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869 Brant-Waterloo Road

Traffic Impact Study FINAL REPORT

2081788 Ontario Corporation & Broos Properties

April 6, 2018



HDR Corporation 100 York Blvd, Suite 300 Richmond Hill, ON L4B 1J8



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1 Introduction

The Official Plan of the Township of North Dumfries (the "Township") identifies the Ayr Urban Area as a primary focus for growth and development within the Township to the year 2031. Much of Township's recent residential developments have been centered around the Ayr Urban Area. In line with the Town's future growth plans, 869 Brant-Waterloo Road is a proposed residential development located in the community of Ayr within the Township in the Region of Waterloo (the "Region").

HDR Corporation has been retained by Broos Properties Ltd. to undertake a traffic study to support this development, which will consist of 302 single family detached units, 108 townhouse units, and 75 townhouse units in medium density residential blocks at full build-out. The site is located at the northeast quadrant of Swan Street and Brant-Waterloo Road as shown in **Exhibit 1**.

The development is expected to occur in phases, with the estimated build-out year of 2026. This report assesses the traffic impacts of the proposed development on existing and proposed intersections within the study area road network in the early phase of the development and after full build-out. This traffic study has been prepared in accordance with the Region of Waterloo Transportation Impact Study (TIS) guidelines and the Region of Waterloo Requirement for Capacity Analysis.



Exhibit 1 Site Location

1.1 Scope of Work

The scope of work for the traffic study was proposed as per discussions with Broos Properties and incorporates comments from the Township; as well as, a review of the study area considered in the 2013 traffic impact study for the adjacent Hilltop Estates Subdivision (Hilltop TIS), which was developed in consultation with the Township and Region. Following is a summary of the proposed scope submitted to the Township and Region and analyzed in this report:

- Existing 2018 Traffic Conditions
- 2020 Background traffic conditions (includes road growth and traffic from approved or under construction background developments in the immediate area)
- 2020 Phase 1 traffic conditions with 139 units from the proposed development
- 2031 Background traffic conditions (includes road growth and traffic from approved or under construction background developments in the immediate area)
- 2031 Total traffic conditions (2031 background plus the proposed development)
- **Time Periods** Time periods that were analyzed are the development peak hours, which include:
 - Weekday AM peak hour (between 7:00 AM and 9:00 AM)
 - Weekday PM peak hour (between 4:00 PM and 6:00 PM)
- **Intersections** It should be noted that during Phase 1, this study assumes that there will be no connections to Swan Street via Leslie Davis Street, and to Brant-Waterloo Road via internal road network. A connection to Brant-Waterloo Road will be assumed in the 2031 scenarios through the internal road network; the need for a connection to Swan Street via Leslie Davis Street may be considered if capacity or operational issues are found at the intersection of Swan Street and Hilltop Drive. As such, the intersections analyzed for capacity purposes include:

External Road Network

- Robert Woolner Street and Leslie Davis Street
- Robert Woolner Street and Howard Marshall Street
- Robert Woolner Street and Gourlay Farm Lane
- Hilltop Drive and Howard Marshall Street
- Swan Street and Hilltop Drive
- Swan Street and Stanley Street
- Swan Street and Leslie Davis Drive
- Stanley Street and Northumberland Street
- Wrigley Road and Hilltop Drive
- Brant-Waterloo Road and Street A
- Brant-Waterloo Road and Robert Woolner Street
- Brant-Waterloo Road and Swan Street

Internal Road Network

- Leslie Davis Street and Street A as a traffic circle based on the BA Group's traffic calming study¹
- Robert Woolner Street and Street A
- Robert Woolner Street /Street F and Freer Dr

1.2 Intersection Operations and Analysis Methodology

Intersection operations were assessed for the site driveways and study intersections using the software program Synchro 9, Traffic Signal Coordination Software Version 9, which employs methodologies from the *Highway Capacity Manual (HCM 2000 and HCM 2010)* published by the Transportation Research Board National Research Council. There are currently no signalized intersection present in the existing road network within the study area. However, if a signalized intersection is warranted in under future conditions within the study area, Synchro can analyze both signalized and unsignalized intersections in a road corridor or network taking into account the spacing, interaction, queues and operations between intersections.

The two-way un-signalized intersection analysis considers two separate measures:

- the capacity of the critical movements, which is based on a volume to capacity ratio; and
- the level of service for the critical movements, which is based on the average control delay per vehicle for the various critical movements within the intersection.

The signalized intersection analysis also considers two separate measures of performance:

- the capacity of all intersection movements, which is based on a volume to capacity ratio; and
- the level of service for all intersection movements, which is based on the average control delay per vehicle for the various movements through the intersection and overall.

Level of service (LOS) is based on the average control delay per vehicle for a given movement. Delay is an indicator of how long a vehicle must wait to complete a movement and is represented by a letter between 'A' and 'F', with 'F' being the longest delay. The volume to capacity (v/c) ratio is a measure of the degree of capacity utilized at an intersection.

2 Existing Conditions

2.1 Site Context

The subject site is located in the northeast quadrant of Swan Street and Brant-Waterloo Road in a Designated Greenfield Area within the boundaries of the Ayr Urban Area. In the immediate area, the site is currently surrounded by agricultural lands to the south and the east, and existing residential development to the north. The Hilltop Estates Subdivision, also part of the Designated Greenfield Area borders the site on the west is currently under development. Due to the greenfield nature of the site, the existing road network and intersections in the study area are external to the site. The intersections within the study area are unsignalized and stop sign controlled.

¹ *Hilltop Subdivision 30T-14301 Stage 4 Traffic Calming Study.* BA Group. September 2017.

2.2 Existing Road Network

The study area road network is comprised of regional roads, as well as local roads serving the existing residential areas to the north of the site. The road network is described below and is also illustrated in **Exhibit 2**.

Northumberland Street (Regional Road 58)	Northumberland Street is a two-lane undivided arterial road which runs in a north south direction and with connection to Highway 401 to the north of community of Ayr. The road primarily provides access to residences and businesses along the corridor. Northumberland Street is under the jurisdiction of the Region of Waterloo and maintains a posted speed limit of 50 km/h. In the study area, Northumberland Street is identified as a main street neighborhood connector ² . It forms an unsignalized "T"-intersection with Stanley Street controlled by stop signs on the southbound and westbound approaches. Each approach has shared movements, with the exception of the auxiliary westbound right-turn lane. There is a driveway for businesses on the south side of Stanley Street. Retail businesses line the west side of the southbound approach and north side of the westbound approach, which are served by angled parking spots on the respective sides.
Stanley Street- Main Street-Scott Street-Wrigley Road (Regional Road 49)	Stanley Street, Main Street, Scott Street and Wrigley Road generally form the east-west two-lane undivided Regional Road 49, also under the jurisdiction of the Region of Waterloo. Stanley Street is a main street neighbourhood connector, Main Street and Scott Street are main street rural connectors, and Wrigley Road is a rural connector2. Since there is no posted speed limit within the study area, it is assumed that the statutory 50 km/h limit applies.
Swan Street	Swan Street is a north-south two lane undivided road that is a continuation of Northumberland Street to the south of Stanley Street. This regional road is classified as a main street neighbourhood connector from its "T"-intersection with Stanley Street to approximately 150m south of the intersection, beyond which it becomes a main street rural connector. From the southern limits of the Ayr community towards Brant-Waterloo Road, the road is classified as a rural connector. This road has a posted speed limit of 50 km/h through the study area, which increases to 80 km/h beyond the limits of the Ayr community. At the "T"-intersection with Stanley Street, there is stop control on the northbound approach. There are no auxiliary left-turn or right-turn lanes on Swan Street or Stanley Street.

² Regional Road Classification. *Context Sensitive Regional Transportation Corridor Design Guidelines*. Region of Waterloo. March 2013.

- Hilltop Drive Hilltop Drive is a two lane undivided local road providing direct access to residential properties to the north of the subject site. The road runs east from its "T"-intersection with Swan Street with stop-control on the east leg. It then curves and runs north to another "T-"intersection with Wrigley Road. The south leg of this intersection is stop-controlled. Shared turn lanes are present on the eastbound and northbound approaches while an auxiliary left turn lane is provided on the westbound approach. The speed limit is assumed to be the statutory 50 km/h limit.
- Howard Marshall Street Howard Marshall Street is a two lane undivided local road within the residential subdivision to the north of the subject site providing driveway access to residential properties. It runs in a north-south direction forms an all-way stop-controlled intersection with Hilltop Drive on the east-west portion of Hilltop Drive. It is assumed that the statutory speed limit of 50 km/h also applies to this road.
- Brant-WaterlooBrant-Waterloo is the boundary road between the two jurisdictions of RegionRoadof Waterloo and the County of Brant. It is an east-west undivided road with a
gravel surface type within the study area and without a posted speed limit.
The assumed speed limit is 50 km/h. The road intersects with Swan Street
and two-way stop control is provided on the Brant-Waterloo Road
approaches.

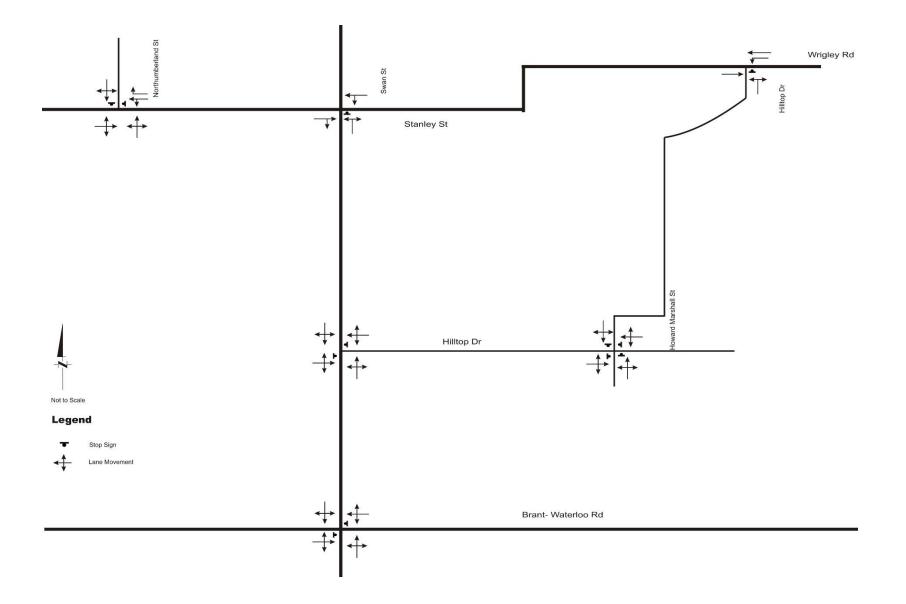


Exhibit 2 Existing Road Network

2.3 Active Transportation and Transit

Pedestrian facilities are present along one or both sides of the roads in the study area road network as described below:

- There are sidewalks on the both sides of Northumberland Drive.
- There are sidewalks on both sides of the street along Stanley Street, on the west side along Main Street, and on the south street of Scott Street and Wrigley Road ending just east of Hilltop Drive.
- Sidewalk is provided on the west side of Swan Street from Stanley Street southerly to Mitchell Street. South of Mitchel Street, sidewalk is provided on the east side down to Hilltop Drive. There are no sidewalks south of Hilltop Drive.
- There is a sidewalk on the south/west side of Hilltop Drive from Swan Street to Wrigley Road.
- There is a sidewalk on the west side of Howard Marshall Street.

Study area intersections generally do not have marked pedestrian crossings, except on some approaches at the intersections of Stanley Street with Northumberland and Swan Street.

There are no existing cycling routes within the study area as per the Township's Official Plan. Cyclists may be accommodated on Northumberland Street, Stanley-Scott-Wrigley Road and Swan Street where shoulders are present since the Official Plan designates these routes as planned cycling routes. In addition, the Region is undertaking a project to upgrade watermain and sanitary sewers beneath Northumberland Street, Stanley Street and Swan Street, presenting an opportunity for road reconstruction with enhanced pedestrian and cycling facilities³. The planned improvements include:

- New on-road cycling lanes on each side of Swan from Hilltop Drive northerly to past Mitchell Street;
- Shared use on-road cycling facilities including potential "sharrows", which are pavement markings along the center of travel lanes advising drivers to share the road with cyclists:
 - o On Northumberland Street from Stanley Street northerly to Hall Street;
 - o On Stanley Street from Northumberland Street to easterly to St. Andrew Street; and,
 - o On Swan Street from Stanley Street northerly to Mitchell Street
- Construction of a new concrete sidewalk on the east side of Swan Street from Stanley Street to the existing sidewalk located midway between both intersections of Mitchell Street and Swan Street;
- Removal of the existing sidewalk on the west side of Swan Street;

Although a parking study is not considered within the scope of this traffic impact study, it is noted that part of the reconstruction project described above also includes replacing the existing angled parking on North on Northumberland Street and Stanley Street with on-road parallel parking. The proposed development will not impact this replacement plan.

³ *Future Construction Projects.* Regional Council. January 11, 2017. <u>http://www.regionofwaterloo.ca/en/gettingAround/FutureConstructionProjects.asp</u>

There is no transit service within the study area or within the designated Ayr Urban Area and the Township.

2.4 Modal Split

The Hilltop TIS presented the modal split for the Hilltop Estates Subdivision based on 2006 Transportation Tomorrow Survey (TTS). Similarly, the modal split for the subject site (869 Brant-Waterloo Road) may considered to be represented by the modal split for residential trips to and from the Town of North Dumfries (2006 TTS Zone 7494). A review of 2011 TTS data confirmed that the following modal splits presented in the Hilltop TIS remain consistent in the more recent survey data.

Modal Split To/From TTS Zone 7494						
Mode Choice	%					
Auto	80%					
Transit	0%					
School Bus	13%					
Walk	5%					
Cycle	2%					
Total	100%					

It is worth noting that although the non-auto mode choices such as walking and cycling add up to 7%, no reductions are considered necessary for Institute of Transportation Engineers (ITE) trip generation rates used in the analysis for the subject site. ITE trip generation rates are developed in locations with little to no transit service or Travel Demand Management programs, which are in line with the existing modal share for the subject site.

2.5 Existing Traffic Volumes

Turning movement counts were performed on behalf of HDR by Traffic Survey Analysis Inc. for the weekday AM and PM peak periods (7:00 AM to 9:00 AM, and 4:00 PM to 6:00 PM) at all existing intersections in the study area excepting Brant Waterloo Road and Swan Street. These hours represent peak traffic generation time for residential developments as well as the peak period of adjacent street traffic. The counts were performed on Thursday, January 18th, 2018.

Following the data collection, the existing intersection of Brant Waterloo Road with Swan Street was included in the scope of the study (after receiving comments from the Township). The present year (2018) traffic volumes at this intersection were based on 2013 turning movement counts presented in the Hilltop TIS and a growth rate of 1.5% per annum for the study area traffic. Detailed discussions of the growth rate are presented in **Section 3.2**.

Existing traffic volumes are shown in **Exhibit 3** and detailed data is provided in **Appendix A**.

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Exhibit 3 Existing Traffic Volumes

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2.6 Existing Traffic Operations

The existing traffic operations were assessed based on the existing traffic counts and supplementary data from Hilltop TIS as shown **Exhibit 3**. This included heavy vehicle percentages derived from the available traffic counts.

The existing road network and intersection controls depicted in **Exhibit 2** were modeled in the Synchro network. It is noted that HCM methodologies do not allow the assessment of the unusual intersection control at the Northumberland Street and Stanley Street/Private Drive. This intersection has a stop control on the southbound and westbound approaches, with the eastbound approach free flowing.

To address this issue, the intersection was modeled as a two-way stop-controlled intersection. Stop control was assumed on the southbound approach, as per existing conditions, and on the northbound approach since it's a private driveway fronting a regional road at the subject intersection.

This analysis method may overestimate the delays for the north and south approaches, and especially so for the heavy southbound volumes because westbound traffic will be considered free-flowing; consequently it may underestimate delays for the westbound traffic, which would otherwise be required to make full stops at the intersection for minor street movements. However, the westbound right turn is modeled as a channelized right-turn stop control as per field conditions, and considering that the westbound through volumes are low, the delays to southbound left turns may be considered to be within reason in the proxy intersection control configuration.

In the Synchro model the respective link speeds within the road network were coded, along with default lane widths of 3.5m at the intersection approaches as per the Region of Waterloo's Capacity Analysis Requirements⁴. The Capacity Analysis requirements also provide values for parameters including the Peak Hour Factor (PHF of 0.9 for all movements), and saturation flow values specified for different lane configurations. All other inputs for the models were kept at the Synchro default values.

Intersection operations are summarized in **Table 1**. Detailed Synchro reports are provided in **Appendix B**.

	Intersection		Veekday A.N	I. Peak	K	V	Veekday P.N	I. Peak	K Contraction of the second se
Approach / Movement		LOS	Delays (s)	v/c	95 th Q	LOS	Delays (s)	v/c	95 th Q
	Swan @ Hilltop								
EB	Left/Through/Right	В	12	0.01	<1	В	15	0	<1
WB	Left/Through/Right	В	10	0.14	4	В	11	0.12	3
NB	Left/Through/Right		0	0	0		0	0	0
SB	Left/Through/Right	А	2	0.02	<1	А	3	0.07	2
Но	Howard Marshall @ Hilltop								
EB	Left/Through/Right	А	7	0.04	-	А	7	0.09	-
WB	Left/Through/Right	А	7	0.05	-	А	7	0.05	-

Table 1: 2018 Existing Traffic Operations

⁴ Transportation Impact Studies (TIS) Requirements for Capacity Analysis, Roundabouts, Signal Warrants. Region of Waterloo.

	Intersection	V	Veekday A.N	I. Peak	(١	Veekday P.N	I. Peak	1
Ар	proach / Movement	LOS	Delays (s)	v/c	95 th Q	LOS	Delays (s)	v/c	95 th Q
NB	Left/Through/Right	А	7	0.05	-	А	8	0.04	-
SB	Left/Through/Right	А	7	0.01	-	А	7	0	-
Nort	humberland @ Stanley								
EB	Left/Through/Right	А	6	0.04	<1	А	5	0.04	1
WB	Left/Through	А	0	0	0	А	0	0	0
WB	Right	-	0	0.23	0	-	0	0.14	0
NB	Left/Through/Right	А	10	0	<1	В	10	0.03	<1
SB	Left/Through/Right	В	11	0.25	8	С	23	0.74	51
	Hilltop @ Wrigley								
EB	Through	-	0	0.07	0	-	0	0.06	0
WB	Left	А	8	0.02	<1	А	8	0.07	2
WB	Through	-	0	0.03	0	-	0	0.05	0
NB	Left/Right	В	10	0.2	6	В	11	0.1	3
	Swan @ Stanley								
EB	Through/Right	-	0	0.11	0	-	0	0.28	0
WB	Left/Through	А	3	0.02	<1	А	3	0.02	<1
NB	Left/Right	В	14	0.48	20	В	14	0.38	13
Sw	an @ Brant-Waterloo								
EB	Left/Through/Right	А	9	0.01	<1	В	11	0.02	<1
WB	Left/Through/Right	А	9	0.01	<1	А	10	0.01	<1
NB	Left/Through/Right	А	0	0	0	А	0	0	0
SB	Left/Through/Right	А	1	0	<1	А	0	0	<1
OS - Le	vel of Service v/c – Volume	to Can	acity Ratio	95 th O -	95 th ne	ercentile	aueue lenath ir	metres	

LOS – Level of Service v/c – Volume to Capacity Ratio $95^{th} Q - 95^{th}$ percentile queue length in metres

Under existing conditions all movements at all study intersections are operating well with LOS C or better and with volume to capacity ratios of 0.74 or lower indicating that the intersections are operating well and with residual capacity.

The existing intersections within the study area generally do not feature turning movement storage lanes. As such, all 95th percentile queues are accommodated in the shared lanes at intersection approaches. Synchro reports that the longest queues under existing conditions may occur at the southbound approach of Northumberland Street and Stanley Street. However, 95th percentile queue of 51 metres will not stretch to the nearest upstream intersection.

3 Future Background Conditions

3.1 Future Road Network

As described in **Section 2.3**, improvements are planned for the active transportation facilities within the study area, which are supportive of the Town of North Dumfries' "Downtown Ayr: Strategic Action Plan for Revitalization". No other public information is currently available on planned construction projects by the Region within the Town. However, during the development of the Hilltop TIS, the

Region provided the input regarding future improvements, which have been incorporated into the TIS for the subject site. These are listed as follows:

- According to the Region⁵ a new southbound left-turn lane from Swan Street to Hilltop Drive is planned for construction within the near future. In addition, the Hilltop TIS also assumed an opposing northbound left-turn lane to serve the development to the west of Swan Street. As such, the existing road network was modified with the above planned improvements for analysis in both the 2020 and 2031 future planning horizons.
- Hilltop TIS also proposed for an all-way stop control at the intersection of Northumberland Street and Stanley Street by the 2027 as a mitigation measure for the study area background growth and additional site traffic generated by the Hilltop Estates Subdivision. Therefore, the 2031 study area road network for the current 869 Brant-Waterloo Road study includes the implementation of an all-way stop control at the intersection of Northumberland Street and Stanley Street.

3.2 Background Traffic Growth

Background traffic growth for the study area was based on the assumptions made in the Hilltop TIS. Insufficient data historical data was available to confirm the assumed 1.5% per annum growth rate in the Hilltop TIS. However, since this growth rate was discussed with the Region staff during the preconsultation meeting for the Hilltop TIS and considered to be applicable to all vehicle movements, the current study maintained consistent assumptions.

Future background growth for the 2020 and 2031 horizon years are shown in **Exhibit 4** and **Exhibit 5**.

⁵ *Hilltop Estates Subdivision Stage 4, Ayr Traffic Impact Study.* Stantec. November 2013.

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Exhibit 4 2020 Background Growth Traffic Volumes

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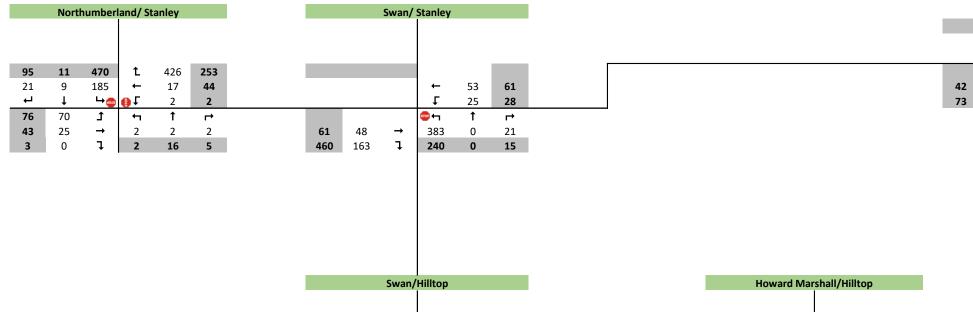
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Exhibit 5 2031 Background Growth Traffic Volumes

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3.3 Background Developments

The Hilltop Estates Subdivision located to the west of the subject site is currently under development. As per Hilltop TIS, the proposed development will consist of 391 total residential units, occupying a total footprint of 22.93 hectares at full built-out. The detailed breakdown of the proposed residential types are listed below:

- 30 Residential Condominiums
- 78 Townhouses
- 34 Semi-Detached Homes
- 249 Single Family Detached Homes

3.3.1 2020 Horizon Year

The Hilltop Estates Subdivision is expected to be developed in phases with full-build out in 2022. Hilltop TIS considered 2021 as an interim year for analysis purposes. The site trips in the 2021 interim year were based on the completion of the first two phases by 2020, totaling 295 units. These interim year site trips were extracted for use in the current study as described below.

Latest information from the Hilltop developers indicates that Phase 1 of Hilltop is yet to commence and will likely occur in 2019. The extent of the Phase 1 development of Hilltop Estates Subdivision is shown in **Exhibit 6**. Phase 1 will include 108 to 120 units. Therefore, for the 2020 horizon year in the present study for 869 Brant-Waterloo Road, Phase 1 of the Hilltop Estates Subdivision is considered to be a background development. As a conservative approach, 120 units are assumed to be completed by 2020, representing 41% of the expected 2021 interim site trips (from 295 units) generated in the Hilltop TIS⁶.

Exhibit 7 shows the site trips expected to be generated by Hilltop Estates Subdivision in 2020 based on 41% of the Hilltop TIS 2021 interim year site traffic volumes.

Exhibit 8 shows the total background traffic in 2020 for the 869 Brant-Waterloo Road site.

It should be noted that vehicular access to Phase 1 of the Hilltop Estates Subdivision is provided from the intersections of Robert Woolner Street and Howard Marshall Road, and Leslie Davis Street and Swan Street.

3.3.2 2031 Horizon Year

By the 2031 horizon year in the current study, Hilltop Estates Subdivision is assumed to be fully built and occupied, and contributing to the 2031 total background traffic. The Hilltop site traffic⁷ was added to the 2031 background traffic growth in **Exhibit 5**.

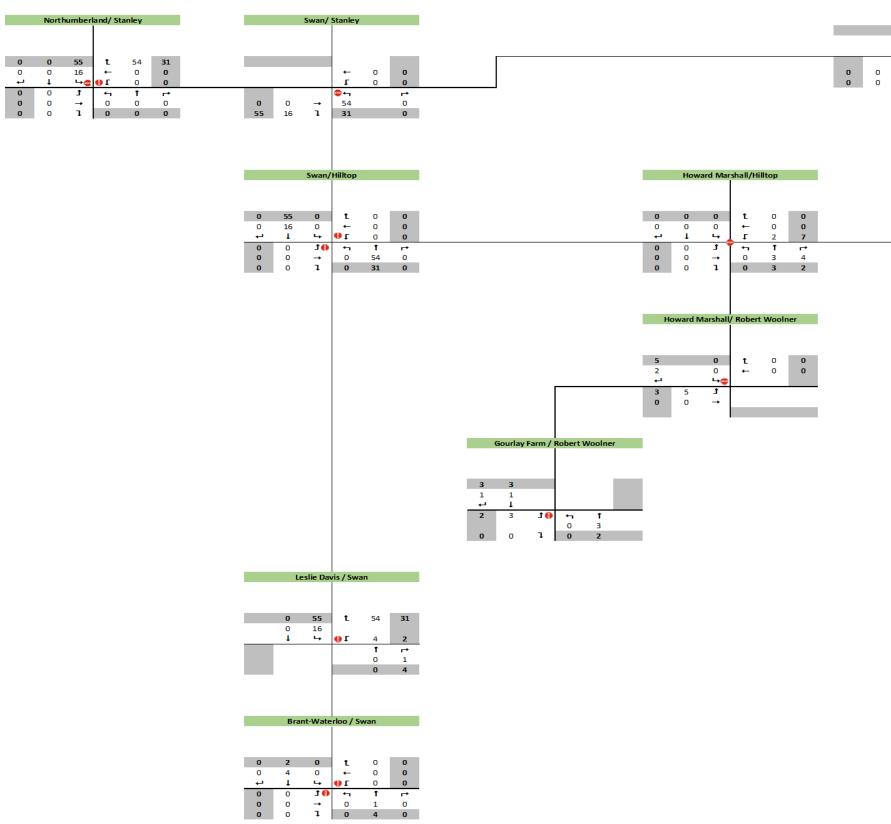
Exhibit 9 shows the total background traffic in 2031 for the 869 Brant-Waterloo Road site.

⁶ Figure 6. *Hilltop Estates Subdivision Stage 4, Ayr Traffic Impact Study*. Stantec. November 2013.

⁷ Figure 7. *Hilltop Estates Subdivision Stage 4, Ayr Traffic Impact Study*. Stantec. November 2013.



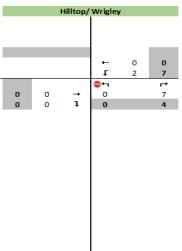
Exhibit 6 Hilltop Phase 1 Development Extent

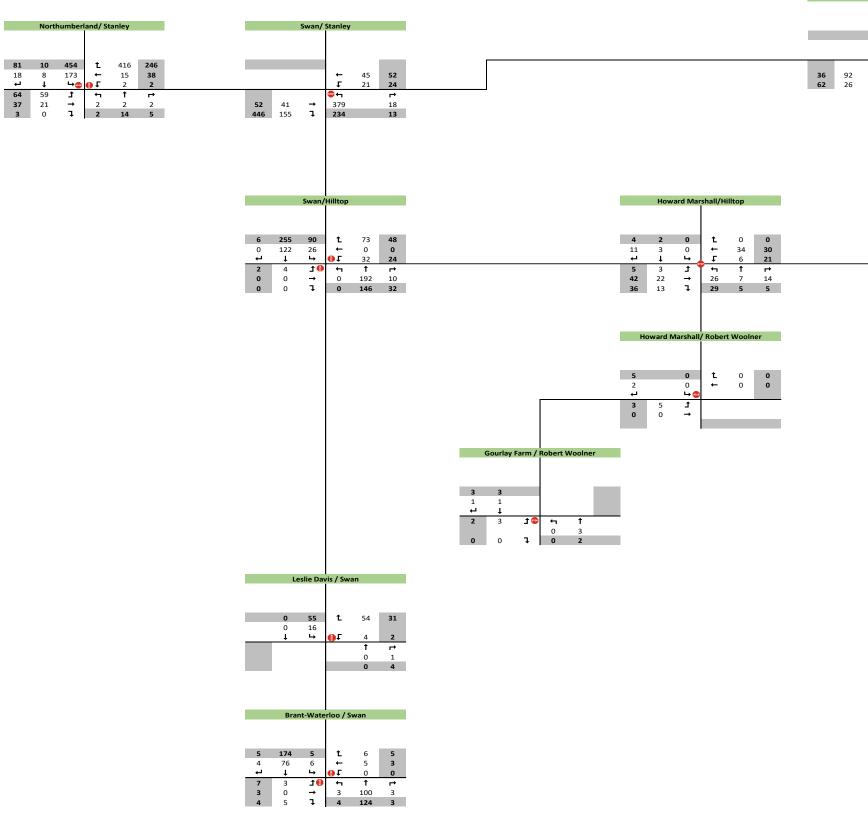


LEGEND							
AM	Х						
PM	Х						
Stop Sign	STOP						

Exhibit 7 Hilltop Phase 1 Site Traffic

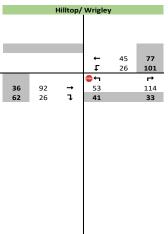
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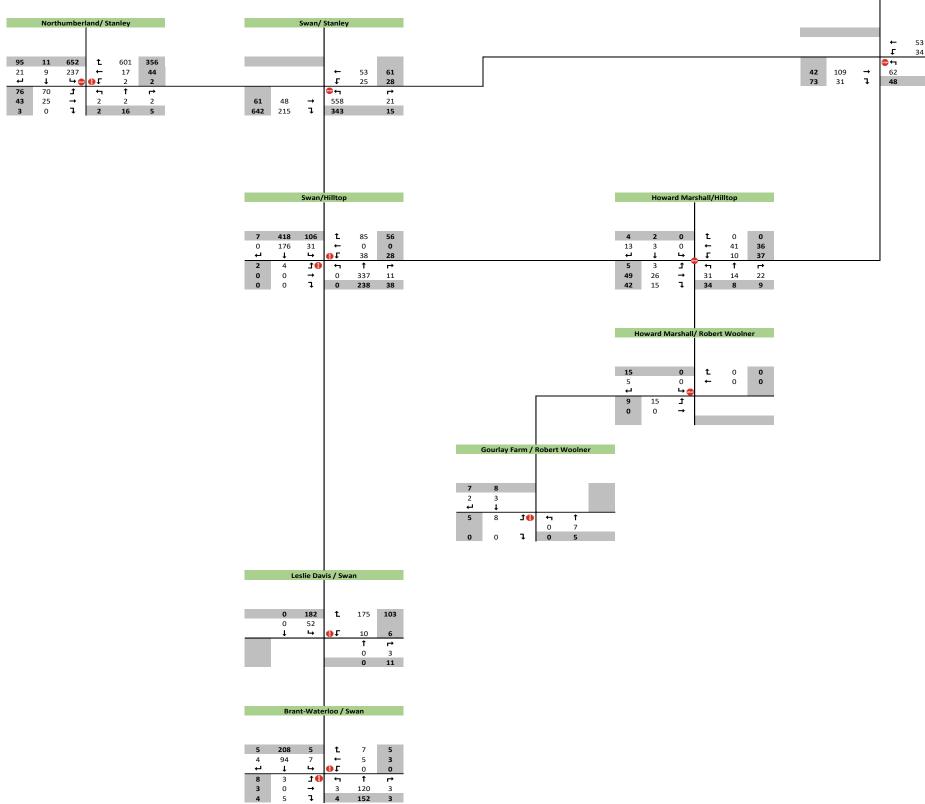




LEGEND						
AM	Х					
PM	Х					
Stop Sign	STOP					

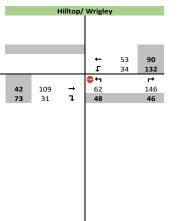
Exhibit 8 2020 Total Background Traffic





LEGEND							
AM	Х						
PM	Х						
Stop Sign	STOP						

Exhibit 9 2031 Total Background Traffic



3.4 Future Background Traffic Operations

3.4.1 2020 Horizon

Traffic operations were assessed under future 2020 background traffic conditions based on the future road network discussed in **Section 3.1** Future Road Network and traffic volumes presented in **Exhibit 4**. Intersection operations are summarized in **Table 2**. Detailed Synchro reports are provided in **Appendix C**. Similar to existing conditions, the Region's Capacity Analysis requirements were maintained.

	Intersection	V	Veekday A.M	I. Peal		V	Veekday P.N	I. Pea	k
Ар	oproach / Movement	LOS	Delays (s)	v/c	95 th Q	LOS	Delays (s)	v/c	95 th Q
	Swan @ Hilltop								
EB	Left/Through/Right	В	13	0.01	<1	С	17	0.01	<1
WB	WB Left/Through/Right		11	0.17	5	В	12	0.14	4
NB	Left	-	0	0	0	-	0	0	0
NB	Through/Right	-	0	0.13	0	-	0	0.12	0
SB	Left	А	8	0.02	<1	А	8	0.07	2
SB	Through/Right	-	0	0.08	0	-	0	0.17	0
Hov	vard Marshall @ Hilltop								
EB	Left/Through/Right	А	7	0.05	-	А	7	0.1	-
WB	Left/Through/Right	А	7	0.05	-	А	8	0.06	-
NB	Left/Through/Right	А	7	0.06	-	А	8	0.05	-
SB	Left/Through/Right	А	7	0.02	-	А	7	0.01	-
Nor	thumberland @ Stanley								
EB	Left/Through/Right	Α	6	0.04	1	А	5	0.05	1
WB	Left/Through	А	1	0	0	А	0	0	0
WB	Right	-	0	0.27	0	-	0	0.16	0
NB	Left/Through/Right	А	10	0.01	<1	В	10	0.03	<1
SB	Left/Through/Right	В	12	0.29	9	E	36	0.88	82
	Hilltop @ Wrigley								
EB	Through	-	0	0.08	0	-	0	0.06	0
WB	Left	А	8	0.02	<1	А	8	0.08	2
WB	Through	-	0	0.03	0	-	0	0.05	0
NB	Left/Right	В	10	0.21	6	В	11	0.12	3
	Swan @ Stanley								
EB	Through/Right	-	0	0.13	0	-	0	0.33	0
WB	Left/Through	Α	3	0.02	<1	А	3	0.03	<1
NB	Left/Right	С	16	0.59	29	С	17	0.47	19
Sv	van @ Brant-Waterloo								
EB	Left/Through/Right	А	9	0.01	<1	В	11	0.02	<1
WB	Left/Through/Right	А	10	0.02	<1	А	10	0.01	<1
NB	Left/Through/Right	А	0	0	0	А	0	0	<1

Table 2: Future 2020 Background Traffic Operations

	Intersection	V	Veekday A.M	I. Peal	k	V	Veekday P.N	I. Peal	k
Ар	proach / Movement	LOS	Delays (s)	v/c	95 th Q	LOS	Delays (s)	v/c	95 th Q
SB	Left/Through/Right	А	1	0	<1	А	0	0	<1
Rob	oert Woolner @ Howard Marshall								
EB	Left/Through	А	7	0	<1	А	7	0	0
WB	WB Through/Right		0	0	0	-	0	0	0
SB Left/Right		А	8	0	0	А	8	0.01	<1
S	Swan @ Leslie Davis								
WB	Left/Right	А	9	0.06	1	А	9	0.03	<1
NB	Through/Right	-	0	0	0	-	0	0	0
SB	Left/Through	А	7	0.01	<1	А	7	0.04	<1
Robert	Woolner @ Gourlay Farm								
EB	EB Left/Right		9	0	<1	А	9	0	0
NB Left/Through		-	0	0	0	-	0	0	0
SB	Through/Right	-	0	0	0	-	0	0	0
LOS – Lev	vel of Service v/c – Volume t	o Capac	ity Ratio 9	95 th Q -	95 th pei	rcentile c	ueue length in	metres	

Under future 2020 background conditions all movements at all study intersections will operate well with LOS C or better, excepting the southbound left turn movement from Northumberland Street to Stanley Street. The delays expected for this movement are expected to increase to over 35 seconds leading to a LOS E. The 95th percentile queue for this movement may extend 82 metres but will not block any upstream intersections. The highest volume to capacity ratio (0.88) is expected at this movement as well. However, all intersections will continue to operate well and with residual capacity.

3.4.2 2031 Horizon

Traffic operations were assessed under future 2031 background traffic conditions based on the future road network discussed in **Section 3.1** and traffic volumes presented in **Exhibit 5**. Intersection operations are summarized in **Table 3**. Detailed Synchro reports are provided in **Appendix C**. Similar to existing conditions, the Region's Capacity Analysis Requirements were followed.

