Project Report

H-353437

Date: October 04, 2017

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City of Barrie
Improvements for Bryne Drive, Harvie Road and Essa Road

Traffic Analysis for Bryne Drive

1. Introduction

1.1 Purpose

The purpose of this report is to provide initial results for the analysis of traffic operations along Bryne Drive from Essa Road to Caplan Avenue. Currently, Bryne Drive is disconnected between Essa Road and Caplan Avenue, with cul-de-sacs at the northern and southern termini. The Bryne Drive Schedule 'C' Municipal Class Environmental Assessment (Phases 1 & 2), completed as part of the City of Barrie Multimodal Active Transportation Master Plan (MMATMP)[1], proposed a 5-lane road extension of Bryne Drive between Essa Road and Caplan Avenue.

Traffic forecasts for horizon years 2021 and 2031 at three intersections of Bryne Drive with Essa Road, Harvie Road and Caplan Avenue are presented along with a capacity and level of service analysis to define road and intersection lane configurations, and traffic control requirements.

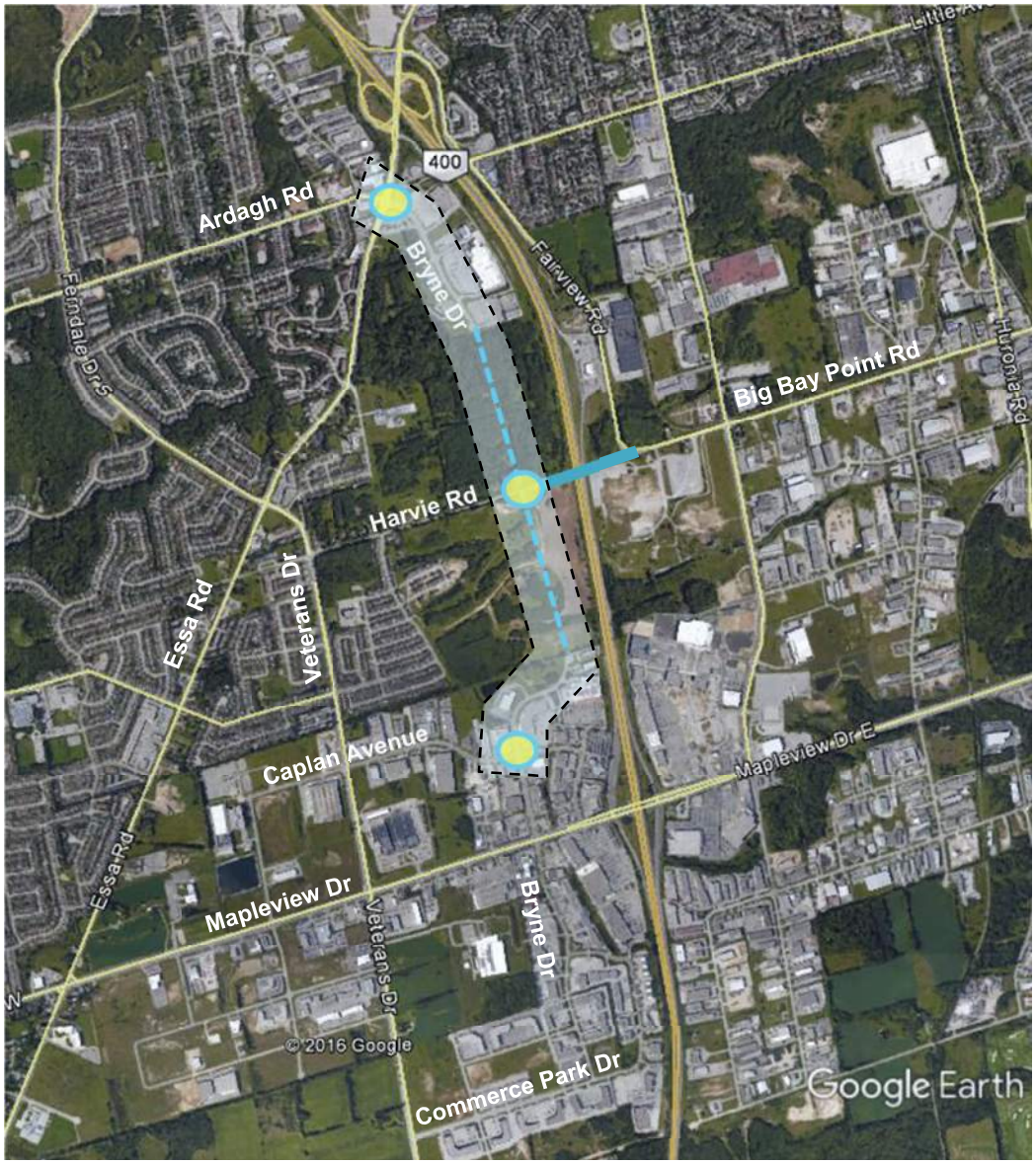
1.2 Study Area

The Study Area for this segment of Bryne Drive is bounded by the intersection Bryne Drive / Ardagh Road and Essa Road to the north, and the intersection of Bryne Drive and Caplan Avenue to the south, as shown in **Figure 1-1**.

1.3 Planning Horizons

The base year for the analysis is 2017 and reflects the existing conditions in the Study Area. Forecast traffic conditions are considered for two planning horizons: a medium-term horizon of 2021 and a long-term horizon of 2031.

[1] *Bryne Drive (Caplan Avenue to Essa Road) Master Plan Update*. City of Barrie. March 2016.



Intersections Assessed

Study Area

Proposed Extension of Bryne Drive

Proposed Harvie Road-Big Bay Point Road Crossing over Highway 400

Figure 1-1 Study Area

2. Study Area Planning Context

2.1 Multi-Modal Active Transportation Master Plan – January 2014

The City of Barrie's Multi-Modal Active Transportation Master Plan (MMATMP), part of six Infrastructure Master Plans that describe improvements necessary to accommodate forecasted growth for Barrie to 2031, offers a roadmap to an acceptable transportation network to serve future needs of the City. The Master Plan reviews all modes of transportation, examines existing transportation infrastructure and identifies current deficiencies, including areas of traffic congestion and locations where active transportation facilities should be provided.

The MMATMP identifies an opportunity for connectivity and alignment improvements for Bryne Drive between Essa Road and Caplan Avenue. The MMATMP's proposed preferred road network in 2031 features an extension of Bryne Drive from 680m south of Essa Road to 530m north of Caplan Avenue, with two lanes in each direction and a center two-way left turn lane (TWLTL)[2]. The existing sections of Bryne Drive connecting to the new extension and the existing intersections with Essa Road and Caplan Avenue, are also recommended to be widened to five lanes.

The Bryne Drive extension and widening are also included in the MMATMP's 2021 proposed preferred road network[3]. Other network connection improvements in southern Barrie to accommodate future growth and development include a new grade-separated crossing of Harvie Road over Highway 400 to provide a continuous east-west connection between Harvie Road and Big Bay Point Road which is located east of Highway 400. As such, a new intersection is proposed at Bryne Drive and Harvie Road by 2021.

3. Existing Transportation Network

This section describes the existing transportation network in and around the Study Area and provides an assessment of existing conditions at intersections along Bryne Drive.

3.1 Existing Road Geometry

3.1.1 Lane Configuration

Bryne Drive is a Major Collector road running southerly from Essa Road to a cul-de-sac, and northerly from Commence Park Drive to another cul-de-sac. The length of the future extension of Bryne Drive is approximately 1.4 km between the current termini. Both segments of the roadway have an urban cross section with a posted speed limit of 50 km/h.

Figure 3-1 illustrates the existing lane configuration and intersection traffic control of roads and intersections within the Study Area.

[2] Section 7.3 Road Network. MMATMP.
[3] Figure 7-12. Section 7.4 Phasing. MMATMP

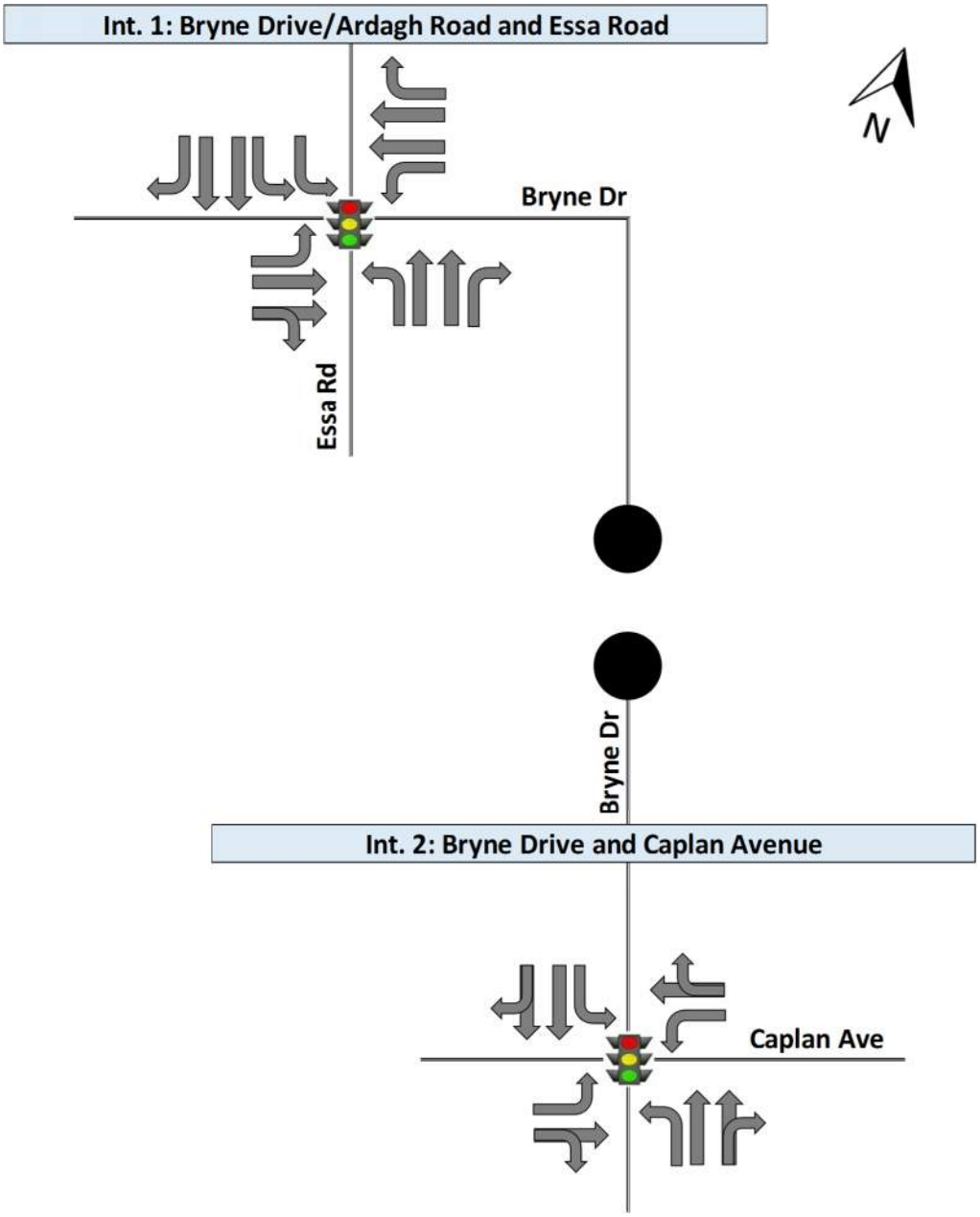


Figure 3-1: Existing Lane Configuration

3.1.2 Transit Services

Barrie Transit operates the following bus routes in the vicinity of the Study Area:

1. Routes 7A and 7B operate along Bryne Drive southerly from Caplan Avenue, connecting Bell Farm Road to the north of the Study Area with Park Place to the east of the Study Area.

