633	30	82	222	173	16	43	77	144	45	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	0%	2%	2%	0%	3%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	4	688	33	89	241	188	17	47	84	157	49	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	725	0	0	518	0	0	148	0	0	206	0
Intersection Summary												

Timings

17: Grandview Road & Vista Drive

5/12/2011

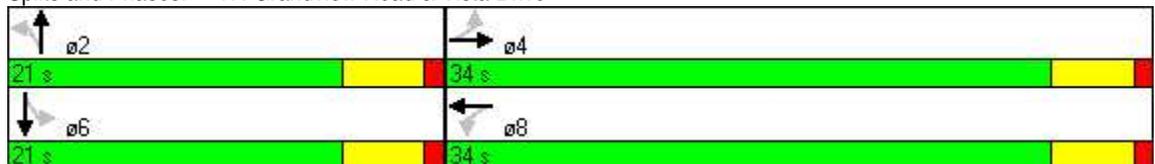


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕		↕		↕		↕
Volume (vph)	4	633	82	222	16	43	144	45
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	34.0	34.0	34.0	34.0	21.0	21.0	21.0	21.0
Total Split (%)	61.8%	61.8%	61.8%	61.8%	38.2%	38.2%	38.2%	38.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max							
Act Effct Green (s)		29.0		29.0		16.0		16.0
Actuated g/C Ratio		0.53		0.53		0.29		0.29
v/c Ratio		0.73		0.65		0.27		0.51
Control Delay		15.6		12.4		9.1		21.5
Queue Delay		0.0		0.0		0.0		0.0
Total Delay		15.6		12.4		9.1		21.5
LOS		B		B		A		C
Approach Delay		15.6		12.4		9.1		21.5
Approach LOS		B		B		A		C

Intersection Summary

Cycle Length: 55
 Actuated Cycle Length: 55
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 55
 Control Type: Pretimed
 Maximum v/c Ratio: 0.73
 Intersection Signal Delay: 14.7
 Intersection LOS: B
 Intersection Capacity Utilization 91.6%
 ICU Level of Service F
 Analysis Period (min) 15

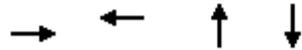
Splits and Phases: 17: Grandview Road & Vista Drive



Queues

17: Grandview Road & Vista Drive

5/12/2011



Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	725	518	148	206
v/c Ratio	0.73	0.65	0.27	0.51
Control Delay	15.6	12.4	9.1	21.5
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	15.6	12.4	9.1	21.5
Queue Length 50th (ft)	163	90	15	55
Queue Length 95th (ft)	281	181	51	110
Internal Link Dist (ft)	4755	3862	1033	1128
Turn Bay Length (ft)				
Base Capacity (vph)	988	802	541	406
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.73	0.65	0.27	0.51

Intersection Summary

HCM Signalized Intersection Capacity Analysis

17: Grandview Road & Vista Drive

5/12/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	4	633	30	82	222	173	16	43	77	144	45	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.99			0.95			0.92			1.00	
Flt Protected		1.00			0.99			0.99			0.96	
Satd. Flow (prot)		1870			1762			1728			1830	
Flt Permitted		1.00			0.82			0.95			0.74	
Satd. Flow (perm)		1866			1450			1657			1397	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	4	688	33	89	241	188	17	47	84	157	49	0
RTOR Reduction (vph)	0	3	0	0	37	0	0	60	0	0	0	0
Lane Group Flow (vph)	0	722	0	0	481	0	0	88	0	0	206	0
Heavy Vehicles (%)	0%	1%	0%	0%	2%	2%	0%	3%	0%	0%	0%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		29.0			29.0			16.0			16.0	
Effective Green, g (s)		29.0			29.0			16.0			16.0	
Actuated g/C Ratio		0.53			0.53			0.29			0.29	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Lane Grp Cap (vph)		984			765			482			406	
v/s Ratio Prot												
v/s Ratio Perm		c0.39			0.33			0.05			c0.15	
v/c Ratio		0.73			0.63			0.18			0.51	
Uniform Delay, d1		10.0			9.2			14.6			16.2	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		4.8			3.9			0.8			4.5	
Delay (s)		14.9			13.1			15.4			20.7	
Level of Service		B			B			B			C	
Approach Delay (s)		14.9			13.1			15.4			20.7	
Approach LOS		B			B			B			C	

Intersection Summary

HCM Average Control Delay	15.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	91.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			