	Intersections		Veekday A.N	I. Peal	(V	Weekday P.M. Peak			
A	oproach / Movement	LOS	Delays (s)	v/c	95 th	LOS	Delays (s)	v/c	95 th	
	Swan @ Hilltop									
EB	EB Left/Through/Right		18	0.01	<1	D	25	0.01	<1	
WB	WB Left/Through/Right		14	0.25	8	С	17	0.23	7	
NB	NB Left		0	0	0		0	0	0	
NB	Through/Right	-	0	0.23	0		0	0.18	0	
SB	Left	А	8	0.03	<1	А	8	0.09	2	
SB	SB Through/Right		0	0.12	0		0	0.28	0	
Ho	Howard Marshall @ Hilltop									
EB	Left/Through/Right	А	7	0.06	-	А	7	0.12	-	

Table 3: Future 2031 Background Traffic Operations

Inte	ersections	N	Veekday A.M	I. Peal	ĸ	Weekday P.M. Peak			
Approa	LOS	Delays (s)	v/c	95 th	LOS	Delays (s)	v/c	95 th	
WB Left/Through/Right		А	8	0.07	-	А	8	0.1	-
NB L	eft/Through/Right	А	8	0.08	-	А	8	0.07	- 1
SB L	eft/Through/Right	А	7	0.02	-	А	7	0.01	-
Northumb	erland @ Stanley								
EB L	eft/Through/Right	А	9	0.14	-	В	11	0.23	-
WB	Left/Through	В	8	0.03	- 1	А	10	0.09	-
WB	Right		11	0.59	-		8	0.35	-
NB L	eft/Through/Right	А	7	0.01	-	А	9	0.04	-
SB L	eft/Through/Right	А	10	0.36	-	F	77	1.08	-
Hillto	p @ Wrigley								
EB	Through	-	0	0.09	0	-	0	0.08	0
WB	Left	А	8	0.03	<1	А	8	0.1	3
WB	Through	-	0	0.03	0	-	0	0.06	0
NB	Left/Right	В	11	0.28	9	В	12	0.16	4
Swa									
EB	Through/Right	-	0	0.17	0	-	0	0.46	0
WB	Left/Through	А	3	0.02	<1	А	3	0.04	<1
NB	Left/Right	E	44	0.93	97	E	40	0.83	62
Swan @	Brant-Waterloo								
EB L	eft/Through/Right	А	9	0.01	<1	В	11	0.03	<1
WB L	eft/Through/Right	А	10	0.02	<1	В	10	0.01	<1
NB L	eft/Through/Right	А	0	0	0	А	0	0	<1
SB L	eft/Through/Right	А	1	0.01	<1	А	0	0	<1
	oolner @ Howard Marshall								
EB	Left/Through	А	7	0.01	<1	А	7	0.01	<1
WB	Through/Right	-	0	0	0		0	0	0
SB	Left/Right	А	8	0.01	<1	А	8	0.02	<1
Swan	@ Leslie Davis								
WB	Left/Right	А	9	0.19	5	А	9	0.12	3
NB	Through/Right	-	0	0	0	-	0	0.01	0
SB	Left/Through	А	7	0.04	<1	А	8	0.13	3
Robert Wool	ner @ Gourlay Farm								
EB	Left/Right	А	9	0.01	<1	А	9	0.01	<1
NB	Left/Through	-	0	0	0	-	0	0	0
SB	Through/Right	-	0	0	0	-	0	0	0
LOS – Level of S	Service v/c – Volume t	o Capac	ity Ratio 9	95 th Q -	95 th per	centile q	ueue length ir	metres	

Under future 2031 background conditions, the two intersections of Stanley Street with Northumberland Street and with Swan Street will deteriorate considerably. All movements at the other intersections remain in acceptable standing with LOS D or better, and with reserve capacity. At the intersection of Swan Street and Stanley Street, the northbound approach is expected to experience delays over 35 seconds in both AM and PM peak periods and operate with LOS E. At the intersection of Northumberland Street and Stanley Street, the southbound approach is expected to experience very high delays exceeding 75 seconds in the PM Peak hour. The volumes expected at this approach, primarily due to left turning vehicles, will exceed the available capacity.

Hilltop TIS showed that the southbound approach at this intersection would operate with long delays (and LOS F) and at capacity by 2027, even with the proposed improvement of an all-way stop control. Therefore, it may be implied that any additional background growth following 2027 conditions would result in unacceptable conditions. A sensitivity analysis was completed assuming no background traffic growth from 2018 existing conditions to 2031, and by assuming a minimal background growth rate of 0.5%. Both cases show that the critical movement at this intersection will operate beyond capacity, at LOS F and with delays exceeding 120 seconds. Similar above capacity conditions will persist for the adjacent intersection of Stanley Street and Swan Street.

Based on the above analysis and sensitivity tests on background growth rates, any new site traffic from the subject site of 869 Brant-Waterloo Road is expected to exacerbate the situation. However, no alternative routes for traffic travelling to and from the north are available to the planned developments within in the Ayr Urban Area. As such, the following sections detail the expected operations in the study area road network with the additional traffic from the subject site of 869 Brant-Waterloo Road.

4 Site Characteristics

4.1 Site Plan and Access

Broos Properties Ltd. is proposing to construct 302 single family units, 108 townhouse units, and 75 townhouse units in medium density residential blocks within the subject site at 869 Brant-Waterloo Road. The proposed development is expected to be carried out in the following four phases:

- Phase 1 construction starts in 2018
- Phase 2 construction starts in 2020
- Phase 3 construction starts in 2022
- Phase 4 construction starts in 2024
- Full build-out and occupied by 2026

Sketch plans showing the subject site at 869 Brant-Waterloo Road at Phase 1 development and fullbuild are presented in **Exhibit 10.** The draft plan for the entire subdivision at 869 Brant-Waterloo Road is presented in **Exhibit 11.**

During Phase 1, access to the subject site will consist of connections to Howard Marshall Street and Freer Street via Robert Woolner Street and Street H, respectively. No connection is provided to Swan Street via Leslie Davis Street although the adjacent Hilltop Estates Subdivision considers the intersection of Leslie Davis Street and Swan Street to be complete by 2020. The new intersections and respective traffic control devices within the internal road network of the subject site are as listed below:

- Robert Woolner Drive & Howard Marshall Street stop-control on southbound approach
- Robert Woolner Drive /Street F & Freer Street stop-control on southbound approach
- Robert Woolner Drive & Gourlay Farm Lane stop-control on eastbound approach

 Leslie Davis & Street A – traffic circle with yield-control at all approaches (see Section 7 for further details)

At full build-out, new access to the subject site include:

- Robert Woolner Street & Leslie Davie Street
- Robert Woolner Street & Brant-Waterloo Road, and
- Brant Waterloo Road & Street A.

Additional intersections and their control types under full build-out are listed below:

- Robert Woolner Drive & Leslie Davis Street traffic circle with yield-control at all approaches
- Brant-Waterloo Road & Robert Woolner Drive stop-control on southbound approach
- Brant-Waterloo Road & Street A stop-control on southbound approach

4.2 Site Vehicular Traffic Trip Generation

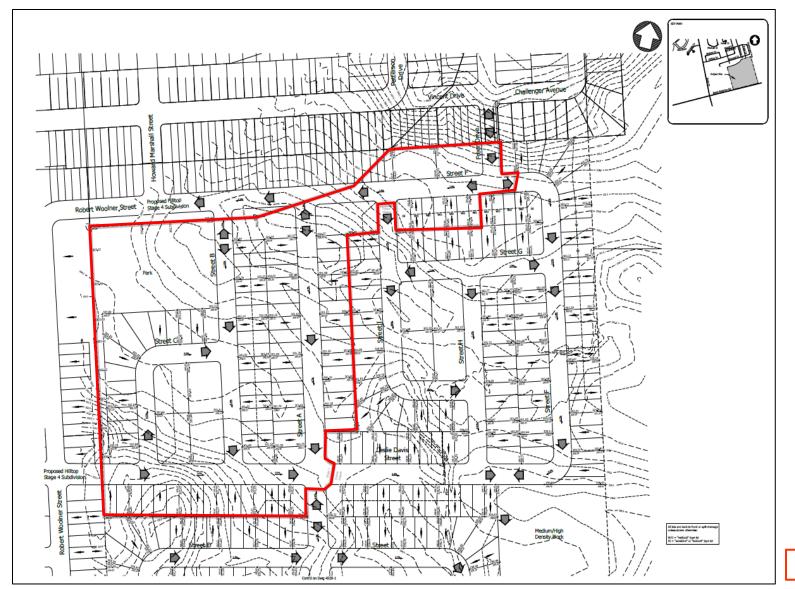
The trip generation for the residential development was based on information in the Trip Generation Manual, 9th Edition by the Institute of Transportation Engineers ("ITE"):

- The "Single-Family Detached Housing" land use code 210 was used to generate trips for the proposed detached houses.
- The "Residential Condominium/Townhouse" land use code 230 was used to generate trips for the proposed townhouse units.

The site trip generation was based on fitted curve equations for the respective land uses, using the fixed variable "dwelling units" and in/out percentage splits. The resulting vehicular traffic generation for the proposed residential units for the AM and PM peak hour is summarized in **Table 4**.

Land Use	LUC #	Units	A.I	M. Peak	Hour	P.M. Peak Hour		
Land Use	LUC #	Units	In	Out	Total	In	Out	Total
Phase 1 (2020)								
Single Family Detached	210	87	19	55	73	62	35	97
Townhouse	230	52	5	26	31	35	21	56
Total	139	24	81	104	97	56	153	
	Fu	ll Build-o	ut (20	26)				
Single Family Detached	210	302	59	166	224	189	107	296
Townhouse 230		183	15	70	85	64	37	101
Total	485	74	236	309	253	144	397	

Table 4 Site Traffic Generation



Extent of Phase 1

Exhibit 10 Proposed Development and Phasing



Exhibit 11 Draft Plan of Subdivision

4.3 Site Traffic Distribution and Assignment

The distribution of site trips provided in the Hilltop TIS was reviewed against existing traffic patterns and 2011 TTS data. Minor changes in the trip distribution are suggested for the current study and is summarized in **Table 5**.

To/From	Via	%
North	Hilltop Drive – Swan Street – Northumberland Street	80
South	Brant Waterloo Road – Swan Street	8
East	Howard Marshall Street – Hilltop Drive – Wrigley Road	12

Table 5: Trip Distribution

The site traffic assignments in Phase 1 in 2020 and at full build-out in 2031 are shown in **Exhibit 12** and **Exhibit 13**. The total traffic volumes include background traffic and the site traffic generated by the proposed development. The resulting future total traffic volumes for 2020 and 2031 horizon years are shown in **Exhibit 14** and **Exhibit 15**.

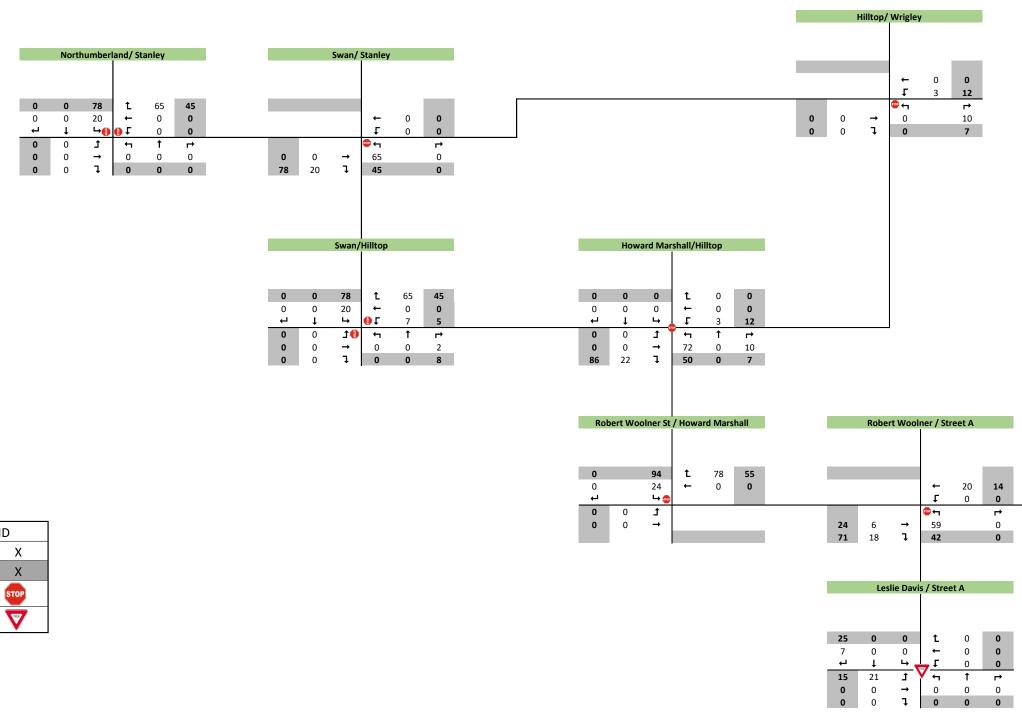


Exhibit 12 Site Generated Traffic Volumes in Phase 1 (2020)

LEGEND

AM

ΡM

Stop Sign

Yield Sign

Robert Woolner / Freer									
5		0	t	0	0				
2		0	-	0	Ő				
ے ب			•	0	U				
		4015							
3	5	t							
0	0	\rightarrow							

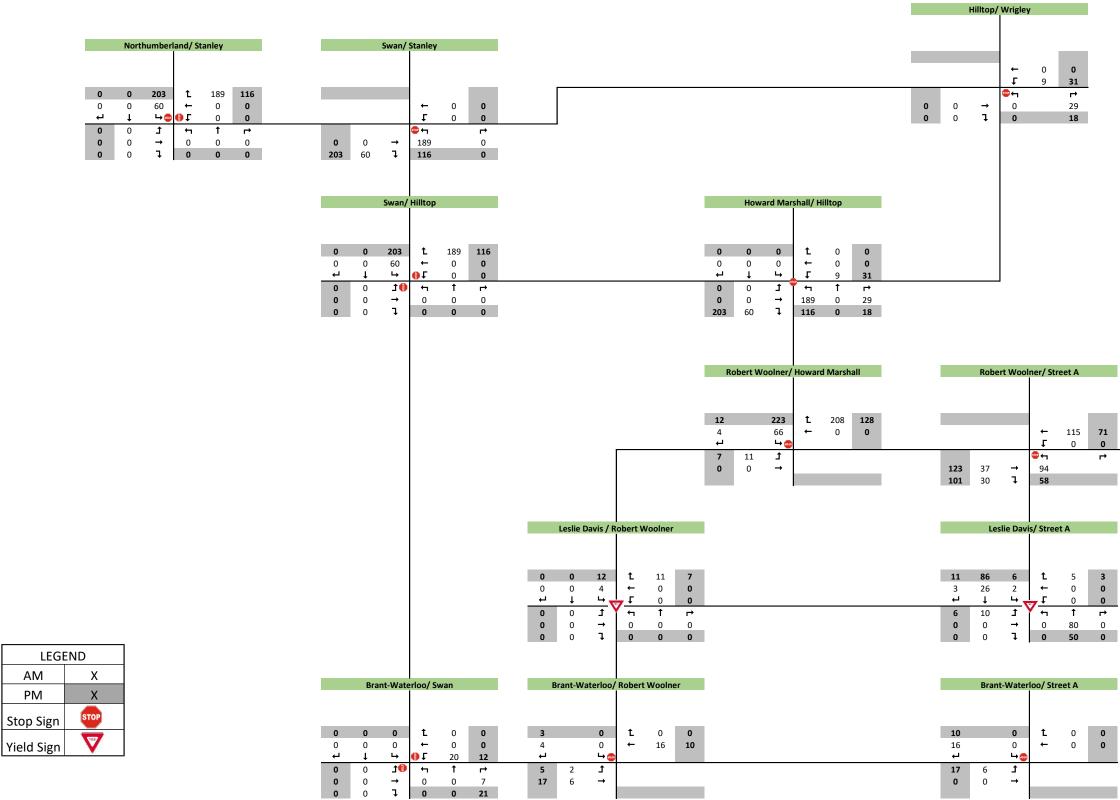


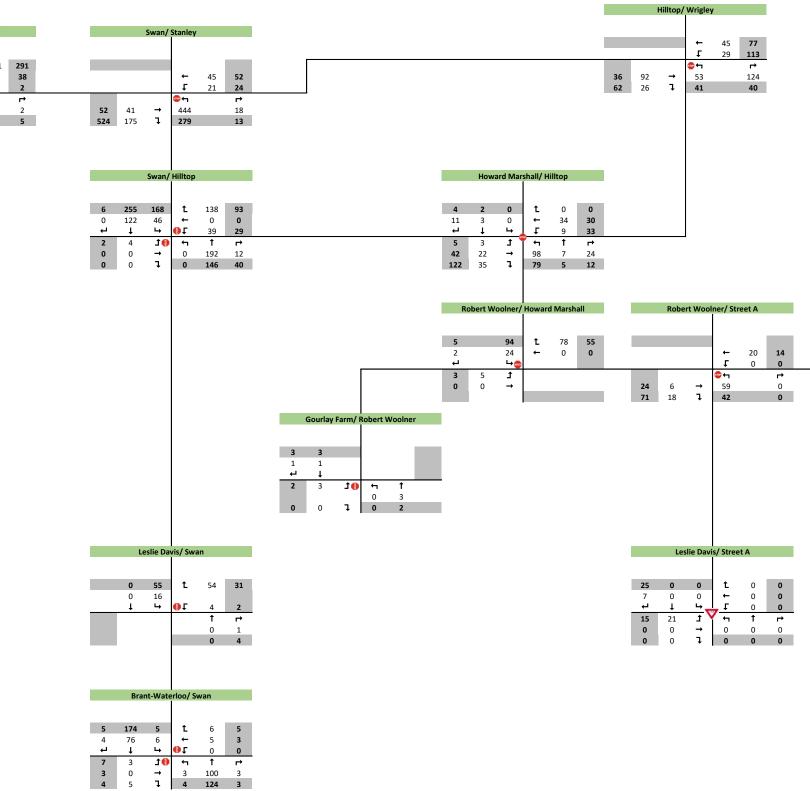
Exhibit 13 Site Generated Traffic Volumes at Full Build-out

AM

ΡM

F	Robert V	Voolner	(Street F)/ Freer			
 0		0	t	0	0	
 0		0	+	115	71	
 Ļ,		-→ @				
0	0	t				
 123	37	→				

April 6, 2018 | 29



	Northumberland/ Stanley										
81	10	532	t	481	291	È					
01	10	552	L.	401	291	Ŀ					
18	8	193	+	15	38						
₽	t	∽∞	🛯 🖓 🚺	2	2						
64	59	t	ţ	1	t						
37	21	→	2	2	2						
3	0	ļ	2	14	5						

Exhibit 14 2020 Total Traffic Volumes

LEGEND

Х

Х

STOP

V

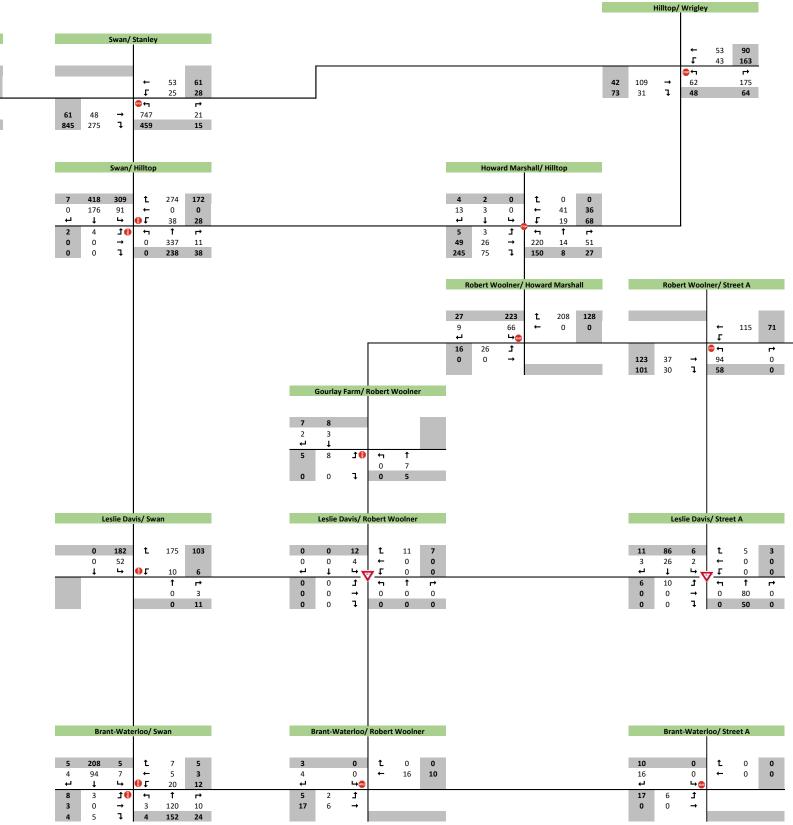
AM

ΡM

Stop Sign

Yield Sign

R	obert V	Voolner	(Street	F) / Free	er
5		0	Ĺ	0	0
2		0	←	0	0
ц					
3	5	t			
0	0	→			



	Northumberland/ Stanley									
95	11	855	Ĺ	790	472					
21	9	297	+	17	44					
Ч	Ļ		0 ₽	2	2					
76	70	t	ţ	t	t,					
43	25	→	2	2	2					
3	0	Ţ	2	16	5					

LEGEND					
AM	Х				
PM	Х				
Stop Sign	STOP				
Yield Sign					

Exhibit 15 2031 Total Traffic Volume

	R	obert V	Voolner	(Street F) / Freer				
	n		•	•	0	0		
	J		0	L L	U	U		
(C		0	+	115	71		
•	-							
12	23	37	→					
	D	0	Ţ					

5 Future Traffic Operations

5.1.1 2020 Horizon

Traffic operations were assessed under future 2020 total traffic conditions, based on the traffic volumes shown in **Exhibit 3** and the existing road network with the described modifications presented in **Section 3.1**. Intersection operations are summarized in **Table 6**. Detailed Synchro reports are provided in **Appendix D**.

Intersection Approach / Movement		Weekday A.M. Peak				Weekday P.M. Peak			
		LOS	Delays (s)	v/c	95 th	LOS	Delays (s)	v/c	95 th
Swan @ Hilltop									
EB	Left/Through/Right	С	16	0.01	<1	С	23	0.01	<1
WB	Left/Through/Right	В	12	0.27	8	В	14	0.25	7
NB	Left	-	0	0	0	-	0	0	0
NB	Through/Right	-	0	0.13	0	-	0	0.12	0
SB	Left	А	8	0.04	<1	А	3	0.13	4
SB	Through/Right	-	0	0.08	0		0	0.17	0
Howard Marshall @ Hilltop									
EB	Left/Through/Right	А	7	0.07	-	А	8	0.2	-
WB	Left/Through/Right	А	8	0.06	-	А	8	0.09	-
NB	Left/Through/Right	А	8	0.17	- 1	А	8	0.14	-
SB	Left/Through/Right	А	7	0.02	-	А	7	0.01	-
Northumberland @ Stanley									
EB	Left/Through/Right	А	6	0.04	1	А	5	0.05	1
WB	Left/Through	А	1	0	0	А	0	0	0
WB	Right	-	0	0.31	0	-	0	0.19	0
NB	Left/Through/Right	А	10	0.01	<1	В	10	0.03	<1
SB	Left/Through/Right	В	12	0.32	11	F	63	1.01	127
Hilltop @ Wrigley									
EB	Through	-	0	0.08	0	-	0	0.06	0
WB	Left	А	8	0.02	<1	А	8	0.08	2
WB	Through	-	0	0.03	0	-	0	0.05	0
NB	Left/Right	В	10	0.23	7	В	11	0.13	3
Swan @ Stanley									
EB	Through/Right	-	0	0.14	0	-	0	0.38	0
WB	Left/Through	А	3	0.02	<1	А	3	0.03	<1
NB	Left/Right	С	20	0.69	43	С	21	0.59	29
Swan @ Brant-Waterloo									
EB	Left/Through/Right	А	9	0.01	<1	В	11	0.02	<1
WB	Left/Through/Right	А	10	0.02	<1	А	10	0.01	<1
NB	Left/Through/Right	А	0	0	0	А	0	0	<1

Table 6: Future 2020 Total Traffic Operations

Intersection	V	Veekday A.M	I. Peal	٢	V	Veekday P.M	I. Peal	ĸ
Approach / Movement	LOS	Delays (s)	v/c	95 th	LOS	Delays (s)	v/c	95 th
SB Left/Through/Right	Α	1	0	<1	А	0	0	<1
Robert Woolner @ Howard Marshall								
EB Left/Through	А	7	0	<1	А	7	0	0
WB Through/Right	-	0	0.05	0	-	0	0.04	0
SB Left/Right	А	9	0.03	<1	А	9	0.11	3
Swan @ Leslie Davis								
WB Left/Right	А	9	0.06	1.4	А	9	0.03	<1
NB Through/Right	-	0	0	0	-	0	0	0
SB Left/Through	А	7	0.01	<1	А	7	0.04	<1
Robert Woolner @ Gourlay Farm								
EB Left/Right	А	9	0	<1	А	9	0	0
NB Left/Through	-	0	0	0	-	0	0	0
SB Through/Right	-	0	0	0	-	0	0	0
Robert Woolner /Street F @ Freer								
EB Left/Through	А	7	0	<1	А	7	0	0
WB Through/Right	-	0	0	0	-	0	0	0
SB Left/Right	А	8	0	0	А	8	0.01	<1
Robert Woolner @ Street A								
EB Through/Right	-	0	0.02	0	-	0	0.06	0
WB Left/Through	-	0	0	0	-	0	0	0
NB Left/Right	А	9	0.07	2	А	9	0.05	1
Leslie Davis @ Street A								
EB Left/Through/Right	А	7	0.03	-	А	7	0.02	-
WB Left/Through/Right	А	7	0	-	А	7	0	-
NB Left/Through/Right	А	7	0	-	А	7	0	- 1
SB Left/Through/Right	А	6	0.01	-	А	7	0.03	-
LOS – Level of Service v/c – Volume	o Capac	ity Ratio 9	95 th – 95	th perce	ntile que	ue length in m	etres	

Under future 2020 total conditions most movements at all study intersections will operate at LOS C or better and with volume to capacity ratios of 0.69 or lower, indicating that intersections will operate well and with residual capacity. Only the southbound approach at the intersection of Northumberland Street and Stanley Street will operate at LOS F and volume to capacity ratio 1.01, indicating high delays and at-capacity conditions for the movement. The 95th percentile queue for this movement will extend to 127 metres north of the intersection.

5.1.2 2031 Horizon

Traffic operations were assessed under future 2031 total traffic conditions, based on the traffic volumes shown in **Exhibit 13** and the future road network discussed in **Section 3.1**. Intersection operations are summarized in **Table 7**. Detailed Synchro reports are provided in **Appendix D**.

	Intersection	N N	/eekday A.M	I. Peal	(V	Veekday P.N	I. Peal	k
Ар	proach / Movement	LOS	Delays (s)	v/c	95 th	LOS	Delays (s)	v/c	95 th
	Swan @ Hilltop								
EB	Left/Through/Right	E	42	0.04	1	F	80	0.04	1
WB	Left/Through/Right	С	20	0.6	30	D	29	0.61	29
NB	Left	-	0	0	0	-	0	0	0
NB	Through/Right	-	0	0.23	0	-	0	0.18	0
SB	Left	А	8	0.09	2	А	9	0.27	8
SB	Through/Right	-	0	0.12	0	-	0	0.28	0
Нои	vard Marshall @ Hilltop								
EB	Left/Through/Right	А	8	0.14	-	А	10	0.4	-
WB	Left/Through/Right	А	8	0.09	-	А	9	0.16	-
NB	Left/Through/Right	В	10	0.39	-	В	10	0.3	-
SB	Left/Through/Right	А	7	0.02	-	А	8	0.01	-
Nort	humberland @ Stanley								
EB	Left/Through/Right	А	9	0.15	-	В	11	0.23	-
WB	Left/Through	С	8	0.03	-	А	10	0.09	-
WB	Right		17	0.78	-		9	0.47	-
NB	Left/Through/Right	А	8	0.01	-	А	9	0.04	-
SB	Left/Through/Right	В	11	0.44	-	F	194	1.4	-
	Hilltop @ Wrigley								
EB	Through	-	0	0.09	0	-	0	0.08	0
WB	Left	А	8	0.03	<1	А	8	0.12	3
WB	Through	-	0	0.03	0	-	0	0.06	0
NB	Left/Right	В	11	0.32	10	В	12	0.19	5
	Swan @ Stanley								
EB	Through/Right	-	0	0.21	0	-	0	0.6	0
WB	Left/Through	А	3	0.02	<1	А	4	0.04	1
NB	Left/Right	F	163	1.29	256	F	177	1.29	178
Sn	an @ Brant-Waterloo								
EB	Left/Through/Right	А	9	0.01	<1	В	12	0.03	<1
WB	Left/Through/Right	В	10	0.05	1	В	11	0.04	<1
NB	Left/Through/Right	А	0	0	0	А	0	0	<1
SB	Left/Through/Right	А	1	0.01	<1	А	0	0	<1
Rob	ert Woolner @ Howard Marshall								
EB	Left/Through	А	8	0.02	<1	А	8	0.01	0
WB	Through/Right	-	0	0.14	0	-	0	0.08	0
SB	Left/Right	А	10	0.1	3	В	11	0.31	10
S	Swan @ Leslie Davis								
WB	Left/Right	А	9	0.19	5	А	9	0.12	3
NB	Through/Right	-	0	0	0	-	0	0.01	0

Table 7: Future 2031 Total Traffic Operations

Intersection	N	/eekday A.M	I. Peal	(V	Veekday P.N	I. Peal	K
Approach / Movement	LOS	Delays (s)	v/c	95 th	LOS	Delays (s)	v/c	95 th
SB Left/Through	А	7	0.04	<1	А	8	0.13	3
Robert Woolner @ Gourlay Farm								
EB Left/Right	А	9	0.01	<1	А	9	0.01	<1
NB Left/Through	-	0	0	0	-	0	0	0
SB Through/Right	-	-	0	0	-	-	0.01	0
Robert Woolner /Street F @ Freer								
EB Left/Through	-	0	0	0	-	0	0	0
WB Through/Right	-	0	0.08	0	-	0	0.05	0
SB Left/Right	А	0	0	0	А	0	0	0
Robert Woolner @ Street A								
EB Through/Right	-	0	0.04	0	-	0	0.15	0
WB Left/Through	-	0	0	0	-	0	0	0
NB Left/Right	В	10	0.13	3	В	11	0.09	2.2
Leslie Davis @ Street A							1	
EB Left/Through/Right	А	8	0.01	-	А	8	0.01	-
WB Left/Through/Right	А	7	0.01	-	А	7	0	-
NB Left/Through/Right	А	7	0.1	-	А	7	0.06	-
SB Left/Through/Right	А	7	0.04	-	А	8	0.13	-
Leslie Davis @ Robert Woolner								
EB Left/Through/Right	А	7	0	-	А	7	0	-
WB Left/Through/Right	А	6	0.01	-	А	6	0.01	-
NB Left/Through/Right	А	7	0	-	А	7	0	-
SB Left/Through/Right	А	7	0	-	А	7	0.01	-
Brant-Waterloo @ Robert Woolner								
EB Left/Through	А	2	0	0	А	2	0	<1
WB Through/Right	-	0	0.01	0	-	0	0.01	0
SB Left/Right	А	8	0	<1	А	8	0	<1
Brant-Waterloo @ Street A								
EB Left/Through	А	7	0	<1	А	7	0.01	<1
WB Through/Right	-	0	0	0	-	0	0	0
SB Left/Right	А	8	0.02	<1	А	8	0.01	<1
LOS – Level of Service v/c – Volume t	o Capac	ity Ratio 9	95 th – 95	th perce	ntile que	eue length in m	netres	

Under future 2031 total conditions, the two intersections identified as operating at unacceptable conditions under 2031 background conditions become worse:

- At the intersection of Northumberland Street and Stanley Street, the southbound left turn volumes are particularly high during the PM peak hour and are expected to experience delays of 194 seconds. The volume at the approach will exceed the available capacity.
- Long delays close to or exceeding 200 seconds will also be experienced by the northbound approach at the intersection of Stanley Street and Swan Street during both peak periods. In both peak periods, the northbound left turn is a critical movement at the intersection.

Other movements at the study area intersections are expected to continue to operate at LOS D or better and with volume to capacity ratios of 0.78 or lower, indicating that intersections will operate well and with residual capacity. Only the eastbound movement at the intersection of Swan Street and Hilltop Drive, representing vehicles exiting the private driveway (west leg) will experience long delays and LOS E or F in the peak periods due to limited gaps in the high north-south through movement to complete turning movements. However, the volumes are very low in both peak periods.

6 Road Network Improvements Analysis

6.1 Signal Warrant Analysis

The analysis of 2031 future total traffic conditions indicate that the southbound approach of the intersection of Northumberland Street and Stanley Street will not operate at desirable LOS and is subject to higher volumes than the available capacity. An all-way stop control is already warranted at this intersection in 2027 as per the recommendations in the Hilltop TIS.

In 2031, the adjacent intersection of Swan Street is also expected to experience operational constraints on the northbound approach. Based on the guidelines presented in the **Ontario Traffic Manual – Book 5, Regulatory Signs**, an all-way stop control may not be considered at the intersection of Swan Street and Stanley Street as well, since it is less than 250 metres east of the intersection of Northumberland Street and Stanley Street. Based on these findings and constraints a traffic signal warrant analysis was completed to evaluate the potential for installation of traffic signals at the intersection of Northumberland and Stanley Street.

Signal warrants for future 2031 total conditions for the existing intersection of Northumberland Street and Stanley Street was completed as per the most recent version of Section 4.10a of the **Ontario Traffic Manual - Book 12, Traffic Signals** (March 2012), based on the Region's Capacity Analysis Requirements. Although the preferred approach is using eight-hour volume projections and evaluation against Justification 1, 2 or 3, there was insufficient data to confirm the hourly variation in traffic during the off-peak period.

Justification 7 – Projected Volumes in OTM Book 12 provides a method to determine whether a traffic signal is justified for future developments using the Average Hourly Volume (AHV). The Average Hourly Volume is calculated using the AM and PM Peak hour volumes determined for the future planning horizon.

Justification 7 considers minimum vehicular volume and delay to cross traffic, similar to Justification 1 and 2, but requires 120 percent compliance for both cases for an existing intersection to warrant a traffic signal. Results for the intersections are summarized in **Table 8**.

		Minimum		Compliance	
Justification	Description	Requirement 1 Lane Highways	Secti	onal	Entire %
		Restricted Flow	Numerical	%	
	A. Vehicle volume, all				
1. Minimum	approaches	720	715	99%	
Vehicular	(average hour)				
Volume	B. Vehicle volume, along				98%
	minor streets	170	166	98%	
	(average hour)				
	A. Vehicle volume, major				
	street (average	720	548	76%	
2. Delay to	hour)				
cross	B. Combined vehicle and				76%
traffic	pedestrian				
	volume crossing artery from	75	295	393%	
	minor streets				
	(average hour)				

Table 8: Signal Warrant - OTM Book 12 Justification 7

For an existing intersection to warrant a traffic signal under future conditions, both Justification 1 and 2 must be satisfied by 120% compliance. Only Justification 2B compliance (393%) satisfies the 120% requirement while Justification 2A remains well below the requirement, confirming that Justification 2 Delay to Cross Traffic is not satisfied. Therefore, for the intersection of Northumberland Street and Stanley Street, since Justification 1 and 2 are not at or above 120%, the installation of a traffic signal is not warranted in 5 years after full build-out.

6.2 Other Improvements

Consideration was given to auxiliary lanes at the two intersections of Stanley Street with Northumberland Street and Swan Street, and determined that they did not provide operational benefits to either intersection during the peak hours. In addition, due to the built up surroundings of the intersections, property takes may be required to accommodate any potential auxiliary lanes. Hence, no auxiliary lane warrant analysis is included in this document.

An alternative that may be considered in place of a traffic signal at the intersection of Northumberland Street and Stanley Street is a single-lane roundabout. A roundabout may provide gateway characteristic to the downtown Ayr area and potential capacity improvements. However, a roundabout may require a large footprint and incur additional costs for construction. To consider a roundabout the Region requires an Intersection Control Study to evaluate the feasibility of implementing a roundabout at a particular location in comparison to other forms of traffic control. Prior to undertaking such a study, the Region also requires the completion of an Initial Screening Form.

7 Traffic Calming

In 2014, BA Group conducted a Traffic Calming Study using the expected daily traffic volumes generated from the Hilltop Estates Subdivision and the subject site of the current study at 869 Brant-Waterloo Road. The study reviewed the potential for higher vehicle speeds on internal roadways

within the Hilltop Estates Subdivision and based on an evaluation of potential traffic calming measures, recommended traffic circles with mountable islands as the preferred alternative at the following internal intersections:

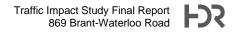
- Leslie Davis Street and Robert Woolner Street
- Vincent Drive and Gourlay Farm Lane

The recommended traffic circles are expected to reduce vehicle speeds, but ensure less of an impact on emergency service response times. The BA study assumes that Leslie Davis Street provides Hilltop Estates Subdivision with connections to Swan Street as well as to the subject site at 869 Brant-Waterloo Road, thereby carrying the highest volumes of traffic in the internal road network. Implementation of the traffic circle at the intersection of Leslie Davis Street and Robert Woolner Street will reduce long straight sections of Leslie Davis Street, and reduce the potential for high speeds for the expected traffic on this road.

In the current study for the subject site at 869 Brant-Waterloo Road, a traffic circle is also recommended at the intersection of Leslie Davis Street and Street A, located east of Robert Woolner Street. Although the analysis presented in this study indicates that a direct connection to Swan Street through the Hilltop Estates Division is not necessary to support the site generated trips, traffic calming benefits of a traffic circle can be still recognized on Leslie Davis Street since long straight sections of the roadway will be reduced.