The MMATMP does not identify or recommend any future transit routes for this section of Bryne Drive or within the Study Area up to the 2031 planning horizon.

3.1.3 *Active Transportation*

Sidewalks are the main component of the City of Barrie's Active Transportation system, along with on-street bicycle lanes, boulevard pathways and signed routes. There are sidewalks on either side of the existing segments of Bryne Drive, but no cycling facilities.

The MMATMP, in Figures ES-2 and ES-3, identified several active transportation measures to be undertaken to provide an integrated pathway network in the City of Barrie. The following measures are proposed through the Study Area:

1. Provision of sidewalks on both sides of the Bryne Drive extension as part of the road construction project from the south of Essa Road to north of Caplan Avenue.
2. Provision of buffered bicycle lanes along Bryne Drive just south of Essa Road, and between Caplan Avenue and Commerce Park Drive; provision of bicycle lanes along the remaining sections of Bryne Drive, including along the proposed extension between the existing segments.

3.2 Existing Traffic Volumes

Traffic volumes provided by the City of Barrie for the existing road network were used as the basis to complete the analysis of existing conditions (See **Table 3-1**). A 2017 base year was used for the traffic analysis based on traffic counts provided by the City. Turning movement count information collected at the intersection of Bryne Drive and Essa Road in 2011 and Bryne Drive and Caplan Avenue were adjusted to 2017 using a 2% p.a. growth assumption. An annual growth rate of 2% for background traffic was selected based on discussions with the City of Barrie. Traffic volumes in the Study Area road network were then balanced to remove any differences in link volumes. **Figure 3-2** provides a summary of 2017 traffic volumes at the Study Area intersections.

Traffic signal timing information used for the analysis was also provided by the City. The traffic data are included in **Appendix A** of this report.

Table 3-1: Turning Movement Counts for the Study Area

Location	Date Collected
Bryne Drive / Ardagh Road and Essa Road	December 6, 2011
Bryne Drive and Caplan Avenue	September 5, 2016

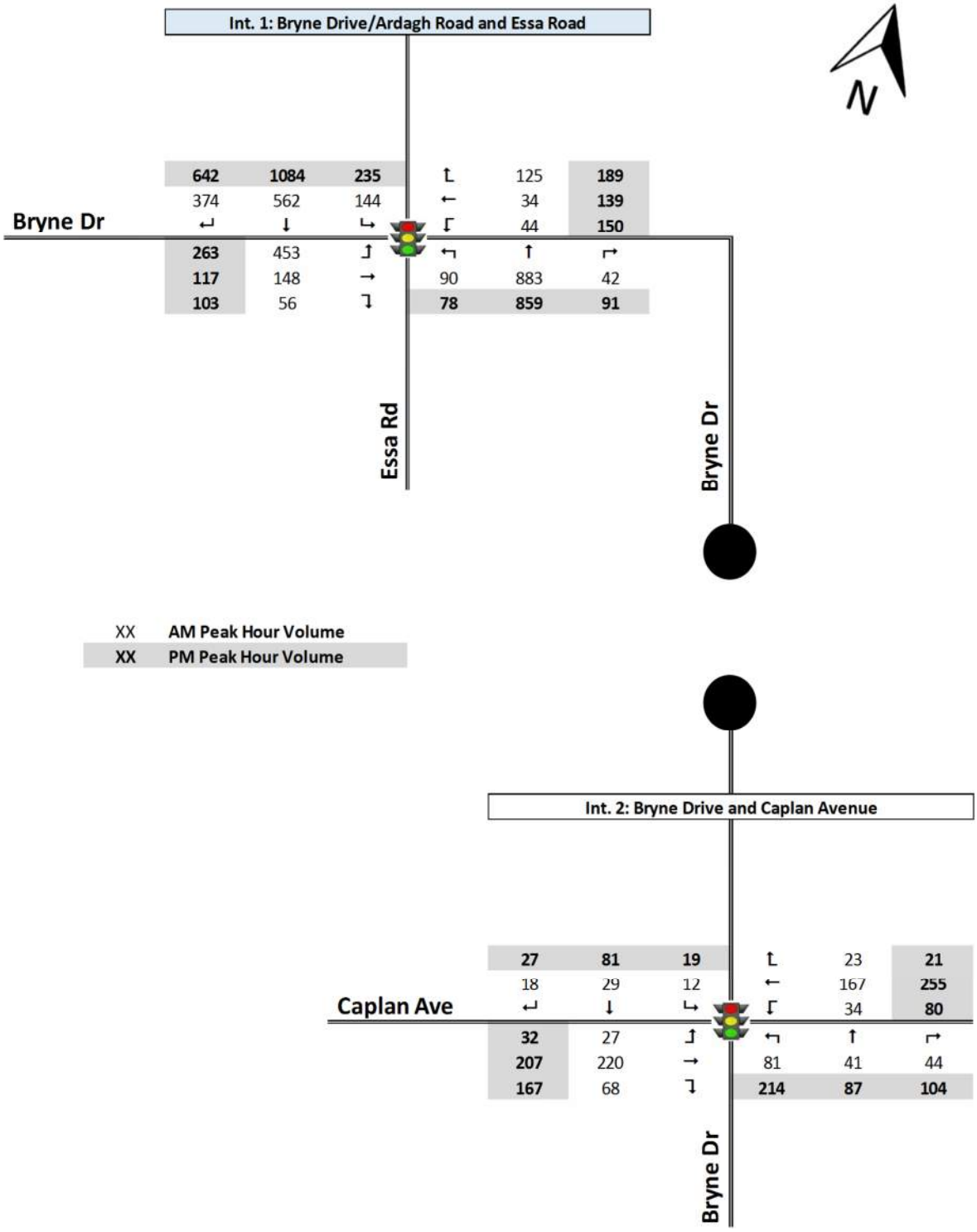


Figure 3-2: Existing Traffic Volumes

3.3 2017 Intersection Operational Analysis

A capacity and level of service analysis was completed for the signalized intersections within the Study Area using Synchro 9 traffic analysis software, which implements methodologies defined in the Highway Capacity Manual (HCM). The Synchro network was developed specifically for this study and further refined through the analysis. The City of Barrie Synchro Guidelines for using Synchro and SimTraffic software were followed in conducting the traffic analysis.

Capacity is assessed based on the volume-to-capacity (v/c) ratio, which is the ratio of demand flow rate to the available capacity at an intersection. The v/c ratio provides an estimate of capacity utilization based on the specific geometry and traffic control at the intersection. A v/c ratio equal to or greater than 1.0 indicates an approach that is operating at effective capacity and that long vehicle delays are occurring.

Operations are defined by the concept of level of service (LOS). LOS is a key measure of effectiveness for both signalized and unsignalized intersections and is based on the average stopped delay per vehicle, in seconds. It is a qualitative measure of the ability of the intersection (or individual movement) to accommodate traffic demand. For signalized intersections, the tabulated LOS is for the intersection as a whole. For unsignalized intersections, the tabulated LOS is for the most critical movement. The LOS criteria as defined in the HCM for each type of intersection control are summarized in **Table 3-2**.

Table 3-2: Intersection Level of Service Criteria for Automobile Mode[4]

Level of Service	Average Control Delay per Vehicle (s/veh)	Average Control Delay per Vehicle (s/veh)
	Signalized Intersections	**Unsignalized Intersections**
A (Free Flow)	=< 10	=< 10
B	> 10 - 20	> 10 – 15
C	> 20 - 35	> 15 - 25
D	> 35 - 55	> 25 - 35
E (Capacity)	> 55 - 80	> 35 - 50
F (Forced Flow)	> 80	> 50

Table 3-3 provides the overall LOS and Control Delay at each intersection in the Study Area during AM and PM peak hours based on the existing traffic conditions. The critical movements at each intersection are also indicated in this table. Critical movements are those that are defined to be at or below the level for which operations are deemed to be satisfactory from a planning perspective, and are considered indicative of a traffic problem that needs attention. For the purpose of this analysis, a critical movement was identified as having a LOS lower than 'D' and v/c ratio higher than 0.85.

The detailed Synchro reports are provided in **Appendix B**.

[4] Highway Capacity Manual, 4th Edition (HCM 2000), Transportation Research Board, Chapter 16: Signalized Intersections, Exhibit 16-2

Table 3-3: 2017 Existing Intersection Operations

Intersection	Movement	AM Peak Hour				PM Peak Hour			
		LOS	Delay(s)	V/C	95th Queue (m)	LOS	Delay(s)	V/C	95th Queue (m)
Bryne Drive/Ardagh Road and Essa Road	***Overall***	***C***	***30***	***0.90***	-	***C***	***32***	***0.84***	-
	EBL	D	46	0.93	122	C	28	0.69	53
	EBTR	C	25	0.32	20	C	31	0.35	17
	WBL	C	26	0.21	11	C	25	0.47	31
	WBT	C	29	0.09	6	C	32	0.34	19
	WBR	C	29	0.11	9	C	30	0.13	16
	NBL	D	38	0.55	27	D	36	0.50	25
	NBT	C	34	0.87	107	C	31	0.82	105
	NBR	B	18	0.04	0	B	19	0.07	8
	SBL	C	33	0.45	19	C	34	0.59	30
	SBT	C	22	0.50	56	D	42	0.96	149
	SBR	B	20	0.27	16	C	24	0.55	57
Bryne Drive and Caplan Avenue	***Overall***	***C***	***26***	***0.38***	-	***C***	***30***	***0.64***	-
	EBL	C	22	0.12	7	C	23	0.17	8
	EBTR	D	38	0.77	72	D	52	0.90	102
	WBL	C	22	0.20	9	C	25	0.54	17
	WBTR	C	28	0.50	46	C	31	0.63	74
	NBL	B	11	0.19	14	B	15	0.46	36
	NBTR	B	13	0.05	7	B	16	0.11	14
	SBL	B	13	0.03	4	B	17	0.06	5
	SBTR	B	15	0.04	5	B	19	0.08	11

Under existing conditions the intersections operate at acceptable levels on an overall basis, with low delays and LOS C in both peak hours. The intersections operate within effective capacity; only the intersection of Bryne Drive and Essa Road operates at a v/c ratio above 0.85 in the AM peak hour. A few intersection movements are also found to be close to effective capacity:

1. The eastbound left (EBL) turn movement from Ardagh Road/Essa Road at the intersection of Bryne Drive and Essa Road operates with a v/C ratio of 0.93, with queues extending to 122m in the AM peak hour. The intersection of Ardagh Road/Essa Road with Morrow Road is located approximately 95m west of the intersection of Bryne Drive and Essa Road and may be blocked by the EBL queueing during the AM peak hour. The high volumes of EBL movements in the AM peak hour are likely due to traffic traveling to the Highway 400 interchange located just north of the Study Area.
2. The southbound through (SBT) movement at the intersection of Bryne Drive / Ardagh Road and Essa Road operates with a v/C ratio of 0.96 with queues stretching to 149m in the PM peak hour. The high volumes of SBT movements in the PM peak hour are likely due to traffic accessing Essa Road from the Highway 400 interchange located just north of the Study Area.
3. The eastbound through-right (EBTR) movement at the intersection of Bryne Drive and Caplan Avenue operates with a v/c ratio of 0.90 with queues stretching to 102m in the PM peak hour. This can attributed to high right turn volumes in the PM peak hour using the

shared lane to access Mapleview Drive, and subsequently the Highway 400 interchange located just south of the Study Area.

3.4 Traffic Safety Review

3.4.1 Road Segment and Intersection Collision Review

The City of Barrie provided collision information for the period between 2012 to 2016 for the following locations within the Study Area:

Intersections:

- Bryne Drive and Essa Road
- Bryne Drive and Caplan Avenue

Road Segments:

- Bryne Drive from Essa Road southerly to the Bryne Drive terminus
- Bryne Drive from Caplan Avenue northerly to the Barrie View Drive

Based on a review of the historical collision data a total of 25 collisions occurred in the Study Area: 15 at the two intersections and 10 along the two midblock sections. A summary of the average collision frequencies is presented in **Table 3-4**.

Table 3-4 Average Collision Frequencies based on Historic Data (2012-2016)

Location Along Bryne Drive	No. of Collisions	Average Collision Frequency (/yr)
Intersections		
Essa Road	6	1.2
Caplan Avenue	9	1.8
Total	**15**	-
Midblock Sections		
Essa Road and Road Terminus	8	1.6
Caplan Avenue and Barrie View Drive	2	0.4
Total	**10**	-

Collision Severity

- The collisions in the Study Area were reported as Non-Fatal Injury or Property Damage Only (PDO) collisions. A number of collisions were also reported to be of “Unknown” severity and were considered to be PDO collisions in this review.
- Most of the collisions were PDO collisions (84%).
- Of the total 4 Non-Fatal Injury collisions in the Study Area, 2 collisions occurred at the intersection of Bryne Drive and Caplan Avenue, and 1 collision occurred at each of the two midblock sections.

Collision Impact Types

- The collision impact types included angle (T-bone), rear-end, sideswipe, turning movement and single motor vehicle type collisions.

- Majority of the collisions at the intersections (40%) were rear-end collisions and a higher proportion of them occurred at the intersection of Bryne Drive and Caplan Avenue.
- Majority of the collisions along the road segments (70%) were turning movement type collisions. A greater proportion of turning movement type collisions occurred at the section of Bryne Drive south of Essa Road.

Rear end collisions are the predominant type of collision at the intersections, which may indicate issues with roadway sightlines, speeding, distracted driving, poor road surface friction and insufficient gap allowance by drivers. Similarly, the predominant turning movement type collisions along the road segments may be indicative of visual limitations of on-coming vehicles due to road alignment, visual blockage by roadside elements, driver inattentiveness etc.

Conditions of Surroundings

- Majority of the collisions (88%) were under clear conditions, with the road surface being mostly dry. 3 collisions were reported under rainy conditions, 2 of which occurred at the intersection of Bryne Drive and Caplan Avenue.
- Most collisions (92%) occurred under daylight conditions, during or between the morning and afternoon peak periods.

3.4.2 Potential for Safety Improvements

The available collision data were used to develop Potential for Safety Improvement (PSI) indices at the intersections of Bryne Drive and Essa Road, and Bryne Drive and Caplan Avenue. A PSI analysis was not done for the road segments of Bryne Drive that currently end in cul-de-sacs and are planned for extension under the MMATMP.

The PSI index is a measure of excess collision frequency, above the expected value, that might be reduced through safety improvements.

Predicted Collisions: The predictive models in the *Highway Safety Manual 2010* were used to estimate the long-term average frequency of collisions by crash severity (Fatal and Injury, and PDO). The HSM prediction methodology is based on regression models of crash data collected at similar sites. This methodology relies on selecting a Safety Performance Factor (SPF) for a road segment or intersection type given by the regression model, and adjusting it for site-specific conditions such as the presence of on-street parking or illumination, by means of a Crash Modification Factor (CMF) or a Calibration Factor for local jurisdiction conditions.

Expected Collisions: The expected collision frequency is a more statistically reliable measure because it is based on the predicted collision frequency, as well as actual historical data collected at the specific location(s). Since observed collision data were available for the locations along Bryne Drive in the Study Area, the EB Method was applied to combine predicted collisions with the observed collision from 2012 to 2016 to derive the expected number of collisions.

The PSI at each location is the difference between the expected and predicted numbers of collision. Locations with positive PSI values have a potential for safety improvement; the larger the positive value, the greater the potential. Likewise, negative values have limited potential for improvement because the expected number of collisions is less than the predicted number of collisions. The results of the PSI analysis at the intersections of Bryne Drive in the Study Area are summarized in **Table 3-5.**

The results show that the intersections within the Study Area have negative PSI values for both collision severity types, with the exception of Bryne Drive and Caplan Avenue, where the PSI for PDO collisions is slightly positive. Since this positive PSI value is small, it is determined that there is limited potential for safety improvements at the intersections along Bryne Drive in the Study Area.

Table 3-5 Potential for Safety Improvements at Study Area Intersections

Intersection	*Observed*	*Predicted*	*Expected*	*PSI*
Bryne Drive at Essa Road	Fatal/Injury Collisions			
	0	8.90	2.3	-6.6
	PDO Collisions			
	6	15.8	7.2	-8.6
	Total Collisions			
	6	24.7	7.8	-16.9
Bryne Drive at Caplan Avenue	Fatal/Injury Collisions			
	2	3.20	2.58	-0.6
	PDO Collisions			
	7	5.80	6.66	***0.9***
	Total Collisions			
	9	9.10	9.02	-0.1

4. Future Transportation Operations

The future transportation operations were assessed using forecast traffic volumes for the 2021 and 2031 planning horizons.

4.1 Traffic Forecast

The City provided the following three (3) sources of forecasted traffic volumes for the 2021 and 2031 horizon years:

1. Outputs from the City's latest EMME model (dated 2014-03-07) which was part of the City's MMATMP.
    a. The data included 2021 and 2031 Weekday AM and PM Peak Hours, with an interchange at Harvie Road.
2. Forecasts prepared by Morrison Hershfield from the Harvie Road / Big Bay Point Road / Highway 400 Crossing Phase 3 & 4 Class EA Study.
    a. This data included only 2031 Weekday AM and PM Peak Hours, with an interchange at Harvie Road.
    b. The forecast was extracted from an enhanced version of an Aimsun model also developed as part of the City's MMATMP.
3. Forecasts prepared by Ainley from the Bryne Drive Phase 1 & 2 Class EA Study.
    a. This data included 2021 and 2031 Weekday AM and PM Peak Hours, Friday PM Peak Hour, and Saturday Peak Hour, all with an interchange at Harvie Road.
    b. Ainley's traffic forecast was done by adjusting the City's EMME model forecasts to account for the following:
        i. *Screenline Adjustment:* Increasing the City's EMME model eastbound movement volume at Harvie Road and Bryne Drive by 40%. The adjustment was made to ensure results reflect a conservative approach since it was observed that the EMME model weighted trips to the highway more than to the arterial roads.
        ii. *Retail Development*: Adjustments made to include trips generated by two 400,000 ft^2 retail developments along Bryne Drive, one north and one south of Harvie Road.
    c. Ainley's 2031 traffic forecast was indicated as representing a 'worst-case' scenario of traffic growth.

These forecasts, provided in **Appendix C**, all included the following infrastructure improvements as recommended in the MMATMP:

1. The Harvie Road / Big Bay Point Road crossing of Highway 400 to complete the connection between Harvie Road and Big Bay Point Road. The MMATMP recommended that the Harvie Road / Big Bay Point Road crossing be constructed in the 2013-2016 timeframe.

2. The Harvie Road / Big Bay Point Road partial interchange with Highway 400. The MMATMP recommended that the interchange be constructed in the 2017-2021 timeframe.

3. The extension and widening of Bryne Drive from its current terminus south of Essa Road to north of Caplan Avenue. The MMATMP recommended that Bryne Drive be extended and widened in the 2013-2016 timeframe.

4.1.1 2021 Horizon Year

For the 2021 horizon year, it was assumed that the Harvie Road / Big Bay Point Road partial interchange with Highway 400 will not have been constructed yet. For the new intersection of Harvie Road and Bryne Drive, the traffic volume forecasts prepared as part of the Harvie / Big Bay Point crossing project as well as those in Ainley's Bryne Drive EA Study were used in the traffic analysis.

As highlighted in Morrison Hershfield's traffic study for the Harvie / Big Bay Point Crossing, the following adjustments were made to reflect anticipated travel patterns without the interchange in place in 2021:

1. The southbound right turning movements from Highway 400 N-E/W Off-ramp were removed from entering Harvie Road / Big Bay Point Road. This resulted in reduced westbound through movements at the intersection of Harvie Road and Bryne Drive.

2. The northbound left turning movements from Highway 400 S-E/W Off-ramp were removed from entering Harvie Road / Big Bay Point Road. This resulted in reduced westbound through movements at the intersection of Harvie Road and Bryne Drive.

3. The eastbound right turns on the E/W-S On-Ramp were removed by a combined reduction of traffic from the westbound through, northbound right and southbound left turns at the intersection of Harvie Road and Bryne Drive.