As such, the traffic analysis completed in the current study includes a traffic circle with yield control on all approaches at the intersection of Leslie Davis Street and Robert Woolner Street. The functional design for the proposed traffic circle has been completed, replicating the design provided in the BA Study, and is shown in **Exhibit 16**. The proposed traffic circle includes the following:

- 7m Inscribed Circle Diameter for the traffic circle
- 7m of pavement around the circle
- Sidewalk on the west side of Street A and pedestrian crossings on the eastbound and northbound approaches



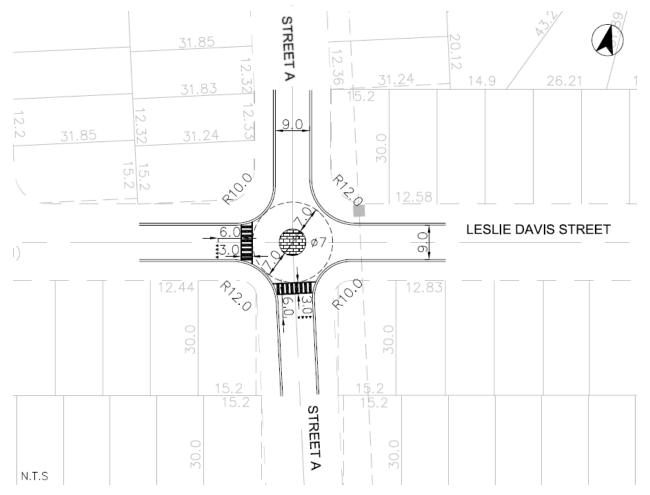


Exhibit 16 Functional Design of Traffic Circle at Leslie Davis Drive and Street A

8 Conclusions & Recommendations

The key findings of the study are summarized below:

- Under existing conditions all intersections and movements operate at acceptable levels.
- With the latent background traffic growth and addition of background developments, namely
 from Hilltop Estates Subdivision, the future road network is mostly able to accommodate
 traffic in the 2020 and 2027 horizon years. The only intersection that is expected to reach
 capacity conditions is the intersection of Northumberland and Stanley Street in the 2031 PM
 Peak hour, due to heavy southbound left turns. The intersection of Stanley Street and Swan
 Street will continue to operate with reserve capacity and the northbound approach will
 operate at LOS E.
- Traffic generated from the subject site at 869 Brant-Waterloo Road and distributed to the future road network in Phase 1 (2020) and at 5 years from full build-out (2031) will result in added volumes at the critical intersections of Northumberland Street and Stanley Street, and Stanley Street and Swan Street. As a result, the southbound approach at the intersection of Northumberland and Stanley Street will reach capacity conditions in 2020, and additionally, the northbound approach at the intersection of Swan Street and Stanley Street is expected to experience above capacity conditions by 2031. However, since the intersection of Northumberland Street and Stanley Street is expected to remain unchanged from the unusual existing configuration in 2020, the delays for southbound vehicles may be lower than indicated by the proxy analysis of a two-way stop controlled intersection (refer to Section for details). We believe the reported delays will be lower given the conservative analysis method.
- In year 2020, the proposed 869 Brant-Waterloo Road development will only add 9-13% to the southbound approach at the intersection of Northumberland and Stanley Street and 14-15% to the northbound approach at the intersection of Swan Street and Stanley Street, relative to existing and background traffic.
- A signal warrant analysis at the intersection of Northumberland Street and Stanley Street is **not warranted** under 2031 total traffic conditions based on Ontario Traffic Manual Book 12.
- The intersection of Stanley Street and Swan Street located 88 metres east of the intersection of Northumberland Street and Stanley Street, and therefore was not considered an ideal location for another all-way stop controlled intersection.
- All movements at the remaining intersections will continue to perform within LOS D or better and with reserve capacity under both 2020 and 2031 total traffic conditions.
- The proposed development traffic can be accommodated on the existing road network (using Howard Marshall and Hilltop Drive to access either Swan Street or Wrigley Road) for both Phase 1 and for the ultimate build-out in 2031. The analysis has demonstrated that the proposed development does not rely on a connection to Swan Street via Leslie Davis Street in Phase 1 or in 2031 (although the connection will be available). This is because the intersections of Hilltop drive and Swan Street, and Hilltop Drive and Howard Marshall Street are expected to operate within acceptable levels of service and with reserve capacity when subjected to all site traffic generated from the proposed development at 869 Brant-Waterloo

Road. The proposed development will also not have any major traffic volumes distributed to Brant-Waterloo Road.

• At full build-out of the proposed site, most internal intersections are expected to have stop control on the minor approach. The intersection of Leslie Davis Street and Street A is proposed to be a traffic circle and provide traffic calming for the internal road network of the proposed development.

Based on the findings above, Phase 1 of the proposed development will not require any physical external or internal road network improvements.

For the 2031 horizon year representing 5 years from full build-out of the proposed site, it is expected that the site traffic will add incremental delays at the critical intersections of Northumberland Street and Stanley Street and Stanley Street and Swan Street. However, there are no other alternative routes for trips to and from the north via Swan Street. Physical improvements such as the addition of auxiliary lanes at the critical intersections are not expected to mitigate the 2031 traffic operating conditions.

A traffic signal is not warranted at the intersection of Northumberland Street and Stanley Street under forecast 2031 conditions.

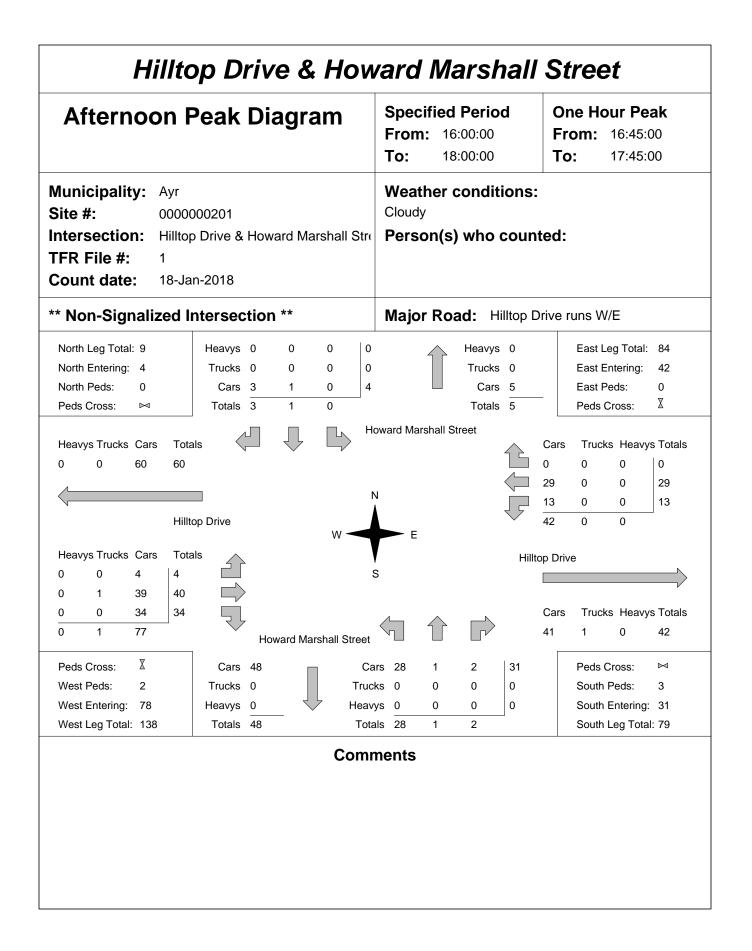
In year 2031, the proposed 869 Brant-Waterloo Road development will only add 18-21% to the southbound approach at the intersection of Northumberland and Stanley Street and 24-25% to the northbound approach at the intersection of Swan Street and Stanley Street, relative to existing and background traffic.

However, it is recommended that the future traffic volumes be monitored to confirm operating conditions and re-evaluate the necessity for signalization or any other road/intersection improvements. A full Intersection Control Study based on the Region's guidelines may be required to address issues that arise as traffic continues to increase at the critical intersections due to background growth within the Ayr Urban Area.

Appendix A

Turning Movement Counts

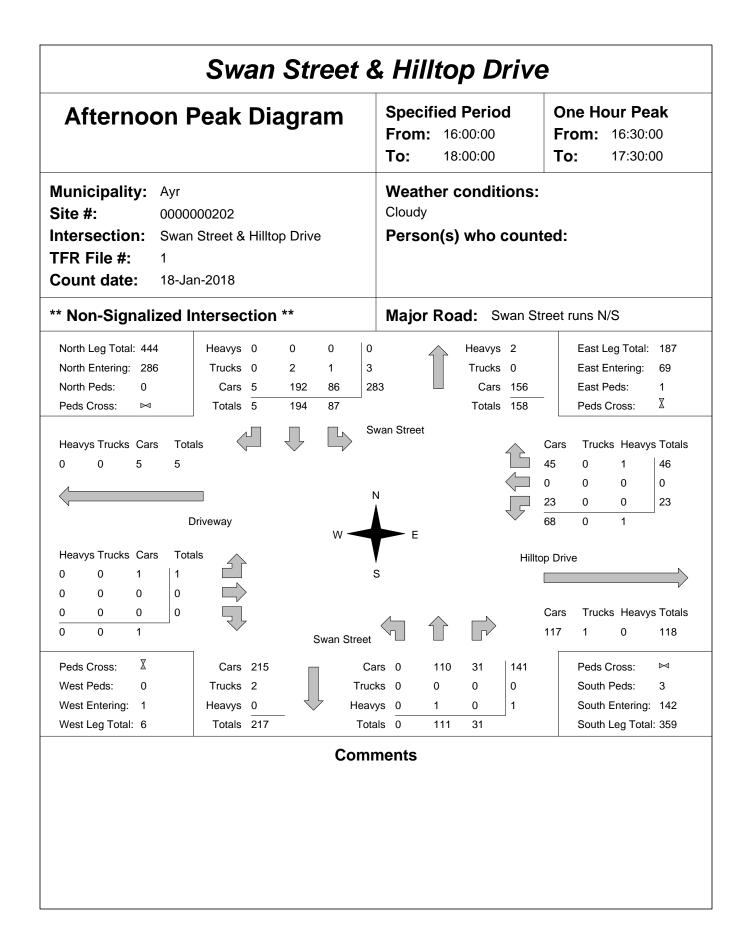
	Hilltop Dr ys 0 ks 0 rs 5 lls 5	rive runs Ea Ea Pe	ast Leg Total ast Entering: ast Peds: eds Cross: rucks Heave	36 0 X
Heavy Truck Ca Tota	ys 0 ks 0 rs 5 	Ea Ea Ea Pe Cars T	ast Leg Total ast Entering: ast Peds: eds Cross: rucks Heave	36 0 X
Truck Ca Tota	ks 0 rs 5 ils 5	Ea Ea Pe Cars T	ast Entering: ast Peds: eds Cross: rucks Heav	36 0 X
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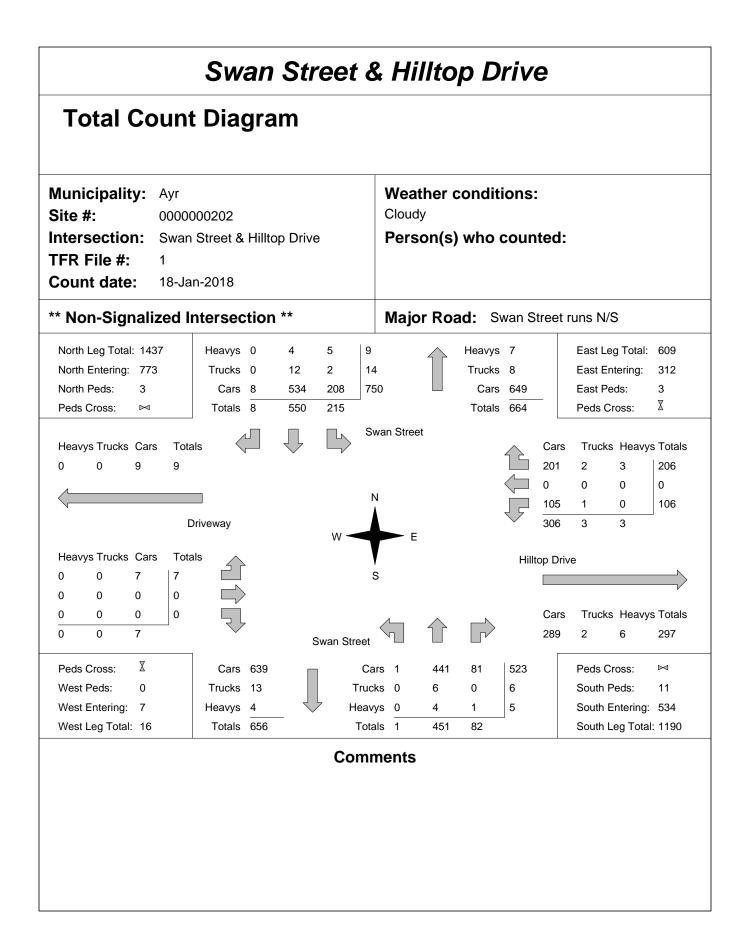


Hilltop Drive & Howard Marshall Street **Total Count Diagram** Weather conditions: Municipality: Ayr Site #: Cloudy 000000201 Intersection: Person(s) who counted: Hilltop Drive & Howard Marshall Stre TFR File #: 1 Count date: 18-Jan-2018 ** Non-Signalized Intersection ** Major Road: Hilltop Drive runs W/E North Leg Total: 44 Heavys 1 0 0 1 Heavys 2 East Leg Total: 258 Trucks 0 0 Trucks 0 North Entering: 29 0 0 East Entering: 134 North Peds: 0 Cars 22 6 0 28 Cars 13 East Peds: 1 X Totals 23 Totals 15 Peds Cross: 6 0 Peds Cross: ⋈ Howard Marshall Street Ъ Totals Trucks Heavys Totals Heavys Trucks Cars Cars 2 5 219 226 0 0 0 0 105 3 1 109 Ν 25 0 0 25 Hilltop Drive 130 3 1 w Heavys Trucks Cars Totals Hilltop Drive 2 0 8 10 S 2 3 99 104 0 100 101 Trucks Heavys Totals 1 Cars 5 3 3 3 207 118 124 Howard Marshall Street X Peds Cross: Peds Cross: \bowtie Cars 131 Cars 92 5 19 116 West Peds: 11 Trucks 0 Trucks 2 0 0 2 South Peds: 45 1 West Entering: 215 Heavys 1 Heavys 0 0 1 South Entering: 119 West Leg Total: 441 Totals 94 South Leg Total: 251 Totals 132 5 20 **Comments**

	Hilltop Drive & Howard Marshall Street Traffic Count Summary Intersection: Hilltop Drive & Howard Marshall St Count Date: 18-Jan-2018												
Intersection:	Hilltop D	rive & H				Date: 18-Jan-20		^{cipality:} Ay	r				
	North	n Appro	ach Tot	als						ach Tot			
	Include	es Cars, T	rucks, & H		Tatal	North/South		Include	es Cars, T	rucks, & H	,	Tatal	
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7:00:00 8:00:00 9:00:00 16:00:00 17:00:00 18:00:00	0 0 0 0	0 2 3 0 1 0	0 8 6 0 6 3	0 10 9 0 7 3	0 0 0 0	0 43 43 0 26 36	7:00:00 8:00:00 9:00:00 16:00:00 17:00:00 18:00:00	0 23 24 0 16 31	0 4 0 0 1	0 6 10 0 3 1	0 33 34 0 19 33	0 4 29 0 9 3	
Totals:			23 ach Tota rucks, & H		0	148 East/West		94 Wes	5 t Appro es Cars, T	20 ach Tota rucks, & H	119 als eavys	45	
Hour Ending	Left	Thru	Right	Grand Total	Total Peds	Total Approaches	Hour Ending	Left	Thru	Right	Grand Total	Total Peds	
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Site #: 000000202 Intersection: Swan Street & Hilltop Drive TFR File #: 1 Count date: 18-Jan-2018 ** Non-Signalized Intersection ** North Leg Total: 333 North Entering: 127 North Peds: 1 Peds Cross: Image: Colspan="2">Image: Colspan="2">Swar 0 0 Heavys Trucks Cars Totals 0 0 Driveway N	Weathe Cloudy Person(Major R	(s) who Road: Heavy Truck Ca	Swan St	reet ru	INS N/S East Leg East Ente East Ped Peds Cro Trucks	Total: ering: ds: oss:	135 101 1 X
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North Entering:127Trucks0505North Peds:1 $Cars$ 09423117Peds Cross: \bowtie Totals010225SwarHeavys TrucksCarsTotals \checkmark \checkmark \checkmark \checkmark \checkmark 00000 \checkmark \checkmark \checkmark \checkmark \checkmark DrivewayDrivewayDriveway \checkmark \checkmark \checkmark \checkmark		Truck	ks 4 rs <u>201</u>	Cars	East Ente East Ped Peds Cro	ering: ls: oss:	101 1
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Heavys Trucks Cars Totals			Hillto	op Drive			
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17:00:00 18:00:00	77 82	180 181	3 5	260 268	02		17:00:00 18:00:00	0 0	101 112	22 39	123 151	22
Totals:			8 ach Tota		3	1307				82 ach Tota		11
Hour	Include	es Cars, T	rucks, & H	,	Total	East/West	Hour	Include	es Cars, T	rucks, & H	eavys Grand	Total
Hour Ending	Left	Thru	Right	Grand Total	Total Peds	Total Approaches	Hour Ending	Left	Thru	Right	Total	Total Peds
7:00:00 8:00:00 9:00:00 16:00:00	0 35 25 0	0 0 0 0	0 73 58 0	0 108 83 0	0 1 0 0	0 111 86 0	7:00:00 8:00:00 9:00:00 16:00:00	0 3 3 0	0 0 0 0	0 0 0 0	0 3 3 0	0 0 0 0
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Hours En Crossing		0:00 0	0:00 0	7:00 0	8:00 46		9:00 28	16:00 0	17:00 29	18:00 24		

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	Wrigley	Road	& Hillt	top D	rive						
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Heavys Trucks Cars T	otals	W	E		Wrigley R	oad					
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Peds Cross:∑West Peds:0West Entering:94West Leg Total:207	Cars 151 Trucks 0 Heavys 0 Totals 151	Ca Truc Heav	ars 39 ks 0 ys <u>0</u> als 39	1	56 I	Peds Cro South Pe South Er South Le	eds: ntering:				
		Comr	nents								

Wrigley Road	& Hilltop Drive
Total Count Diagram	
Municipality:AyrSite #:000000203Intersection:Wrigley Road & Hilltop DriveTFR File #:1Count date:18-Jan-2018	Weather conditions: Cloudy Person(s) who counted:
** Non-Signalized Intersection **	Major Road: Wrigley Road runs W/E
	East Leg Total: 783 East Entering: 377 East Peds: 1 Peds Cross: ^ℤ
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Heavys Trucks Cars Totals	Wrigley Road
2 2 149 153 6 8 335 Hilltop Drive	Cars Trucks Heavys Totals 391 10 5 406
West Peds: 1 Trucks 5 Trucks West Entering: 349 Heavys 4 Heavys	Ins 142 205 347 Peds Cross: ⋈ ks 0 4 4 South Peds: 13 ys 1 1 2 South Entering: 353 als 143 210 South Leg Total: 701
Comr	nents

						ad & H ount S	-		ive			
Intersection:	Vrialev	Road &				^{vate:} 18-Jan-20		cipality: Ay	r			
			ach Tot							ach Tot	als	
			rucks, & H			North/South				rucks, & H		
Hour Ending	Left	Thru	Right	Grand Total	Total Peds	Total Approaches	Hour Ending	Left	Thru	Right	Grand Total	Total Peds
7:00:00	0	0	0	0	0	0	7:00:00	0	0	0	0	0
8:00:00 9:00:00	0 0	0 0	0 0	0 0	0 0	142 100	8:00:00 9:00:00	43 44	0 0	99 56	142 100	4 5
16:00:00	0	0	0	0	0	001	16:00:00	44	0	0	0	0
17:00:00	0	0	0	0	0	66	17:00:00	32	0	34	66	1
18:00:00	0	0	0	0	0	45	18:00:00	24	0	21	45	3
Totals:	0	0	0	0	0	353		143	0	210	353	13
			ach Tota rucks, & H							ach Tota rucks, & H		
Hour	Left	Thru		Grand	Total	East/West Total	Hour	Left	Thru		Grand	Total
Ending 7:00:00	0	0	Right 0	Total 0	Peds 0	Approaches 0	Ending 7:00:00	0	0	Right 0	Total 0	Peds 0
8:00:00	15	36	Ő	51	ŏ	137	8:00:00	Ő	68	18	86	ŏ
9:00:00	26	32	0	58	1	142	9:00:00	0	56	28	84	0
16:00:00 17:00:00	0 70	0 62	0	0 132	0 0	0 220	16:00:00 17:00:00	0 0	0 36	0 52	0 88	0 1
18:00:00	84	52	0	136	0	227	18:00:00	0	36	55	91	ò
Totals: Hours En	195 ding:	182	0 Calc 8:00	<u>377</u> ulated V 9:00	1 /alues f 16:00	726 or Traffic Cr	ossing Ma 17:00	0 ajor Stre 17:00	<u>196</u> eet 18:00	153	349	1
Crossing			43	9.00 45	0.00		133	33	24			

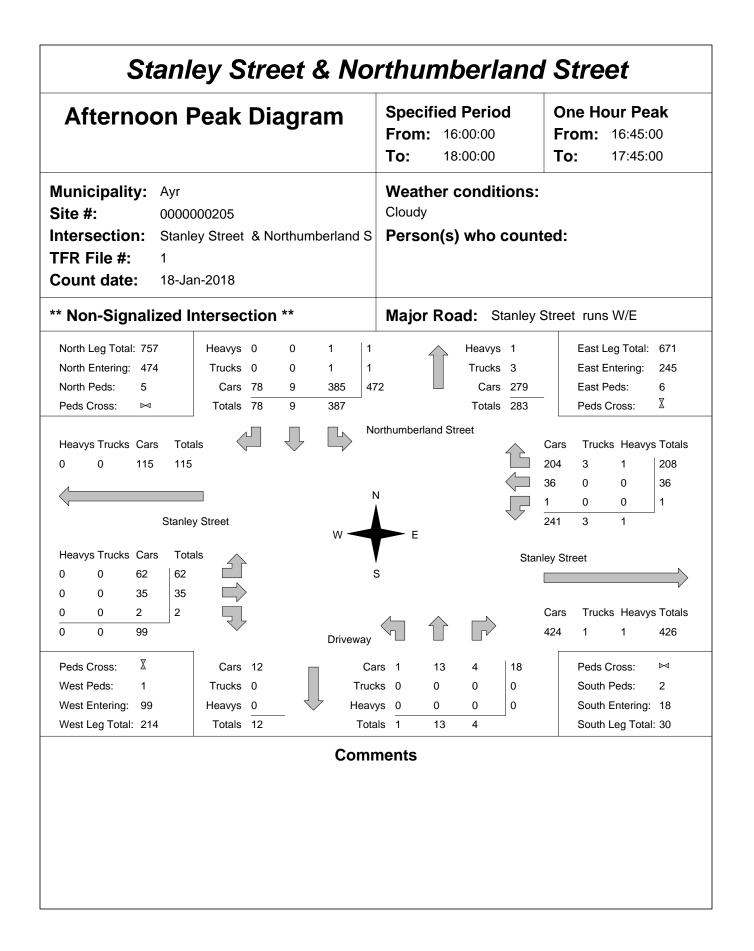
	Swan Street	& Stanle	y Stre	et		
Morning	Peak Diagram	Specified From: 7:0 To: 9:0			ne Hour Pe om: 7:30:0 o: 8:30:0	0
Site #: 0 Intersection: S TFR File #: 1	yr 000000204 stanley Street & Swan Street 8-Jan-2018	Weather c Cloudy Person(s)				
** Non-Signalize	ed Intersection **	Major Roa	d: Stanley	Stree	t runs W/E	
					East Leg Total: East Entering: East Peds: Peds Cross:	119 63 0 ∑
Heavys Trucks Cars 5 3 350	Totals 358			Cars	Trucks Heavy	vs Totals
<u>/</u>		N		41	1 1	43
\ {	Stanley Street			20 61	0 0	20
	W -	E				
Heavys Trucks Cars	Totals	V S	Star	nley Str	reet	
1 2 36 5 7 122	39 134			Cars	Trucks Heavy	
6 9 158	Swan St	eet 🔨		51	3 2	56
Peds Cross:IWest Peds:1West Entering:173West Leg Total:531	Cars 142 Trucks 7 Heavys 5 Totals 154	Cars 309 Frucks 2 leavys <u>4</u> Totals 315	15 324 1 3 1 5 17		Peds Cross: South Peds: South Entering: South Leg Tota	
	C/	mments				

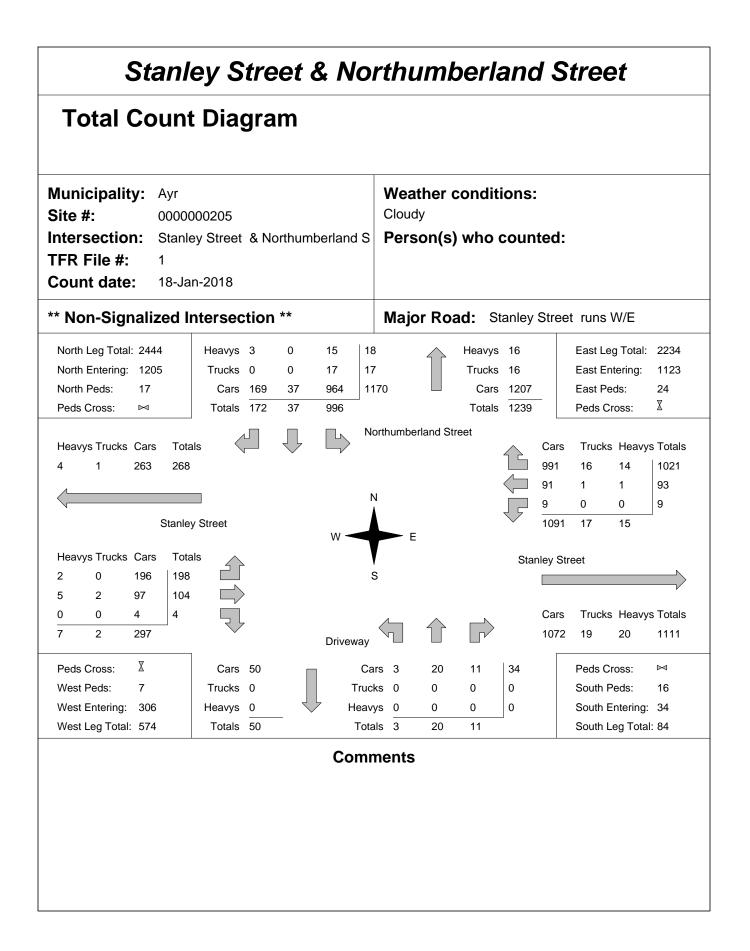
unicipality: Ayr te #: 000000204 tersection: Stanley Street & Swan Street FR File #: 1 ount date: 18-Jan-2018 Non-Signalized Intersection ** Heavys Trucks Cars Totals 4 242 247 Stanley Street Heavys Trucks Cars Totals 0 50 50 1 378 379	Cloudy Person	er condit n(s) who Road: S	coun	ted: Stree Cars	East L East E East P Peds C Truck 0 0	eg Total: ntering: eds:	73 0 X
Heavys Trucks Cars Totals 4 242 247 Stanley Street Heavys Trucks Cars Totals	E	Road: S	Stanley	Cars 50 23	East L East E East P Peds C Truck 0 0	eg Total: ntering: eds: Cross: S Heavy 0	73 0 X vs Totals
4 242 247 Stanley Street W Heavys Trucks Cars Totals	E		Į.	50 23	East E East P Peds C Truck 0 0	ntering: eds: Cross: s Heavy 0	73 0 X vs Totals
4 242 247 Stanley Street W Heavys Trucks Cars Totals	E		Ŷŀ	50 23	0 0	0	50
Stanley Street Heavys Trucks Cars Totals	E		↓ ↓	23	0		
Heavys Trucks Cars Totals	r –			23	-	0	23
Heavys Trucks Cars Totals	r –			73	0	0	
0 50 50			0				
			Star	nley Str	eet		
Z Z				Cars	Truck	s Heavy	s Totals
0 1 428 Swan Street				62	0	0	62
Peds Cross: X Cars 401 Ca	s 192	12	204		Peds C	Cross:	\bowtie
Vest Peds: 1 Trucks 1 Truck		0	4		South		1
Vest Entering: 429 Heavys 0 Vest Leg Total: 676 Totals 402 Totals	s 1 s 197	0	1			Entering: Leg Tota	
-		.2			Couli		
Comn	nents						

15 18 1075 1108 $I = 174 3 3 180$ $F = 174 3 3 180$	Site #:O000000204Intersection:Stanley Street & Swan StreetCloudyPerson(s) who counted:TER File #:1Count date:18-Jan-2018Major Road:Stanley Street runs W/EEast Leg Total:483Cars TotalsCars TotalsStanley StreetNNCars Trucks Heavys TotalsStanley StreetNMeavys Trucks Cars TotalsStanley StreetNNCars 973Trucks 16Peds Cross:XCars 973Trucks 16Peds Cross:XSuch Peds:10South Entering:20East Peds:3171Stanley StreetCars 973Trucks 16Peds Cross:XCars 973Trucks 16Peds Cross:Meavys 12219South Entering:106Such Entering:20Cars 973Trucks	Total Count	t Diagram												
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Site #:00000Intersection:StanleTFR File #:1	ey Street & Swan S	treet	Cloudy										
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} \text{East Entering: } 250\\ \text{East Peds: } 3\\ \text{Peds Cross: } \overline{X}\\ \end{array}$	* Non-Signalized I	ntersection **		Major Roa	ad: Stanle	y Stree	et runs W/E							
15 18 1075 1108 Stanley Street Heavys Trucks Cars Totals 3 3 165 171 19 18 1069 Peds Cross: \overline{X} West Peds: 6 West Leg Total: 2214 \overline{X}	15 18 1075 1108 Stanley Street Heavys Trucks Cars Totals 3 3 165 171 19 18 1069 Peds Cross: X West Peds: 6 West Leg Total: 2214 Cars 973 Trucks 16 Heavys 16 Totals 1005 Cars 973 Trucks 15 Heavys 12 Totals 928 Cars 928							East Entering: East Peds:	250 3						
15 18 1075 1108 Stanley Street Heavys Trucks Cars Totals 3 3 165 171 19 18 1069 Peds Cross: \overline{X} West Peds: 6 West Leg Total: 2214 Cars 973 Cars 973 Cars 973 Trucks 16 Heavys 12 2 7 12 2 116 12 116 1105 110	15 18 1075 1108 Stanley Street Heavys Trucks Cars Totals 3 3 165 171 19 18 1069 Peds Cross: \overline{X} West Peds: 6 West Leg Total: 2214 Cars 973 Trucks 16 Heavys 16 Totals 1005 Cars 973 Trucks 15 Heavys 12 Totals 928 Cars	Heavys Trucks Cars Tota	als				Cars	Trucks Heavy	s Totals						
N Stanley StreetN 43 70Stanley Street 69 10Stanley StreetStanley StreetCarsTrucks Heavys Totals 221Peds Cross:MPeds Cross:MSwan StreetStanley StreetCarsTrucks 16Trucks 16Frucks 154Nest Leg Total: 2214Stanley StreetCarsStanley StreetCarsTrucks 16News 16Frucks 154News 16Stanley StreetCarsStanley StreetCarsTrucks 16News 16Frucks 16News 16Stanley StreetSouth Peds: 10South Peds: 20South Leg Total: 1995 </td <td>N$1$$0$$1$$1$$0$$1$$1$$0$$1$$1$00000000000000000000<th <="" colspan="6" td=""><td>-</td><td>8</td><td></td><td></td><td>4</td><td></td><td></td><td></td></th></td>	N 1 0 1 1 0 1 1 0 1 1 00000000000000000000 <th <="" colspan="6" td=""><td>-</td><td>8</td><td></td><td></td><td>4</td><td></td><td></td><td></td></th>	<td>-</td> <td>8</td> <td></td> <td></td> <td>4</td> <td></td> <td></td> <td></td>						-	8			4			
Stanley StreetStanley StreetHeavys Trucks Cars Totals33165171161590419181069Peds Cross: \mathbb{X} West Peds:6West Entering:1106West Leg Total:2214Cars973Trucks16Heavys12161005Totals1005Totals1005Totals92862	Stanley StreetHeavys Trucks CarsTotals33165161590419181069Peds Cross: \mathbb{X} Cars973Trucks16Mest Peds:6West Leg Total:22141061005Totals1005 </td <td><u>/</u></td> <td></td> <td>Ν</td> <td>J</td> <td></td> <td></td> <td></td> <td></td>	<u>/</u>		Ν	J										
Heavys Trucks Cars Totals 3 3 165 16 15 904 19 18 1069 Peds Cross: X West Entering: 1106 West Leg Total: 2214 Cars 973 Trucks 16 Heavys 16 Totals 1005 Totals 928 Cars 901 Totals 928 Cars 901 Totals 928 Cars 973 Trucks Heavys Totals Stanley Street Cars Trucks Heavys Totals 221 7 5 233 Cars 977 Peds Cross: M South Peds: 10 South Leg Total: 1995	Heavys Trucks Cars Totals 3 3 165 16 15 904 19 18 1069 Peds Cross: X W F E S Stanley Street Cars Trucks Heavys Totals Swan Street Cars Trucks Heavys Totals Swan Street Cars Trucks Heavys Totals 221 7 5 233 Cars 973 Trucks 16 Heavys 16 Heavys 16 Heavys 12 2 1 14 South Peds: 10 South Entering: 990 South Leg Total: 2214	Staple		·					70						
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3 3 165 171 Image: stress of the str	Stante	Sueer	w <	E		243	4 5							
3 3 165 171 </td <td>3 3 165 171 Image: constraint of the constrain</td> <td>Heavys Trucks Cars Tota</td> <td>als</td> <td></td> <td></td> <td>Sta</td> <td>anley St</td> <td>reet</td> <td></td>	3 3 165 171 Image: constraint of the constrain	Heavys Trucks Cars Tota	als			Sta	anley St	reet							
16 15 904 935 Image: Carse of the carse of t	16 15 904 935 Image: Carse of the carse of t	0 0 405 474		ę	6										
19 18 1069 Swan Street 221 7 5 233 Peds Cross: X Cars 973 Cars 901 56 957 Peds Cross: M West Peds: 6 Trucks 16 Trucks 15 4 19 South Peds: 10 West Entering: 1106 Heavys 16 Totals 1005 Totals 928 62 14 South Leg Total: 1990 South Leg Total: 2214 Totals 1005 Totals 928 62 South Leg Total: 1995	19 18 1069 Swan Street 221 7 5 233 Peds Cross: X Cars 973 Cars 901 56 957 Peds Cross: M West Peds: 6 Trucks 16 Trucks 15 4 19 South Peds: 10 West Entering: 1106 Heavys 16 Totals 1005 Totals 928 62 South Leg Total: 1990						Cars	Trucks Heavy	s Totals						
Peds Cross:XCars973Cars90156957Peds Cross:>West Peds:6Trucks16Trucks15419South Peds:10West Entering:1106Heavys16Heavys12214South Leg Total:990West Leg Total:2214Totals1005Totals92862South Leg Total:1995	Peds Cross:XCars973Cars90156957Peds Cross: \bowtie West Peds:6Trucks16Trucks15419South Peds:10West Entering:1106Heavys16Heavys12214South Leg Total:1990West Leg Total:2214Totals1005Totals92862South Leg Total:1995			a a <i>i</i>	$\langle \neg \rangle$										
West Peds:6Trucks16Trucks15419South Peds:10West Entering:1106Heavys16Heavys12214South Entering:990West Leg Total:2214Totals1005Totals92862South Leg Total:1995	West Peds:6Trucks16Trucks15419South Peds:10West Entering:1106Heavys16Heavys12214South Entering:990West Leg Total:2214Totals1005Totals92862South Leg Total:1995]												
West Entering:1106Heavys16Heavys12214South Entering:990West Leg Total:2214Totals1005Totals92862South Leg Total:1995	West Entering:1106Heavys16Heavys12214South Entering:990West Leg Total:2214Totals1005Totals92862South Leg Total:1995														
West Leg Total: 2214 Totals 1005 Totals 928 62 South Leg Total: 1995	West Leg Total: 2214 Totals 1005 Totals 928 62 South Leg Total: 1995														
		-						-							
Comments	Comments			0											
				Comn	nents										

						t & Sta ount S		-	reet			
Intersection:	Stanley Stanley	Street &				^{vate:} 18-Jan-20		unicipality: A	vr			
	North	n Appro	ach Tot	als					th Appro	oach Tot	als	
	Include	es Cars, T	rucks, & H		T ()	North/South			les Cars, T		eavys	-
Hour Ending	Left	Thru	Right	Grand Total	Total Peds	Total Approaches	Hour Ending	Left	Thru	Right	Grand Total	Total Peds
7:00:00	0	0	0	0	0	0	7:00:0		-	0	0	0
8:00:00 9:00:00	0 0	0 0	0 0	0 0	0 0	315 265	8:00:0 9:00:0			17 18	315 265	2 4
16:00:00	0	Ő	Ő	Ő	Ő	0				0	0	0
17:00:00	0	0	0	0	0		17:00:0			15	214	3
18:00:00	0	0	0	0	0	196	18:00:0	00 184	. 0	12	196	1
Totals:	0 East	0	0 ach Tota	0	0	990		928	0 St Appro	62	990	10
			rucks, & H			East/West			les Cars, T			
Hour Ending	Left	Thru	Right	Grand Total	Total Peds	Total Approaches	Hour Ending	Left	Thru	Right	Grand Total	Total Peds
7:00:00	0	0	0	0	0	0	7:00:0		-	0	0	0
8:00:00 9:00:00	18 15	45 38	0 0	63 53	0 0	198 228	8:00:0 9:00:0		-	110 138	135 175	4
16:00:00	0	0	0	0	0	0	16:00:0			0	0	Ö
17:00:00	15	53	0	68 66	3				-	312	373	0 1
18:00:00	22	44	0	00	0	489	18:00:0		48	375	423	1
Totals:	70	180	0	250	3	1356		C	171	935	1106	6
						or Traffic Cr	ossing					
Hours En Crossing		7:00 0	8:00 302	9:00 248	16:00 0		17:0 20			18:00 71		

Weather conditions	:
Person(s) who cou	nted:
Major Road: Stanley	/ Street runs W/E
Heavys 5 Trucks 3 Cars 401 Totals 409	East Leg Total: 539 East Entering: 366 East Peds: 3 Peds Cross: X
orthumberland Street	
	Cars Trucks Heavys Totals 343 3 5 351
	14 0 0 14
	1 0 0 1
F F	358 3 5
Sta	anley Street
6	
	V
$ \land \land \land$	Cars Trucks Heavys Totals
	156 10 7 173
rs 1 1 1 3	Peds Cross: 🛛 🖂
xs 0 0 0	South Peds: 3
	South Entering: 3
ls 1 1 1	South Leg Total: 11
	Trucks 3 Cars 401 Totals 409 orthumberland Street E Standard Street E E Standard Street E E Standard Street E E E E E E E E





	S	tanl	-			North count S			nd S	tree	et	
Intersection:	Stanley Stanley	Street &				Date: 18-Jan-20		^{cipality:} Ay	r			
			ach Tot					Sout	h Appro	ach Tot	als	
-	Include	es Cars, T	rucks, & H		Tatal	North/South		Include	es Cars, T	rucks, & H		Tatal
Hour Ending	Left	Thru	Right	Grand Total	Total Peds	Total Approaches	Hour Ending	Left	Thru	Right	Grand Total	Total Peds
7:00:00 8:00:00 9:00:00 16:00:00 17:00:00 18:00:00	0 120 151 0 347 378	0 4 10 0 13 10	0 16 27 0 55 74	0 140 188 0 415 462	0 1 4 0 9 3	0 141 192 0 427 479	7:00:00 8:00:00 9:00:00 16:00:00 17:00:00 18:00:00	0 0 1 0 1 1	0 1 0 6 13	0 0 3 0 5 3	0 1 4 0 12 17	0 3 7 0 4 2
Totals:			172 ach Tot a rucks, & H	eavys	17	1239 East/West				11 ach Tota rucks, & H	eavys	16
Hour Ending	Left	Thru	Right	Grand Total	Total Peds	Total Approaches	Hour Ending	Left	Thru	Right	Grand Total	Total Peds
7:00:00 8:00:00 9:00:00 16:00:00 17:00:00 18:00:00	0 0 1 0 3 5	0 15 13 0 38 27	0 334 272 0 222 193	0 349 286 0 263 225	0 5 4 0 9 6	0 419 355 0 337 318	7:00:00 8:00:00 9:00:00 16:00:00 17:00:00 18:00:00	0 54 44 0 45 55	0 16 23 0 29 36	0 0 2 0 0 2	0 70 69 0 74 93	0 0 5 0 1 1
Totals: Hours En Crossing		93 7:00 0	1021 Calc 8:00 129	<u>1123</u> ulated V 9:00 171	24 /alues f 16:00 0	1429 or Traffic Cr	ossing M 17:00 371	198 ajor Stre 17:00 99	<u>104</u> eet 18:00 399	4 18:00 101	306	7

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Appendix B

Synchro Reports 2018 Existing Conditions

HCM Unsignalized Intersection Capacity Analysis 1: Swan & Hilltop

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		\$			\$			\$			\$	
Traffic Volume (veh/h)	3	0	0	31	0	70	0	133	9	25	102	0
Future Volume (Veh/h)	3	0	0	31	0	70	0	133	9	25	102	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	3	0	0	34	0	78	0	148	10	28	113	0
Pedestrians					1			7			1	
Lane Width (m)					3.5			3.5			3.5	
Walking Speed (m/s)					1.1			1.1			1.1	
Percent Blockage					0			1			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	401	328	120	330	323	155	113			159		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	401	328	120	330	323	155	113			159		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.3		
p0 queue free %	99	100	100	94	100	91	100			98		
cM capacity (veh/h)	505	581	931	613	585	892	1489			1383		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	3	112	158	141								
Volume Left	3	34	0	28								
Volume Right	0	78	10	20								
cSH	505	783	1489	1383								
	0.01	0.14	0.00	0.02								
Volume to Capacity	0.01	3.8	0.0	0.02								
Queue Length 95th (m)	12.2	10.4	0.0	1.7								
Control Delay (s)			0.0									
Lane LOS	B	B	0.0	A								
Approach Delay (s)	12.2	10.4	0.0	1.7								
Approach LOS	В	В										
Intersection Summary												
Average Delay			3.5									
Intersection Capacity Utilization	n		34.6%	IC	CU Level of	of Service			А			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis 2: Howard Marshall & Hilltop

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		\$			\$			\$			\$	
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	2	21	12	3	33	0	25	3	9	0	2	10
Future Volume (vph)	2	21	12	3	33	0	25	3	9	0	2	10
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	23	13	3	37	0	28	3	10	0	2	11
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	38	40	41	13								
Volume Left (vph)	2	3	28	0								
Volume Right (vph)	13	0	10	11								
Hadj (s)	-0.10	0.02	0.04	-0.51								
Departure Headway (s)	4.0	4.1	4.1	3.6								
Degree Utilization, x	0.04	0.05	0.05	0.01								
Capacity (veh/h)	890	868	848	972								
Control Delay (s)	7.1	7.3	7.3	6.6								
Approach Delay (s)	7.1	7.3	7.3	6.6								
Approach LOS	А	А	Α	А								
Intersection Summary												
Delay			7.2									
Level of Service			А									
Intersection Capacity Utiliza	ation		21.0%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis 21: Northumberland & Stanley

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			÷.	1		4			4	
Traffic Volume (veh/h)	57	20	0	1	14	351	1	1	1	152	7	17
Future Volume (Veh/h)	57	20	0	1	14	351	1	1	1	152	7	17
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	63	22	0	1	16	390	1	1	1	169	8	19
Pedestrians		1			3			3			1	
Lane Width (m)		3.5			3.5			3.5			3.5	
Walking Speed (m/s)		1.1			1.1			1.1			1.1	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	17			25			193	170	28	172	170	18
vC1, stage 1 conf vol									•			
vC2, stage 2 conf vol												
vCu, unblocked vol	17			25			193	170	28	172	170	18
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)								0.0	0.2		0.0	0.2
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			100			100	100	100	78	99	98
cM capacity (veh/h)	1612			1598			723	695	1047	759	695	1064
,					05 /		120	000	1047	100	000	1004
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1							
Volume Total	85	17	390	3	196							
Volume Left	63	1	0	1	169							
Volume Right	0	0	390	1	19							
cSH	1612	1598	1700	795	778							
Volume to Capacity	0.04	0.00	0.23	0.00	0.25							
Queue Length 95th (m)	0.9	0.0	0.0	0.1	7.6							
Control Delay (s)	5.5	0.4	0.0	9.5	11.2							
Lane LOS	А	А		А	В							
Approach Delay (s)	5.5	0.0		9.5	11.2							
Approach LOS				А	В							
Intersection Summary												
Average Delay			3.9									
Intersection Capacity Utilizati	on		43.9%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

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Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	1		٦	1	Y	
Traffic Volume (veh/h)	89	25	23	43	51	103
Future Volume (Veh/h)	89	25	23	43	51	103
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	99	28	26	48	57	114
Pedestrians					3	
Lane Width (m)					3.5	
Walking Speed (m/s)					1.1	
Percent Blockage					0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			130		216	116
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			130		216	116
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		93	88
cM capacity (veh/h)			1439		761	936
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	127	26	48	171		
Volume Left	0	26	0	57		
Volume Right	28	0	0	114		
cSH	1700	1439	1700	869		
Volume to Capacity	0.07	0.02	0.03	0.20		
Queue Length 95th (m)	0.0	0.4	0.0	5.5		
Control Delay (s)	0.0	7.5	0.0	10.2		
Lane LOS		А		В		
Approach Delay (s)	0.0	2.7		10.2		
Approach LOS				В		
Intersection Summary						
Average Delay			5.2			
Intersection Capacity Utilization	ation		24.6%	IC	U Level c	of Service
Analysis Period (min)			15			
, ,						

	-	7	*	-	1	1	
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	1	2011		4	Y		_
Traffic Volume (veh/h)	39	134	20	43	315	17	
Future Volume (Veh/h)	39	134	20	43	315	17	
Sign Control	Free	101	23	Free	Stop		
Grade	0%			0%	0%		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	
Hourly flow rate (vph)	43	149	22	48	350	19	
Pedestrians	1				4		
Lane Width (m)	3.5				3.5		
Walking Speed (m/s)	1.1				1.1		
Percent Blockage	0				0		
Right turn flare (veh)	v				v		
Median type	None			None			
Median storage veh)	Homo			110110			
Upstream signal (m)							
pX, platoon unblocked							
vC, conflicting volume			196		214	122	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol			196		214	122	
tC, single (s)			4.1		6.4	6.3	
tC, 2 stage (s)							
tF (s)			2.2		3.5	3.4	
p0 queue free %			98		54	98	
cM capacity (veh/h)			1384		760	916	
Direction, Lane #	EB 1	WB 1	NB 1				
Volume Total	192	70	369				
Volume Left	0	22	350				
Volume Right	149	0	19				
cSH	1700	1384	767				
Volume to Capacity	0.11	0.02	0.48				
Queue Length 95th (m)	0.0	0.4	20.1				
Control Delay (s)	0.0	2.5	14.0				
Lane LOS		A	В				
Approach Delay (s)	0.0	2.5	14.0				
Approach LOS			В				
Intersection Summary							
Average Delay			8.4				
Intersection Capacity Utiliza	ation		46.1%	IC	U Level c	of Service	
Analysis Period (min)			15				

HCM Unsignalized Intersection Capacity Analysis 35: Swan & Brant-Waterloo

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			\$	
Traffic Volume (veh/h)	2	0	4	0	4	5	2	96	2	5	69	3
Future Volume (Veh/h)	2	0	4	0	4	5	2	96	2	5	69	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	0	4	0	4	6	2	107	2	6	77	3
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	210	204	78	206	204	108	80			109		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	210	204	78	206	204	108	80			109		
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	99	99	100			100		
cM capacity (veh/h)	740	693	988	749	692	938	1531			1494		
,					002	000	1001			1101		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	6	10	111	86								
Volume Left	2	0	2	6								
Volume Right	4	6	2	3								
cSH	888	821	1531	1494								
Volume to Capacity	0.01	0.01	0.00	0.00								
Queue Length 95th (m)	0.2	0.3	0.0	0.1								
Control Delay (s)	9.1	9.4	0.1	0.5								
Lane LOS	А	А	А	А								
Approach Delay (s)	9.1	9.4	0.1	0.5								
Approach LOS	А	А										
Intersection Summary												
Average Delay			1.0									
Intersection Capacity Utiliza	ition		17.9%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis 1: Swan & Hilltop

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		\$			\$			\$			\$	
Traffic Volume (veh/h)	1	0	0	23	0	46	0	111	31	87	194	5
Future Volume (Veh/h)	1	0	0	23	0	46	0	111	31	87	194	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	1	0	0	26	0	51	0	123	34	97	216	6
Pedestrians					1			3				
Lane Width (m)					3.5			3.5				
Walking Speed (m/s)					1.1			1.1				
Percent Blockage					0			0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	604	571	222	557	557	141	222			158		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	604	571	222	557	557	141	222			158		
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	94	100	94	100			93		
cM capacity (veh/h)	370	404	820	419	411	906	1359			1433		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	1	77	157	319								
Volume Left	1	26	0	97								
Volume Right	0	51	34	6								
cSH	370	651	1359	1433								
Volume to Capacity	0.00	0.12	0.00	0.07								
Queue Length 95th (m)	0.1	3.0	0.0	1.7								
Control Delay (s)	14.8	11.3	0.0	2.8								
Lane LOS	В	В		А								
Approach Delay (s)	14.8	11.3	0.0	2.8								
Approach LOS	В	В										
Intersection Summary												
Average Delay			3.2									
Intersection Capacity Utilizat	tion		42.9%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis 2: Howard Marshall & Hilltop

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		\$			\$			\$			\$	
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	4	40	34	13	29	0	28	1	2	0	1	3
Future Volume (vph)	4	40	34	13	29	0	28	1	2	0	1	3
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	4	44	38	14	32	0	31	1	2	0	1	3
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	86	46	34	4								
Volume Left (vph)	4	14	31	0								
Volume Right (vph)	38	0	2	3								
Hadj (s)	-0.26	0.06	0.15	-0.45								
Departure Headway (s)	3.8	4.1	4.3	3.8								
Degree Utilization, x	0.09	0.05	0.04	0.00								
Capacity (veh/h)	936	858	799	920								
Control Delay (s)	7.1	7.4	7.5	6.8								
Approach Delay (s)	7.1	7.4	7.5	6.8								
Approach LOS	А	А	А	А								
Intersection Summary												
Delay			7.3									
Level of Service			А									
Intersection Capacity Utiliza	tion		23.8%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			र्स	1		4			4	
Traffic Volume (veh/h)	62	35	2	1	36	208	1	13	4	387	9	78
Future Volume (Veh/h)	62	35	2	1	36	208	1	13	4	387	9	78
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	69	39	2	1	40	231	1	14	4	430	10	87
Pedestrians		1			6			2			5	
Lane Width (m)		3.5			3.5			3.5			3.5	
Walking Speed (m/s)		1.1			1.1			1.1			1.1	
Percent Blockage		0			1			0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	45			43			315	227	48	242	228	46
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	45			43			315	227	48	242	228	46
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 %	96			100			100	98	100	36	98	92
cM capacity (veh/h)	1569			1576			556	642	1019	668	641	1024
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1							
Volume Total	110	41	231	19	527							
Volume Left	69	1	0	1	430							
Volume Right	2	0	231	4	87							
cSH	1569	1576	1700	690	708							
Volume to Capacity	0.04	0.00	0.14	0.03	0.74							
Queue Length 95th (m)	1.0	0.0	0.0	0.6	51.1							
Control Delay (s)	4.8	0.2	0.0	10.4	23.4							
Lane LOS	A	A	0.0	B	C							
Approach Delay (s)	4.8	0.0		10.4	23.4							
Approach LOS	4.0	0.0		B	C							
Intersection Summary												
Average Delay			14.0									
Intersection Capacity Utiliza	ation		59.3%	IC	CU Level o	of Service			В			
Analysis Period (min)			15						-			

	-	7	1	-	1	1
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	1		٢	1	Y	
Traffic Volume (veh/h)	34	60	91	74	39	28
Future Volume (Veh/h)	34	60	91	74	39	28
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	38	67	101	82	43	31
Pedestrians					2	
Lane Width (m)					3.5	
Walking Speed (m/s)					1.1	
Percent Blockage					0	
Right turn flare (veh)					•	
Median type	None			None		
Median storage veh)				Tionio		
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			107		358	74
vC1, stage 1 conf vol					000	
vC2, stage 2 conf vol						
vCu, unblocked vol			107		358	74
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.1	J.E
tF (s)			2.2		3.5	3.3
p0 queue free %			93		93	97
cM capacity (veh/h)			1494		600	992
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	105	101	82	74		
Volume Left	0	101	02	43		
Volume Right	67	0	0	43 31		
cSH	1700	1494	1700	719		
Volume to Capacity	0.06	0.07	0.05	0.10		
	0.00	1.7	0.05	2.6		
Queue Length 95th (m)	0.0	7.6	0.0	10.6		
Control Delay (s)	0.0		0.0			
Lane LOS	0.0	A		B		
Approach Delay (s)	0.0	4.2		10.6		
Approach LOS				В		
Intersection Summary						
Average Delay			4.3			
Intersection Capacity Utilization	tion		22.9%	IC	U Level c	of Service
Analysis Period (min)			15			

	-	7	1	-	1	1	
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	ţ,			4	M		
Traffic Volume (veh/h)	50	379	23	50	197	12	
Future Volume (Veh/h)	50	379	23	50	197	12	
Sign Control	Free			Free	Stop		
Grade	0%			0%	0%		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	
Hourly flow rate (vph)	56	421	26	56	219	13	
Pedestrians	1				1		
Lane Width (m)	3.5				3.5		
Walking Speed (m/s)	1.1				1.1		
Percent Blockage	0				0		
Right turn flare (veh)							
Median type	None			None			
Median storage veh)							
Upstream signal (m)							
pX, platoon unblocked							
vC, conflicting volume			478		376	268	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol			478		376	268	
tC, single (s)			4.1		6.4	6.2	
tC, 2 stage (s)							
tF (s)			2.2		3.5	3.3	
p0 queue free %			98		64	98	
cM capacity (veh/h)			1094		611	775	
Direction, Lane #	EB 1	WB 1	NB 1				
Volume Total	477	82	232				
Volume Left	0	26	219				
Volume Right	421	0	13				
cSH	1700	1094	618				
Volume to Capacity	0.28	0.02	0.38				
Queue Length 95th (m)	0.0	0.6	13.2				
Control Delay (s)	0.0	2.8	14.3				
Lane LOS		A	В				
Approach Delay (s)	0.0	2.8	14.3				
Approach LOS			В				
Intersection Summary							
Average Delay			4.5				
Intersection Capacity Utilization	ation		49.3%	IC	U Level c	f Service	
Analysis Period (min)			15				
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HCM Unsignalized Intersection Capacity Analysis 35: Swan & Brant-Waterloo

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			\$			4	
Traffic Volume (veh/h)	6	2	3	0	2	4	3	116	2	4	166	4
Future Volume (Veh/h)	6	2	3	0	2	4	3	116	2	4	166	4
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	7	2	3	0	2	4	3	129	2	4	184	4
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	335	331	186	334	332	130	188			131		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	335	331	186	334	332	130	188			131		
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 %	99	100	100	100	100	100	100			100		
cM capacity (veh/h)	616	589	861	617	588	925	1398			1467		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	12	6	134	192								
Volume Left	7	0	3	4								
Volume Right	3	4	2	4								
cSH	658	777	1398	1467								
Volume to Capacity	0.02	0.01	0.00	0.00								
Queue Length 95th (m)	0.4	0.2	0.0	0.1								
Control Delay (s)	10.6	9.7	0.2	0.2								
Lane LOS	В	A	A	A								
Approach Delay (s)	10.6	9.7	0.2	0.2								
Approach LOS	В	A	0.2	0.2								
Intersection Summary												
Average Delay			0.7									
Intersection Capacity Utiliza	ition		27.1%	IC	U Level o	of Service			А			
Analysis Period (min)			15	.0	5 _0.01				7.			

Appendix C

Synchro Reports

2020 and 2031 Future Background Conditions

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4		٦	T.		7	T.	
Traffic Volume (veh/h)	4	0	0	32	0	73	0	192	10	26	122	0
Future Volume (Veh/h)	4	0	0	32	0	73	0	192	10	26	122	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	4	0	0	36	0	81	0	213	11	29	136	0
Pedestrians					1			3				
Lane Width (m)					3.5			3.5				
Walking Speed (m/s)					1.1			1.1				
Percent Blockage					0			0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	488	419	139	416	414	220	136			225		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	488	419	139	416	414	220	136			225		
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 %	99	100	100	93	100	90	100			98		
cM capacity (veh/h)	437	517	912	539	520	822	1461			1354		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	4	117	0	224	29	136						
Volume Left	4	36	0	0	29	0						
Volume Right	0	81	0	11	0	0						
cSH	437	708	1700	1700	1354	1700						
Volume to Capacity	0.01	0.17	0.00	0.13	0.02	0.08						
Queue Length 95th (m)	0.2	4.5	0.0	0.0	0.5	0.0						
Control Delay (s)	13.3	11.1	0.0	0.0	7.7	0.0						
Lane LOS	В	В			А							
Approach Delay (s)	13.3	11.1	0.0		1.4							
Approach LOS	В	В										
Intersection Summary												
Average Delay			3.1									
Intersection Capacity Utilization	on		33.4%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis 5: Howard Marshall & Hilltop

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		\$			\$			\$			\$	
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	3	22	13	6	34	0	26	7	14	0	3	11
Future Volume (vph)	3	22	13	6	34	0	26	7	14	0	3	11
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	3	24	14	7	38	0	29	8	16	0	3	12
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	41	45	53	15								
Volume Left (vph)	3	7	29	0								
Volume Right (vph)	14	0	16	12								
Hadj (s)	-0.09	0.03	-0.02	-0.48								
Departure Headway (s)	4.0	4.1	4.1	3.7								
Degree Utilization, x	0.05	0.05	0.06	0.02								
Capacity (veh/h)	879	855	853	954								
Control Delay (s)	7.2	7.3	7.3	6.7								
Approach Delay (s)	7.2	7.3	7.3	6.7								
Approach LOS	А	А	А	А								
Intersection Summary												
Delay			7.2									
Level of Service			А									
Intersection Capacity Utiliza	tion		19.5%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			र्भ	1		4			4	
Traffic Volume (veh/h)	59	21	0	2	15	416	2	2	2	173	8	18
Future Volume (Veh/h)	59	21	0	2	15	416	2	2	2	173	8	18
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	66	23	0	2	17	462	2	2	2	192	9	20
Pedestrians		1			6			2			5	
Lane Width (m)		3.5			3.5			3.5			3.5	
Walking Speed (m/s)		1.1			1.1			1.1			1.1	
Percent Blockage		0			1			0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	22			25			204	183	31	190	183	23
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	22			25			204	183	31	190	183	23
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 %	96			100			100	100	100	74	99	98
cM capacity (veh/h)	1600			1600			708	680	1042	736	680	1054
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1							
Volume Total	89	19	462	6	221							
Volume Left	66	2	0	2	192							
Volume Right	0	0	462	2	20							
cSH	1600	1600	1700	781	754							
Volume to Capacity	0.04	0.00	0.27	0.01	0.29							
Queue Length 95th (m)	1.0	0.0	0.0	0.2	9.3							
Control Delay (s)	5.5	0.8	0.0	9.6	11.7							
Lane LOS	A	A	0.0	A	В							
Approach Delay (s)	5.5	0.0		9.6	11.7							
Approach LOS		0.0		A	В							
Intersection Summary												
Average Delay			4.0									
Intersection Capacity Utiliza	ation		49.5%	IC	CU Level o	of Service			А			
Analysis Period (min)			15									

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Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	1		٦	1	¥	
Traffic Volume (veh/h)	92	26	26	45	53	114
Future Volume (Veh/h)	92	26	26	45	53	114
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	102	29	29	50	59	127
Pedestrians					2	
Lane Width (m)					3.5	
Walking Speed (m/s)					1.1	
Percent Blockage					0	
Right turn flare (veh)					v	
Median type	None			None		
Median storage veh)	None			None		
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			133		226	118
vC1, stage 1 conf vol			100		220	110
vC2, stage 2 conf vol						
vCu, unblocked vol			133		226	118
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)			7.1		0.4	0.2
tF (s)			2.2		3.5	3.3
p0 queue free %			98		92	3.3 86
cM capacity (veh/h)			1437		92 749	934
					749	904
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	131	29	50	186		
Volume Left	0	29	0	59		
Volume Right	29	0	0	127		
cSH	1700	1437	1700	866		
Volume to Capacity	0.08	0.02	0.03	0.21		
Queue Length 95th (m)	0.0	0.5	0.0	6.2		
Control Delay (s)	0.0	7.6	0.0	10.3		
Lane LOS		А		В		
Approach Delay (s)	0.0	2.8		10.3		
Approach LOS				В		
Intersection Summary						
Average Delay			5.4			
Intersection Capacity Utiliza	ation		25.6%	IC	U Level c	f Service
Analysis Period (min)			15	10		
			15			

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Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	ţ,			۹.	Y	
Traffic Volume (veh/h)	41	155	21	45	379	18
Future Volume (Veh/h)	41	155	21	45	379	18
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	46	172	23	50	421	20
Pedestrians	1				1	
Lane Width (m)	3.5				3.5	
Walking Speed (m/s)	1.1				1.1	
Percent Blockage	0				0	
Right turn flare (veh)	Ŭ				v	
Median type	None			None		
Median storage veh)	Tione			1 tonio		
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			219		230	133
vC1, stage 1 conf vol			210		200	100
vC2, stage 2 conf vol						
vCu, unblocked vol			219		230	133
tC, single (s)			4.1		6.4	6.3
tC, 2 stage (s)					0.1	0.0
tF (s)			2.2		3.5	3.4
p0 queue free %			98		44	98
cM capacity (veh/h)			1361		746	905
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	218	73	441			
Volume Left	0	23	441			
Volume Right	172	0	20			
cSH	1700	1361	752			
Volume to Capacity	0.13	0.02	0.59			
	0.13	0.02	29.4			
Queue Length 95th (m)	0.0	2.5	29.4 16.3			
Control Delay (s) Lane LOS	0.0	2.5 A	10.5 C			
	0.0		16.3			
Approach Delay (s)	0.0	2.5	10.3 C			
Approach LOS			U			
Intersection Summary						
Average Delay			10.1			
Intersection Capacity Utilization	on		51.4%	IC	U Level c	of Service
Analysis Period (min)			15			

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Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		र्भ	ħ		Y	
Traffic Volume (veh/h)	5	0	0	0	0	2
Future Volume (Veh/h)	5	0	0	0	0	2
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	0	0	0	0	2
Pedestrians	· ·	, ,	, ,	Ū	Ū	-
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)		None	NONC			
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				12	0
vC1, stage 1 conf vol	U				12	U
vC2, stage 2 conf vol						
vCu, unblocked vol	0				12	0
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)	4.1				0.4	0.2
tF (s)	2.2				3.5	3.3
p0 queue free %	100				3.5 100	3.3 100
	1623				100	100
cM capacity (veh/h)					1004	COUL
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	6	0	2			
Volume Left	6	0	0			
Volume Right	0	0	2			
cSH	1623	1700	1085			
Volume to Capacity	0.00	0.00	0.00			
Queue Length 95th (m)	0.1	0.0	0.0			
Control Delay (s)	7.2	0.0	8.3			
Lane LOS	А		А			
Approach Delay (s)	7.2	0.0	8.3			
Approach LOS			А			
Intersection Summary						
Average Delay			7.5			
Intersection Capacity Utiliza	ation		13.3%	IC	Ulevelo	of Service
Analysis Period (min)			15.578	10		
			15			

HCM Unsignalized Intersection Capacity Analysis 51: Swan & Brant-Waterloo

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
Traffic Volume (veh/h)	3	0	5	0	5	6	3	100	3	6	76	4
Future Volume (Veh/h)	3	0	5	0	5	6	3	100	3	6	76	4
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	3	0	6	0	6	7	3	111	3	7	84	4
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	228	220	86	224	220	112	88			114		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	228	220	86	224	220	112	88			114		
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	99	100	99	99	100			100		
cM capacity (veh/h)	717	677	978	727	677	946	1520			1488		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	9	13	117	95								
Volume Left	3	0	3	7								
Volume Right	6	7	3	4								
cSH	872	799	1520	1488								
Volume to Capacity	0.01	0.02	0.00	0.00								
Queue Length 95th (m)	0.2	0.4	0.0	0.1								
Control Delay (s)	9.2	9.6	0.2	0.6								
Lane LOS	А	А	А	А								
Approach Delay (s)	9.2	9.6	0.2	0.6								
Approach LOS	А	А										
Intersection Summary												
Average Delay			1.2									
Intersection Capacity Utiliza	ation		19.2%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

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Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	¥		4			र्स
Traffic Volume (veh/h)	4	54	0	1	16	0
Future Volume (Veh/h)	4	54	0	1	16	0
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	4	60	0	1	18	0
Pedestrians	•	00	Ŭ	•	10	Ŭ
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)			NONE			None
Upstream signal (m)						
pX, platoon unblocked	36	0			4	
vC, conflicting volume	30	U			1	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol	00	0			4	
vCu, unblocked vol	36	0			1	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	<u> </u>					
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	94			99	
cM capacity (veh/h)	965	1084			1622	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	64	1	18			
Volume Left	4	0	18			
Volume Right	60	1	0			
cSH	1076	1700	1622			
Volume to Capacity	0.06	0.00	0.01			
Queue Length 95th (m)	1.4	0.0	0.3			
Control Delay (s)	8.6	0.0	7.2			
Lane LOS	А		А			
Approach Delay (s)	8.6	0.0	7.2			
Approach LOS	А					
Intersection Summary						
Average Delay			8.2			
Intersection Capacity Utiliz	ation		18.1%	IC	Ulevelo	of Service
Analysis Period (min)			15	.0	5 201010	
			10			

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Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			र्भ	4	
Traffic Volume (veh/h)	3	0	0	3	1	1
Future Volume (Veh/h)	3	0	0	3	1	1
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	3	0	0	3	1	1
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)				110110	110110	
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	4	2	2			
vC1, stage 1 conf vol		-	-			
vC2, stage 2 conf vol						
vCu, unblocked vol	4	2	2			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	0.1	0.2				
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	1017	1083	1620			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	3	3	2			
Volume Left	3	0	0			
Volume Right	0	0	1			
cSH	1017	1620	1700			
Volume to Capacity	0.00	0.00	0.00			
Queue Length 95th (m)	0.1	0.0	0.0			
Control Delay (s)	8.5	0.0	0.0			
Lane LOS	А					
Approach Delay (s)	8.5	0.0	0.0			
Approach LOS	А					
Intersection Summary						
Average Delay			3.2			
Intersection Capacity Utiliz	zation		13.3%	IC	CU Level o	of Service
Analysis Period (min)			15			
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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4		ሻ	ţ,		٦	1+	
Traffic Volume (veh/h)	2	0	0	24	0	48	0	146	32	90	255	6
Future Volume (Veh/h)	2	0	0	24	0	48	0	146	32	90	255	6
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	0	0	27	0	53	0	162	36	100	283	7
Pedestrians					1			3				
Lane Width (m)					3.5			3.5				
Walking Speed (m/s)					1.1			1.1				
Percent Blockage					0			0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	702	686	290	667	671	181	290			199		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	702	686	290	667	671	181	290			199		
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 %	99	100	100	92	100	94	100			93		
cM capacity (veh/h)	315	346	752	353	352	861	1283			1384		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	2	80	0	198	100	290						
Volume Left	2	27	0	0	100	0						
Volume Right	0	53	0	36	0	7						
cSH	315	579	1700	1700	1384	1700						
Volume to Capacity	0.01	0.14	0.00	0.12	0.07	0.17						
Queue Length 95th (m)	0.1	3.6	0.0	0.0	1.8	0.0						
Control Delay (s)	16.5	12.2	0.0	0.0	7.8	0.0						
Lane LOS	С	В			А							
Approach Delay (s)	16.5	12.2	0.0		2.0							
Approach LOS	С	В										
Intersection Summary												
Average Delay			2.7									
Intersection Capacity Utiliza	tion		35.0%	IC	U Level o	of Service			А			
Analysis Period (min)			15									
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HCM Unsignalized Intersection Capacity Analysis 5: Howard Marshall & Hilltop

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		\$			\$			\$			\$	
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	5	42	36	21	30	0	29	5	5	0	2	4
Future Volume (vph)	5	42	36	21	30	0	29	5	5	0	2	4
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	47	40	23	33	0	32	6	6	0	2	4
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	93	56	44	6								
Volume Left (vph)	6	23	32	0								
Volume Right (vph)	40	0	6	4								
Hadj (s)	-0.25	0.08	0.06	-0.40								
Departure Headway (s)	3.8	4.2	4.3	3.9								
Degree Utilization, x	0.10	0.06	0.05	0.01								
Capacity (veh/h)	922	844	805	891								
Control Delay (s)	7.2	7.5	7.5	6.9								
Approach Delay (s)	7.2	7.5	7.5	6.9								
Approach LOS	А	А	А	А								
Intersection Summary												
Delay			7.4									
Level of Service			А									
Intersection Capacity Utiliza	ation		24.9%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			र्भ	1		4			4	
Traffic Volume (veh/h)	64	37	3	2	38	246	2	14	5	454	10	81
Future Volume (Veh/h)	64	37	3	2	38	246	2	14	5	454	10	81
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	71	41	3	2	42	273	2	16	6	504	11	90
Pedestrians		1			6			2			5	
Lane Width (m)		3.5			3.5			3.5			3.5	
Walking Speed (m/s)		1.1			1.1			1.1			1.1	
Percent Blockage		0			1			0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	47			46			329	238	50	256	239	48
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	47			46			329	238	50	256	239	48
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 %	95			100			100	97	99	23	98	91
cM capacity (veh/h)	1567			1572			541	632	1016	651	631	1021
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1							
Volume Total	115	44	273	24	605							
Volume Left	71	2	0	2	504							
Volume Right	3	0	273	6	90							
cSH	1567	1572	1700	687	687							
Volume to Capacity	0.05	0.00	0.16	0.03	0.88							
Queue Length 95th (m)	1.1	0.0	0.0	0.8	81.9							
Control Delay (s)	4.7	0.3	0.0	10.4	36.2							
Lane LOS	A	A		В	E							
Approach Delay (s)	4.7	0.0		10.4	36.2							
Approach LOS				В	E							
Intersection Summary												
Average Delay			21.4									
Intersection Capacity Utilizat	tion		64.5%	IC	U Level c	of Service			С			
Analysis Period (min)			15									

MovementEBTEBRWBLWBTNBLNBRLane ConfigurationsImage: Additional system of the system of
Lane Configurations Image: Configuration of the image: Configuration of th
Traffic Volume (veh/h) 36 62 101 77 41 33 Future Volume (Veh/h) 36 62 101 77 41 33 Sign Control Free Free Stop Grade 0% 0% Grade 0% 0% 0% 0% 0% Peak Hour Factor 0.90 0.90 0.90 0.90 0.90 Hourly flow rate (vph) 40 69 112 86 46 37 Pedestrians 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3 </td
Future Volume (Veh/h) 36 62 101 77 41 33 Sign Control Free Free Stop Grade 0% 1.1 1 0% Right turn flare (veh) 0 0%
Sign Control Free Free Stop Grade 0% 0% 0% Peak Hour Factor 0.90 0.90 0.90 0.90 Hourly flow rate (vph) 40 69 112 86 46 37 Pedestrians 2
Grade 0% 0% 0% Peak Hour Factor 0.90
Peak Hour Factor 0.90
Hourly flow rate (vph) 40 69 112 86 46 37 Pedestrians 2
Pedestrians2Lane Width (m)3.5Walking Speed (m/s)1.1Percent Blockage0Right turn flare (veh)1
Lane Width (m)3.5Walking Speed (m/s)1.1Percent Blockage0Right turn flare (veh)
Walking Speed (m/s)1.1Percent Blockage0Right turn flare (veh)0
Percent Blockage 0 Right turn flare (veh)
Right turn flare (veh)
Median storage veh)
Upstream signal (m)
pX, platoon unblocked
vC, conflicting volume 111 386 76
vC1, stage 1 conf vol
vC2, stage 2 conf vol
vCu, unblocked vol 111 386 76
tC, single (s) 4.1 6.4 6.2
tC, 2 stage (s)
tF (s) 2.2 3.5 3.3
p0 queue free % 92 92 96
cM capacity (veh/h) 1489 573 988
Volume Total 109 112 86 83
Volume Left 0 112 0 46
Volume Right 69 0 0 37
cSH 1700 1489 1700 705
Volume to Capacity 0.06 0.08 0.05 0.12
Queue Length 95th (m) 0.0 1.9 0.0 3.0
Control Delay (s) 0.0 7.6 0.0 10.8
Lane LOS A B
Approach Delay (s) 0.0 4.3 10.8
Approach LOS B
Intersection Summary
Average Delay 4.5
Intersection Capacity Utilization 23.9% ICU Level of Service
Analysis Period (min) 15

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Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	4Î			र्स	¥	
Traffic Volume (veh/h)	52	446	24	52	234	13
Future Volume (Veh/h)	52	446	24	52	234	13
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	58	496	27	58	260	14
Pedestrians	1				1	
Lane Width (m)	3.5				3.5	
Walking Speed (m/s)	1.1				1.1	
Percent Blockage	0				0	
Right turn flare (veh)	•				Ū	
Median type	None			None		
Median storage veh)				110110		
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			555		420	307
vC1, stage 1 conf vol			000		120	001
vC2, stage 2 conf vol						
vCu, unblocked vol			555		420	307
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					0.1	0.2
tF (s)			2.2		3.5	3.3
p0 queue free %			97		55	98
cM capacity (veh/h)			1025		575	737
					010	
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	554	85	274			
Volume Left	0	27	260			
Volume Right	496	0	14			
cSH	1700	1025	582			
Volume to Capacity	0.33	0.03	0.47			
Queue Length 95th (m)	0.0	0.6	19.1			
Control Delay (s)	0.0	2.9	16.6			
Lane LOS		А	С			
Approach Delay (s)	0.0	2.9	16.6			
Approach LOS			С			
Intersection Summary						
Average Delay			5.2			
Intersection Capacity Utiliza	ation		56.4%	IC	U Level c	of Service
Analysis Period (min)			15			

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Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		é.	t,		Y	
Traffic Volume (veh/h)	3	0	0	0	0	5
Future Volume (Veh/h)	3	0	0	0	0	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	3	0	0	0	0	6
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)		110110	10110			
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				6	0
vC1, stage 1 conf vol	Ū				U	U
vC2, stage 2 conf vol						
vCu, unblocked vol	0				6	0
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)	7.1				0.4	0.2
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	99
cM capacity (veh/h)	1623				1014	1085
					T	1000
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	3	0	6			
Volume Left	3	0	0			
Volume Right	0	0	6			
cSH	1623	1700	1085			
Volume to Capacity	0.00	0.00	0.01			
Queue Length 95th (m)	0.0	0.0	0.1			
Control Delay (s)	7.2	0.0	8.3			
Lane LOS	А		А			
Approach Delay (s)	7.2	0.0	8.3			
Approach LOS			А			
Intersection Summary						
Average Delay			8.0			
Intersection Capacity Utiliza	ation		13.3%	IC	U Level o	of Service
Analysis Period (min)			15			
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HCM Unsignalized Intersection Capacity Analysis 51: Swan & Brant-Waterloo

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
Traffic Volume (veh/h)	7	3	4	0	3	5	4	124	3	5	174	5
Future Volume (Veh/h)	7	3	4	0	3	5	4	124	3	5	174	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	8	3	4	0	3	6	4	138	3	6	193	6
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	363	357	196	361	358	140	199			141		
vC1, stage 1 conf vol		001	100	001	000		100					
vC2, stage 2 conf vol												
vCu, unblocked vol	363	357	196	361	358	140	199			141		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)		0.0	0.2	7.1	0.0	0.2						
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	99	100	100	99	99	100			100		
cM capacity (veh/h)	587	568	850	590	567	914	1385			1455		
					507	514	1000			1400		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	15	9	145	205								
Volume Left	8	0	4	6								
Volume Right	4	6	3	6								
cSH	635	759	1385	1455								
Volume to Capacity	0.02	0.01	0.00	0.00								
Queue Length 95th (m)	0.6	0.3	0.1	0.1								
Control Delay (s)	10.8	9.8	0.2	0.3								
Lane LOS	В	А	Α	А								
Approach Delay (s)	10.8	9.8	0.2	0.3								
Approach LOS	В	А										
Intersection Summary												
Average Delay			0.9									
Intersection Capacity Utilization	n		28.5%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