Based on discussions with the City of Barrie, the typical background growth rate in the vicinity of the Study Area was assumed to be 2%. The traffic volumes at the existing intersections of Bryne Drive and Essa Road, and Bryne Drive and Caplan Avenue, were grown using the 2% per annum growth rate to 2021. The differences in link volumes on the two segments of Bryne Drive were adjusted by assuming that some vehicles will access the existing and potential future commercial properties along Bryne Drive during both peak hours.

Ainley's forecasts generally assigned higher traffic volumes on Bryne Drive, as well as higher turning movements onto Harvie Road from Bryne Drive. A summary of the forecasted traffic volumes for the 2021 (without interchange) from both sources are presented in **Figures 4-1** and **4-2**.

4.1.2 2031 Horizon Year

For the 2031 horizon year, the traffic volumes at the new intersection of Bryne Drive and Harvie Road were extracted from the previously completed Harvie / Big Bay Point crossing project (which included the interchange in the 2031 forecasts) and Ainley's Bryne Drive EA.

The traffic volumes at the existing intersections of Bryne Drive / Ardagh Road and Essa Road, and Bryne Drive and Caplan Avenue, were grown using the 2% per annum growth rate to 2031.

The differences in link volumes on the two segments of Bryne Drive were adjusted by assuming that some vehicles will access the existing and potential future commercial properties along Bryne Drive during both peak hours.

Comparison of 2031 Traffic Forecasts

A number of key observations were made on the 2031 traffic forecasts in the above described sets of data:

1. Both forecasted volumes used in the Ainley's Bryne Drive EA Study, and Morrison Hershfield's Harvie Rd / Big Bay Point Rd highway crossing study are considerably higher than the City's EMME model volumes.
2. The eastbound and westbound volumes over the highway crossing are similar between Morrison Hershfield's and Ainley's forecasts, being within 10% of each other.
3. The traffic forecast in Ainley's Bryne Drive EA Study was developed by diverting more traffic onto Bryne Drive, in contrast to Morrison Hershfield's Harvie Rd / Big Bay Point Rd highway crossing forecast.

As such, the higher traffic volumes projected in Morrison Hershfield's study and Ainley's study were considered in the analysis for this report, in order to maintain a conservative approach as well as consistency with the Harvie / Big Bay Point project. The **weekday PM Peak Hour in Ainley's forecast was considered the critical hour for design purposes**, and is shown in the Midblock and Intersection operations analysis in the following sections for the respective planning horizons.

Even though the Ainley's Weekday PM Peak Hour was selected as the critical design hour to assess worst-case conditions, it is recognized that the Friday PM Peak and Saturday Peak hours have overall volumes that are 6% and 11% higher respectively than the worst-case conditions analysis. The differences in volume between the Weekday, Friday, and Saturday Peak hours are not enough to have a major impact on the proposed geometric configuration resulting from the worst-case conditions analysis. However, during the Friday and Saturday peak periods traffic volume demand on some movements may exceed available capacity.

Figures 4-3 and **4-4** provide a summary of forecasted traffic volumes for the 2031 (with interchange) horizon year based on the Morrison Hershfield traffic study for the Harvie / Big Bay Point Crossing and Ainley's Bryne Drive EA, respectively. Traffic operations and capacity analyses were completed for midblock road sections and intersections within the Study Area using these traffic forecasts.