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Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	¥		t,			र्स
Traffic Volume (veh/h)	2	31	0	4	55	0
Future Volume (Veh/h)	2	31	0	4	55	0
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	34	0	4	61	0
Pedestrians				-		-
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)			110110			110110
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	124	2			4	
vC1, stage 1 conf vol	127	2			т	
vC2, stage 2 conf vol						
vCu, unblocked vol	124	2			4	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	U. T	0.2			7.1	
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	97			96	
cM capacity (veh/h)	838	1082			1618	
,			a- (1010	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	36	4	61			
Volume Left	2	0	61			
Volume Right	34	4	0			
cSH	1065	1700	1618			
Volume to Capacity	0.03	0.00	0.04			
Queue Length 95th (m)	0.8	0.0	0.9			
Control Delay (s)	8.5	0.0	7.3			
Lane LOS	А		А			
Approach Delay (s)	8.5	0.0	7.3			
Approach LOS	А					
Intersection Summary						
Average Delay			7.4			
Intersection Capacity Utiliz	ation		19.7%	IC	U Level o	of Service
Analysis Period (min)	-		15			

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Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			र्भ	4î	
Traffic Volume (veh/h)	2	0	0	2	3	3
Future Volume (Veh/h)	2	0	0	2	3	3
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	0	0	2	3	3
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)				110110	110110	
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	6	4	6			
vC1, stage 1 conf vol	U	т	U			
vC2, stage 2 conf vol						
vCu, unblocked vol	6	4	6			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	т.,	0.2	т. I			
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	1015	1079	1615			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	2	2	6			
Volume Left	2	0	0			
Volume Right	0	0	3			
cSH	1015	1615	1700			
Volume to Capacity	0.00	0.00	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	8.6	0.0	0.0			
Lane LOS	А					
Approach Delay (s)	8.6	0.0	0.0			
Approach LOS	А					
Intersection Summary						
Average Delay			1.7			
Intersection Capacity Utiliza	ation		13.3%	IC	CU Level o	of Service
Analysis Period (min)			15			
			10			

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4		ሻ	Þ		7	1.	
Traffic Volume (veh/h)	4	0	0	38	0	85	0	337	11	31	176	0
Future Volume (Veh/h)	4	0	0	38	0	85	0	337	11	31	176	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	4	0	0	42	0	94	0	374	12	34	196	0
Pedestrians					1			3				
Lane Width (m)					3.5			3.5				
Walking Speed (m/s)					1.1			1.1				
Percent Blockage					0			0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	732	651	199	648	645	381	196			387		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	732	651	199	648	645	381	196			387		
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 %	99	100	100	89	100	86	100			97		
cM capacity (veh/h)	285	379	845	376	382	668	1389			1181		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	4	136	0	386	34	196						
Volume Left	4	42	0	0	34	0						
Volume Right	0	94	0	12	0	0						
cSH	285	539	1700	1700	1181	1700						
Volume to Capacity	0.01	0.25	0.00	0.23	0.03	0.12						
Queue Length 95th (m)	0.3	7.5	0.0	0.0	0.7	0.0						
Control Delay (s)	17.8	13.9	0.0	0.0	8.1	0.0						
Lane LOS	С	В			А							
Approach Delay (s)	17.8	13.9	0.0		1.2							
Approach LOS	С	В										
Intersection Summary												
Average Delay			3.0									
Intersection Capacity Utilization			44.0%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis 5: Howard Marshall & Hilltop

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		\$			\$			\$			\$	
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	3	26	15	10	41	0	31	14	22	0	3	13
Future Volume (vph)	3	26	15	10	41	0	31	14	22	0	3	13
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	3	29	17	11	46	0	34	16	24	0	3	14
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	49	57	74	17								
Volume Left (vph)	3	11	34	0								
Volume Right (vph)	17	0	24	14								
Hadj (s)	-0.10	0.04	-0.04	-0.49								
Departure Headway (s)	4.1	4.2	4.1	3.7								
Degree Utilization, x	0.06	0.07	0.08	0.02								
Capacity (veh/h)	862	838	846	935								
Control Delay (s)	7.3	7.5	7.5	6.8								
Approach Delay (s)	7.3	7.5	7.5	6.8								
Approach LOS	А	А	Α	А								
Intersection Summary												
Delay			7.4									
Level of Service			А									
Intersection Capacity Utiliza	tion		22.5%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		\$			ŧ	1		\$			\$	
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	70	25	0	2	17	601	2	2	2	237	9	21
Future Volume (vph)	70	25	0	2	17	601	2	2	2	237	9	21
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	78	28	0	2	19	668	2	2	2	263	10	23
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1							
Volume Total (vph)	106	21	668	6	296							
Volume Left (vph)	78	2	0	2	263							
Volume Right (vph)	0	0	668	2	23							
Hadj (s)	0.19	0.02	-0.58	-0.13	0.13							
Departure Headway (s)	4.8	4.8	3.2	4.4	4.4							
Degree Utilization, x	0.14	0.03	0.59	0.01	0.36							
Capacity (veh/h)	697	695	1118	770	798							
Control Delay (s)	8.6	7.9	10.8	7.4	9.8							
Approach Delay (s)	8.6	10.7		7.4	9.8							
Approach LOS	А	В		Α	А							
Intersection Summary												
Delay			10.2									
Level of Service			В									
Intersection Capacity Utilizati	ion		62.9%	IC	U Level o	of Service			В			
Analysis Period (min)			15									

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Movement EBT EBR WBL WBT	NBL	NBR
Lane Configurations	Y	
Traffic Volume (veh/h) 109 31 34 53	62	146
Future Volume (Veh/h) 109 31 34 53	62	146
Sign Control Free Free	Stop	
Grade 0% 0%	0%	
Peak Hour Factor 0.90 0.90 0.90 0.90	0.90	0.90
Hourly flow rate (vph) 121 34 38 59	69	162
Pedestrians	2	
Lane Width (m)	3.5	
Walking Speed (m/s)	1.1	
Percent Blockage	0	
Right turn flare (veh)	v	
Median type None None		
Median storage veh)		
Upstream signal (m)		
pX, platoon unblocked		
vC, conflicting volume 157	275	140
vC1, stage 1 conf vol	210	110
vC2, stage 2 conf vol		
vCu, unblocked vol 157	275	140
tC, single (s) 4.1	6.4	6.2
tC, 2 stage (s)	•	•
tF (s) 2.2	3.5	3.3
p0 queue free % 97	90	82
cM capacity (veh/h) 1408	698	909
Direction, Lane # EB 1 WB 1 WB 2 NB 1		
Volume Total 155 38 59 231		
Volume Left 0 38 0 69		
Volume Right 34 0 0 162 cSH 1700 1408 1700 834		
Queue Length 95th (m) 0.0 0.6 0.0 8.6 Control Dolary (a) 0.0 7.6 0.0 11.0		
Control Delay (s) 0.0 7.6 0.0 11.0		
Lane LOS A B		
Approach Delay (s) 0.0 3.0 11.0		
Approach LOS B		
Intersection Summary		
Average Delay 5.8		
	J Level c	of Service
Analysis Period (min) 15		

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Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	4Î			र्स	¥	
Traffic Volume (veh/h)	48	215	25	53	558	21
Future Volume (Veh/h)	48	215	25	53	558	21
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	53	239	28	59	620	23
Pedestrians	1				1	
Lane Width (m)	3.5				3.5	
Walking Speed (m/s)	1.1				1.1	
Percent Blockage	0				0	
Right turn flare (veh)	-				-	
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			293		290	174
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			293		290	174
tC, single (s)			4.1		6.4	6.3
tC, 2 stage (s)					0.1	0.0
tF (s)			2.2		3.5	3.4
p0 queue free %			98		10	97
cM capacity (veh/h)			1279		687	859
					001	
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	292	87	643			
Volume Left	0	28	620			
Volume Right	239	0	23			
cSH	1700	1279	692			
Volume to Capacity	0.17	0.02	0.93			
Queue Length 95th (m)	0.0	0.5	97.2			
Control Delay (s)	0.0	2.7	43.7			
Lane LOS		A	E			
Approach Delay (s)	0.0	2.7	43.7			
Approach LOS			Е			
Intersection Summary						
Average Delay			27.7			
Intersection Capacity Utiliza	ation		67.7%	IC	U Level c	of Service
Analysis Period (min)			15			
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Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		र्स	ţ,		Y	
Traffic Volume (veh/h)	15	0	0	0	0	5
Future Volume (Veh/h)	15	0	0	0	0	5
Sign Control		Free	Free	·	Stop	Ū
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	17	0.50	0.30	0.50	0.50	6
Pedestrians	17	U	U	U	U	U
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		Nere	Ness			
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				34	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				34	0
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	99
cM capacity (veh/h)	1623				969	1085
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	17	0	6			
Volume Left	17	0	0			
Volume Right	0	0	6			
cSH	1623	1700	1085			
Volume to Capacity	0.01	0.00	0.01			
Queue Length 95th (m)	0.2	0.0	0.1			
Control Delay (s)	7.2	0.0	8.3			
Lane LOS	A	0.0	0.0 A			
Approach Delay (s)	7.2	0.0	8.3			
Approach LOS	1.2	0.0	0.5 A			
••						
Intersection Summary			7 5			
Average Delay			7.5			(0 ·
Intersection Capacity Utilizati	ion		13.3%	IC	U Level c	ot Service
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis 51: Swan & Brant-Waterloo

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
Traffic Volume (veh/h)	3	0	5	0	5	7	3	120	3	7	94	4
Future Volume (Veh/h)	3	0	5	0	5	7	3	120	3	7	94	4
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	3	0	6	0	6	8	3	133	3	8	104	4
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	274	264	106	268	264	134	108			136		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	274	264	106	268	264	134	108			136		
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	99	100	99	99	100			99		
cM capacity (veh/h)	668	640	954	680	639	920	1495			1461		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	9	14	139	116								
Volume Left	3	0	3	8								
Volume Right	6	8	3	4								
cSH	835	774	1495	1461								
Volume to Capacity	0.01	0.02	0.00	0.01								
Queue Length 95th (m)	0.2	0.4	0.0	0.1								
Control Delay (s)	9.4	9.7	0.2	0.6								
Lane LOS	А	А	А	А								
Approach Delay (s)	9.4	9.7	0.2	0.6								
Approach LOS	А	А										
Intersection Summary												
Average Delay			1.1									
Intersection Capacity Utiliza	tion		21.2%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

	4	*	t	1	1	Ŧ
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	¥		4		-	et.
Traffic Volume (veh/h)	10	175	0	3	52	0
Future Volume (Veh/h)	10	175	0	3	52	0
Sign Control	Stop		Free	Ū		Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	11	194	0.00	3	58	0.00
Pedestrians	11	134	U	0	50	U
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)			Mare			Nore
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked		-			_	
vC, conflicting volume	118	2			3	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	118	2			3	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	82			96	
cM capacity (veh/h)	847	1083			1619	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	205	3	58			
Volume Left	11	0	58			
Volume Right	194	3	0			
cSH	1067	1700	1619			
Volume to Capacity	0.19	0.00	0.04			
Queue Length 95th (m)	5.4	0.0	0.8			
Control Delay (s)	9.2	0.0	7.3			
Lane LOS	A	0.0	A			
Approach Delay (s)	9.2	0.0	7.3			
Approach LOS	3.2 A	0.0	7.0			
	, (
Intersection Summary			0.7			
0 ,		8.7			(Q)	
Intersection Capacity Utilization		28.5%	IC	U Level o	of Service	
Analysis Period (min)			15			

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Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			र्भ	4	
Traffic Volume (veh/h)	8	0	0	7	3	2
Future Volume (Veh/h)	8	0	0	7	3	2
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	9	0	0	8	3	2
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)				110110	110110	
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	12	4	5			
vC1, stage 1 conf vol	14	т	U			
vC2, stage 2 conf vol						
vCu, unblocked vol	12	4	5			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	V.7	5.2	7.1			
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	100	100			
cM capacity (veh/h)	1008	1080	1616			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	9	8	5			
Volume Left	9	0	0			
Volume Right	0	0	2			
cSH	1008	1616	1700			
Volume to Capacity	0.01	0.00	0.00			
Queue Length 95th (m)	0.2	0.0	0.0			
Control Delay (s)	8.6	0.0	0.0			
Lane LOS	А					
Approach Delay (s)	8.6	0.0	0.0			
Approach LOS	А					
Intersection Summary						
Average Delay 3.5						
		13.3%	IC	CU Level o	of Service	
Analysis Period (min)			15			

Lane Configurations 4 5 5 7 5 7 Traffic Volume (veh/h) 2 0 0 28 0 56 0 238 38 106 418 Sign Control Stop Stop Free Free Free Free Free Free Free Free 0% <th></th> <th>۶</th> <th>→</th> <th>*</th> <th>•</th> <th>Ŧ</th> <th>*</th> <th>1</th> <th>1</th> <th>1</th> <th>1</th> <th>ŧ</th> <th>~</th>		۶	→	*	•	Ŧ	*	1	1	1	1	ŧ	~
Traffic Volume (veh/h) 2 0 0 28 0 56 0 238 38 106 418 Future Volume (Veh/h) 2 0 0 28 0 56 0 238 38 106 418 Future Volume (Veh/h) 2 0 0 28 0 56 0 238 38 106 418 Grade 0%	Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (Veh/h) 2 0 0 28 0 56 0 238 38 106 418 Sign Control Stop Stop Free F			4			4		٦	ţ,		٦	ţ,	
Sign Control Stop Free Free Free Grade 0% 0		2		0	28		56	0	238	38	106	418	7
Grade 0% 0% 0% 0% 0% 0% Peak Hour Factor 0.90 0	Future Volume (Veh/h)	2	0	0	28	0	56	0	238	38	106	418	7
Peak Hour Factor 0.90	Sign Control		Stop			Stop			Free			Free	
Hourly flow rate (vph) 2 0 0 31 0 62 0 264 42 118 464 Pedestrians 1 3 3.5 3.7 3.7 3.7 3.7 3.7 3.7 3.7 3.7 4.1 4.1 4.1 4.1 4.1 4.1 4.1 4.1 4.1 4.1 4.1 4.1	Grade		0%			0%			0%			0%	
Pedestrians 1 3 Lane Witht (m) 3.5 3.5 Walking Speed (m/s) 1.1 1.1 Percent Blockage 0 0 Right turn flare (veh) None None Median storage veh) Upstream signal (m) None None pX, platoon unblocked - - - vC, conflicting volume 1030 1011 471 989 994 286 472 307 vC1, stage 1 conf vol -	Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Lane Width (m) 3.5 3.5 Walking Speed (m/s) 1.1 1.1 Percent Blockage 0 0 Right turn flare (veh) None None Median type None None Median storage veh) Upstream signal (m) None None pX, platoon unblocked vC, conflicting volume 1030 1011 471 989 994 286 472 307 vC1, stage 1 conf vol vC2, stage 2 conf vol vC2, stage 1 conf vol vC2, stage 2 conf vol vC1 4.1 <t< td=""><td>Hourly flow rate (vph)</td><td>2</td><td>0</td><td>0</td><td>31</td><td>0</td><td>62</td><td>0</td><td>264</td><td>42</td><td>118</td><td>464</td><td>8</td></t<>	Hourly flow rate (vph)	2	0	0	31	0	62	0	264	42	118	464	8
Walking Speed (m/s) 1.1 1.1 Percent Blockage 0 0 Right turn flare (veh) None None Median storage veh) Upstream signal (m) None None yz, platoon unblocked vC, conflicting volume 1030 1011 471 989 994 286 472 307 vC1, stage 1 conf vol vC, stage 2 conf vol vCu, unblocked vol 1030 1011 471 989 994 286 472 307 vC1, stage 1 conf vol vCu, unblocked vol 1030 1011 471 989 994 286 472 307 vC1, stage 1 conf vol vCu, unblocked vol 1030 1011 471 989 994 286 472 307 vC1, stage 1 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC2 222 20 307 tC2, stage 2 (s) T.1 6.5 6.2 7.1 6.5 6.2 4.1 4.1 tC2, stage 2 (s) T.1 0.0 3.3 3.5 4.0 3.3 2.2 2.2 2.0<	Pedestrians					1			3				
Percent Blockage 0 0 Right turn flare (veh) None None Median storage veh) Upstream signal (m) None None Upstream signal (m) pX, platoon unblocked vc. conflicting volume 1030 1011 471 989 994 286 472 307 vC1, stage 1 conf vol vc2, stage 2 conf vol vc1 41.1 4.1 4.1 4.1 4.1 102, 24.2 207 90 94 286 472 307 1011 4.1 4.1 1011 4.1 4.1 1011 4.1 4.1 1011 4.1 1011 4.1 1011 4.1 1011 4.1 1011 4.1 1011 4.1 1011 4.1 1011 4.1 1011 4.1 1011 4.1 1011 4.1 1011 4.1 1011 4.1 1011 4.1 1011 4.1 1011 4.1 1011 4.1	Lane Width (m)					3.5			3.5				
Right turn flare (veh) None None None Median storage veh) Upstream signal (m) None None None pX, platoon unblocked 1030 1011 471 989 994 286 472 307 vC1, stage 1 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC2, stage 1 4.1 4.1 vC2, stage 1 conf vol vC1, assige 1 6.5 6.2 7.1 6.5 6.2 4.1 4.1 tC, stage 1 conf vol vC2, stage (s) tf (s) 3.5 4.0 3.3 2.2 2.2 2.0 p0 queue free % 99 100 100 85 100 92 100 91 cM capacity (veh/h) 182 219 595 211 224 752 1100 1264 Direction, Lane # EB 1 WB 1 NB 1 NB 2 SB 1 SB 2 Volume 1264 Volume 1264 Volume 1264 1700 1264 1700 1264 1264 1264 1264 1264 1264 1264 1264	Walking Speed (m/s)					1.1			1.1				
Median type None None Median storage veh) Upstream signal (m) None None yz, platoon unblocked vc, conflicting volume 1030 1011 471 989 994 286 472 307 vC1, stage 1 conf vol vc2, stage 2 conf vol vc1 4.1 4.1 tC, sigle (s) 7.1 6.5 6.2 7.1 6.5 6.2 2.2 2.2 2.2 p0 queue free % 99 100 100 85 100 92 100 91 cdx capacity (veh/h) 182 219 595 211 224 752 1100 1264 Direction, Lane # EB 1 WB 1 NB 2 SB 1 SB 2 Volume 10 1264 100 1264 Volume Left 2 31 0 0 118 0 100 1264 1700 1264 1700 1264 1700 1264	Percent Blockage					0			0				
Median storage veh) Upstream signal (m) pX, platoon unblocked vC, conficting volume 1030 1011 471 989 994 286 472 307 vC, conficting volume 1030 1011 471 989 994 286 472 307 vCL, stage 1 conf vol vC2, stage 2 conf vol vCu, unblocked vol 1030 1011 471 989 994 286 472 307 vCL, stage 1 conf vol vC2, stage 2 conf vol vCu, unblocked vol 1030 1011 471 989 994 286 472 307 vCL, stage (s) T.1 6.5 6.2 7.1 6.5 6.2 4.1 4.1 tC, 2 stage (s) T T 595 211 224 752 1100 1264 Direction, Lane # EB1 WB1 NB 1 NB 2 SB 1 SB 2 SB 2 Volume rotal 2 93 0 306 118 472 Volume rotal 2 93 0 148 0 Volume rotal 0 18 0.9	Right turn flare (veh)												
Upstream signal (m) pX, platoon unblocked vC, conflicting volume 1030 1011 471 989 994 286 472 307 vC1, stage 1 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC1 stage 1 conf vol vC2, stage 1 conf vol vC2, stage 2 conf vol vC1 1030 1011 471 989 994 286 472 307 vC2, stage 2 conf vol vC2, stage 1 conf vol vC2, stage 1 conf vol stage 1 conf vol 4.1 4.1 vC2, stage (s) r 6.5 6.2 7.1 6.5 6.2 4.1 4.1 tC, single (s) 3.5 4.0 3.3 3.5 4.0 3.3 2.2 2.2 D0 queue free % 99 100 100 85 100 92 100 1264 Direction, Lane # EB 1 WB 1 NB 1 NB 2 SB 1 SB 2 Volume Right 0 62 0 42 0 8 cSH SU VOlume Right 0 62 0 42 0 8 CSH	Median type								None			None	
pX, platoon unblocked vC, conflicting volume 1030 1011 471 989 994 286 472 307 vC1, stage 1 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC1, unblocked vol 1030 1011 471 989 994 286 472 307 vC2, stage 2 conf vol vC2, stage 2 conf vol vC1, unblocked vol 1030 1011 471 989 994 286 472 307 tC, single (s) 7.1 6.5 6.2 4.1 4.1 4.1 tC, 2 stage (s) 3.3 2.2 2.2 2.2 p0 queue free % 99 100 100 85 100 92 100 91 264 Direction, Lane # EB1 WB1 NB1 NB2 SB1 SB2 Volume Total 2 93 0 306 118 472 Volume Total 2 31 0 0 118 0 Volume Right 0 62 0 42 0 8	Median storage veh)												
pX, platoon unblocked vC, conflicting volume 1030 1011 471 989 994 286 472 307 vC1, stage 1 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC1, unblocked vol 1030 1011 471 989 994 286 472 307 vC2, stage 2 conf vol vC2, stage 2 conf vol vC1, unblocked vol 1030 1011 471 989 994 286 472 307 tC, single (s) 7.1 6.5 6.2 4.1 4.1 4.1 tC, 2 stage (s) 3.3 2.2 2.2 2.2 p0 queue free % 99 100 100 85 100 92 100 91 264 Direction, Lane # EB1 WB1 NB1 NB2 SB1 SB2 Volume Total 2 93 0 306 118 472 Volume Total 2 31 0 0 118 0 Volume Right 0 62 0 42 0 8													
vC, conflicting volume 1030 1011 471 989 994 286 472 307 vC1, stage 1 conf vol vC2, stage 2 conf vol vC2, unblocked vol 1030 1011 471 989 994 286 472 307 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 % 99 100 100 85 100 92 100 91 cM capacity (veh/h) 182 219 595 211 224 752 1100 1264 <u>Direction, Lane # EB 1 WB 1 NB 1 NB 2 SB 1 SB 2</u> Volume Total 2 93 0 306 118 472 Volume Right 0 62 0 42 0 8 cSH 182 405 1700 1700 1264 1700 Volume to Capacity 0.01 0.23 0.00 0.18 0.09 0.28 Queue Length 95th (m) 0.3 6.6 0.0 0.0 2.3 0.0 Control Delay (s) 25.0 16.5 0.0 0.1 8 Approach LOS D C <u>Intersection Summary</u> Average Delay <u>2.6</u> Intersection Capacity Utilization 46.3% ICU Level of Service A													
vC1, stage 1 conf vol vC2, stage 2 conf vol vCu, unblocked vol 1030 1011 471 989 994 286 472 307 tC, single (s) 7.1 6.5 6.2 7.1 6.5 6.2 4.1 4.1 tC, 2 stage (s)		1030	1011	471	989	994	286	472			307		
vC2, stage 2 conf vol vCu, unblocked vol 1030 1011 471 989 994 286 472 307 tC, single (s) 7.1 6.5 6.2 7.1 6.5 6.2 4.1 4.1 tC, single (s) 7.1 6.5 6.2 7.1 6.5 6.2 4.1 4.1 tC, single (s) 7.1 6.5 6.2 7.1 6.5 6.2 4.1 4.1 tC, stage (s) p0 queue free % .99 100 100 85 100 92 100 . <td></td>													
vCu, unblocked vol 1030 1011 471 989 994 286 472 307 tC, single (s) 7.1 6.5 6.2 7.1 6.5 6.2 4.1 4.1 tC, 2 stage (s)													
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 % 99 100 100 85 100 92 100 91 cM capacity (veh/h) 182 219 595 211 224 752 1100 1264 Direction, Lane # EB 1 WB 1 NB 1 NB 2 SB 1 SB 2 Volume Total 2 93 0 306 118 472 Volume Total 2 93 0 306 118 472 Volume Edft 2 31 0 0 118 0 Volume Right 0 62 0 42 0 8 cSH 182 405 1700 1700 1264 1700 Volume to Capacity 0.01 0.23 0.00 0.18 0.09 0.28 Queue Length 95th (m) 0.3 6.6 0.0 0.0 8.1 0.0 Lane LOS D C A Approa	vCu, unblocked vol	1030	1011	471	989	994	286	472			307		
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 % 99 100 100 85 100 92 100 91 cM capacity (veh/h) 182 219 595 211 224 752 1100 1264 Direction, Lane # EB 1 WB 1 NB 1 NB 2 SB 1 SB 2 Volume Total 2 93 0 306 118 472 Volume Left 2 31 0 0 118 0 Volume Right 0 62 0 42 0 8 cSH 182 405 1700 1700 1264 1700 Volume to Capacity 0.01 0.23 0.00 0.18 0.09 0.28 Queue Length 95th (m) 0.3 6.6 0.0 0.0 8.1 0.0 Lane LOS D C A Approach Delay (s) 25.0 16.5 0.0 1.6 Approach LOS D </td <td>tC, single (s)</td> <td>7.1</td> <td>6.5</td> <td>6.2</td> <td>7.1</td> <td>6.5</td> <td>6.2</td> <td>4.1</td> <td></td> <td></td> <td>4.1</td> <td></td> <td></td>	tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tF (s) 3.5 4.0 3.3 3.5 4.0 3.3 2.2 2.2 p0 queue free % 99 100 100 85 100 92 100 91 cM capacity (veh/h) 182 219 595 211 224 752 1100 1264 Direction, Lane # EB 1 WB 1 NB 1 NB 2 SB 1 SB 2 Volume Total 2 93 0 306 118 472 Volume Left 2 31 0 0 118 0 Volume Right 0 62 0 42 0 8 cSH 182 405 1700 1264 1700 Volume to Capacity 0.01 0.23 0.00 0.18 0.09 0.28 Queue Length 95th (m) 0.3 6.6 0.0 0.0 2.3 0.0 Control Delay (s) 25.0 16.5 0.0 1.6 Approach LOS D C Average Delay 25.0 16.5 0.0 1.6 Average													
p0 queue free % 99 100 100 85 100 92 100 91 cM capacity (veh/h) 182 219 595 211 224 752 1100 1264 Direction, Lane # EB 1 WB 1 NB 1 NB 2 SB 1 SB 2 Volume Total 2 93 0 306 118 472 Volume Left 2 31 0 0 118 0 Volume Right 0 62 0 42 0 8 CSH 182 405 1700 1700 1264 1700 Volume to Capacity 0.01 0.23 0.00 0.18 0.09 0.28 Queue Length 95th (m) 0.3 6.6 0.0 0.0 2.3 0.0 Lane LOS D C A Approach Delay (s) 25.0 16.5 0.0 1.6 Approach LOS D C A Intersection Capacity Utilization		3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
Direction, Lane # EB 1 WB 1 NB 1 NB 2 SB 1 SB 2 Volume Total 2 93 0 306 118 472 Volume Left 2 31 0 0 118 0 Volume Right 0 62 0 42 0 8 cSH 182 405 1700 1700 1264 1700 Volume to Capacity 0.01 0.23 0.00 0.18 0.09 0.28 Queue Length 95th (m) 0.3 6.6 0.0 0.0 2.3 0.0 Control Delay (s) 25.0 16.5 0.0 0.0 8.1 0.0 Lane LOS D C A Approach Delay (s) 25.0 16.5 0.0 1.6 Approach LOS D C A Approach LOS D C Intersection Summary 2.6 Intersection Capacity Utilization 46.3% ICU Level of Service A		99	100	100	85	100	92	100			91		
Volume Total 2 93 0 306 118 472 Volume Left 2 31 0 0 118 0 Volume Right 0 62 0 42 0 8 cSH 182 405 1700 1264 1700 Volume to Capacity 0.01 0.23 0.00 0.18 0.09 0.28 Queue Length 95th (m) 0.3 6.6 0.0 0.0 2.3 0.0 Control Delay (s) 25.0 16.5 0.0 0.0 8.1 0.0 Lane LOS D C A Approach Delay (s) 25.0 16.5 0.0 1.6 Approach LOS D C A Approach LOS D C Intersection Summary 2.6 Intersection Capacity Utilization 46.3% ICU Level of Service A	cM capacity (veh/h)	182	219	595	211	224	752	1100			1264		
Volume Left 2 31 0 0 118 0 Volume Right 0 62 0 42 0 8 cSH 182 405 1700 1264 1700 Volume to Capacity 0.01 0.23 0.00 0.18 0.09 0.28 Queue Length 95th (m) 0.3 6.6 0.0 0.0 2.3 0.0 Control Delay (s) 25.0 16.5 0.0 0.0 8.1 0.0 Lane LOS D C A Approach Delay (s) 25.0 16.5 0.0 1.6 Approach LOS D C A Approach LOS D C A Average Delay 2.6 Intersection Summary 2.6 A A	Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Right 0 62 0 42 0 8 cSH 182 405 1700 1264 1700 Volume to Capacity 0.01 0.23 0.00 0.18 0.09 0.28 Queue Length 95th (m) 0.3 6.6 0.0 0.0 2.3 0.0 Control Delay (s) 25.0 16.5 0.0 0.0 8.1 0.0 Lane LOS D C A Approach Delay (s) 25.0 16.5 0.0 1.6 Approach LOS D C A Approach LOS D C A Average Delay 2.6 Itersection Capacity Utilization 46.3% ICU Level of Service A	Volume Total	2	93	0	306	118	472						
cSH 182 405 1700 1700 1264 1700 Volume to Capacity 0.01 0.23 0.00 0.18 0.09 0.28 Queue Length 95th (m) 0.3 6.6 0.0 0.0 2.3 0.0 Control Delay (s) 25.0 16.5 0.0 0.0 8.1 0.0 Lane LOS D C A Approach Delay (s) 25.0 16.5 0.0 1.6 Approach LOS D C A Average Delay 2.6 1 Intersection Capacity Utilization 46.3% ICU Level of Service A	Volume Left	2	31	0	0	118	0						
Volume to Capacity 0.01 0.23 0.00 0.18 0.09 0.28 Queue Length 95th (m) 0.3 6.6 0.0 0.0 2.3 0.0 Control Delay (s) 25.0 16.5 0.0 0.0 8.1 0.0 Lane LOS D C A Approach Delay (s) 25.0 16.5 0.0 1.6 Approach Delay (s) 25.0 16.5 0.0 1.6 A Approach LOS D C	Volume Right	0	62	0	42	0	8						
Queue Length 95th (m) 0.3 6.6 0.0 0.0 2.3 0.0 Control Delay (s) 25.0 16.5 0.0 0.0 8.1 0.0 Lane LOS D C A Approach Delay (s) 25.0 16.5 0.0 1.6 Approach LOS D C Intersection Summary Average Delay 2.6 ICU Level of Service A	cSH	182	405	1700	1700	1264	1700						
Control Delay (s) 25.0 16.5 0.0 0.0 8.1 0.0 Lane LOS D C A A Approach Delay (s) 25.0 16.5 0.0 1.6 A Approach LOS D C Intersection Summary 2.6 Intersection Capacity Utilization 46.3% ICU Level of Service A A	Volume to Capacity	0.01	0.23	0.00	0.18	0.09	0.28						
Lane LOS D C A Approach Delay (s) 25.0 16.5 0.0 1.6 Approach LOS D C Intersection Summary Intersection Summary 2.6 Intersection Capacity Utilization 46.3% ICU Level of Service A	Queue Length 95th (m)	0.3	6.6	0.0	0.0	2.3	0.0						
Approach Delay (s) 25.0 16.5 0.0 1.6 Approach LOS D C Intersection Summary Intersection Summary 2.6 Intersection Capacity Utilization 46.3% ICU Level of Service A	Control Delay (s)	25.0	16.5	0.0	0.0	8.1	0.0						
Approach LOS D C Intersection Summary 2.6 Intersection Capacity Utilization 46.3% ICU Level of Service A	Lane LOS	D	С			А							
Intersection Summary 2.6 Average Delay 2.6 Intersection Capacity Utilization 46.3% ICU Level of Service A	Approach Delay (s)	25.0	16.5	0.0		1.6							
Average Delay 2.6 Intersection Capacity Utilization 46.3% ICU Level of Service A	Approach LOS	D	С										
Intersection Capacity Utilization 46.3% ICU Level of Service A	Intersection Summary												
Intersection Capacity Utilization 46.3% ICU Level of Service A	Average Delay			2.6									
				46.3%	IC	ICU Level of Service				А			
Analysis Period (min) 15	Analysis Period (min)			15									

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			\$			\$			\$	
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	5	49	42	37	36	0	34	8	9	0	2	4
Future Volume (vph)	5	49	42	37	36	0	34	8	9	0	2	4
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	54	47	41	40	0	38	9	10	0	2	4
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	107	81	57	6								
Volume Left (vph)	6	41	38	0								
Volume Right (vph)	47	0	10	4								
Hadj (s)	-0.25	0.10	0.03	-0.40								
Departure Headway (s)	3.9	4.2	4.3	4.0								
Degree Utilization, x	0.12	0.10	0.07	0.01								
Capacity (veh/h)	907	829	790	859								
Control Delay (s)	7.4	7.7	7.6	7.0								
Approach Delay (s)	7.4	7.7	7.6	7.0								
Approach LOS	А	А	Α	А								
Intersection Summary												
Delay			7.5									
Level of Service			А									
Intersection Capacity Utilization	tion		26.8%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis 21: Stanley & Northumberland

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		\$			ŧ	1		\$			\$	
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	76	43	3	2	44	356	2	16	5	652	11	95
Future Volume (vph)	76	43	3	2	44	356	2	16	5	652	11	95
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	84	48	3	2	49	396	2	18	6	724	12	106
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1							
Volume Total (vph)	135	51	396	26	842							
Volume Left (vph)	84	2	0	2	724							
Volume Right (vph)	3	0	396	6	106							
Hadj (s)	0.11	0.01	-0.60	-0.12	0.10							
Departure Headway (s)	6.0	6.1	3.2	5.3	4.6							
Degree Utilization, x	0.23	0.09	0.35	0.04	1.08							
Capacity (veh/h)	586	571	1114	652	773							
Control Delay (s)	10.8	9.7	7.9	8.5	76.9							
Approach Delay (s)	10.8	8.1		8.5	76.9							
Approach LOS	В	А		А	F							
Intersection Summary												
Delay			48.3									
Level of Service			Е									
Intersection Capacity Utilizat	ion		80.3%	IC	U Level o	of Service			D			
Analysis Period (min)			15									

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Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	٨		۲	•	Y	
Traffic Volume (veh/h)	42	73	132	90	48	46
Future Volume (Veh/h)	42	73	132	90	48	46
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	47	81	147	100	53	51
Pedestrians		•			2	•.
Lane Width (m)					3.5	
Walking Speed (m/s)					1.1	
Percent Blockage					0	
Right turn flare (veh)					v	
Median type	None			None		
Median storage veh)	NOTIC			None		
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			130		484	90
vC1, stage 1 conf vol			150		404	30
vC2, stage 2 conf vol						
vCu, unblocked vol			130		484	90
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)			4.1		0.4	0.2
tF (s)			2.2		3.5	3.3
p0 queue free %			2.2 90		89	95
cM capacity (veh/h)			1465		490	972
					430	512
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	128	147	100	104		
Volume Left	0	147	0	53		
Volume Right	81	0	0	51		
cSH	1700	1465	1700	648		
Volume to Capacity	0.08	0.10	0.06	0.16		
Queue Length 95th (m)	0.0	2.5	0.0	4.3		
Control Delay (s)	0.0	7.7	0.0	11.6		
Lane LOS		А		В		
Approach Delay (s)	0.0	4.6		11.6		
Approach LOS				В		
Intersection Summary						
Average Delay			4.9			
Intersection Capacity Utiliz	zation		27.1%	IC	U Level o	of Service
Analysis Period (min)			15			

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Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	4			د	¥	
Traffic Volume (veh/h)	61	642	28	61	343	15
Future Volume (Veh/h)	61	642	28	61	343	15
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	68	713	31	68	381	17
Pedestrians	1				1	
Lane Width (m)	3.5				3.5	
Walking Speed (m/s)	1.1				1.1	
Percent Blockage	0				0	
Right turn flare (veh)	v				v	
Median type	None			None		
Median storage veh)				110110		
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			782		556	426
vC1, stage 1 conf vol			102		000	720
vC2, stage 2 conf vol						
vCu, unblocked vol			782		556	426
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)			7.1		0.4	0.2
tF (s)			2.2		3.5	3.3
p0 queue free %			96		20	97
cM capacity (veh/h)			844		475	633
	/				110	000
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	781	99	398			
Volume Left	0	31	381			
Volume Right	713	0	17			
cSH	1700	844	480			
Volume to Capacity	0.46	0.04	0.83			
Queue Length 95th (m)	0.0	0.9	61.8			
Control Delay (s)	0.0	3.2	39.6			
Lane LOS		А	E			
Approach Delay (s)	0.0	3.2	39.6			
Approach LOS			E			
Intersection Summary						
Average Delay			12.6			
Intersection Capacity Utiliza	ation		77.6%	IC	U Level o	of Service
Analysis Period (min)			15			

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Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		ŧ	ţ,		Y	
Traffic Volume (veh/h)	9	0	0	0	0	15
Future Volume (Veh/h)	9	0	0	0	0	15
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	10	0	0	0	0	17
Pedestrians	10	Ŭ	Ŭ	Ŭ	Ű	
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)		NULL				
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				20	0
vC1, stage 1 conf vol	U				20	U
vC2, stage 2 conf vol	0				20	0
vCu, unblocked vol	0					
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)	0.0				25	2.2
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	98
cM capacity (veh/h)	1623				991	1085
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	10	0	17			
Volume Left	10	0	0			
Volume Right	0	0	17			
cSH	1623	1700	1085			
Volume to Capacity	0.01	0.00	0.02			
Queue Length 95th (m)	0.1	0.0	0.4			
Control Delay (s)	7.2	0.0	8.4			
Lane LOS	А		А			
Approach Delay (s)	7.2	0.0	8.4			
Approach LOS			А			
Intersection Summary						
Average Delay			7.9			
Intersection Capacity Utilizat	ion		13.3%	IC	Ulevelo	of Service
Analysis Period (min)			15.570	10		
			15			

HCM Unsignalized Intersection Capacity Analysis 51: Swan & Brant-Waterloo

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
Traffic Volume (veh/h)	8	3	4	0	3	5	4	152	3	5	208	5
Future Volume (Veh/h)	8	3	4	0	3	5	4	152	3	5	208	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	9	3	4	0	3	6	4	169	3	6	231	6
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	432	426	234	430	428	170	237			172		
vC1, stage 1 conf vol	102	120	201	100	.20		201					
vC2, stage 2 conf vol												
vCu, unblocked vol	432	426	234	430	428	170	237			172		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	7.1	0.0	0.2	7.1	0.0	0.2				1.1		
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	99	100	100	99	99	100			100		
cM capacity (veh/h)	528	520	810	531	519	879	1342			1417		
					010	015	1072			1717		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	16	9	176	243								
Volume Left	9	0	4	6								
Volume Right	4	6	3	6								
cSH	577	714	1342	1417								
Volume to Capacity	0.03	0.01	0.00	0.00								
Queue Length 95th (m)	0.6	0.3	0.1	0.1								
Control Delay (s)	11.4	10.1	0.2	0.2								
Lane LOS	В	В	А	А								
Approach Delay (s)	11.4	10.1	0.2	0.2								
Approach LOS	В	В										
Intersection Summary												
Average Delay			0.8									
Intersection Capacity Utiliza	tion		31.0%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

	4	*	t	1	1	ŧ	
Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations	Y		¢Î,			4	Ĩ
Traffic Volume (veh/h)	6	103	0	11	182	0	
Future Volume (Veh/h)	6	103	0	11	182	0	
Sign Control	Stop		Free			Free	
Grade	0%		0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	
Hourly flow rate (vph)	7	114	0	12	202	0	
Pedestrians							
Lane Width (m)							
Walking Speed (m/s)							
Percent Blockage							
Right turn flare (veh)							
Median type			None			None	
Median storage veh)							
Upstream signal (m)							
pX, platoon unblocked							
vC, conflicting volume	410	6			12		
vC1, stage 1 conf vol	VIT	v			14		
vC2, stage 2 conf vol							
vCu, unblocked vol	410	6			12		
tC, single (s)	6.4	6.2			4.1		
tC, 2 stage (s)	т.,	0.2			т. I		
tF (s)	3.5	3.3			2.2		
p0 queue free %	99	89			87		
cM capacity (veh/h)	523	1077			1607		
			0 - /		1007		
Direction, Lane #	WB 1	NB 1	SB 1				
Volume Total	121	12	202				
Volume Left	7	0	202				
Volume Right	114	12	0				
cSH	1015	1700	1607				
Volume to Capacity	0.12	0.01	0.13				
Queue Length 95th (m)	3.1	0.0	3.3				
Control Delay (s)	9.0	0.0	7.6				
Lane LOS	А		А				
Approach Delay (s)	9.0	0.0	7.6				
Approach LOS	А						
Intersection Summary							
Average Delay			7.8				
Intersection Capacity Utiliza	ation		30.6%	IC	CU Level o	of Service	
Analysis Period (min)			15				
			10				

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Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			र्भ	4	
Traffic Volume (veh/h)	5	0	0	5	8	7
Future Volume (Veh/h)	5	0	0	5	8	7
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	0	0	6	9	8
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	19	13	17			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	19	13	17			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	100	100			
cM capacity (veh/h)	998	1067	1600			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	6	6	17			
Volume Left	6	0	0			
Volume Right	0	0	8			
cSH	998	1600	1700			
Volume to Capacity	0.01	0.00	0.01			
Queue Length 95th (m)	0.1	0.0	0.0			
Control Delay (s)	8.6	0.0	0.0			
Lane LOS	A	0.0	0.0			
Approach Delay (s)	8.6	0.0	0.0			
Approach LOS	A	0.0	0.0			
Intersection Summary						
Average Delay			1.8			
Intersection Capacity Utiliza	ation		13.3%	IC	CU Level o	fSonioo
Analysis Period (min)	auon		15.5 %	IC.		
Analysis Fenou (mm)			15			

Appendix D

Synchro Reports 2020 and 2031 Future Total Conditions

HCM Unsignalized Intersection Capacity Analysis 1: Hilltop & Swan

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4		ሻ	Þ		7	1.	
Traffic Volume (veh/h)	4	0	0	39	0	138	0	192	12	46	122	0
Future Volume (Veh/h)	4	0	0	39	0	138	0	192	12	46	122	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	4	0	0	43	0	153	0	213	13	51	136	0
Pedestrians					1			3				
Lane Width (m)					3.5			3.5				
Walking Speed (m/s)					1.1			1.1				
Percent Blockage					0			0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	604	465	139	462	458	220	136			227		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	604	465	139	462	458	220	136			227		
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 %	99	100	100	91	100	81	100			96		
cM capacity (veh/h)	326	479	912	497	483	821	1461			1352		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	4	196	0	226	51	136						
Volume Left	4	43	0	0	51	0						
Volume Right	0	153	0	13	0	0						
cSH	326	718	1700	1700	1352	1700						
Volume to Capacity	0.01	0.27	0.00	0.13	0.04	0.08						
Queue Length 95th (m)	0.3	8.4	0.0	0.0	0.9	0.0						
Control Delay (s)	16.2	11.9	0.0	0.0	7.8	0.0						
Lane LOS	С	В			А							
Approach Delay (s)	16.2	11.9	0.0		2.1							
Approach LOS	С	В										
Intersection Summary												
Average Delay			4.6									
Intersection Capacity Utilizatio	n		38.6%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		\$			\$			\$			\$	
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	3	22	35	9	34	0	98	7	24	0	3	11
Future Volume (vph)	3	22	35	9	34	0	98	7	24	0	3	11
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	3	24	39	10	38	0	109	8	27	0	3	12
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	66	48	144	15								
Volume Left (vph)	3	10	109	0								
Volume Right (vph)	39	0	27	12								
Hadj (s)	-0.23	0.04	0.07	-0.48								
Departure Headway (s)	4.1	4.4	4.2	3.8								
Degree Utilization, x	0.07	0.06	0.17	0.02								
Capacity (veh/h)	845	790	821	901								
Control Delay (s)	7.4	7.6	8.1	6.9								
Approach Delay (s)	7.4	7.6	8.1	6.9								
Approach LOS	А	А	А	А								
Intersection Summary												
Delay			7.8									
Level of Service			А									
Intersection Capacity Utiliza	tion		25.9%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis 21: Stanley & Northumberland

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			र्स	1		4			4	
Traffic Volume (veh/h)	59	21	0	2	15	481	2	2	2	193	8	18
Future Volume (Veh/h)	59	21	0	2	15	481	2	2	2	193	8	18
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	66	23	0	2	17	534	2	2	2	214	9	20
Pedestrians		1			6			2			5	
Lane Width (m)		3.5			3.5			3.5			3.5	
Walking Speed (m/s)		1.1			1.1			1.1			1.1	
Percent Blockage		0			1			0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	22			25			204	183	31	190	183	23
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	22			25			204	183	31	190	183	23
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 %	96			100			100	100	100	71	99	98
cM capacity (veh/h)	1600			1600			708	680	1042	736	680	1054
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1							
Volume Total	89	19	534	6	243							
Volume Left	66	2	0	2	214							
Volume Right	0	0	534	2	20							
cSH	1600	1600	1700	781	752							
Volume to Capacity	0.04	0.00	0.31	0.01	0.32							
Queue Length 95th (m)	1.0	0.0	0.0	0.2	10.7							
Control Delay (s)	5.5	0.8	0.0	9.6	12.1							
Lane LOS	A	A	0.0	A	В							
Approach Delay (s)	5.5	0.0		9.6	12.1							
Approach LOS	0.0	0.0		A	B							
Intersection Summary												
Average Delay			3.9									
Intersection Capacity Utilizat	tion		53.9%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

	-	7	*	+	1	1
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	1		٦	1	Y	
Traffic Volume (veh/h)	92	26	29	45	53	124
Future Volume (Veh/h)	92	26	29	45	53	124
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	102	29	32	50	59	138
Pedestrians					2	
Lane Width (m)					3.5	
Walking Speed (m/s)					1.1	
Percent Blockage					0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)				-		
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			133		232	118
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			133		232	118
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		92	85
cM capacity (veh/h)			1437		742	934
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	131	32	50	197		
Volume Left	0	32	0	59		
Volume Right	29	0	0	138		
cSH	1700	1437	1700	867		
Volume to Capacity	0.08	0.02	0.03	0.23		
Queue Length 95th (m)	0.0	0.5	0.0	6.6		
Control Delay (s)	0.0	7.6	0.0	10.4		
Lane LOS		А		В		
Approach Delay (s)	0.0	3.0		10.4		
Approach LOS				В		
Intersection Summary						
Average Delay			5.6			
Intersection Capacity Utiliza	ation		26.4%	IC	U Level c	f Service
Analysis Period (min)			15			
j = = = = ()						

	-	7	1	-	1	1
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	ţ,			د	¥	
Traffic Volume (veh/h)	41	175	21	45	444	18
Future Volume (Veh/h)	41	175	21	45	444	18
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	46	194	23	50	493	20
Pedestrians	1				1	
Lane Width (m)	3.5				3.5	
Walking Speed (m/s)	1.1				1.1	
Percent Blockage	0				0	
Right turn flare (veh)	•					
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			241		241	144
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			241		241	144
tC, single (s)			4.1		6.4	6.3
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.4
p0 queue free %			98		33	98
cM capacity (veh/h)			1336		735	892
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	240	73	513			
Volume Left	0	23	493			
Volume Right	194	0	20			
cSH	1700	1336	740			
Volume to Capacity	0.14	0.02	0.69			
Queue Length 95th (m)	0.0	0.4	42.9			
Control Delay (s)	0.0	2.5	20.1			
Lane LOS	0.0	A	C			
Approach Delay (s)	0.0	2.5	20.1			
Approach LOS	0.0	2.0	C			
Intersection Summary						
Average Delay			12.7			
Intersection Capacity Utiliza	ation		56.7%	10	U Level c	f Service
	auon			IC		or Service
Analysis Period (min)			15			

Ine Configurations Image: Configurations Image: Configurations Image: Configurations affic Volume (veh/h) 5 0 0 78 24 2 gn Control Free Free Stop 20 2 ade 0% 0% 0% 0% 24 2 protein factor 0.90 <		٨	+	Ļ	•	1	~	
Ine Configurations Image: Configuration of the second	Movement	EBL	EBT	WBT	WBR	SBL	SBR	
affic Volume (veh/h) 5 0 0 78 24 2 gn Control Free Free Stop 24 2 gade 0% 0% 0% 0% 0% 24 2 gade 0 0.90	Lane Configurations							
thure Volume (Veh/h) 5 0 0 78 24 2 gn Control Free Free Stop Image: Stop	Traffic Volume (veh/h)	5			78		2	
gn Control Free Free Stop rade 0% 0% 0% 0% pack Hour Factor 0.90 0.90 0.90 0.90 0.90 pack Hour Factor 0.90 0.90 0.90 0.90 0.90 pack Hour Factor 0.90 0.90 0.90 0.90 0.90 pack Hour Factor 0 87 27 2 pack Hour Factor None None None Sector pack Hour Factor None None None Sector pack Hour Factor None None None Sector				0				
ade 0% 0% 0% aak Hour Factor 0.90 <t< td=""><td>Sign Control</td><td></td><td>Free</td><td>Free</td><td></td><td>Stop</td><td></td><td></td></t<>	Sign Control		Free	Free		Stop		
bask Hour Factor 0.90	Grade		0%	0%				
burly flow rate (vph) 6 0 87 27 2 adestrians ine Width (m) alking Speed (m/s) ercent Blockage ght turn flare (veh) edian storage veh)	Peak Hour Factor	0.90			0.90		0.90	
adestrians ine Width (m) alking Speed (m/s) preent Blockage ght turn flare (veh) edian type None None edian type Solution softream signal (m) (, platoon unblocked C, conflicting volume 87 56 44 1, stage 1 conf vol 22, stage 2 conf vol 20, unblocked vol 87 56 44 , single (s) 4.1 6.4 6.2 , 2 stage (s) (s) 2.2 3.5 3.3 0 queue free % 100 97 100 A capacity (veh/h) 1509 948 1027 rection, Lane # EB 1 WB 1 SB 1 olume Total 6 87 29 olume Right 0 87 2 H 1509 1700 953 olume Loft 6 0 27 olume Right 0 87 2 H 1509 1700 953 olume Log A A poroach Delay (s) 7.4 0.0 8.9 ine LOS A A tersection Summary rerage Delay 2.5 ICU Level of Service	Hourly flow rate (vph)							
alking Speed (m/s) arcent Blockage ght turn flare (veh) edian type None edian storage veh) ostream signal (m) (x, platoon unblocked 2, conflicting volume 87 56 44 2, stage 1 conf vol 22, stage 2 conf vol Cu, unblocked vol 87 2, stage 2 (s) (s) 2.2 3.5 3.3 0 queue free % 100 97 100 M capacity (veh/h) 1509 948 1027 rection, Lane # EB 1 WB 1 SB 1 Dume Total 6 87 29 Dume Total 6 87 29 Dume Eft 0 87 2 SH 1509 1700 953 Dume to Capacity 0.00 0.07 portrol Delay (s) 7.4 0.0 8.9 une LOS A A oproach LOS A A oproach LOS	Pedestrians							
alking Speed (m/s) arcent Blockage ght turn flare (veh) edian type None edian storage veh) ostream signal (m) (x, platoon unblocked 2, conflicting volume 87 56 44 2, stage 1 conf vol 22, stage 2 conf vol Cu, unblocked vol 87 2, stage 2 (s) (s) 2.2 (s) 2.2 3.5 3.3 0 queue free % 100 97 100 M capacity (veh/h) 1509 948 1027 rection, Lane # EB 1 WB 1 SB1 SB1 olume Total 6 87 0 87 2 SH 1509 1700 953 950 1700 954 1509 1700 953 91700 953 9104 1509 170 954 1509 1700 955 7.4 0.0 9104 </td <td>Lane Width (m)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Lane Width (m)							
arcent Blockage ght turn flare (veh) edian type None edian type None edian storage veh) sstream signal (m) K, platoon unblocked C, conflicting volume 87 S, tage 1 conf vol S2, stage 2 conf vol Cu, unblocked vol 87 S4, single (s) 4.1 (s) 2.2 Olume Left 6 0 87 0.00 0.05 0.01 0.0 0.21 0.0 0.21 0.0	Walking Speed (m/s)							
ght turn flare (veh) None None None edian storage veh) ostream signal (m) . . . Systeam signal (m) Systeam signal (m) Systeam signal (m) .	Percent Blockage							
edian type None None edian storage veh) ostream signal (m)	Right turn flare (veh)							
edian storage veh) postream signal (m) K, platoon unblocked C, conflicting volume 87 C, stage 1 conf vol S2, stage 2 conf vol Cu, unblocked vol 87 Single (s) 4.1 , single (s) 4.1 , single (s) 4.1 (s) 2.2 , 2 stage (s) (s) (s) 2.2 (s) 7.4 polume Total 6 6 87 polume Right 0 0.0 0.05 0.01 0.0 0.02 0.03 ueue Length 95th (m) 0.1 0.1 0.0	Median type		None	None				
bestream signal (m) K, platoon unblocked C, conflicting volume 87 56 44 C1, stage 1 conf vol 22, stage 2 conf vol 22, stage 2 conf vol 22, stage 2 conf vol Cu, unblocked vol 87 56 44 c, single (s) 4.1 6.4 6.2 c, 2 stage (s) (s) 2.2 3.5 3.3 0 queue free % 100 97 100 M capacity (veh/h) 1509 948 1027 rection, Lane # EB 1 WB 1 SB 1 olume Total 6 87 29 olume Right 0 87 2 SH 1509 1700 953 olume Right 0 87 2 SH 1509 1700 953 olume to Capacity 0.00 0.05 0.03 ueue Length 95th (m) 0.1 0.0 0.7 optroach Delay (s) 7.4 0.0 8.9 optroach LOS A A A optroach LOS A A A	Median storage veh)							
K, platoon unblocked C, conflicting volume 87 56 44 C1, stage 1 conf vol C2, stage 2 conf vol Cu, unblocked vol 87 56 44 single (s) 4.1 6.4 6.2 , 2 stage (s) (s) 2.2 3.5 3.3 Oqueue free % 100 97 100 M capacity (veh/h) 1509 948 1027 rection, Lane # EB 1 WB 1 SB 1 olume Total 6 87 29 olume Right 0 87 2 SH 1509 1700 953 olume to Capacity 0.00 0.05 0.03 ueue Length 95th (m) 0.1 0.0 0.7 ontrol Delay (s) 7.4 0.0 8.9 oproach Delay (s) 7.4 0.0 8.9 oproach LOS A A oproach LOS A A oproach LOS A A oproach LOS A A oproach LOS A	Upstream signal (m)							
C, conflicting volume 87 56 44 C1, stage 1 conf vol 22, stage 2 conf vol 56 44 C2, stage 2 conf vol 87 56 44 Cu, unblocked vol 87 6.4 6.2 C3, stage (s) 6.4 6.2 6.4 6.2 (s) 2.2 3.5 3.3 0 Queue free % 100 97 100 M capacity (veh/h) 1509 948 1027 rection, Lane # EB 1 WB 1 SB 1 plume Total 6 87 29 plume Left 6 0 27 plume Right 0 87 2 SH 1509 1700 953 plume to Capacity 0.00 0.05 0.03 ueue Length 95th (m) 0.1 0.0 8.9 nne LOS A A A oproach Delay (s) 7.4 0.0 8.9 oproach LOS A A A tersection Summary 2.5 ICU Level of Service <td>pX, platoon unblocked</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	pX, platoon unblocked							
C1, stage 1 conf vol C2, stage 2 conf vol Cu, unblocked vol 87 Single (s) 4.1 , single (s) 4.1 (s) 2.2 (s) 2.2 (s) 2.2 (s) 97 0 queue free % 100 100 97 A capacity (veh/h) 1509 948 1027 rection, Lane # EB 1 WB 1 SB 1 SB 1 olume Total 6 87 olume Right 0 87 0.0 87 2 SH 1509 1700 Dume to Capacity 0.00 0.05 Outme to Capacity 0.00 0.07 ontrol Delay (s) 7.4 0.0 8.9 oproach Delay (s) 7.4 0.0 8.9 oproach LOS A A A verage Delay 2.5 1CU Level of Service	vC, conflicting volume	87				56	44	
22, stage 2 conf vol 87 56 44 2, single (s) 4.1 6.4 6.2 3, single (s) 2.2 3.5 3.3 2, a stage (s) 97 100 97 100 3.5 3.3 97 100 97 100 A capacity (veh/h) 1509 948 1027 100 rection, Lane # EB 1 WB 1 SB 1 100 100 plume Total 6 87 29 100 100 plume Right 0 87 2 100 <	vC1, stage 1 conf vol							
Cu, unblocked vol 87 56 44 , single (s) 4.1 6.4 6.2 , 2 stage (s) .	vC2, stage 2 conf vol							
, 2 stage (s) 3.5 3.3 (s) 2.2 3.5 3.3 0 queue free % 100 97 100 A capacity (veh/h) 1509 948 1027 rection, Lane # EB 1 WB 1 SB 1 olume Total 6 87 29 olume Left 6 0 27 olume Right 0 87 2 SH 1509 1700 953 olume to Capacity 0.00 0.05 0.03 ueue Length 95th (m) 0.1 0.0 8.9 one LOS A A A oproach LOS A A A opproach LOS A A A verage Delay 2.5 ICU Level of Service	vCu, unblocked vol	87				56	44	
(s) 2.2 3.5 3.3 0 queue free % 100 97 100 0 queue free % 100 97 100 A capacity (veh/h) 1509 948 1027 rection, Lane # EB 1 WB 1 SB 1 olume Total 6 87 29 olume Left 6 0 27 olume Right 0 87 2 SH 1509 1700 953 olume to Capacity 0.00 0.05 0.03 ueue Length 95th (m) 0.1 0.0 0.7 ontrol Delay (s) 7.4 0.0 8.9 oproach Delay (s) 7.4 0.0 8.9 oproach LOS A A tersection Summary 2.5 ICU Level of Service	tC, single (s)	4.1				6.4	6.2	
(s) 2.2 3.5 3.3 0 queue free % 100 97 100 A capacity (veh/h) 1509 948 1027 rection, Lane # EB 1 WB 1 SB 1 olume Total 6 87 29 olume Left 6 0 27 olume Right 0 87 2 SH 1509 1700 953 olume to Capacity 0.00 0.05 0.03 ueue Length 95th (m) 0.1 0.0 0.7 ontrol Delay (s) 7.4 0.0 8.9 oproach Delay (s) 7.4 0.0 8.9 oproach LOS A A tersection Summary 2.5 ICU Level of Service	tC, 2 stage (s)							
O queue free % 100 97 100 A capacity (veh/h) 1509 948 1027 rection, Lane # EB 1 WB 1 SB 1 olume Total 6 87 29 olume Left 6 0 27 olume Right 0 87 2 SH 1509 1700 953 olume to Capacity 0.00 0.05 0.03 ueue Length 95th (m) 0.1 0.0 0.7 ontrol Delay (s) 7.4 0.0 8.9 oproach Delay (s) 7.4 0.0 8.9 oproach LOS A A tersection Summary 2.5 ICU Level of Service	tF (s)	2.2				3.5	3.3	
A capacity (veh/h) 1509 948 1027 rection, Lane # EB 1 WB 1 SB 1 SB 1 olume Total 6 87 29 29 olume Left 6 0 27 27 olume Right 0 87 2 2 SH 1509 1700 953 2 olume to Capacity 0.00 0.05 0.03 2 ueue Length 95th (m) 0.1 0.0 0.7 2 ontrol Delay (s) 7.4 0.0 8.9 3 oproach Delay (s) 7.4 0.0 8.9 3 oproach LOS A A A tersection Summary 2.5 ICU Level of Service	p0 queue free %	100				97	100	
blume Total 6 87 29 blume Left 6 0 27 blume Right 0 87 2 SH 1509 1700 953 blume to Capacity 0.00 0.05 0.03 ueue Length 95th (m) 0.1 0.0 0.7 bontrol Delay (s) 7.4 0.0 8.9 oproach Delay (s) 7.4 0.0 8.9 oproach LOS A A tersection Summary 2.5 ICU Level of Service	cM capacity (veh/h)	1509				948	1027	
Solume Left 6 0 27 SH 1509 1700 953 SH 1509 1700 953 Sume to Capacity 0.00 0.05 0.03 ueue Length 95th (m) 0.1 0.0 0.7 pontrol Delay (s) 7.4 0.0 8.9 une LOS A A oproach Delay (s) 7.4 0.0 8.9 oproach LOS A A tersection Summary 2.5 ICU Level of Service	Direction, Lane #	EB 1	WB 1	SB 1				
Olume Right 0 87 2 SH 1509 1700 953 Olume to Capacity 0.00 0.05 0.03 Jueue Length 95th (m) 0.1 0.0 0.7 Ontrol Delay (s) 7.4 0.0 8.9 Ame LOS A A Oproach Delay (s) 7.4 0.0 8.9 Oproach Delay (s) 7.4 0.0 8.9 Oproach LOS A A Verage Delay 2.5 ICU Level of Service	Volume Total	6	87	29				
SH 1509 1700 953 plume to Capacity 0.00 0.05 0.03 ueue Length 95th (m) 0.1 0.0 0.7 pontrol Delay (s) 7.4 0.0 8.9 ane LOS A A pproach Delay (s) 7.4 0.0 8.9 pproach LOS A A tersection Summary 2.5 tersection Capacity Utilization 15.6% ICU Level of Service	Volume Left	6	0	27				
olume to Capacity 0.00 0.05 0.03 ueue Length 95th (m) 0.1 0.0 0.7 ontrol Delay (s) 7.4 0.0 8.9 one LOS A A oproach Delay (s) 7.4 0.0 8.9 oproach Delay (s) 7.4 0.0 8.9 oproach LOS A A tersection Summary 2.5 1000000000000000000000000000000000000	Volume Right	0	87	2				
ueue Length 95th (m) 0.1 0.0 0.7 pontrol Delay (s) 7.4 0.0 8.9 une LOS A A oproach Delay (s) 7.4 0.0 8.9 oproach Delay (s) 7.4 0.0 8.9 oproach LOS A A tersection Summary 2.5 1000000000000000000000000000000000000	cSH	1509	1700	953				
ueue Length 95th (m) 0.1 0.0 0.7 pontrol Delay (s) 7.4 0.0 8.9 une LOS A A oproach Delay (s) 7.4 0.0 8.9 oproach Delay (s) 7.4 0.0 8.9 oproach LOS A A tersection Summary 2.5 1000000000000000000000000000000000000	Volume to Capacity	0.00	0.05	0.03				
ontrol Delay (s) 7.4 0.0 8.9 ne LOS A A oproach Delay (s) 7.4 0.0 8.9 oproach LOS A tersection Summary verage Delay 2.5 tersection Capacity Utilization 15.6% ICU Level of Service	Queue Length 95th (m)	0.1	0.0	0.7				
ine LOS A A oproach Delay (s) 7.4 0.0 8.9 oproach LOS A tersection Summary verage Delay 2.5 tersection Capacity Utilization 15.6% ICU Level of Service		7.4	0.0	8.9				
pproach Delay (s) 7.4 0.0 8.9 pproach LOS A tersection Summary verage Delay 2.5 tersection Capacity Utilization 15.6% ICU Level of Service	Lane LOS			А				
A tersection Summary verage Delay tersection Capacity Utilization	Approach Delay (s)		0.0					
verage Delay 2.5 tersection Capacity Utilization 15.6% ICU Level of Service	Approach LOS							
tersection Capacity Utilization 15.6% ICU Level of Service	Intersection Summary							
tersection Capacity Utilization 15.6% ICU Level of Service	Average Delay			2.5				
		tion			IC	U Level o	of Service	
	Analysis Period (min)			15				

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Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		र्स	ţ,		¥	
Traffic Volume (veh/h)	5	0	0	0	0	2
Future Volume (Veh/h)	5	0	0	0	0	2
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	0	0	0	0	2
Pedestrians	•	Ŭ	•	•	·	-
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)		None	None			
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				12	0
vC1, stage 1 conf vol	0				12	U
vC2, stage 2 conf vol						
vCu, unblocked vol	0				12	0
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)	7.1				0.4	0.2
	2.2				3.5	3.3
tF (s) p0 queue free %	100				100	100
	1623				1004	1085
cM capacity (veh/h)	1023				1004	1005
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	6	0	2			
Volume Left	6	0	0			
Volume Right	0	0	2			
cSH	1623	1700	1085			
Volume to Capacity	0.00	0.00	0.00			
Queue Length 95th (m)	0.1	0.0	0.0			
Control Delay (s)	7.2	0.0	8.3			
Lane LOS	А		А			
Approach Delay (s)	7.2	0.0	8.3			
Approach LOS			А			
Intersection Summary						
Average Delay			7.5			
Intersection Capacity Utiliza	ation		13.3%	IC	Ulevelo	of Service
Analysis Period (min)			15			
			10			

	→	7	1	-	1	1
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	4î			र्स	¥	
Traffic Volume (veh/h)	6	18	0	20	59	0
Future Volume (Veh/h)	6	18	0	20	59	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	7	20	0	22	66	0
Pedestrians			-			-
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)	None			None		
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			27		39	17
vC1, stage 1 conf vol			21		39	17
vC2, stage 2 conf vol						
vCu, unblocked vol			27		39	17
			4.1		6.4	6.2
tC, single (s)			4.1		0.4	0.2
tC, 2 stage (s)			2.2		3.5	3.3
tF (s)			100		3.5 93	3.3 100
p0 queue free %						
cM capacity (veh/h)			1587		973	1062
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	27	22	66			
Volume Left	0	0	66			
Volume Right	20	0	0			
cSH	1700	1587	973			
Volume to Capacity	0.02	0.00	0.07			
Queue Length 95th (m)	0.0	0.0	1.7			
Control Delay (s)	0.0	0.0	9.0			
Lane LOS			А			
Approach Delay (s)	0.0	0.0	9.0			
Approach LOS			А			
Intersection Summary						
Average Delay			5.1			
Intersection Capacity Utiliza	ation		13.5%	IC	U Level o	f Service
Analysis Period (min)			15.578	10		
			15			

HCM Unsignalized Intersection Capacity Analysis 47: Leslie Davis & Street A

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		\$			\$			4			4	
Sign Control		Yield			Yield			Yield			Yield	
Traffic Volume (vph)	21	0	0	0	0	0	0	0	0	0	0	7
Future Volume (vph)	21	0	0	0	0	0	0	0	0	0	0	7
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	23	0	0	0	0	0	0	0	0	0	0	8
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	23	0	0	8								
Volume Left (vph)	23	0	0	0								
Volume Right (vph)	0	0	0	8								
Hadj (s)	0.23	0.00	0.00	-0.57								
Departure Headway (s)	4.1	3.9	4.0	3.4								
Degree Utilization, x	0.03	0.00	0.00	0.01								
Capacity (veh/h)	860	900	900	1050								
Control Delay (s)	7.3	6.9	7.0	6.4								
Approach Delay (s)	7.3	0.0	0.0	6.4								
Approach LOS	А	A	Α	A								
Intersection Summary												
Delay			7.0									
Level of Service			А									
Intersection Capacity Utilizat	ion		13.3%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis 51: Swan & Brant-Waterloo

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
Traffic Volume (veh/h)	3	0	5	0	5	6	3	100	3	6	76	4
Future Volume (Veh/h)	3	0	5	0	5	6	3	100	3	6	76	4
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	3	0	6	0	6	7	3	111	3	7	84	4
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	228	220	86	224	220	112	88			114		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	228	220	86	224	220	112	88			114		
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	99	100	99	99	100			100		
cM capacity (veh/h)	717	677	978	727	677	946	1520			1488		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1	-							
Volume Total	9	13	117	95								
Volume Left	3	0	3	7								
Volume Right	6	7	3	4								
cSH	872	799	1520	1488								
Volume to Capacity	0.01	0.02	0.00	0.00								
Queue Length 95th (m)	0.01	0.02	0.00	0.00								
Control Delay (s)	9.2	0.4 9.6	0.0	0.1								
, ()												
Lane LOS	A	A	A	A								
Approach Delay (s)	9.2	9.6	0.2	0.6								
Approach LOS	А	А										
Intersection Summary												
Average Delay			1.2			(0 ·						
Intersection Capacity Utiliza	tion		19.2%	IC	U Level o	of Service			A			
Analysis Period (min)			15									

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Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	¥		4			र्स
Traffic Volume (veh/h)	4	54	0	1	16	0
Future Volume (Veh/h)	4	54	0	1	16	0
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	4	60	0	1	18	0
Pedestrians	•	00	Ŭ	•	10	Ŭ
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)			NONE			NONE
Upstream signal (m)						
pX, platoon unblocked	36	0			4	
vC, conflicting volume	30	0			1	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol	00	0			4	
vCu, unblocked vol	36	0			1	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	<u> </u>					
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	94			99	
cM capacity (veh/h)	965	1084			1622	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	64	1	18			
Volume Left	4	0	18			
Volume Right	60	1	0			
cSH	1076	1700	1622			
Volume to Capacity	0.06	0.00	0.01			
Queue Length 95th (m)	1.4	0.0	0.3			
Control Delay (s)	8.6	0.0	7.2			
Lane LOS	А		А			
Approach Delay (s)	8.6	0.0	7.2			
Approach LOS	А					
Intersection Summary						
Average Delay			8.2			
Intersection Capacity Utiliz	ation		18.1%	IC	Ulevelo	of Service
Analysis Period (min)			15	.0	5 201010	
			10			

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Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			र्भ	4	
Traffic Volume (veh/h)	3	0	0	3	1	1
Future Volume (Veh/h)	3	0	0	3	1	1
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	3	0	0	3	1	1
Pedestrians	-	-	-	-		
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)				110110	110110	
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	4	2	2			
vC1, stage 1 conf vol	T	L	2			
vC2, stage 2 conf vol						
vCu, unblocked vol	4	2	2			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	т. 0	0.2	т. I			
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	1017	1083	1620			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	3	3	2			
Volume Left	3	0	0			
Volume Right	0	0	1			
cSH	1017	1620	1700			
Volume to Capacity	0.00	0.00	0.00			
Queue Length 95th (m)	0.1	0.0	0.0			
Control Delay (s)	8.5	0.0	0.0			
Lane LOS	А					
Approach Delay (s)	8.5	0.0	0.0			
Approach LOS	А					
Intersection Summary						
Average Delay			3.2			
Intersection Capacity Utiliz	ation		13.3%	IC	CU Level o	of Service
Analysis Period (min)			15			
			10			

HCM Unsignalized Intersection Capacity Analysis 1: Hilltop & Swan

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		\$			\$		٦	¢Î,		7	¢Î,	
Traffic Volume (veh/h)	2	0	0	29	0	93	0	146	40	168	255	6
Future Volume (Veh/h)	2	0	0	29	0	93	0	146	40	168	255	6
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	0	0	32	0	103	0	162	44	187	283	7
Pedestrians					1			3				
Lane Width (m)					3.5			3.5				
Walking Speed (m/s)					1.1			1.1				
Percent Blockage					0			0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	926	868	290	845	849	185	290			207		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	926	868	290	845	849	185	290			207		
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 %	99	100	100	87	100	88	100			86		
cM capacity (veh/h)	198	253	752	254	259	856	1283			1375		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	2	135	0	206	187	290						
Volume Left	2	32	0	0	187	0						
Volume Right	0	103	0	44	0	7						
cSH	198	548	1700	1700	1375	1700						
Volume to Capacity	0.01	0.25	0.00	0.12	0.14	0.17						
Queue Length 95th (m)	0.2	7.3	0.0	0.0	3.6	0.0						
Control Delay (s)	23.4	13.7	0.0	0.0	8.0	0.0						
Lane LOS	С	В			А							
Approach Delay (s)	23.4	13.7	0.0		3.1							
Approach LOS	С	В										
Intersection Summary												
Average Delay			4.1									
Intersection Capacity Utilization	tion		42.1%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		\$			\$			\$			\$	
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	5	42	122	33	30	0	79	5	12	0	2	4
Future Volume (vph)	5	42	122	33	30	0	79	5	12	0	2	4
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	47	136	37	33	0	88	6	13	0	2	4
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	189	70	107	6								
Volume Left (vph)	6	37	88	0								
Volume Right (vph)	136	0	13	4								
Hadj (s)	-0.43	0.11	0.09	-0.40								
Departure Headway (s)	3.8	4.5	4.5	4.2								
Degree Utilization, x	0.20	0.09	0.14	0.01								
Capacity (veh/h)	911	769	748	792								
Control Delay (s)	7.8	7.9	8.3	7.2								
Approach Delay (s)	7.8	7.9	8.3	7.2								
Approach LOS	А	А	Α	А								
Intersection Summary												
Delay			7.9									
Level of Service			А									
Intersection Capacity Utiliza	tion		35.4%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis 21: Stanley & Northumberland

	٨	-	7	1	+	*	1	1	1	4	Ŧ	4
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			र्स	1		4			4	
Traffic Volume (veh/h)	64	37	3	2	38	291	2	14	5	532	10	81
Future Volume (Veh/h)	64	37	3	2	38	291	2	14	5	532	10	81
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	71	41	3	2	42	323	2	16	6	591	11	90
Pedestrians		1			6			2			5	
Lane Width (m)		3.5			3.5			3.5			3.5	
Walking Speed (m/s)		1.1			1.1			1.1			1.1	
Percent Blockage		0			1			0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	47			46			329	238	50	256	239	48
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	47			46			329	238	50	256	239	48
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 %	95			100			100	97	99	9	98	91
cM capacity (veh/h)	1567			1572			541	632	1016	651	631	1021
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1							
Volume Total	115	44	323	24	692							
Volume Left	71	2	020	2	591							
Volume Right	3	0	323	6	90							
cSH	1567	1572	1700	687	682							
Volume to Capacity	0.05	0.00	0.19	0.03	1.01							
Queue Length 95th (m)	1.1	0.00	0.19	0.03	127.1							
2 (<i>i</i>	4.7	0.0	0.0	10.4	62.6							
Control Delay (s) Lane LOS	4.7 A	0.3 A	0.0	10.4 B	62.6 F							
	4.7	0.0		ы 10.4	г 62.6							
Approach Delay (s) Approach LOS	4.7	0.0		10.4 B	02.0 F							
Intersection Summary			26.0									
Average Delay	tion		36.8			f Consist			0			
Intersection Capacity Utiliza			69.8%	IC	CU Level c	DI SEIVICE			С			
Analysis Period (min)			15									

	-	7	4	-	1	1
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	1		۲	•	Y	
Traffic Volume (veh/h)	36	62	113	77	41	40
Future Volume (Veh/h)	36	62	113	77	41	40
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	40	69	126	86	46	44
Pedestrians					2	
Lane Width (m)					3.5	
Walking Speed (m/s)					1.1	
Percent Blockage					0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)	1 tonio			Home		
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			111		414	76
vC1, stage 1 conf vol						10
vC2, stage 2 conf vol						
vCu, unblocked vol			111		414	76
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.1	5.2
tF (s)			2.2		3.5	3.3
p0 queue free %			92		92	96
cM capacity (veh/h)			1489		547	988
					011	000
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	109	126	86	90		
Volume Left	0	126	0	46		
Volume Right	69	0	0	44		
cSH	1700	1489	1700	699		
Volume to Capacity	0.06	0.08	0.05	0.13		
Queue Length 95th (m)	0.0	2.1	0.0	3.3		
Control Delay (s)	0.0	7.6	0.0	10.9		
Lane LOS		A		В		
Approach Delay (s)	0.0	4.5		10.9		
Approach LOS				В		
Intersection Summary						
Average Delay			4.7			
Intersection Capacity Utilization	ation		25.1%	IC	U Level c	of Service
Analysis Period (min)			15			
, , , , , , , , , ,						

	→	7	1	-	1	1
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	¢			4	M	
Traffic Volume (veh/h)	52	524	24	52	279	13
Future Volume (Veh/h)	52	524	24	52	279	13
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	58	582	27	58	310	14
Pedestrians	1				1	
Lane Width (m)	3.5				3.5	
Walking Speed (m/s)	1.1				1.1	
Percent Blockage	0				0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			641		463	350
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			641		463	350
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		43	98
cM capacity (veh/h)			952		542	697
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	640	85	324			
Volume Left	0	27	310			
Volume Right	582	0	14			
cSH	1700	952	547			
Volume to Capacity	0.38	0.03	0.59			
Queue Length 95th (m)	0.0	0.7	29.1			
Control Delay (s)	0.0	3.0	20.7			
Lane LOS	0.0	A	C			
Approach Delay (s)	0.0	3.0	20.7			
Approach LOS	0.0		C			
Intersection Summary						
Average Delay			6.6			
Intersection Capacity Utiliza	ation		64.7%	IC	U Level c	of Service
Analysis Period (min)			15	10	2 201010	
			15			