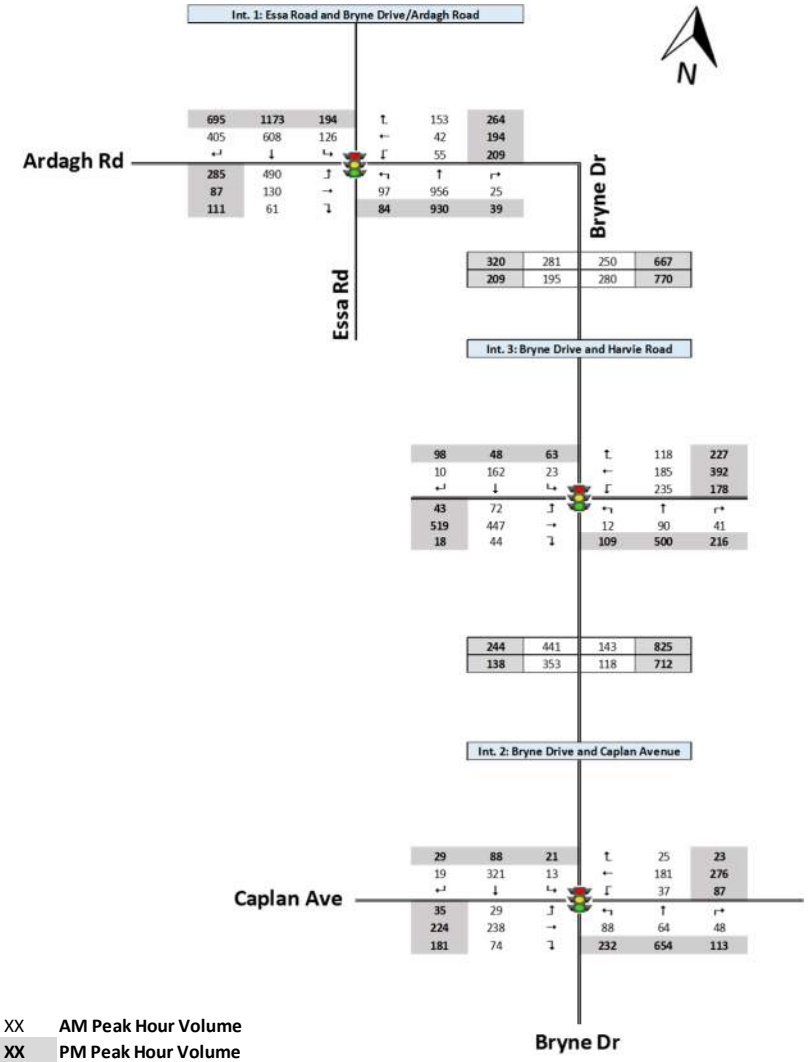


Figure 4-1: 2021 Forecast Traffic Volumes – Morrison Hershfield

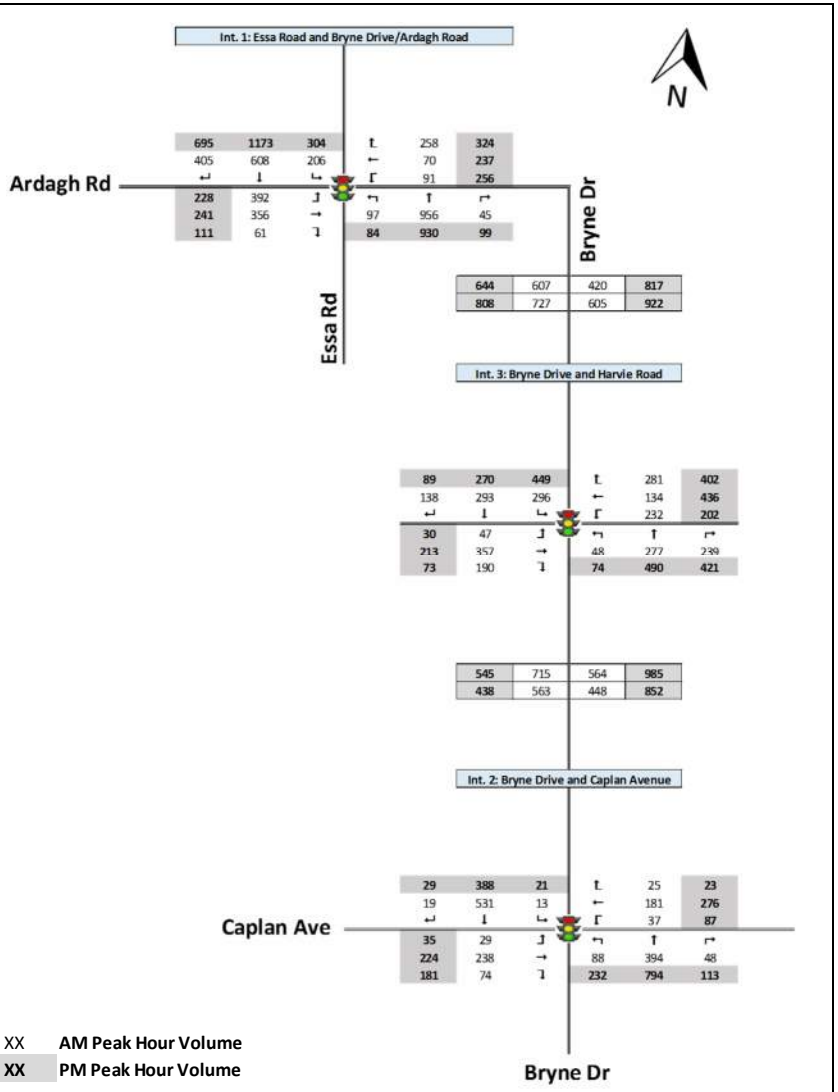


Figure 4-2: 2021 Forecast Traffic Volumes – Ainley

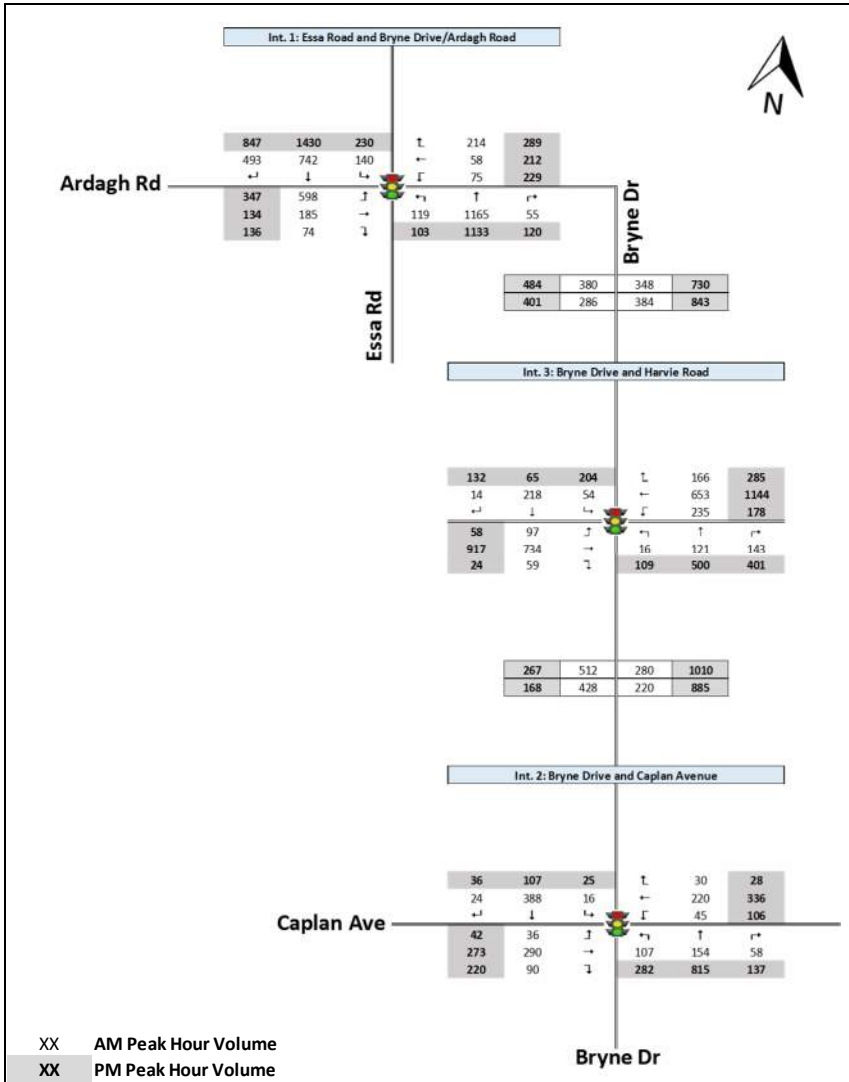


Figure 4-3: 2031 Forecast Traffic Volumes – Morrison Hershfield

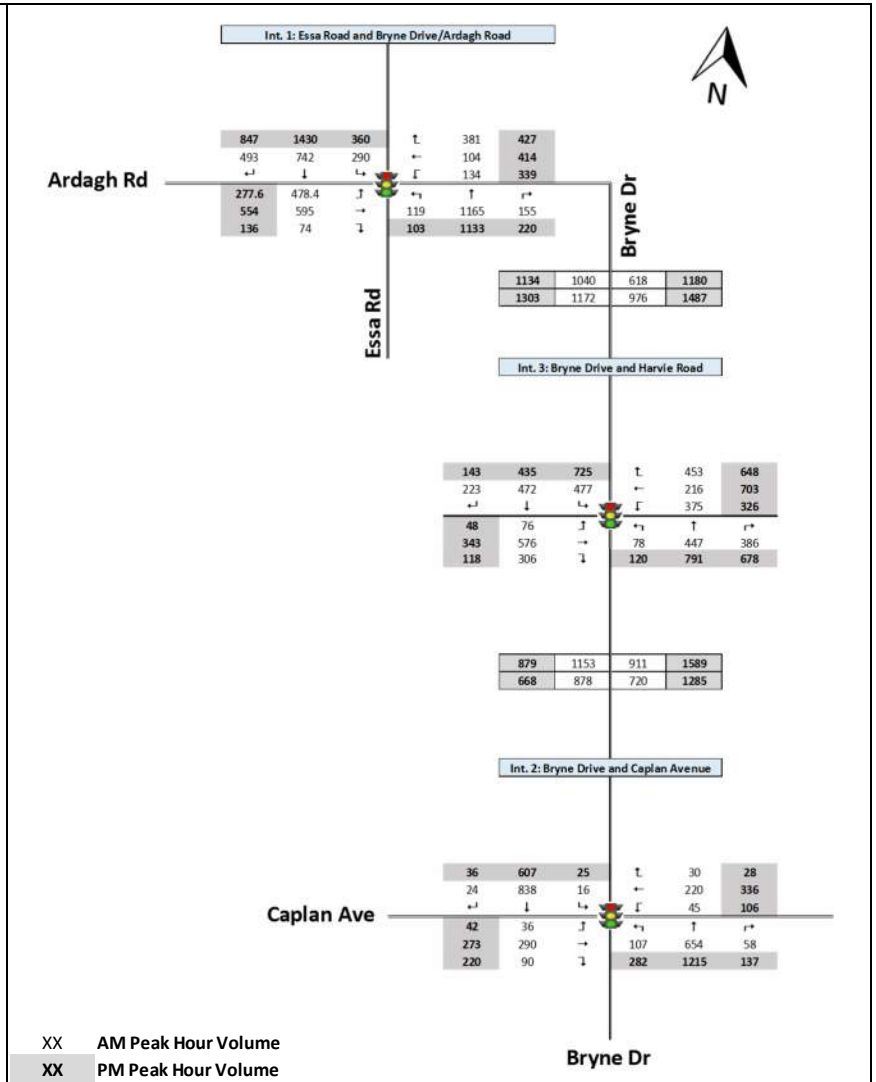


Figure 4-4: 2031 Forecast Traffic Volumes – Ainley

4.2 Future Midblock Analysis

A midblock analysis was not considered under existing conditions because Bryne Drive is disconnected between the south of Essa Road and north of Caplan Avenue in 2017. However, in 2021 and 2031, with the proposed Bryne Drive extension in place and under projected traffic volumes, the quality of service along midblock sections of the road was characterized on the basis of volume-to-capacity (v/c) ratio for each road section. The v/c ratio provides a measure of traffic volume demand to available capacity, with an at-capacity condition represented by a v/c ratio of 1.00 (i.e., volume demand equals theoretical capacity). For this planning level analysis, a **v/c ratio of 0.85 or less was deemed an acceptable level of operation** for midblock locations. The City of Barrie's Urban Design Manual (Revised October 2014) indicates that road segments with v/c ratios exceeding this threshold should be considered as candidates for remedial action.

The midblock v/c ratios were calculated by dividing the traffic link volume by the theoretical capacity for the subject link (i.e., the maximum hourly flow rate at which vehicles can be expected to traverse the section of roadway within a given time period under prevailing roadway, traffic and control conditions). A theoretical lane capacity based on adjusted road classification in the MMATMP[5] was used in the analysis.

In the MMATMP, existing Bryne Drive is designated as a Major Collector road[6] and the future extension is proposed to have a 5-lane cross section including a TWLTL with an adjusted lane capacity of 550 vehicles per hour. The analysis in this report also considered a 3-lane cross section of the proposed extension to confirm the required configuration for projected traffic volumes in the future planning horizons.

4.2.1 2021 Midblock Analysis

4.2.1.1 3-Lane Extension

A 3-lane extension of Bryne Drive between the current termini (one through traffic lane in each direction and a center TWLTL) will result in two road sections along Bryne Drive in the Study Area – from Essa Road to Harvie Road and from Harvie Road to Caplan Avenue. The results of the midblock capacity analysis under 2021 forecast traffic conditions are summarized in **Table 4-1**.

[5] *City of Barrie Multi-modal Active Transportation Mater Plan, Appendix H - Table 1-3.*
[6] *City of Barrie Multi-modal Active Transportation Mater Plan, Figure 2-1 Roadways Classification Existing 2011.*

Table 4-1 2021 Midblock Capacity Analysis with 3-Lane Extension

Section	AM Peak Direction Volume (vph)	AM Volume-to-Capacity Ratio (v/c)	PM Peak Direction Volume (vph)	PM Volume-to-Capacity Ratio (v/c)
Bryne Drive (550 vph/l) – Morrison Hershfield Traffic Volumes				
Essa Road to Harvie Road	280	0.51	770	1.40
Harvie Road to Caplan Avenue	440	0.80	825	1.50
Bryne Drive (550 vph/l) – Ainley Traffic Volumes during PM Critical Hour				
Essa Road to Harvie Road	-	-	922	1.68
Harvie Road to Caplan Avenue	-	-	985	1.79

In the 2021 horizon year, based on the forecasted traffic volumes, it is expected that Bryne Drive, between both Essa Road and Harvie Road, and between Harvie Road and Caplan Avenue **will exceed effective capacity in the PM Peak Hour with a 3-lane extension**.

4.2.1.2 *5-Lane Extension*

The MMATMP identified a 5-lane cross section (two through traffic lanes and one TWLTL) for the Bryne Drive extension between the current termini, 680m south of Essa Road and 530m north of Caplan Avenue, as the preferred option for the 2031 horizon. It also recommended widening the existing 3-lane sections to 5 lanes between the intersections of Bryne Drive with Essa Road and Caplan Avenue, and the termini, to maintain consistency with the lane configurations of the existing intersections and the future extension. It should be noted that the MMATMP does not identify any further expansion of Bryne Drive in the Study Area beyond 2031.

In 2021, both sections of Bryne Drive, between Essa Road and Harvie Road, and between Harvie Road and Caplan Avenue, under the projected traffic volumes from Morrison Hershfield's study **will operate within effective capacity with a 5-lane cross section**, as shown in **Table 4-2.** In the critical design hour based on weekday PM traffic forecasts based on Ainley's Bryne Drive EA Study, the stretch of Bryne Drive between Harvie Road and Caplan Avenue will approach effective capacity with a v/c ratio of 0.9.

Table 4-2 2021 Midblock Capacity Analysis with 5-Lane Extension

Section	AM Peak Direction Volume (vph)	AM Volume-to-Capacity Ratio (v/c)	PM Peak Direction Volume (vph)	PM Volume-to-Capacity Ratio (v/c)
Bryne Drive (550 vph/l) – Morrison Hershfield Traffic Volumes				
Essa Road to Harvie Road	280	0.25	770	0.70
Harvie Road to Caplan Avenue	440	0.40	825	0.75
Bryne Drive (550 vph/l) – Ainley Traffic Volumes during PM Critical Hour				
Essa Road to Harvie Road	-	-	922	0.84
Harvie Road to Caplan Avenue	-	-	985	0.90

4.2.2 2031 Midblock Analysis

4.2.2.1 3-Lane Extension

Under 2031 forecast traffic conditions, a 3-lane extension of Bryne Drive between the current termini will result in the midblock sections of the road **exceeding effective capacity**, as shown in **Table 4-3**.

Table 4-3 2031 Midblock Capacity Analysis with 3-Lane Extension

Section	AM Peak Direction Volume (vph)	AM Volume-to-Capacity Ratio (v/c)	PM Peak Direction Volume (vph)	PM Volume-to-Capacity Ratio (v/c)
Essa Road (550 vph/l) - Morrison Hershfield Traffic Volumes				
Essa Road to Harvie Road	380	0.69	845	1.54
Harvie Road to Caplan Avenue	510	0.93	1,010	1.84
Bryne Drive (550 vph/l) – Ainley Traffic Volumes during PM Critical Hour				
Essa Road to Harvie Road	-	-	1,487	2.70
Harvie Road to Caplan Avenue	-	-	1,589	2.89

4.2.2.2 5-Lane Extension

Under the 2031 traffic forecast based on Morrison Hershfield's study, a 5-lane extension of Bryne Drive between the current termini will result in the midblock sections of the road **operating within effective capacity as shown in Table 4-4. However, the v/c ratio at the midblock section between Harvie Road and Caplan Avenue in the PM peak hour is expected to be 0.92**, **which exceeds the City's acceptable threshold**.