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Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations		र्स	t,		Y		
Traffic Volume (veh/h)	3	0	0	55	94	5	
Future Volume (Veh/h)	3	0	0	55	94	5	
Sign Control		Free	Free		Stop		
Grade		0%	0%		0%		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	
Hourly flow rate (vph)	3	0	0	61	104	6	
Pedestrians							
Lane Width (m)							
Walking Speed (m/s)							
Percent Blockage							
Right turn flare (veh)							
Median type		None	None				
Median storage veh)							
Upstream signal (m)							
pX, platoon unblocked							
vC, conflicting volume	61				36	30	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	61				36	30	
tC, single (s)	4.1				6.4	6.2	
tC, 2 stage (s)							
tF (s)	2.2				3.5	3.3	
p0 queue free %	100				89	99	
cM capacity (veh/h)	1542				974	1044	
Direction, Lane #	EB 1	WB 1	SB 1		-	-	
Volume Total		61	110				
	3 3		104				
Volume Left	3 0	0					
Volume Right		61	6				
cSH Valume te Canacitu	1542	1700	978				
Volume to Capacity	0.00	0.04	0.11				
Queue Length 95th (m)	0.0	0.0	2.9				
Control Delay (s)	7.3	0.0	9.1				
Lane LOS	A	0.0	A				
Approach Delay (s)	7.3	0.0	9.1				
Approach LOS			А				
Intersection Summary							
Average Delay			5.9				
Intersection Capacity Utilization	on		16.5%	IC	U Level o	of Service	
Analysis Period (min)			15				

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Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		र्स	Þ		¥	
Traffic Volume (veh/h)	3	0	0	0	0	5
Future Volume (Veh/h)	3	0	0	0	0	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	3	0	0	0	0	6
Pedestrians	, , , , , , , , , , , , , , , , , , ,	, , , , , , , , , , , , , , , , , , ,	, ,	•	·	,
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)		None	None			
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				6	0
vC1, stage 1 conf vol	0				0	U
vC2, stage 2 conf vol						
vCu, unblocked vol	0				6	0
tC, single (s)	4.1				6.4	6.2
	4.1				0.4	0.2
tC, 2 stage (s)	2.2				3.5	3.3
tF (s)	2.2				3.5 100	3.3 99
p0 queue free %	1623				100	
cM capacity (veh/h)	1023				1014	1085
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	3	0	6			
Volume Left	3	0	0			
Volume Right	0	0	6			
cSH	1623	1700	1085			
Volume to Capacity	0.00	0.00	0.01			
Queue Length 95th (m)	0.0	0.0	0.1			
Control Delay (s)	7.2	0.0	8.3			
Lane LOS	А		А			
Approach Delay (s)	7.2	0.0	8.3			
Approach LOS			А			
Intersection Summary						
Average Delay			8.0			
Intersection Capacity Utiliz	ation		13.3%	IC	U Level o	of Service
Analysis Period (min)			15			
			10			

	-	7	4	+	1	1
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	ţ,			र्भ	¥	
Traffic Volume (veh/h)	24	71	0	14	42	0
Future Volume (Veh/h)	24	71	0	14	42	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	27	79	0	16	47	0
Pedestrians						-
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)	None			None		
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			106		82	66
vC1, stage 1 conf vol			100		02	00
vC2, stage 2 conf vol						
vCu, unblocked vol			106		82	66
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)			7.1		0.4	0.2
tF (s)			2.2		3.5	3.3
p0 queue free %			100		95	100
cM capacity (veh/h)			1485		95 919	997
,					313	551
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	106	16	47			
Volume Left	0	0	47			
Volume Right	79	0	0			
cSH	1700	1485	919			
Volume to Capacity	0.06	0.00	0.05			
Queue Length 95th (m)	0.0	0.0	1.2			
Control Delay (s)	0.0	0.0	9.1			
Lane LOS			А			
Approach Delay (s)	0.0	0.0	9.1			
Approach LOS			А			
Intersection Summary						
Average Delay			2.5			
Intersection Capacity Utiliz	ation		16.5%	IC	U Level c	of Service
Analysis Period (min)			15	10		
			10			

HCM Unsignalized Intersection Capacity Analysis 47: Leslie Davis & Street A

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		\$			\$			4			4	
Sign Control		Yield			Yield			Yield			Yield	
Traffic Volume (vph)	15	0	0	0	0	0	0	0	0	0	0	25
Future Volume (vph)	15	0	0	0	0	0	0	0	0	0	0	25
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	17	0	0	0	0	0	0	0	0	0	0	28
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	17	0	0	28								
Volume Left (vph)	17	0	0	0								
Volume Right (vph)	0	0	0	28								
Hadj (s)	0.23	0.00	0.00	-0.57								
Departure Headway (s)	4.2	4.0	4.0	3.4								
Degree Utilization, x	0.02	0.00	0.00	0.03								
Capacity (veh/h)	848	900	900	1056								
Control Delay (s)	7.3	7.0	7.0	6.5								
Approach Delay (s)	7.3	0.0	0.0	6.5								
Approach LOS	A	Α	Α	А								
Intersection Summary												
Delay			6.8									
Level of Service			А									
Intersection Capacity Utilizati	on		13.3%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis 51: Swan & Brant-Waterloo

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
Traffic Volume (veh/h)	7	3	4	0	3	5	4	124	3	5	174	5
Future Volume (Veh/h)	7	3	4	0	3	5	4	124	3	5	174	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	8	3	4	0	3	6	4	138	3	6	193	6
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	363	357	196	361	358	140	199			141		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	363	357	196	361	358	140	199			141		
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 %	99	99	100	100	99	99	100			100		
cM capacity (veh/h)	587	568	850	590	567	914	1385			1455		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	15	9	145	205								
Volume Left	8	0	4	6								
Volume Right	4	6	3	6								
cSH	635	759	1385	1455								
Volume to Capacity	0.02	0.01	0.00	0.00								
Queue Length 95th (m)	0.6	0.3	0.1	0.1								
Control Delay (s)	10.8	9.8	0.2	0.3								
Lane LOS	B	A	A	A								
Approach Delay (s)	10.8	9.8	0.2	0.3								
Approach LOS	B	A	0.2	0.0								
Intersection Summary												
Average Delay			0.9									
Intersection Capacity Utiliza	tion		28.5%	IC	Ulevelo	of Service			А			
Analysis Period (min)			15						Λ			
			10									

Lane Configurations Y ↓		1	*	t	1	4	ŧ	
Traffic Volume (veh/h) 2 31 0 4 55 0 Future Volume (Veh/h) 2 31 0 4 55 0 Sign Control Stop Free Free Free Grade 0% 0% 0% Peak Hour Factor 0.90	Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Traffic Volume (veh/h) 2 31 0 4 55 0 Future Volume (Veh/h) 2 31 0 4 55 0 Sign Control Stop Free Free Free Grade 0% 0% 0% Peak Hour Factor 0.90	Lane Configurations	Y		¢Î,			é.	
Sign Control Stop Free Free Grade 0% 0% 0% Grade 0% 0% 0% Peak Hour Factor 0.90 0.90 0.90 0.90 0.90 Hourly flow rate (vph) 2 34 0 4 61 0 Pedestrians	Traffic Volume (veh/h)		31		4	55		
Grade 0% 0% 0% Peak Hour Factor 0.90 0.90 0.90 0.90 0.90 0.90 Hourly flow rate (vph) 2 34 0 4 61 0 Pedestrians Lane Width (m) Values	Future Volume (Veh/h)	2	31	0	4	55	0	
Grade 0% 0% 0% Peak Hour Factor 0.90 0.90 0.90 0.90 0.90 0.90 Hourly flow rate (vph) 2 34 0 4 61 0 Pedestrians Lane Width (m) Values	Sign Control	Stop		Free			Free	
Hourly flow rate (vph) 2 34 0 4 61 0 Pedestrians Lane Width (m) Walking Speed (m/s) Velocity Velocity </td <td>Grade</td> <td></td> <td></td> <td>0%</td> <td></td> <td></td> <td>0%</td> <td></td>	Grade			0%			0%	
Pedestrians Lane Width (m) Walking Speed (m/s) Percent Blockage Right turn flare (veh) Median storage veh) Upstream signal (m) pX, platoon unblocked vC, conflicting volume 124 VC, stage 1 conf vol vCu, unblocked vol 124 VCu, stage 2 conf vol vCu, unblocked vol 124 VC, stage 2 conf vol vCu, unblocked vol 124 VC, stage 2 conf vol vCu, unblocked vol 124 VC, stage 3 6.4 F(s) 3.5 JO queue free % 100 JO queue free % 100 Volume Total 36 Volume Total 36 Volume Right 34 Volume Right 34 Volume to Capacity 0.03 Volume to Capacity 0.3 Queue Length 95th (m) 0.8 Volume to Capacity 0.3 Right 35 Mat 0 SB 0.0 Control Delay (s)	Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	
Pedestrians Lane Width (m) Walking Speed (m/s) Percent Blockage Right turn flare (veh) Median storage veh) Upstream signal (m) pX, platoon unblocked vC, conflicting volume 124 VC1, stage 1 conf vol vC2, stage 2 conf vol vC4, unblocked vol 124 VC4, stage 1 conf vol vC2, stage 2 conf vol vC4, stage (s) EF (s) 3.5 90 queue free % 100 97 96 CM capacity (veh/h) 838 1082 1618 Direction, Lane # WB 1 NB 1 Volume Total 36 4 Volume Right 34 4 Volume Right 34 4 Volume to Capacity 0.03 0.04 Queue Length 95th (m) 0.8 0.0 0.9 Control Delay (s) 8.5 0.0 7.3 Lane LOS A A A Approach LOS A A A Approach LOS	Hourly flow rate (vph)	2	34	0	4	61	0	
Walking Speed (m/s) Percent Blockage Right turn flare (veh) Median type None Median storage veh) Upstream signal (m) px, platoon unblocked vC, conflicting volume 124 2 4 vC1, stage 1 conf vol vC2, stage 2 conf vol vC2, stage 1 conf vol 2 4 vC2, stage 2 conf vol vC4, unblocked vol 124 2 4 L7, stage 1 conf vol 2 4 4 vC2, stage 2 conf vol 2 4 4 VC2, stage (s) 6.4 6.2 4.1 6 L7, stage (s) 8.5 3.3 2.2 p0 queue free % 100 97 96 CM capacity (veh/h) 838 1082 1618 1618 1618 1618 Direction, Lane # WB 1 NB 1 SB 1 1618 1618 1618 1618 1618 1618 1618 1618 1618 1618 1618 1618 1618 1618 1618 16161 1618 16161	Pedestrians							
Walking Speed (m/s) Percent Blockage Right turn flare (veh) Median type None Median storage veh) Upstream signal (m) pX, platoon unblocked vC, conflicting volume 124 2 4 vC1, stage 1 conf vol vC2, stage 2 conf vol vC2, stage 1 conf vol 2 4 vC2, stage 2 conf vol vC4, unblocked vol 124 2 4 L7, stage 1 conf vol 2 4 4 vC2, stage 2 conf vol 2 4 4 VC2, stage (s) 164 6.2 4.1 6 L7, stage (s) 3.5 3.3 2.2 p0 queue free % 100 97 96 CM capacity (veh/h) 838 1082 1618 1618 1618 1618 Direction, Lane # WB 1 NB 1 SB 1 1618 1618 1618 1618 1618 1618 1618 1618 1618 1618 1618 1618 1618 1618 1618 1614 1615 1700	Lane Width (m)							
Weedian type None None Median type None None Median type None None Median storage veh) Upstream signal (m) px, platoon unblocked vC, conflicting volume 124 2 4 vC1, stage 1 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC2, stage (s)	Walking Speed (m/s)							
Right turn flare (veh) None None Median storage veh) Upstream signal (m) None None yX, platoon unblocked VC, conflicting volume 124 2 4 vC1, stage 1 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC4, unblocked vol 124 2 4 C5, single (s) 6.4 6.2 4.1 C C7, stage (s) T 96 100 97 96 vC1 capacity (veh/h) 838 1082 1618 1618 Direction, Lane # WB 1 NB 1 SB 1 Volume Total 36 4 61 Volume Total 36 4 61 Volume to Capacity 0.03 0.00 0.04 Queue Length 95th (m) 0.8 0.0 0.9 Control Delay (s) 8.5 0.0 7.3 Lane LOS A A A A Approach LOS A A Approach LOS A	Percent Blockage							
Median storage veh) Upstream signal (m) pX, platoon unblocked vC, conflicting volume 124 2 4 vC1, stage 1 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol 4 100 124 2 4 VC, single (s) 6.4 6.2 4.1 100 124 2 4 VC, stage (s) T 100 97 96 96 96 96 96 96 97 96 96 96 97 96 96 97 96 96 97 96 96 97 97 <td< td=""><td>Right turn flare (veh)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	Right turn flare (veh)							
Median storage veh) Upstream signal (m) pX, platoon unblocked vC, conflicting volume 124 2 4 vC1, stage 1 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol 4 2 4 VC, single (s) 6.4 6.2 4.1 4 C, single (s) 6.4 6.2 4.1 4 C, stage (s) T 96 97 96 p0 queue free % 100 97 96 97 96 cM capacity (veh/h) 838 1082 1618 1618 Direction, Lane # WB 1 NB 1 SB 1 1618 1618 Volume Total 36 4 61 1618 <t< td=""><td>Median type</td><td></td><td></td><td>None</td><td></td><td></td><td>None</td><td></td></t<>	Median type			None			None	
pX, platoon unblocked vC, conflicting volume 124 2 4 vC1, stage 1 conf vol vC2, stage 2 conf vol vCu, unblocked vol 124 2 4 tC, single (s) 6.4 6.2 4.1 tC, 2 stage (s) tr 4 4 tF (s) 3.5 3.3 2.2 p0 queue free % 100 97 96 cdm capacity (veh/h) 838 1082 1618 Direction, Lane # WB 1 NB 1 SB 1 Volume Total 36 4 61 Volume Left 2 0 61 Volume Right 34 4 0 cSH 1065 1700 1618 Volume to Capacity 0.03 0.00 0.04 Queue Length 95th (m) 0.8 0.0 0.9 Control Delay (s) 8.5 0.0 7.3 Lane LOS A A A Approach LOS A A Approach LOS A A Approach	Median storage veh)							
pX, platoon unblocked vC, conflicting volume 124 2 4 vC1, stage 1 conf vol vC2, stage 2 conf vol vCu, unblocked vol 124 2 4 tC, single (s) 6.4 6.2 4.1 tC, 2 stage (s) 100 97 96 tF (s) 3.5 3.3 2.2 p0 queue free % 100 97 96 cdm capacity (veh/h) 838 1082 1618 Direction, Lane # WB 1 NB 1 SB 1 Volume Total 36 4 61 Volume Left 2 0 61 Volume Right 34 4 0 cSH 1065 1700 1618 Volume to Capacity 0.03 0.00 0.04 Queue Length 95th (m) 0.8 0.0 0.9 Control Delay (s) 8.5 0.0 7.3 Lane LOS A A A Approach LOS A A Approach LOS A A Appro	Upstream signal (m)							
vC1, stage 1 conf vol vC2, stage 2 conf vol vCu, unblocked vol 124 2 4 tC, single (s) 6.4 6.2 4.1 tC, 2 stage (s)	pX, platoon unblocked							
vC2, stage 2 conf vol vCu, unblocked vol 124 2 4 tC, single (s) 6.4 6.2 4.1 tC, 2 stage (s)	vC, conflicting volume	124	2			4		
vCu, unblocked vol 124 2 4 tC, single (s) 6.4 6.2 4.1 tC, 2 stage (s)	vC1, stage 1 conf vol							
tC, single (s) 6.4 6.2 4.1 tC, 2 stage (s) 100 97 96 p0 queue free % 100 97 96 p0 queue free % 100 97 96 cM capacity (veh/h) 838 1082 1618 Direction, Lane # WB 1 NB 1 SB 1 Volume Total 36 4 61 Volume Left 2 0 61 Volume Right 34 4 0 cSH 1065 1700 1618 Volume to Capacity 0.03 0.00 0.04 Queue Length 95th (m) 0.8 0.0 0.9 Control Delay (s) 8.5 0.0 7.3 Lane LOS A A A Approach Delay (s) 8.5 0.0 7.3 Approach LOS A A A Average Delay 7.4 ICU Level of Service	vC2, stage 2 conf vol							
tC, 2 stage (s) tF (s) 3.5 3.3 2.2 p0 queue free % 100 97 96 cM capacity (veh/h) 838 1082 1618 Direction, Lane # WB 1 NB 1 SB 1 Volume Total 36 4 61 Volume Left 2 0 61 Volume Right 34 4 0 cSH 1065 1700 1618 Volume to Capacity 0.03 0.00 0.04 Queue Length 95th (m) 0.8 0.0 0.9 Control Delay (s) 8.5 0.0 7.3 Lane LOS A A Approach LOS A A Approach LOS A A Average Delay 7.4 ICU Level of Service	vCu, unblocked vol	124	2			4		
IF (s) 3.5 3.3 2.2 p0 queue free % 100 97 96 cM capacity (veh/h) 838 1082 1618 Direction, Lane # WB 1 NB 1 SB 1 Volume Total 36 4 61 Volume Total 36 4 61 Volume Right 34 4 0 cSH 1065 1700 1618 Volume to Capacity 0.03 0.00 0.04 Queue Length 95th (m) 0.8 0.0 0.9 Control Delay (s) 8.5 0.0 7.3 Lane LOS A A Approach Delay (s) 8.5 0.0 7.3 Approach LOS A A Average Delay 7.4 ICU Level of Service	tC, single (s)	6.4	6.2			4.1		
p0 queue free % 100 97 96 cM capacity (veh/h) 838 1082 1618 Direction, Lane # WB 1 NB 1 SB 1 Volume Total 36 4 61 Volume Left 2 0 61 Volume Right 34 4 0 cSH 1065 1700 1618 Volume to Capacity 0.03 0.00 0.04 Queue Length 95th (m) 0.8 0.0 0.9 Control Delay (s) 8.5 0.0 7.3 Lane LOS A A Approach Delay (s) 8.5 0.0 7.3 Approach LOS A A Average Delay 7.4 ICU Level of Service	tC, 2 stage (s)							
CM capacity (veh/h) 838 1082 1618 Direction, Lane # WB 1 NB 1 SB 1 Volume Total 36 4 61 Volume Left 2 0 61 Volume Right 34 4 0 cSH 1065 1700 1618 Volume to Capacity 0.03 0.00 0.04 Queue Length 95th (m) 0.8 0.0 0.9 Control Delay (s) 8.5 0.0 7.3 Lane LOS A A Approach Delay (s) 8.5 0.0 7.3 Approach LOS A A Average Delay 7.4 ICU Level of Service	tF (s)	3.5	3.3			2.2		
Direction, Lane # WB 1 NB 1 SB 1 Volume Total 36 4 61 Volume Left 2 0 61 Volume Right 34 4 0 cSH 1065 1700 1618 Volume to Capacity 0.03 0.00 0.04 Queue Length 95th (m) 0.8 0.0 0.9 Control Delay (s) 8.5 0.0 7.3 Lane LOS A A Approach Delay (s) 8.5 0.0 7.3 Approach LOS A A Average Delay 7.4 ICU Level of Service	p0 queue free %	100	97			96		
Volume Total 36 4 61 Volume Left 2 0 61 Volume Right 34 4 0 cSH 1065 1700 1618 Volume to Capacity 0.03 0.00 0.04 Queue Length 95th (m) 0.8 0.0 0.9 Control Delay (s) 8.5 0.0 7.3 Lane LOS A A Approach Delay (s) 8.5 0.0 7.3 Approach LOS A A Average Delay 7.4 ICU Level of Service	cM capacity (veh/h)	838	1082			1618		
Volume Left 2 0 61 Volume Right 34 4 0 cSH 1065 1700 1618 Volume to Capacity 0.03 0.00 0.04 Queue Length 95th (m) 0.8 0.0 0.9 Control Delay (s) 8.5 0.0 7.3 Lane LOS A A Approach Delay (s) 8.5 0.0 7.3 Approach LOS A A Average Delay 7.4 Intersection Capacity Utilization 19.7% ICU Level of Service	Direction, Lane #	WB 1	NB 1	SB 1				
Volume Right 34 4 0 cSH 1065 1700 1618 Volume to Capacity 0.03 0.00 0.04 Queue Length 95th (m) 0.8 0.0 0.9 Control Delay (s) 8.5 0.0 7.3 Lane LOS A A Approach Delay (s) 8.5 0.0 7.3 Intersection Summary 7.4 Intersection Capacity Utilization 19.7% ICU Level of Service	Volume Total	36	4	61				
cSH 1065 1700 1618 Volume to Capacity 0.03 0.00 0.04 Queue Length 95th (m) 0.8 0.0 0.9 Control Delay (s) 8.5 0.0 7.3 Lane LOS A A Approach Delay (s) 8.5 0.0 7.3 Intersection Summary 7.4 Intersection Capacity Utilization 19.7% ICU Level of Service	Volume Left	2	0	61				
Volume to Capacity0.030.000.04Queue Length 95th (m)0.80.00.9Control Delay (s)8.50.07.3Lane LOSAAApproach Delay (s)8.50.07.3Approach LOSA7.3Intersection SummaryAverage Delay7.4Intersection Capacity Utilization19.7%ICU Level of Service	Volume Right	34	4	0				
Queue Length 95th (m) 0.8 0.0 0.9 Control Delay (s) 8.5 0.0 7.3 Lane LOS A A Approach Delay (s) 8.5 0.0 7.3 Approach LOS A A Intersection Summary 7.4 Intersection Capacity Utilization 19.7% ICU Level of Service	cSH	1065	1700	1618				
Queue Length 95th (m) 0.8 0.0 0.9 Control Delay (s) 8.5 0.0 7.3 Lane LOS A A Approach Delay (s) 8.5 0.0 7.3 Approach LOS A A Intersection Summary 7.4 Intersection Capacity Utilization 19.7% ICU Level of Service	Volume to Capacity	0.03	0.00	0.04				
Control Delay (s) 8.5 0.0 7.3 Lane LOS A A Approach Delay (s) 8.5 0.0 7.3 Approach LOS A Intersection Summary Average Delay 7.4 Intersection Capacity Utilization 19.7% ICU Level of Service		0.8	0.0	0.9				
Lane LOS A A Approach Delay (s) 8.5 0.0 7.3 Approach LOS A A Intersection Summary A Average Delay 7.4 Intersection Capacity Utilization 19.7% ICU Level of Service	• • • •	8.5	0.0	7.3				
Approach Delay (s) 8.5 0.0 7.3 Approach LOS A Intersection Summary Average Delay 7.4 Intersection Capacity Utilization 19.7% ICU Level of Service	• • • /	А		А				
Approach LOS A Intersection Summary Average Delay 7.4 Intersection Capacity Utilization 19.7% ICU Level of Service			0.0					
Average Delay 7.4 Intersection Capacity Utilization 19.7% ICU Level of Service	Approach LOS							
Intersection Capacity Utilization 19.7% ICU Level of Service	Intersection Summary							
	Average Delay			7.4				
		ation		19.7%	IC	U Level o	of Service	
	Analysis Period (min)			15				

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Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			र्भ	4	
Traffic Volume (veh/h)	2	0	0	2	3	3
Future Volume (Veh/h)	2	0	0	2	3	3
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	0	0	2	3	3
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)				110110	1.0110	
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	6	4	6			
vC1, stage 1 conf vol	v		Ŭ			
vC2, stage 2 conf vol						
vCu, unblocked vol	6	4	6			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	v .न	5.2	7.1			
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	1015	1079	1615			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	2	2	6			
Volume Left	2	0	0			
Volume Right	0	0	3			
cSH	1015	1615	1700			
Volume to Capacity	0.00	0.00	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	8.6	0.0	0.0			
Lane LOS	А					
Approach Delay (s)	8.6	0.0	0.0			
Approach LOS	А					
Intersection Summary						
Average Delay			1.7			
Intersection Capacity Utiliz	zation		13.3%	IC	CU Level o	of Service
Analysis Period (min)			15			
			10			

HCM Unsignalized Intersection Capacity Analysis 1: Hilltop & Swan

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4		ሻ	î.		٦	T+	
Traffic Volume (veh/h)	4	0	0	38	0	274	0	337	11	91	176	0
Future Volume (Veh/h)	4	0	0	38	0	274	0	337	11	91	176	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	4	0	0	42	0	304	0	374	12	101	196	0
Pedestrians					1			3				
Lane Width (m)					3.5			3.5				
Walking Speed (m/s)					1.1			1.1				
Percent Blockage					0			0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1076	785	199	782	779	381	196			387		
vC1, stage 1 conf vol	1010	100	100	102		001	100			001		
vC2, stage 2 conf vol												
vCu, unblocked vol	1076	785	199	782	779	381	196			387		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	7.1	0.0	0.2	7.1	0.0	0.2						
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	100	100	86	100	54	100			91		
cM capacity (veh/h)	101	299	845	292	301	668	1389			1181		
							1003			1101		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	4	346	0	386	101	196						
Volume Left	4	42	0	0	101	0						
Volume Right	0	304	0	12	0	0						
cSH	101	578	1700	1700	1181	1700						
Volume to Capacity	0.04	0.60	0.00	0.23	0.09	0.12						
Queue Length 95th (m)	0.9	30.0	0.0	0.0	2.1	0.0						
Control Delay (s)	42.1	20.1	0.0	0.0	8.3	0.0						
Lane LOS	E	С			А							
Approach Delay (s)	42.1	20.1	0.0		2.8							
Approach LOS	Е	С										
Intersection Summary												
Average Delay			7.7									
Intersection Capacity Utiliza	ation		60.9%	IC	U Level o	of Service			В			
Analysis Period (min)			15									

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		\$			\$			\$			\$	
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	3	26	75	19	41	0	220	14	51	0	3	13
Future Volume (vph)	3	26	75	19	41	0	220	14	51	0	3	13
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	3	29	83	21	46	0	244	16	57	0	3	14
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	115	67	317	17								
Volume Left (vph)	3	21	244	0								
Volume Right (vph)	83	0	57	14								
Hadj (s)	-0.31	0.06	0.08	-0.49								
Departure Headway (s)	4.5	4.9	4.4	4.2								
Degree Utilization, x	0.14	0.09	0.39	0.02								
Capacity (veh/h)	741	677	785	789								
Control Delay (s)	8.2	8.4	10.3	7.3								
Approach Delay (s)	8.2	8.4	10.3	7.3								
Approach LOS	А	А	В	А								
Intersection Summary												
Delay			9.5									
Level of Service			А									
Intersection Capacity Utiliza	ition		39.2%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		\$			\$			\$			\$	
Sign Control		Yield			Yield			Yield			Yield	
Traffic Volume (vph)	0	0	0	0	0	11	0	0	0	4	0	0
Future Volume (vph)	0	0	0	0	0	11	0	0	0	4	0	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	0	0	0	0	12	0	0	0	4	0	0
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	0	12	0	4								
Volume Left (vph)	0	0	0	4								
Volume Right (vph)	0	12	0	0								
Hadj (s)	0.00	-0.57	0.00	0.23								
Departure Headway (s)	3.9	3.3	3.9	4.2								
Degree Utilization, x	0.00	0.01	0.00	0.00								
Capacity (veh/h)	913	1069	910	859								
Control Delay (s)	6.9	6.4	6.9	7.2								
Approach Delay (s)	0.0	6.4	0.0	7.2								
Approach LOS	Α	Α	A	A								
Intersection Summary												
Delay			6.6									
Level of Service			А									
Intersection Capacity Utilizat	ion		13.3%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis 21: Stanley & Northumberland

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		\$			é.	1		\$			\$	
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	70	25	0	2	17	790	2	2	2	297	9	21
Future Volume (vph)	70	25	0	2	17	790	2	2	2	297	9	21
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	78	28	0	2	19	878	2	2	2	330	10	23
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1							
Volume Total (vph)	106	21	878	6	363							
Volume Left (vph)	78	2	0	2	330							
Volume Right (vph)	0	0	878	2	23							
Hadj (s)	0.19	0.02	-0.58	-0.13	0.14							
Departure Headway (s)	5.0	4.9	3.2	4.5	4.4							
Degree Utilization, x	0.15	0.03	0.78	0.01	0.44							
Capacity (veh/h)	669	665	1121	753	796							
Control Delay (s)	8.8	8.1	16.5	7.5	10.8							
Approach Delay (s)	8.8	16.3		7.5	10.8							
Approach LOS	А	С		Α	В							
Intersection Summary												
Delay			14.2									
Level of Service			В									
Intersection Capacity Utilizat	ion		75.6%	IC	U Level o	of Service			D			
Analysis Period (min)			15									

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Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	1		٦	1	Y	
Traffic Volume (veh/h)	109	31	43	53	62	175
Future Volume (Veh/h)	109	31	43	53	62	175
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	121	34	48	59	69	194
Pedestrians					2	
Lane Width (m)					3.5	
Walking Speed (m/s)					1.1	
Percent Blockage					0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)				-		
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			157		295	140
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			157		295	140
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		90	79
cM capacity (veh/h)			1408		675	909
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	155	48	59	263		
Volume Left	0	48	0	69		
Volume Right	34	0	0	194		
cSH	1700	1408	1700	833		
Volume to Capacity	0.09	0.03	0.03	0.32		
Queue Length 95th (m)	0.0	0.8	0.0	10.3		
Control Delay (s)	0.0	7.6	0.0	11.3		
Lane LOS		А		В		
Approach Delay (s)	0.0	3.4		11.3		
Approach LOS				В		
Intersection Summary						
Average Delay			6.4			
Intersection Capacity Utiliza	ation		36.7%	IC	U Level c	f Service
Analysis Period (min)			15			
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Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	ţ,			र्स	Y	
Traffic Volume (veh/h)	48	275	25	53	747	21
Future Volume (Veh/h)	48	275	25	53	747	21
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	53	306	28	59	830	23
Pedestrians	1				1	
Lane Width (m)	3.5				3.5	
Walking Speed (m/s)	1.1				1.1	
Percent Blockage	0				0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			360		323	207
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			360		323	207
tC, single (s)			4.1		6.4	6.3
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.4
p0 queue free %			98		0	97
cM capacity (veh/h)			1209		656	823
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	359	87	853			
Volume Left	0	28	830			
Volume Right	306	0	23			
cSH	1700	1209	660			
Volume to Capacity	0.21	0.02	1.29			
Queue Length 95th (m)	0.0	0.5	255.8			
Control Delay (s)	0.0	2.7	163.1			
Lane LOS	0.0	A	F			
Approach Delay (s)	0.0	2.7	163.1			
Approach LOS	0.0	2.1	F			
••						
Intersection Summary						
Average Delay			107.3			
Intersection Capacity Utiliza	tion		81.2%	IC	CU Level c	f Service
Analysis Period (min)			15			

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Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations		د	¢Î,		Y		
Traffic Volume (veh/h)	26	0	0	208	66	9	
Future Volume (Veh/h)	26	0	0	208	66	9	
Sign Control		Free	Free		Stop		
Grade		0%	0%		0%		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	
Hourly flow rate (vph)	29	0	0	231	73	10	
Pedestrians							
Lane Width (m)							
Walking Speed (m/s)							
Percent Blockage							
Right turn flare (veh)							
Median type		None	None				
Median storage veh)							
Upstream signal (m)							
pX, platoon unblocked							
vC, conflicting volume	231				174	116	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	231				174	116	
tC, single (s)	4.1				6.4	6.2	
tC, 2 stage (s)					••••	•	
tF (s)	2.2				3.5	3.3	
p0 queue free %	98				91	99	
cM capacity (veh/h)	1337				799	937	
Direction, Lane #	EB 1	WB 1	SB 1				
Volume Total	29	231	83				
Volume Left	29	0	73				
Volume Right	0	231	10				
cSH	1337	1700	813				
Volume to Capacity	0.02	0.14	0.10				
Queue Length 95th (m)	0.5	0.0	2.6				
Control Delay (s)	7.8	0.0	9.9				
Lane LOS	А		А				
Approach Delay (s)	7.8	0.0	9.9				
Approach LOS			А				
Intersection Summary							
Average Delay			3.1				
Intersection Capacity Utilizati	on		32.7%	IC	CU Level o	of Service	
Analysis Period (min)			15				

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Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		र्स	ħ		¥	
Traffic Volume (veh/h)	0	37	115	0	0	0
Future Volume (Veh/h)	0	37	115	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	41	128	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	128				169	128
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	128				169	128
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1458				821	922
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	41	128	0			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1458	1700	1700			
Volume to Capacity	0.00	0.08	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS			А			
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS			А			
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization	ation		10.3%	IC	U Level o	of Service
Analysis Period (min)			15			
· · · · · · · · · · · · · · · · · · ·						

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Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	4			र्भ	¥		
Traffic Volume (veh/h)	37	30	0	115	94	0	
Future Volume (Veh/h)	37	30	0	115	94	0	
Sign Control	Free			Free	Stop		
Grade	0%			0%	0%		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	
Hourly flow rate (vph)	41	33	0	128	104	0	
Pedestrians							
Lane Width (m)							
Walking Speed (m/s)							
Percent Blockage							
Right turn flare (veh)							
Median type	None			None			
Median storage veh)							
Upstream signal (m)							
pX, platoon unblocked							
vC, conflicting volume			74		186	58	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol			74		186	58	
tC, single (s)			4.1		6.4	6.2	
tC, 2 stage (s)							
tF (s)			2.2		3.5	3.3	
p0 queue free %			100		87	100	
cM capacity (veh/h)			1526		804	1009	
Direction, Lane #	EB 1	WB 1	NB 1				
Volume Total	74	128	104				
Volume Left	0	0	104				
Volume Right	33	0	0				
cSH	1700	1526	804				
Volume to Capacity	0.04	0.00	0.13				
Queue Length 95th (m)	0.04	0.00	3.4				
Control Delay (s)	0.0	0.0	10.1				
	0.0	0.0	-				
Lane LOS Approach Delay (s)	0.0	0.0	В 10.1				
Approach LOS	0.0	0.0	B				
			D				
Intersection Summary							
Average Delay			3.4				
Intersection Capacity Utiliza	tion		19.2%	IC	U Level c	of Service	
Analysis Period (min)			15				

HCM Unsignalized Intersection Capacity Analysis 47: Leslie Davis & Street A

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		\$			\$			\$			\$	
Sign Control		Yield			Yield			Yield			Yield	
Traffic Volume (vph)	10	0	0	0	0	5	0	80	0	2	26	3
Future Volume (vph)	10	0	0	0	0	5	0	80	0	2	26	3
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	11	0	0	0	0	6	0	89	0	2	29	3
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	11	6	89	34								
Volume Left (vph)	11	0	0	2								
Volume Right (vph)	0	6	0	3								
Hadj (s)	0.23	-0.57	0.03	-0.01								
Departure Headway (s)	4.4	3.6	4.0	4.0								
Degree Utilization, x	0.01	0.01	0.10	0.04								
Capacity (veh/h)	791	960	883	885								
Control Delay (s)	7.5	6.6	7.4	7.2								
Approach Delay (s)	7.5	6.6	7.4	7.2								
Approach LOS	А	А	А	А								
Intersection Summary												
Delay			7.3									
Level of Service			А									
Intersection Capacity Utilizati	on		19.2%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

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Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		र्स	ţ,		¥	
Traffic Volume (veh/h)	2	6	16	0	0	4
Future Volume (Veh/h)	2	6	16	0	0	4
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	7	18	0	0	4
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)		NONC	NOTIC			
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	18				29	18
vC1, stage 1 conf vol	10				25	10
vC2, stage 2 conf vol						
vCu, unblocked vol	18				29	18
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)	7.1				U.7	0.2
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1599				984	1061
					504	1001
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	9	18	4			
Volume Left	2	0	0			
Volume Right	0	0	4			
cSH	1599	1700	1061			
Volume to Capacity	0.00	0.01	0.00			
Queue Length 95th (m)	0.0	0.0	0.1			
Control Delay (s)	1.6	0.0	8.4			
Lane LOS	А		А			
Approach Delay (s)	1.6	0.0	8.4			
Approach LOS			А			
Intersection Summary						
Average Delay			1.6			
Intersection Capacity Utiliza	ation		13.3%	IC	U Level o	of Service
Analysis Period (min)			15			

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Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		÷.	ţ,		¥	
Traffic Volume (veh/h)	6	0	0	0	0	16
Future Volume (Veh/h)	6	0	0	0	0	16
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	7	0	0	0	0	18
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)		110110	110110			
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				14	0
vC1, stage 1 conf vol	0				T	v
vC2, stage 2 conf vol						
vCu, unblocked vol	0				14	0
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)	7.1				V .न	0.2
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	98
cM capacity (veh/h)	1623				1001	1085
					1001	1000
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	7	0	18			
Volume Left	7	0	0			
Volume Right	0	0	18			
cSH	1623	1700	1085			
Volume to Capacity	0.00	0.00	0.02			
Queue Length 95th (m)	0.1	0.0	0.4			
Control Delay (s)	7.2	0.0	8.4			
Lane LOS	А		А			
Approach Delay (s)	7.2	0.0	8.4			
Approach LOS			А			
Intersection Summary						
Average Delay			8.1			
Intersection Capacity Utiliz	ation		13.3%	IC	U Level o	of Service
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis 51: Swan & Brant-Waterloo

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
Traffic Volume (veh/h)	3	0	5	20	5	7	3	120	10	7	94	4
Future Volume (Veh/h)	3	0	5	20	5	7	3	120	10	7	94	4
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	3	0	6	22	6	8	3	133	11	8	104	4
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	278	272	106	272	268	138	108			144		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	278	272	106	272	268	138	108			144		
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	99	97	99	99	100			99		
cM capacity (veh/h)	664	633	954	676	636	915	1495			1451		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1		010	1100					
Volume Total	9	36	147	116								_
Volume Left	3	22	3	8								
Volume Right	6	8	11	4								
cSH	833	710	1495	1451								
Volume to Capacity	0.01	0.05	0.00	0.01								
Queue Length 95th (m)	0.2	1.2	0.0	0.1								
Control Delay (s)	9.4	10.3	0.2	0.6								
Lane LOS	А	В	A	A								
Approach Delay (s)	9.4	10.3	0.2	0.6								
Approach LOS	А	В										
Intersection Summary												
Average Delay			1.8									
Intersection Capacity Utiliza	tion		21.0%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