A 5-lane cross section is also found to be insufficient for the midblock traffic projections along Bryne Drive in the critical design hour. However, as noted earlier, the 2031 traffic volume projections by Ainley represent a "worst-case" scenario. Furthermore, no additional widening of Bryne Drive has been identified in the MMATMP beyond 2031. Under the existing conditions Bryne Drive is designated as a Minor Collector Road. There are limited opportunities to add capacity to Bryne Drive in the Study Area to accommodate the critical design hour volumes, unless this designation is changed to a higher order road, or the road is widened.

Table 4-4 2031 Midblock Capacity Analysis with 5-Lane Extension

Section	AM Peak Direction Volume (vph)	AM Volume-to-Capacity Ratio (v/c)	PM Peak Direction Volume (vph)	PM Volume-to-Capacity Ratio (v/c)
Essa Road (550 vph/l) - Morrison Hershfield Traffic Volumes				
Essa Road to Harvie Road	380	0.35	845	0.77
Harvie Road to Caplan Avenue	510	0.46	1,010	0.92
Bryne Drive (550 vph/l) – Ainley Traffic Volumes during PM Critical Hour				
Essa Road to Harvie Road	-	-	1,487	1.35
Harvie Road to Caplan Avenue	-	-	1,589	1.44

4.3 Future Intersection Operations

As part of the future operations analysis, the intersections were analyzed based on the forecast traffic volumes for the horizon years 2021 and 2031 based on the study by Morrison Hershfield. The intersection operations analysis was also completed for the critical design hour based on the weekday PM Peak hour traffic volumes in Ainley's Bryne Drive EA. The analysis focused on a scenario for each horizon year that evaluated the operations of the existing road network, with the approved improvements in place. In 2021, it is assumed that there will be no interchange with Highway 400. In 2031, it is assumed that the partial interchange with Highway 400 will be in place for the scenario. A subsequent analysis was then completed (where required) that identified improvements to the approved road network to accommodate the forecast volumes. This is referred to in the following discussion as the 'Improved' scenario for its respective horizon year.

The Synchro models were optimized and a peak hour factor of 1.00 was applied to all movements and a 1900 v/h/l saturation flow rate was used in accordance with the City of Barrie Synchro and SimTraffic guidelines. Detailed Synchro reports are provided in **Appendix D** and **Appendix E**.

Lane configurations and the need for auxiliary lanes at signalized intersections were identified based on the operational assessment of the 2021 and 2031 traffic and network conditions using SimTraffic outputs (average of five simulation runs) and based on Transportation Association Canada (TAC) Geometric Design Guide for Canadian Roads (Chapter 2.3).

The extension and widening of Bryne Drive is not expected to impact the existing lane configurations of the intersections at Bryne Drive and Essa Road, and Bryne Drive and Caplan Avenue. However, in both horizon years, there will be a new intersection of Harvie Road and Bryne Drive. The lane configuration of the new intersection in 2021 is assumed to include two through lanes and dedicated left and right turning lanes at the north and south approaches. The east approach will have one through lane with a dedicated left turn and a shared through-right turn lane. The west approach will have one through lane and dedicated left and right turning lanes. For the 2031 scenario, the intersection is assumed to include two through lanes and dedicated left and right turning lanes at each approach. The configuration of the intersection for each horizon year can be seen in **Figure 4-5**.

The two through lanes at the north and south approaches of the intersection are based on the 5-lane cross-section of Bryne Drive as identified by the MMATMP. The continuous TWLTLs are expected to accommodate dedicated left turn lanes at the intersection approaches. The lane configurations at the east and west approaches of the intersection are consistent with the assumptions made for traffic analysis on Harvie Road Environmental Assessment (EA) study.

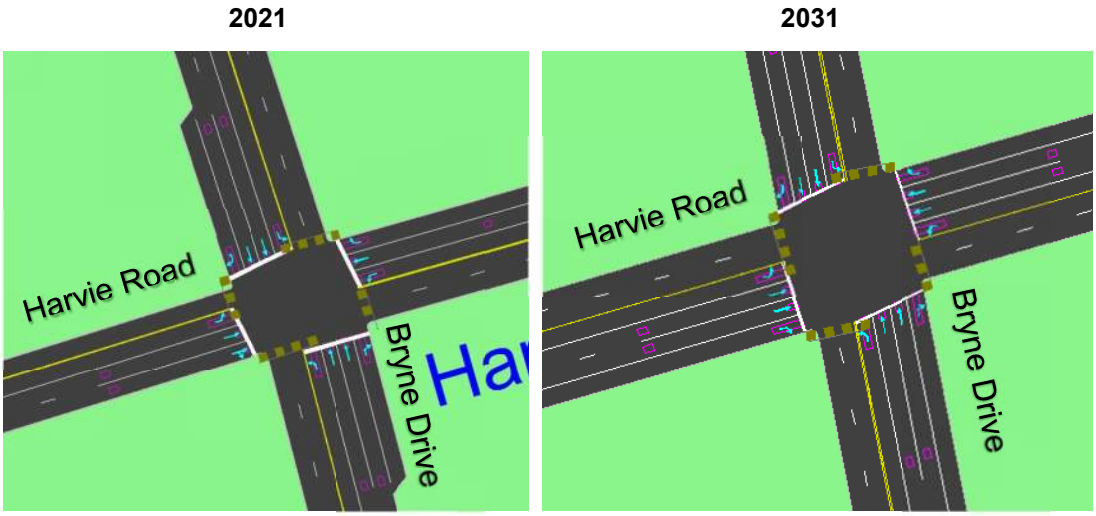


Figure 4-5 Lane Configuration at New Intersection of Harvie Road and Bryne Drive

4.3.1 2021 Intersection Analysis

For the 2021 scenario, the existing configurations of the signalized intersections of Bryne Drive at Essa Road and Caplan Avenue were analyzed using 2021 forecast traffic volumes from the two sources investigated in this report. The new intersection of Bryne Drive and Harvie Road was also analyzed using the lane configuration shown in **Figure 4-5**.

Table 4-5 and **Table 4-6** summarize the results of the analysis using traffic forecasts based on Morrison Hershfield's study and Ainley's Bryne Drive EA, respectively. Detailed results can be found in **Appendix D**.

4.3.1.1 *Results based on Morrison Hershfield's Forecasts*

Table 4-5 2021 Intersection Operations with 5-Lane Extension (Morrison Hershfield)

Intersection	Movement	AM Peak Hour				PM Peak Hour			
		LOS	Delay(s)	V/C	95th Queue (m)	LOS	Delay(s)	V/C	95th Queue (m)
Bryne Drive/Ardagh Road and Essa Road	***Overall***	***C***	***30***	***0.90***	-	***C***	***30***	***0.77***	-
	EBL	D	54	0.96	129	C	26	0.64	52
	EBTR	C	24	0.18	18	C	29	0.21	15
	WBL	C	26	0.20	13	C	24	0.50	38
	WBT	C	29	0.08	7	C	31	0.37	24
	WBR	C	29	0.10	16	C	30	0.16	19
	NBL	D	37	0.54	27	D	36	0.48	25
	NBT	C	29	0.78	91	C	29	0.78	105
	NBR	B	17	0.02	0	B	18	0.02	0
	SBL	C	34	0.35	17	C	33	0.45	24
	SBT	C	22	0.50	55	D	36	0.91	151
	SBR	B	20	0.25	18	C	23	0.53	50
Bryne Drive and Caplan Avenue	***Overall***	***C***	***23***	***0.38***	-	***C***	***26***	***0.63***	-
	EBL	C	23	0.10	8	C	22	0.12	9
	EBTR	D	37	0.75	71	D	45	0.85	101
	WBL	C	22	0.16	9	C	23	0.41	18
	WBTR	C	27	0.47	47	C	30	0.60	68
	NBL	B	10	0.16	15	B	13	0.38	36
	NBTR	B	12	0.06	9	C	20	0.53	75
	SBL	B	14	0.02	4	B	16	0.07	5
	SBTR	B	16	0.23	32	B	18	0.08	11
Bryne Drive and Harvie Road	***Overall***	***C***	***21***	***0.38***	-	***C***	***24***	***0.49***	-
	EBL	C	25	0.23	23	C	27	0.17	15
	EBT	C	27	0.52	58	C	31	0.58	65
	WBL	B	17	0.55	40	B	19	0.48	33
	WBT	B	14	0.22	33	C	20	0.27	77
	WBR	B	13	0.08	7	B	17	0.15	12
	NBL	C	21	0.04	6	C	22	0.26	28
	NBT	C	21	0.08	13	C	25	0.42	56
	NBR	C	21	0.03	0	C	22	0.14	20
	SBL	B	18	0.05	9	C	22	0.18	18
	SBT	C	20	0.14	20	C	22	0.04	8
	SBR	B	19	0.01	0	C	22	0.06	10

Although traffic in the Study Area is assumed to grow at a rate of 2% per annum between 2017 and 2021, the overall traffic operations at the existing intersections of Bryne Drive with Essa Road and Caplan Avenue are expected to improve slightly or remain similar to the existing conditions based on the traffic volumes by Morrison Hershfield. Key observations based on **Table 4-5** are as follows:

- At the intersection of Bryne Drive and Essa Road, the traffic volumes making southbound left, eastbound through and northbound right turning movements were assumed to be reduced due to vehicles using alternative routes to access the newly constructed crossing

of the Harvie Road-Big Bay Point Road over Highway 400. The eastbound left (EBL) turn at this intersection is still a critical movement, especially with increased westbound movements along Bryne Drive.

- At the intersection of Bryne Drive and Caplan Avenue, slight improvements are noticed as well – in the PM peak hour, the eastbound through-right (EBTR) movement is no longer critical because with the increase in northbound through movements on Bryne Drive there are more opportunities for right turn on red movements in the eastbound direction from Caplan Avenue.
- The new intersection of Bryne Drive and Harvie Road is expected to operate with acceptable delays, queues and LOS in both peak hours under the assumed intersection configuration and the forecast traffic in 2021.

"Improved" scenarios were not considered for the 2021 horizon year as all intersections along Bryne Drive in the Study Area and the intersection turning movements perform at overall acceptable LOS under both sets of traffic volumes forecasts.

4.3.1.2 *Results based on Ainley Forecasts*

Table 4-6 2021 Intersection Operations with 5-Lane Extension (Ainley)

Intersection	Movement	PM Peak Hour			
		LOS	Delay(s)	V/C	95th Queue (m)
Bryne Drive/Ardagh Road and Essa Road	***Overall***	***C***	***28***	***0.8***	-
	EBL	C	32	0.67	45
	EBTR	C	33	0.52	33
	WBL	D	53	0.88	54
	WBT	C	32	0.40	28
	WBR	C	33	0.42	33
	NBL	D	45	0.62	29
	NBT	C	23	0.65	94
	NBR	B	16	0.06	7
	SBL	D	41	0.72	45
	SBT	C	23	0.74	126
	SBR	C	21	0.59	74
Bryne Drive and Caplan Avenue	***Overall***	***C***	***27***	***0.69***	-
	EBL	C	24	0.13	9
	EBTR	D	52	0.89	108
	WBL	C	25	0.44	18
	WBTR	C	32	0.62	71
	NBL	B	13	0.46	34
	NBTR	C	21	0.61	90
	SBL	B	16	0.09	5
	SBTR	C	21	0.32	39
Harvie Road and Bryne Drive	***Overall***	***C***	***28***	***0.85***	-
	EBL	D	44	0.39	16
	EBT	D	43	0.55	42
	WBL	D	36	0.70	57
	WBT	D	44	0.83	130
	WBR	C	28	0.27	21
	NBL	B	20	0.17	13
	NBT	C	26	0.41	71
	NBR	C	26	0.35	43
	SBL	B	18	0.77	79
	SBT	B	12	0.15	24
	SBR	B	11	0.06	8

In the critical design hour represented by the traffic volumes in Ainley's Bryne Drive EA, there are more through movements along Bryne Drive and higher turning movements on to Harvie Drive. However, all intersections operate at LOS C or better with low overall delays as shown in **Table 4-6**.

"Improved" scenarios were not considered for the 2021 horizon year as all intersections along Bryne Drive in the Study Area and the intersection turning movements perform at overall acceptable LOS under both sets of traffic volumes forecasts.

4.3.2 2031 Intersection Analysis

For the 2031 horizon year, the same lane configurations as 2021 were considered at the intersections of Bryne Drive with Essa Road and Caplan Avenue. The Bryne Drive and Harvie Road intersection was updated to reflect the configuration in **Figure 4-5**. The analysis was completed with 2031 traffic forecasts based on Morrison Hershfield's study as well as Ainley's Bryne Drive EA. **Table 4-7** and **Table 4-8** summarize the results of the analysis. Detailed results can be found in **Appendix E**.

4.3.2.1 *Results based on Morrison Hershfield's Forecasts*

Table 4-7 2031 Intersection Operations with 5-Lane Extension (Morrison Hershfield)

Intersection	Movement	AM Peak Hour				PM Peak Hour			
		LOS	Delay(s)	V/C	95th Queue (m)	LOS	Delay(s)	V/C	95th Queue (m)
Bryne Drive/Ardagh Road and Essa Road	***Overall***	***D***	***37***	***0.98***	-	***D***	***40***	***0.92***	-
	EBL	E	71	1.04	155	C	32	0.77	66
	EBTR	C	26	0.29	25	C	30	0.30	20
	WBL	C	25	0.25	16	C	25	0.55	42
	WBT	C	30	0.12	9	C	31	0.40	26
	WBR	C	30	0.14	18	C	30	0.18	20
	NBL	D	40	0.62	33	D	38	0.56	30
	NBT	D	41	0.94	138	D	39	0.93	141
	NBR	B	17	0.03	0	B	19	0.08	11
	SBL	C	34	0.38	18	C	33	0.51	28
	SBT	C	24	0.61	71	D	54	1.02	188
	SBR	C	21	0.31	20	D	38	0.84	134
Bryne Drive and Caplan Avenue	***Overall***	***C***	***26***	***0.47***	-	***C***	***32***	***0.78***	-
	EBL	C	22	0.13	9	C	22	0.16	10
	EBTR	D	46	0.86	98	E	63	0.96	137
	WBL	C	23	0.23	11	C	26	0.54	21
	WBTR	C	29	0.57	57	C	31	0.67	85
	NBL	B	11	0.22	18	B	16	0.49	44
	NBTR	B	14	0.12	17	C	25	0.68	100
	SBL	B	15	0.03	4	B	18	0.13	6
	SBTR	B	18	0.29	39	B	20	0.10	13
Bryne Drive and Harvie Road	***Overall***	***C***	***24***	***0.49***	-	***C***	***28***	***0.71***	-
	EBL	C	29	0.45	31	C	30	0.51	23
	EBT	C	33	0.72	88	C	34	0.81	107
	EBR	C	24	0.04	0	C	22	0.02	0
	WBL	B	23	0.69	39	C	32	0.76	45
	WBT	B	17	0.40	52	C	23	0.73	114
	WBR	C	14	0.11	9	B	16	0.22	18
	NBL	C	25	0.06	8	C	28	0.31	33
	NBT	C	26	0.12	18	C	32	0.51	66
	NBR	C	25	0.09	15	C	35	0.54	68
	SBL	C	21	0.12	19	C	32	0.62	55
	SBT	C	23	0.19	30	C	25	0.07	11
	SBR	C	21	0.01	0	C	25	0.10	18

Under the 2031 traffic forecasts, the overall operations at intersections in the Study Area are expected to deteriorate from 2021 levels. The critical movements identified in both existing conditions and in the 2021 horizon year will worsen. Overall, the intersections will perform at LOS D or better with acceptable delays in both peak hours; however, the intersection of Bryne Drive with Essa Road is expected to approach effective capacity and operate with a v/c ratio of 0.98 in the AM peak hour and a v/c ratio of 0.92 in the PM peak hour.

A couple of turning movements at the intersections of Bryne Drive with Essa Road and with Caplan Avenue are expected to operate close to or at effective capacity with moderate to high delays. In particular, the eastbound left (EBL) turn movement is expected to operate at effective capacity and at LOS E due to the high volume of left turning vehicles in the AM peak hour being accommodated by a single left turn lane. This also has an impact on the operations of the opposing northbound through (NBT) movement.

At the intersection of Bryne Drive and Caplan Avenue, the eastbound through right movement from the shared lane will operate at LOS E, and experience high delays and longer queues with the forecast traffic volumes in 2031.

4.3.2.2 *Results based on Ainley Forecasts*

Table 4-8 2031 Intersection Operations with 5-Lane Extension (Ainley)

Intersection	Movement	PM Peak Hour			
		LOS	Delay(s)	V/C	95th Queue (m)
Bryne Drive/Ardagh Road and Essa Road	***Overall***	***E***	***57***	***1.18***	**-**
	EBL	C	33	0.75	53
	EBTR	C	35	0.74	76
	WBL	F	200	1.33	110
	WBT	C	29	0.44	46
	WBR	C	34	0.65	69
	NBL	E	65	0.76	49
	NBT	D	41	0.91	161
	NBR	C	22	0.15	18
	SBL	E	74	0.95	67
	SBT	D	51	1.00	207
	SBR	F	86	1.07	214
Bryne Drive and Caplan Avenue	***Overall***	***D***	***40***	***0.94***	**-**
	EBL	C	23	0.18	10
	EBTR	F	87	1.04	144
	WBL	C	27	0.54	21
	WBTR	C	35	0.72	97
	NBL	C	21	0.72	46
	NBTR	D	36	0.93	179
	SBL	C	21	0.18	6
	SBTR	C	25	0.52	62
Harvie Road and Bryne Drive	***Overall***	***F***	***127***	***1.5***	**-**
	EBL	C	26	0.23	16
	EBT	C	26	0.34	37
	EBR	C	24	0.08	4
	WBL	C	28	0.75	59
	WBT	B	20	0.48	61
	WBR	C	28	0.77	111
	NBL	C	27	0.45	35
	NBT	D	37	0.78	119
	NBR	D	49	0.84	142
	SBL	F	706	2.47	316
	SBT	C	27	0.42	57
	SBR	C	24	0.09	15

Under the critical design hour traffic forecasts based on Ainley's Bryne Drive EA, intersections along Bryne Drive are expected to worsen significantly as several turning movements operate close to or at effective capacity with high delays as shown in **Table 4-8**. With the high traffic volumes, the existing intersection of Bryne Drive with Essa Road and the

new intersection Bryne Drive and of Harvie Road with the configuration shown in **Figure 4-5** are expected to operate significantly over capacity.

1. At the intersection of Bryne Drive and Essa Road, all southbound movements will operate close to capacity or at LOS E or worse. With the high through movements on this approach and the high east and westbound turning movements from Bryne Drive, multiple movements compete for the right of way in the signal timing for the intersection.
2. The high turning movements from Bryne Drive at the intersection of Bryne Drive and Harvie Road, especially for the southbound left movement, will result in unreasonable delays. This indicates more capacity and signal time is required by these movements to clear the intersection.
3. The high through movements expected on Bryne Drive under the critical design hour traffic forecasts based on Ainley's Bryne Drive EA experience high delays.

4.3.2.3 2031 Intersection Analysis with Improvements

There is scope for improvements to the intersections along Bryne Drive based on the analysis with the two sets of traffic forecasts. Since the forecasts are inherently different in weighting the traffic along arterial roads and Highway 400, two sets of adjustments were considered to improve the traffic operations at the Study Area intersections:

1. Traffic Forecasts based on Morrison Hershfield's Study:

   Bryne Drive and Essa Road:

   1. Addition of a second eastbound left turn lane
   2. Optimization of signal timing splits

   Bryne Drive and Caplan Avenue:

   1. Increasing signal cycle length to 100 seconds
   2. Optimization of signal timing splits

   The analysis of traffic conditions in the 2031 horizon year with the improvements listed above indicates that the intersections along Bryne Drive in the Study Area can be expected to operate at acceptable LOS C or better and within capacity. Only one critical movement was identified with the improvements in place. The southbound through movement at the intersection of Bryne Drive and Essa Road is expected to approach its effective capacity (v/c 0.94) but remain operating at LOS D with moderate delay. Results are summarized in **Table 4-9**.