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Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations	¥		¢Î,			र्स	
Traffic Volume (veh/h)	10	175	0	3	52	0	
Future Volume (Veh/h)	10	175	0	3	52	0	
Sign Control	Stop		Free			Free	
Grade	0%		0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	
Hourly flow rate (vph)	11	194	0	3	58	0	
Pedestrians			·	Ū		•	
Lane Width (m)							
Walking Speed (m/s)							
Percent Blockage							
Right turn flare (veh)							
Median type			None			None	
Median storage veh)			NULLE			None	
Upstream signal (m)							
pX, platoon unblocked							
vC, conflicting volume	118	2			3		
vC1, stage 1 conf vol	110	Z			3		
vC1, stage 1 conf vol							
	118	n			2		
vCu, unblocked vol		2			3		
tC, single (s)	6.4	6.2			4.1		
tC, 2 stage (s)	0.5	0.0			0.0		
tF (s)	3.5	3.3			2.2		
p0 queue free %	99	82			96		
cM capacity (veh/h)	847	1083			1619		
Direction, Lane #	WB 1	NB 1	SB 1				
Volume Total	205	3	58				
Volume Left	11	0	58				
Volume Right	194	3	0				
cSH	1067	1700	1619				
Volume to Capacity	0.19	0.00	0.04				
Queue Length 95th (m)	5.4	0.0	0.8				
Control Delay (s)	9.2	0.0	7.3				
Lane LOS	А		А				
Approach Delay (s)	9.2	0.0	7.3				
Approach LOS	А						
Intersection Summary							
Average Delay			8.7				
Intersection Capacity Utiliz	ation		28.5%			of Service	2
	allon			iC			,
Analysis Period (min)			15				

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Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			र्स	4î	
Traffic Volume (veh/h)	8	0	0	7	3	2
Future Volume (Veh/h)	8	0	0	7	3	2
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	9	0	0	8	3	2
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	12	4	5			
vC1, stage 1 conf vol	12	1	Ŭ			
vC2, stage 2 conf vol						
vCu, unblocked vol	12	4	5			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	0.1	0.2				
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	100	100			
cM capacity (veh/h)	1008	1080	1616			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	9	8	5			
Volume Left	9	0	0			
Volume Right	0	0	2			
cSH	1008	1616	1700			
Volume to Capacity	0.01	0.00	0.00			
Queue Length 95th (m)	0.2	0.0	0.0			
Control Delay (s)	8.6	0.0	0.0			
Lane LOS	А					
Approach Delay (s)	8.6	0.0	0.0			
Approach LOS	А					
Intersection Summary						
Average Delay			3.5			
Intersection Capacity Utiliz	ation		13.3%	IC	CU Level o	of Service
Analysis Period (min)			15			
			10			

HCM Unsignalized Intersection Capacity Analysis 1: Hilltop & Swan

Movement EBL EBR WBL WBT WBR NBL NBT NBR SBL SBT SBR Lane Configurations -		٠	+	1	4	ł	*	•	Ť	1	1	ţ	~
Traffic Volume (veh/h) 2 0 0 28 0 172 0 238 38 309 418 7 Future Volume (Veh/h) 2 0 0 28 0 172 0 238 38 309 418 7 Future Volume (Veh/h) 2 0 0 28 0 172 0 238 38 309 418 7 Sign Control Stop Stop Free Free Free Free Free Free Free Free Pageshians 0	Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (Veh/h) 2 0 0 28 0 172 0 238 38 309 418 7 Sign Control Stop Stop Free Fre	Lane Configurations		4			4		٦	1+		٦	T+	
Sign Control Stop Free Free Free Grade 0% 0% 0% 0.90	Traffic Volume (veh/h)	2		0	28	0	172	0	238	38	309	418	7
Grade 0% 0% 0% 0% 0% Peak Hour Factor 0.90 <td< td=""><td>Future Volume (Veh/h)</td><td>2</td><td>0</td><td>0</td><td>28</td><td>0</td><td>172</td><td>0</td><td>238</td><td>38</td><td>309</td><td>418</td><td>7</td></td<>	Future Volume (Veh/h)	2	0	0	28	0	172	0	238	38	309	418	7
Peak Hour Factor 0.90 0.9	Sign Control		Stop			Stop			Free			Free	
Hourly flow rate (vph) 2 0 0 31 0 191 0 264 42 343 464 8 Pedestrians 1 3 3 3 3 3 3 4 34 Lane Width (m) 3.4 3.4 3.4 3.4 3.4 34 Walking Speed (m/s) 1 1.1 1.1 1<	Grade		0%			0%			0%			0%	
Pedestrians 1 3 Lane Width (m) 3.4 3.4 Lane Width (m) 3.4 3.4 Walking Speed (m/s) 1.1 1.1 Percent Blockage 0 0 Right turn flare (veh) 0 0 Median type None None VC, conflicting volume 1609 1461 471 1439 1444 286 472 307 vC1, stage 1 conf vol vC2, stage	Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Lane Width (m) 3.4 3.4 Walking Speed (m/s) 1.1 1.1 Percent Blockage 0 0 0 Right turn flare (veh) Median storage veh) Upstream signal (m) pX, platoon unblocked vC, conflicting volume 1609 1461 471 1439 1444 286 472 307 vC2, stage 2 conf vol vC2, stage 2 conf vol vO100 75 100 73 L000 73	Hourly flow rate (vph)	2	0	0	31	0	191	0	264	42	343	464	8
Walking Speed (m/s) 1.1 1.1 1.1 Percent Blockage 0 0 Right turn flare (veh) None None Median storage veh) Upstream signal (m) None None yZ, platoon unblocked vC, conflicting volume 1609 1461 471 1439 1444 286 472 307 vC1, stage 1 conf vol vC2, stage 2 conf vol vC2, stage 3 3.7 7 VC2, stage (s) 7.1 6.5 6.2 7.1 6.5 6.2 4.1 4.1 U2, ublocked vol 1609 1461 471 1439 1444 286 472 307 U2, ublocked vol 1609 1461 471 1439 1444 286 472 307 U2, ublocked vol 1609 1461 471 1439 1444 286 472 307 U2, ublocked vol 1609 1461 471 1439 1444 286 472 307 U2, ublocked vol 1609	Pedestrians					1			3				
Percent Blockage 0 0 Right turn flare (veh) None None Median storage veh) Volumet and the storage veh None None Upstream signal (m) pX, platoon unblocked Volumet and the storage veh None None Vc, conflicting volume 1609 1461 471 1439 1444 286 472 307 Vc1, stage 1 conf vol Vc2, stage 2 conf vol Vc2, stage 3 307 Ct2, stage (s) T 6.5 6.2 4.1 <td>Lane Width (m)</td> <td></td> <td></td> <td></td> <td></td> <td>3.4</td> <td></td> <td></td> <td>3.4</td> <td></td> <td></td> <td></td> <td></td>	Lane Width (m)					3.4			3.4				
Right turn flare (veh) None None Median storage veh) Upstream signal (m) None None pX, platoon unblocked vC, conflicting volume 1609 1461 471 1439 1444 286 472 307 vC1, stage 1 conf vol vC2, stage 2 conf vol vC1 471 1439 1444 286 472 307 vC2, stage 2 conf vol vC4 vC7, onflicting volume 1609 1461 471 1439 1444 286 472 307 vC2, stage 1 conf vol vC2, stage 2 conf vol vC4 v1 4.1 4.1 4.1 4.1 4.1 4.1 4.1 4.1 4.2 4.0 3.3 2.2 2.2 2.2 p0 queue free % 96 100 100 65 100 75 100 73 cM apacity (veh/h) 50 95 585 88 97 752 1100 1264 1264 1264 1264 1264 1264 1264 1264 1264 1264 1264 1264 1264 1264 1264 1264 14	Walking Speed (m/s)					1.1			1.1				
Median type None None Median storage veh) Upstream signal (m) PX PAtomublecked VC, conflicting volume 1609 1461 471 1439 1444 286 472 307 VC2, stage 1 conf vol VC2, stage 2 co	Percent Blockage					0			0				
Median storage veh) Upstream signal (m) pX, platoon unblocked vC, conflicting volume 1609 1461 471 1439 1444 286 472 307 vC1, stage 1 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC2, unblocked vol 1609 1461 471 1439 1444 286 472 307 vC2, stage 2 conf vol vC2, unblocked vol 1609 1461 471 1439 1444 286 472 307 vC2, stage 2 conf vol vC2, unblocked vol 1609 1461 471 1439 1444 286 472 307 vC2, stage 2 conf vol vC2, unblocked vol 1609 1461 471 1439 1444 286 472 307 vC2, stage 2 conf vol vC1, unblocked vol 1609 1461 471 1439 1444 286 472 307 vC, stage 2 conf vol vC1, unblocked vol 1609 1461 871 1439 1444 286 472 307 tF (s) 3.5 4.0 3.3 3.5 4.0 3.3	Right turn flare (veh)												
Upstream signal (m) pX, platoon unblocked vC, conflicting volume 1609 1461 471 1439 1444 286 472 307 vC2, stage 2 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC2, stage 3 conf vol vC2, stage 3 conf vol vC2, stage 4 conf vol vC2, stage 4 conf vol vC2, stage 5 conf vol vC2, stage 5 conf vol VC2, stage 6 conf vol F (s) 3.5 4.0 3.3 3.5 4.0 3.3 2.2 2.2 pd queu free % 96 100 100 65 100 75 100 73 cM capacity (veh/h) 50 95 595 88 97 752 1100 1264 Direction, Lane # EB 1 WB 1 NB 1 NB 2 SB 1 SB 2 Volume Total 2 222 0 306 343 472 Volume Right 0 191 0 42 0 8 cSH 50 366 1700 1700 1264 1700 Volume C Capacity 0.04 0.61 0.00 0.1 8 0.27 0.28 Queue Length 95th (m) 0.9 29.0 0.0 0.0 8.4 0.0 Control Delay (s) 79.7 28.8 0.0 3.7 Approach Delay (s) 79.7 28.8 0.0 3.7 Approach LOS F D A Approach LOS F D. Intersection Summary Net State 50 362 ICU Level of Service B	Median type								None			None	
pX, platoon unblocked vC, conflicting volume 1609 1461 471 1439 1444 286 472 307 vC1, stage 1 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC1, unblocked vol 1609 1461 471 1439 1444 286 472 307 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 pl queue free % 96 100 100 65 100 75 100 73 cM capacity (veh/h) 50 95 595 88 97 752 1100 1264 Direction, Lane # EB 1 WB 1 NB 1 NB 2 SB 1 SB 2 Volume Total 2 222 0 306 343 472 Volume Right 0 191 0 42 0 8 cSH 50 366 1700 1700 1264 1700 Volume to Capacity 0.04 0.61 0.00 0.18 0.27 0.28 Queue Length 95th (m) 0.9 29.0 0.0 0.0 8.4 0.0 Control Delay (s) 79.7 28.8 0.0 0.0 8.9 0.0 Lane LOS F D A Approach Delay (s) 79.7 28.8 0.0 3.7 Approach Delay (s) 79.7 28.7 Average	Median storage veh)												
pX, platoon unblocked vC, conflicting volume 1609 1461 471 1439 1444 286 472 307 vC1, stage 1 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC1, unblocked vol 1609 1461 471 1439 1444 286 472 307 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 pl queue free % 96 100 100 65 100 75 100 73 cM capacity (veh/h) 50 95 595 88 97 752 1100 1264 Direction, Lane # EB 1 WB 1 NB 1 NB 2 SB 1 SB 2 Volume Total 2 222 0 306 343 472 Volume Right 0 191 0 42 0 8 cSH 50 366 1700 1700 1264 1700 Volume to Capacity 0.04 0.61 0.00 0.18 0.27 0.28 Queue Length 95th (m) 0.9 29.0 0.0 0.0 8.4 0.0 Control Delay (s) 79.7 28.8 0.0 0.0 8.9 0.0 Lane LOS F D A Approach Delay (s) 79.7 28.8 0.0 3.7 Approach Delay (s) 79.7 28.7 Average	,												
vC, conflicting volume 1609 1461 471 1439 1444 286 472 307 vC1, stage 1 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol vC2, stage 2 conf vol 307 0 vC1, unblocked vol 1609 1461 471 1439 1444 286 472 307 tC, stage 2 conf vol vC1, unblocked vol 1609 1461 471 1439 1444 286 472 307 tC, stage (s) T.1 6.5 6.2 7.1 6.5 6.2 4.1 4.1 tC, 2 stage (s) T T 6.5 100 75 100 73 73 pd queue free % 96 100 100 65 100 75 100 73 73 cd capacity (veh/h) 50 95 595 88 97 752 1100 1264 Direction, Lane # EB1 WB1 NB 2 SB1 SB 2 SB SB 2 Volume Total 2 222 0 306 343 472 08 <td></td>													
vC1, stage 1 conf vol vC2, stage 2 conf vol vC1, unblocked vol 1609 1461 471 1439 1444 286 472 307 tC, single (s) 7.1 6.5 6.2 7.1 6.5 6.2 4.1 4.1 tC, 2 stage (s)		1609	1461	471	1439	1444	286	472			307		
vC2, stage 2 conf vol vCu, unblocked vol 1609 1461 471 1439 1444 286 472 307 tC, single (s) 7.1 6.5 6.2 7.1 6.5 6.2 4.1 4.1 tC, single (s) 7.1 6.5 6.2 4.1 4.1 4.1 tC, stage (s) 75 100 73 73 6.5 6.2 4.1 4.1 tC, stage (s) 75 100 73 73 73 73 73 73 p0 queue free % 96 100 100 65 100 75 100 73 cM capacity (veh/h) 50 95 595 88 97 752 1100 1264 Direction, Lane # EB 1 WB 1 NB 2 SB 1 SB 2 Volume total 2 222 0 306 343 472 Volume total 2 31 0 0 343 0 Volume total 2 31 0 0 343 0 0 0 0 6													
vCu, unblocked vol 1609 1461 471 1439 1444 286 472 307 tC, single (s) 7.1 6.5 6.2 7.1 6.5 6.2 4.1 4.1 tC, 2 stage (s)													
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 % 96 100 100 65 100 75 100 73 cM capacity (veh/h) 50 95 595 88 97 752 1100 1264 Direction, Lane # EB 1 WB 1 NB 1 NB 2 SB 1 SB 2 Volume Total 2 222 0 306 343 472 Volume Left 2 31 0 0 343 0 Volume Right 0 191 0 42 0 8 cSH 50 366 1700 1700 1264 1700 Volume to Capacity 0.04 0.61 0.00 0.18 0.27 0.28 Queue Length 95th (m) 0.9 29.0 0.0 8.9 0.0 1264 Lane LOS F D A Approach LOS F D A Approach LOS F D A </td <td></td> <td>1609</td> <td>1461</td> <td>471</td> <td>1439</td> <td>1444</td> <td>286</td> <td>472</td> <td></td> <td></td> <td>307</td> <td></td> <td></td>		1609	1461	471	1439	1444	286	472			307		
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 % 96 100 100 65 100 75 100 73 cM capacity (veh/h) 50 95 595 88 97 752 1100 1264 Direction, Lane # EB 1 WB 1 NB 1 NB 2 SB 1 SB 2 Volume Total 2 222 0 306 343 472 Volume Left 2 31 0 0 343 0 Volume Right 0 191 0 42 0 8 cSH 50 366 1700 1700 1264 1700 Volume to Capacity 0.04 0.61 0.00 0.18 0.27 0.28 Queue Length 95th (m) 0.9 29.0 0.0 0.0 8.9 0.0 Lane LOS F D A Approach LOS F D A Approach LOS F D ICU		7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tF (s) 3.5 4.0 3.3 3.5 4.0 3.3 2.2 2.2 p0 queue free % 96 100 100 65 100 75 100 73 cM capacity (veh/h) 50 95 595 88 97 752 1100 1264 Direction, Lane # EB 1 WB 1 NB 1 NB 2 SB 1 SB 2 Volume Total 2 222 0 306 343 472 Volume Left 2 31 0 0 343 0 Volume Right 0 191 0 42 0 8 cSH 50 366 1700 1264 1700 Volume to Capacity 0.04 0.61 0.00 0.18 0.27 0.28 Queue Length 95th (m) 0.9 29.0 0.0 0.0 8.9 0.0 Lane LOS F D A Approach LOS F D A Approach LOS F D A Aporage Delay 7.1 ICU Level													
p0 queue free % 96 100 100 65 100 75 100 73 cM capacity (veh/h) 50 95 595 88 97 752 1100 1264 Direction, Lane # EB 1 WB 1 NB 1 NB 2 SB 1 SB 2 Volume Total 2 222 0 306 343 472 Volume Left 2 31 0 0 343 0 Volume Right 0 191 0 42 0 8 CSH 50 366 1700 1700 1264 1700 Volume to Capacity 0.04 0.61 0.00 0.18 0.27 0.28 Queue Length 95th (m) 0.9 29.0 0.0 0.89 0.0 0.0 Control Delay (s) 79.7 28.8 0.0 0.89 0.0 0.0 Lane LOS F D A Approach LOS F D A Intersection Summary		3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
CM capacity (veh/h) 50 95 595 88 97 752 1100 1264 Direction, Lane # EB 1 WB 1 NB 1 NB 2 SB 1 SB 2 Volume Total 2 222 0 306 343 472 Volume Left 2 31 0 0 343 0 Volume Right 0 191 0 42 0 8 CSH 50 366 1700 1264 1700 Volume to Capacity 0.04 0.61 0.00 0.18 0.27 0.28 Queue Length 95th (m) 0.9 29.0 0.0 0.0 8.4 0.0 Control Delay (s) 79.7 28.8 0.0 0.3.7 Approach Delay (s) 79.7 28.8 0.0 3.7 Approach LOS F D A Approach LOS F D Intersection Capacity Utilization 63.2% ICU Level of Service B		96	100	100	65	100	75	100			73		
Volume Total 2 222 0 306 343 472 Volume Left 2 31 0 0 343 0 Volume Right 0 191 0 42 0 8 cSH 50 366 1700 1264 1700 Volume to Capacity 0.04 0.61 0.00 0.18 0.27 0.28 Queue Length 95th (m) 0.9 29.0 0.0 0.84 0.0 Control Delay (s) 79.7 28.8 0.0 0.0 8.9 0.0 Lane LOS F D A A Approach Delay (s) 79.7 28.8 0.0 3.7 Approach LOS F D A A Approach LOS F D Intersection Summary 7.1 Intersection Capacity Utilization 63.2% ICU Level of Service B	• •												
Volume Left 2 31 0 0 343 0 Volume Right 0 191 0 42 0 8 cSH 50 366 1700 1264 1700 Volume to Capacity 0.04 0.61 0.00 0.18 0.27 0.28 Queue Length 95th (m) 0.9 29.0 0.0 0.0 8.4 0.0 Control Delay (s) 79.7 28.8 0.0 0.0 8.9 0.0 Lane LOS F D A Approach Delay (s) 79.7 28.8 0.0 3.7 Approach LOS F D A Approach LOS F D Intersection Summary 7.1 Average Delay 7.1 ICU Level of Service B	Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Right 0 191 0 42 0 8 cSH 50 366 1700 1264 1700 Volume to Capacity 0.04 0.61 0.00 0.18 0.27 0.28 Queue Length 95th (m) 0.9 29.0 0.0 0.0 8.4 0.0 Control Delay (s) 79.7 28.8 0.0 0.0 8.9 0.0 Lane LOS F D A Approach Delay (s) 79.7 28.8 0.0 3.7 Approach LOS F D A Average Delay F D A Intersection Summary 7.1 1CU Level of Service B	Volume Total	2	222	0	306	343	472						
Volume Right 0 191 0 42 0 8 cSH 50 366 1700 1264 1700 Volume to Capacity 0.04 0.61 0.00 0.18 0.27 0.28 Queue Length 95th (m) 0.9 29.0 0.0 0.0 8.4 0.0 Control Delay (s) 79.7 28.8 0.0 0.0 8.9 0.0 Lane LOS F D A Approach Delay (s) 79.7 28.8 0.0 3.7 Approach LOS F D A Average Delay F D A Intersection Summary 7.1 1CU Level of Service B	Volume Left	2	31	0	0	343	0						
cSH 50 366 1700 1700 1264 1700 Volume to Capacity 0.04 0.61 0.00 0.18 0.27 0.28 Queue Length 95th (m) 0.9 29.0 0.0 0.0 8.4 0.0 Control Delay (s) 79.7 28.8 0.0 0.0 8.9 0.0 Lane LOS F D A Approach Delay (s) 79.7 28.8 0.0 3.7 Approach LOS F D A Average Delay F D A Intersection Summary 7.1 1CU Level of Service B	Volume Right	0		0	42	0							
Volume to Capacity 0.04 0.61 0.00 0.18 0.27 0.28 Queue Length 95th (m) 0.9 29.0 0.0 0.0 8.4 0.0 Control Delay (s) 79.7 28.8 0.0 0.0 8.9 0.0 Lane LOS F D A A Approach Delay (s) 79.7 28.8 0.0 3.7 Approach LOS F D A A A Approach LOS F D A Approach LOS F D A A A Approach LOS F D A <td></td> <td>50</td> <td>366</td> <td>1700</td> <td>1700</td> <td>1264</td> <td>1700</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>		50	366	1700	1700	1264	1700						
Queue Length 95th (m) 0.9 29.0 0.0 0.0 8.4 0.0 Control Delay (s) 79.7 28.8 0.0 0.0 8.9 0.0 Lane LOS F D A Approach Delay (s) 79.7 28.8 0.0 3.7 Approach LOS F D A Average Delay F D A Intersection Summary 7.1 ICU Level of Service B		0.04	0.61	0.00	0.18	0.27	0.28						
Control Delay (s) 79.7 28.8 0.0 0.0 8.9 0.0 Lane LOS F D A				0.0	0.0	8.4	0.0						
Lane LOS F D A Approach Delay (s) 79.7 28.8 0.0 3.7 Approach LOS F D Intersection Summary 7.1 Average Delay 7.1 Intersection Capacity Utilization 63.2%	•												
Approach Delay (s) 79.7 28.8 0.0 3.7 Approach LOS F D D Intersection Summary Average Delay 7.1 Intersection Capacity Utilization 63.2% ICU Level of Service B	,,,					А							
Approach LOS F D Intersection Summary 7.1 Average Delay 7.1 Intersection Capacity Utilization 63.2% ICU Level of Service B		79.7		0.0									
Average Delay 7.1 Intersection Capacity Utilization 63.2% ICU Level of Service B													
Average Delay 7.1 Intersection Capacity Utilization 63.2% ICU Level of Service B	Intersection Summary												
Intersection Capacity Utilization 63.2% ICU Level of Service B				7.1									
		ition		63.2%	IC	U Level o	of Service			В			
	Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis 5: Howard Marshall & Hilltop

04/05/2018	
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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		\$			\$			\$			\$	
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	5	49	245	68	36	0	150	8	27	0	2	4
Future Volume (vph)	5	49	245	68	36	0	150	8	27	0	2	4
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	54	272	76	40	0	167	9	30	0	2	4
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	332	116	206	6								
Volume Left (vph)	6	76	167	0								
Volume Right (vph)	272	0	30	4								
Hadj (s)	-0.49	0.13	0.07	-0.40								
Departure Headway (s)	4.1	5.0	5.0	4.8								
Degree Utilization, x	0.38	0.16	0.29	0.01								
Capacity (veh/h)	837	680	675	653								
Control Delay (s)	9.6	8.9	10.0	7.8								
Approach Delay (s)	9.6	8.9	10.0	7.8								
Approach LOS	А	А	Α	А								
Intersection Summary												
Delay			9.6									
Level of Service			А									
Intersection Capacity Utiliza	ation		50.7%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		\$			\$			\$			\$	
Sign Control		Yield			Yield			Yield			Yield	
Traffic Volume (vph)	0	0	0	0	0	7	0	0	0	12	0	0
Future Volume (vph)	0	0	0	0	0	7	0	0	0	12	0	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	0	0	0	0	8	0	0	0	13	0	0
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	0	8	0	13								
Volume Left (vph)	0	0	0	13								
Volume Right (vph)	0	8	0	0								
Hadj (s)	0.00	-0.57	0.00	0.23								
Departure Headway (s)	3.9	3.4	3.9	4.1								
Degree Utilization, x	0.00	0.01	0.00	0.01								
Capacity (veh/h)	900	1060	911	861								
Control Delay (s)	6.9	6.4	6.9	7.2								
Approach Delay (s)	0.0	6.4	0.0	7.2								
Approach LOS	A	A	A	A								
Intersection Summary												
Delay			6.9									
Level of Service			А									
Intersection Capacity Utilizat	tion		13.3%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis 21: Stanley & Northumberland

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		\$			ŧ	1		\$			\$	
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	76	43	3	2	44	472	2	16	5	855	11	95
Future Volume (vph)	76	43	3	2	44	472	2	16	5	855	11	95
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	84	48	3	2	49	524	2	18	6	950	12	106
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1							
Volume Total (vph)	135	51	524	26	1068							
Volume Left (vph)	84	2	0	2	950							
Volume Right (vph)	3	0	524	6	106							
Hadj (s)	0.11	0.01	-0.60	-0.12	0.12							
Departure Headway (s)	6.0	6.1	3.2	5.3	4.6							
Degree Utilization, x	0.23	0.09	0.47	0.04	1.38							
Capacity (veh/h)	586	571	1116	652	765							
Control Delay (s)	10.8	9.7	9.0	8.5	193.8							
Approach Delay (s)	10.8	9.0		8.5	193.8							
Approach LOS	В	А		А	F							
Intersection Summary												
Delay			118.5									
Level of Service			F									
Intersection Capacity Utilizat	ion		94.0%	IC	CU Level o	of Service			F			
Analysis Period (min)			15									

	-	7	1	-	1	1
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	+		٦	1	¥	
Traffic Volume (veh/h)	42	73	163	90	48	64
Future Volume (Veh/h)	42	73	163	90	48	64
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	47	81	181	100	53	71
Pedestrians		• •			2	
Lane Width (m)					3.4	
Walking Speed (m/s)					1.1	
Percent Blockage					0	
Right turn flare (veh)					v	
Median type	None			None		
Median storage veh)	Nono			None		
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			130		552	90
vC1, stage 1 conf vol			100		552	50
vC2, stage 2 conf vol						
vCu, unblocked vol			130		552	90
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)			7.1		0.4	0.2
tF (s)			2.2		3.5	3.3
p0 queue free %			88		88	93
cM capacity (veh/h)			1465		436	972
					400	512
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	128	181	100	124		
Volume Left	0	181	0	53		
Volume Right	81	0	0	71		
cSH	1700	1465	1700	637		
Volume to Capacity	0.08	0.12	0.06	0.19		
Queue Length 95th (m)	0.0	3.2	0.0	5.4		
Control Delay (s)	0.0	7.8	0.0	12.0		
Lane LOS		А		В		
Approach Delay (s)	0.0	5.0		12.0		
Approach LOS				В		
Intersection Summary						
Average Delay			5.4			
Intersection Capacity Utiliza	ation		30.1%	IC	U Level c	f Service
Analysis Period (min)	-		15			
			10			

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Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	ţ,			د	Y		
Traffic Volume (veh/h)	61	845	28	61	459	15	
Future Volume (Veh/h)	61	845	28	61	459	15	
Sign Control	Free			Free	Stop		
Grade	0%			0%	0%		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	
Hourly flow rate (vph)	68	939	31	68	510	17	
Pedestrians	1				1		
Lane Width (m)	3.4				3.4		
Walking Speed (m/s)	1.1				1.1		
Percent Blockage	0				0		
Right turn flare (veh)							
Median type	None			None			
Median storage veh)							
Upstream signal (m)							
pX, platoon unblocked							
vC, conflicting volume			1008		670	538	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol			1008		670	538	
tC, single (s)			4.1		6.4	6.2	
tC, 2 stage (s)							
tF (s)			2.2		3.5	3.3	
p0 queue free %			96		0	97	
cM capacity (veh/h)			695		404	546	
Direction, Lane #	EB 1	WB 1	NB 1				
Volume Total	1007	99	527				
Volume Left	0	31	510				
Volume Right	939	0	17				
cSH	1700	695	408				
Volume to Capacity	0.59	0.04	1.29				
Queue Length 95th (m)	0.0	1.1	177.5				
Control Delay (s)	0.0	3.6	176.8				
Lane LOS		A	F				
Approach Delay (s)	0.0	3.6	176.8				
Approach LOS	0.0	5.0	F				
Intersection Summary							
Average Delay			57.3				
Intersection Capacity Utiliza	tion		99.0%	IC	U Level o	f Service	
Analysis Period (min)			15	10			
			15				

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Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		é.	ţ,		Y	
Traffic Volume (veh/h)	16	0	0	128	223	27
Future Volume (Veh/h)	16	0	0	128	223	27
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	18	0	0	142	248	30
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)		110110	110110			
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	142				107	71
vC1, stage 1 conf vol	172				107	11
vC2, stage 2 conf vol						
vCu, unblocked vol	142				107	71
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)	4.1				0.4	0.2
tF (s)	2.2				3.5	3.3
p0 queue free %	99				72	97
cM capacity (veh/h)	1441				879	97 991
,					019	331
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	18	142	278			
Volume Left	18	0	248			
Volume Right	0	142	30			
cSH	1441	1700	890			
Volume to Capacity	0.01	0.08	0.31			
Queue Length 95th (m)	0.3	0.0	10.2			
Control Delay (s)	7.5	0.0	10.9			
Lane LOS	А		В			
Approach Delay (s)	7.5	0.0	10.9			
Approach LOS			В			
Intersection Summary						
Average Delay			7.2			
Intersection Capacity Utiliza	ation		37.0%	IC	U Level o	of Service
Analysis Period (min)			15		5 201010	
			10			

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Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		é.	ţ,		Y	
Traffic Volume (veh/h)	0	123	71	0	0	0
Future Volume (Veh/h)	0	123	71	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	137	79	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)		1.0110	110110			
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	79				216	79
vC1, stage 1 conf vol	10				210	15
vC2, stage 2 conf vol						
vCu, unblocked vol	79				216	79
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)	т. 1				т.т	0.2
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1519				772	981
,					112	301
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	137	79	0			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1519	1700	1700			
Volume to Capacity	0.00	0.05	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS			А			
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS			А			
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utiliza	ation		10.8%	IC	U Level o	of Service
Analysis Period (min)			15	.0		
			10			

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Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	ŧ,			र्भ	¥		
Traffic Volume (veh/h)	123	101	0	71	58	0	
Future Volume (Veh/h)	123	101	0	71	58	0	
Sign Control	Free			Free	Stop		
Grade	0%			0%	0%		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	
Hourly flow rate (vph)	137	112	0	79	64	0	
Pedestrians							
Lane Width (m)							
Walking Speed (m/s)							
Percent Blockage							
Right turn flare (veh)							
Median type	None			None			
Median storage veh)							
Upstream signal (m)							
pX, platoon unblocked							
vC, conflicting volume			249		272	193	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol			249		272	193	
tC, single (s)			4.1		6.4	6.2	
tC, 2 stage (s)							
tF (s)			2.2		3.5	3.3	
p0 queue free %			100		91	100	
cM capacity (veh/h)			1317		717	849	
Direction, Lane #	EB 1	WB 1	NB 1				
Volume Total	249	79	64				
Volume Left	0	0	64				
Volume Right	112	0	0				
cSH	1700	1317	717				
Volume to Capacity	0.15	0.00	0.09				
Queue Length 95th (m)	0.0	0.0	2.2				
Control Delay (s)	0.0	0.0	10.5				
Lane LOS			В				
Approach Delay (s)	0.0	0.0	10.5				
Approach LOS			В				
Intersection Summary							
Average Delay			1.7				
Intersection Capacity Utiliza	ation		24.7%	IC	U Level c	of Service	
Analysis Period (min)			15				

HCM Unsignalized Intersection Capacity Analysis 47: Leslie Davis & Street A

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			\$			\$			4	
Sign Control		Yield			Yield			Yield			Yield	
Traffic Volume (vph)	6	0	0	0	0	3	0	50	0	6	86	11
Future Volume (vph)	6	0	0	0	0	3	0	50	0	6	86	11
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	7	0	0	0	0	3	0	56	0	7	96	12
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	7	3	56	115								
Volume Left (vph)	7	0	0	7								
Volume Right (vph)	0	3	0	12								
Hadj (s)	0.23	-0.57	0.03	-0.02								
Departure Headway (s)	4.5	3.7	4.1	4.0								
Degree Utilization, x	0.01	0.00	0.06	0.13								
Capacity (veh/h)	766	924	868	901								
Control Delay (s)	7.5	6.7	7.3	7.5								
Approach Delay (s)	7.5	6.7	7.3	7.5								
Approach LOS	А	А	Α	А								
Intersection Summary												
Delay			7.5									
Level of Service			А									
Intersection Capacity Utilizati	on		25.3%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

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Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		é.	ţ,		Y	
Traffic Volume (veh/h)	5	17	10	0	0	3
Future Volume (Veh/h)	5	17	10	0	0	3
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	19	11	0	0	3
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)		10110	10110			
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	11				42	11
vC1, stage 1 conf vol					74	
vC2, stage 2 conf vol						
vCu, unblocked vol	11				42	11
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)	4.1				0.4	0.2
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
	1608				965	1070
cM capacity (veh/h)					905	1070
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	25	11	3			
Volume Left	6	0	0			
Volume Right	0	0	3			
cSH	1608	1700	1070			
Volume to Capacity	0.00	0.01	0.00			
Queue Length 95th (m)	0.1	0.0	0.1			
Control Delay (s)	1.8	0.0	8.4			
Lane LOS	А		А			
Approach Delay (s)	1.8	0.0	8.4			
Approach LOS			А			
Intersection Summary						
Average Delay			1.8			
Intersection Capacity Utiliza	ation		16.0%	IC	ULevelo	of Service
Analysis Period (min)			10.070	10		
			13			

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Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		र्स	ţ,		Y	
Traffic Volume (veh/h)	17	0	0	0	0	10
Future Volume (Veh/h)	17	0	0	0	0	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	19	0	0	0	0	11
Pedestrians		-	-	-	-	
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)		110110	110110			
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0				38	0
vC1, stage 1 conf vol	v				00	Ŭ
vC2, stage 2 conf vol						
vCu, unblocked vol	0				38	0
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)	7.1				0.4	0.2
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	99
cM capacity (veh/h)	1623				963	1085
					505	1000
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	19	0	11			
Volume Left	19	0	0			
Volume Right	0	0	11			
cSH	1623	1700	1085			
Volume to Capacity	0.01	0.00	0.01			
Queue Length 95th (m)	0.3	0.0	0.2			
Control Delay (s)	7.2	0.0	8.4			
Lane LOS	А		А			
Approach Delay (s)	7.2	0.0	8.4			
Approach LOS			А			
Intersection Summary						
Average Delay			7.7			
Intersection Capacity Utilization	ation		13.3%	IC	U Level o	of Service
Analysis Period (min)			15			
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HCM Unsignalized Intersection Capacity Analysis 51: Swan & Brant-Waterloo

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
Traffic Volume (veh/h)	8	3	4	12	3	5	4	152	24	5	208	5
Future Volume (Veh/h)	8	3	4	12	3	5	4	152	24	5	208	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	9	3	4	13	3	6	4	169	27	6	231	6
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	444	450	234	442	440	182	237			196		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	444	450	234	442	440	182	237			196		
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 %	98	99	100	98	99	99	100			100		
cM capacity (veh/h)	519	504	810	521	511	865	1342			1389		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	16	22	200	243								
Volume Left	9	13	4	6								
Volume Right	4	6	27	6								
cSH	566	583	1342	1389								
Volume to Capacity	0.03	0.04	0.00	0.00								
Queue Length 95th (m)	0.7	0.9	0.1	0.1								
Control Delay (s)	11.5	11.4	0.2	0.2								
Lane LOS	B	В	A	A								
Approach Delay (s)	11.5	11.4	0.2	0.2								
Approach LOS	B	В	0.2	0.2								
Intersection Summary												
Average Delay			1.1									
Intersection Capacity Utilizat	ion		26.8%	IC	Ulevelo	of Service			А			
Analysis Period (min)			15						/\			
			10									

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Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations	Y		4Î			ર્સ	
Traffic Volume (veh/h)	6	103	0	11	182	0	
Future Volume (Veh/h)	6	103	0	11	182	0	
Sign Control	Stop		Free			Free	
Grade	0%		0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	
Hourly flow rate (vph)	7	114	0	12	202	0	
Pedestrians							
Lane Width (m)							
Walking Speed (m/s)							
Percent Blockage							
Right turn flare (veh)							
Median type			None			None	
Median storage veh)							
Upstream signal (m)							
pX, platoon unblocked							
vC, conflicting volume	410	6			12		
vC1, stage 1 conf vol	•	Ū					
vC2, stage 2 conf vol							
vCu, unblocked vol	410	6			12		
tC, single (s)	6.4	6.2			4.1		
tC, 2 stage (s)	0.1	0.2					
tF (s)	3.5	3.3			2.2		
p0 queue free %	99	89			87		
cM capacity (veh/h)	523	1077			1607		
,					1001		
Direction, Lane #	WB 1	NB 1	SB 1				
Volume Total	121	12	202				
Volume Left	7	0	202				
Volume Right	114	12	0				
cSH	1015	1700	1607				
Volume to Capacity	0.12	0.01	0.13				
Queue Length 95th (m)	3.1	0.0	3.3				
Control Delay (s)	9.0	0.0	7.6				
Lane LOS	А		A				
Approach Delay (s)	9.0	0.0	7.6				
Approach LOS	А						
Intersection Summary							
Average Delay			7.8				
Intersection Capacity Utiliz	ation		30.6%	IC	U Level o	of Service	
Analysis Period (min)			15				
			10				

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Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			र्भ	4	
Traffic Volume (veh/h)	5	0	0	5	8	7
Future Volume (Veh/h)	5	0	0	5	8	7
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	0	0	6	9	8
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)				110110	1.0110	
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	19	13	17			
vC1, stage 1 conf vol	10	10	17			
vC2, stage 2 conf vol						
vCu, unblocked vol	19	13	17			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	0.4	0.2	7.1			
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	100	100			
cM capacity (veh/h)	998	1067	1600			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	6	6	17			
Volume Left	6	0	0			
Volume Right	0	0	8			
cSH	998	1600	1700			
Volume to Capacity	0.01	0.00	0.01			
Queue Length 95th (m)	0.1	0.0	0.0			
Control Delay (s)	8.6	0.0	0.0			
Lane LOS	А					
Approach Delay (s)	8.6	0.0	0.0			
Approach LOS	А					
Intersection Summary						
Average Delay			1.8			
Intersection Capacity Utiliza	ation		13.3%	IC	CU Level o	of Service
Analysis Period (min)			15			
			10			