Table 4-9 2031 "Improved" 2031 Intersection Operations with 5-Lane Extension

Signalized Intersections

Intersection	Movement	AM Peak Hour				PM Peak Hour			
		LOS	Delay(s)	V/C	95th Queue (m)	LOS	Delay(s)	V/C	95th Queue (m)
Bryne Drive/Ardagh Road and Essa Road	***Overall***	***C***	***32***	***0.79***	***-***	***D***	***34***	***0.85***	***-***
	EBL	D	44	0.67	77	D	48	0.82	56
	EBTR	C	26	0.38	23	C	30	0.28	20
	WBL	C	26	0.26	16	C	26	0.57	43
	WBT	C	30	0.12	9	C	31	0.34	25
	WBR	C	31	0.21	23	C	34	0.55	43
	NBL	D	40	0.54	39	D	49	0.68	44
	NBT	C	35	0.75	133	C	27	0.79	133
	NBR	B	17	0.03	0	B	17	0.08	11
	SBL	D	36	0.47	20	D	49	0.77	40
	SBT	C	25	0.53	71	D	36	0.94	185
	SBR	C	21	0.31	20	D	35	0.83	145
Bryne Drive and Caplan Avenue	***Overall***	***C***	***24***	***0.46***	***-***	***C***	***29***	***0.76***	***-***
	EBL	C	21	0.12	9	C	21	0.14	10
	EBTR	D	38	0.79	87	D	43	0.85	115
	WBL	C	22	0.20	10	C	24	0.51	20
	WBTR	C	28	0.53	55	C	28	0.59	82
	NBL	B	12	0.22	22	B	19	0.51	56
	NBTR	B	15	0.12	20	C	28	0.71	133
	SBL	B	16	0.03	5	C	21	0.14	8
	SBTR	B	19	0.30	45	C	22	0.10	15
Bryne Drive and Harvie Road	***Overall***	***C***	***24***	***0.49***	***-***	***C***	***29***	***0.72***	***-***
	EBL	C	28	0.44	30	C	30	0.51	23
	EBT	C	32	0.71	85	C	34	0.80	107
	EBR	C	23	0.04	0	C	22	0.02	0
	WBL	B	23	0.69	38	C	33	0.75	45
	WBT	B	16	0.40	51	C	23	0.72	114
	WBR	C	14	0.11	9	B	16	0.22	18
	NBL	C	25	0.06	8	C	27	0.30	32
	NBT	C	25	0.13	18	C	31	0.50	65
	NBR	C	25	0.09	15	C	34	0.53	68
	SBL	C	21	0.12	18	C	34	0.61	57
	SBT	C	23	0.19	29	C	26	0.07	11
	SBR	C	21	0.01	0	C	26	0.09	15

2. Traffic Forecasts based on Ainley's Bryne Drive EA:

Bryne Drive and Essa Road:

1. Increasing signal cycle length to 115 seconds
2. Optimization of signal timing splits

Bryne Drive and Harvie Road:

1. Increasing signal cycle length to 140 seconds
2. Addition of a second southbound left turn lane and westbound left turn lane
3. Optimization of signal timing splits

Bryne Drive and Caplan Avenue:

1. Increasing signal cycle length to 100 seconds
2. Optimization of signal timing splits

The analysis of traffic conditions in the 2031 horizon year with the improvements listed above indicates that the intersections along Bryne Drive in the Study Area will operate at LOS E or better, with several movements still close to or at effective capacity. Results are summarized in **Table 4-10**.

At Bryne Drive and Essa Road, the presence of high left turn volumes in several directions, and high through movements continues to cause high delays. While dual left turn lanes in the westbound direction may be provided, there are mostly residential areas to the west of the intersection along Essa Road and may not be a cost effective solution for the 339 vehicles per hour. Property constraints limit any widening improvements at the intersection of Bryne Drive and Caplan Avenue. However, addition of turning lanes at the intersection of Bryne Drive and Harvie Road is possible. Under the improved scenario, the unreasonable delay experienced by a single southbound left turn lane is alleviated with dual left turn lanes accommodating over 700 vehicles per hour. Dual left turn lanes in the westbound direction is also included in the improvements for this new intersection.

Table 4-10 2031 "Improved" 2031 Intersection Operations with 5-Lane Extension

Intersection	Movement	PM Peak Hour			
		LOS	Delay(s)	V/C	95th Queue (m)
Bryne Drive/Ardagh Road and Essa Road	***Overall***	***E***	***57***	***1.07***	**-**
	EBL	C	30	0.64	57
	EBTR	D	44	0.79	91
	WBL	E	75	0.99	112
	WBT	C	33	0.41	52
	WBR	D	36	0.57	70
	NBL	C	28	0.50	23
	NBT	E	60	0.98	185
	NBR	C	29	0.19	25
	SBL	E	63	0.86	68
	SBT	E	70	1.04	236
	SBR	E	74	1.00	211
Bryne Drive and Caplan Avenue	***Overall***	***D***	***38***	***0.91***	**-**
	EBL	C	23	0.16	11
	EBTR	D	53	0.90	139
	WBL	C	29	0.59	22
	WBTR	C	32	0.63	89
	NBL	C	23	0.72	53
	NBTR	D	42	0.95	204
	SBL	C	25	0.20	7
	SBTR	C	30	0.57	75
Harvie Road and Bryne Drive	***Overall***	***E***	***57***	***0.92***	**-**
	EBL	D	50	0.36	24
	EBT	D	51	0.53	60
	EBR	D	46	0.08	13
	WBL	F	98	0.96	78
	WBT	D	41	0.64	106
	WBR	D	46	0.73	119
	NBL	B	18	0.15	23
	NBT	D	44	0.70	125
	NBR	E	79	0.97	212
	SBL	E	71	0.94	140
	SBT	E	56	0.71	74
	SBR	D	48	0.17	24

4.4 Queueing Assessment, Storage Lane Requirements

An analysis of storage lane requirements for left and right turning lanes was completed for the intersections within the Study Area assuming that the improvements suggested in **Section 4.3.2.3** are made by 2031. Storage lengths were reviewed and recommended based on the average of five (5) simulation runs from SimTraffic – as specified in the project Terms of Reference. This is to ensure that they are sufficiently long to accommodate the maximum vehicle queue expected to accumulate during the peak hours of the 2031 design year conditions. Detailed SimTraffic reports are provided in **Appendix F**.

Table 4-11 displays and compares the results from both Synchro and SimTraffic analysis and provides recommended storage lengths for the auxiliary turning lanes. When determining the back of queue for turning movements, SimTraffic takes into account the road geometry and lane blocking by vehicles on an adjacent lane. Therefore, the recommended storage lengths were provided by visually checking the simulation to ensure that the storage requirement for a specific turning movement supports the traffic volume, but is not overstated due to any potential lane blocking. It is noted that the design of left and right turn auxiliary lanes should also incorporate sufficient parallel lane lengths to satisfy the deceleration length requirements that are in accordance with the design speed selected for the roadway.

These recommended set of storage length considers the Synchro/SimTraffic results for both the sets of traffic volumes. The critical design hour traffic volumes represented by Ainley's projections in the Bryne Drive EA correspond to higher turning movements at a couple of the intersections, and result in much longer storage lengths than those required by Morrison Hershfield's turning movement projections. These longer recommended storage lengths are highlighted in **Table 4-11**.

Table 4-11 Recommended Storage Lengths

Intersection	Movement	Synchro 95th Queue (m)		SimTraffic 95th Queue (m)		Recommended Storage Length (m)
		Morrison Hershfield Traffic - AM (PM)	Ainley Traffic - PM	Morrison Hershfield Traffic - AM (PM)	Ainley Traffic - PM	
Bryne Drive/Ardagh Road and Essa Road	EBL	77 (56)	57	156 (89)	82	85
	WBL	16 (43)	112	22 (51)	101	**100**
	WBR	23 (43)	70	47 (59)	86	85
	NBL	39 (44)	23	145 (134)	197	45
	NBR	0 (11)	25	160 (134)	222	25
	SBL	20 (40)	68	46 (189)	186	50
	SBR	20 (145)	211	50 (130)	127	145
Bryne Drive and Caplan Avenue	EBL	9 (10)	11	29 (35)	55	55
	WBL	10 (20)	22	25 (36)	37	40
	NBL	22 (56)	53	25 (55)	53	55
	SBL	5 (8)	7	9 (15)	14	25
Bryne Drive and Harvie Road	EBL	30 (23)	24	36 (47)	33	45
	EBR	0 (0)	13	14 (10)	20	25
	WBL	38 (45)	78	53 (59)	112	**110**
	WBR	9 (18)	119	21 (59)	57	60
	NBL	8 (32)	23	9 (35)	54	50
	NBR	15 (68)	212	22 (72)	265	**265**
	SBL	18 (57)	140	23 (68)	199	**200**
	SBR	0 (15)	24	6 (25)	21	25

4.5 Future Daily Traffic and Truck Traffic Analysis

The expected Annual Average Daily Traffic (AADT) and Annual Average Daily Truck Traffic (AADTT) volumes along Bryne Drive under future traffic conditions were estimated using the 2021 and 2031 traffic forecasts based on the two data sources discussed earlier.

AADT

The PM peak hour volumes were generally found to be the higher of the peak hour volumes in the two midblock sections along Bryne Drive between Essa Road and Harvie Road, and between Harvie Road and Caplan Avenue. A factor was used to convert the PM peak hour volumes to daily volumes at the midblock sections along Bryne Drive in the Study Area. To develop this factor, 24-hour Automatic Traffic Recording (ATR) data for the section of Bryne Drive between Caplan Avenue and Mapleview Drive, as provided by the City of Barrie, were used. This section of Bryne Drive is located immediately south of the Study Area, and is assumed to be representative of the trends in daily traffic volumes along the Study Area. Data was collected on Bryne Drive between Caplan Avenue and Mapleview Drive on Tuesday, August 24, 2010. The ATR data showed that 9% of total daily traffic occurred in the PM peak hour. As such, a factor of 0.09 was used to calculate the AADT for the two sections of Bryne Drive within the Study Area. The ATR data also showed a 54%-46% split in total daily traffic between the northbound and southbound directions. This directional split was used to find the directional daily traffic volumes.

A similar approach was taken for the side streets along Bryne Drive in the Study Area:

- A factor of 0.08 and directional split of 45%-50% between northbound and southbound directions were used to calculate AADT on Essa Road based on ATR data on Essa Road between Loggers Road and Bryne Drive.
- A factor of 0.08 and directional split of 49%-51% between eastbound and westbound directions were used to calculate AADT on Harvie Road, based on ATR data on the parallel running Mapleview Drive between Veterans Drive and Bryne Drive.
- A factor of 0.08 and were used to calculate AADT on Caplan Avenue based on ATR data between Bryne Drive and Barrie View Drive. Since directional hourly traffic data was unavailable a 50%-50% split was assumed between east and westbound directions.

AADTT

To estimate AADTT along Bryne Drive, the percentage of heavy vehicles in the main street through movements at the existing intersections of Bryne Drive with Essa Road and with Caplan Avenue were reviewed from existing traffic volumes. In both peak hours and both directions of travel, the percentage of heavy vehicles in the through movements along Bryne Drive ranged from 0% to 6%. It was assumed that 4% of the daily traffic volume will be comprised of truck traffic, based on the presence of major commercial land uses along the existing sections of Bryne Drive and the potential for similar future land development along this corridor when the Harvie Road-Big Bay Point Road crossing and Bryne Drive extension are completed. The assumed truck percentage was applied to the AADT volumes along Bryne Drive to estimate the number of trucks on each roadway section.

For the side streets, the approach taken to determine AADTT volumes was consistent with that for Bryne Drive. It was assumed that 2% of daily traffic along Essa Road and Harvie Road, and 4% of daily traffic along Caplan Avenue is composed of truck traffic in the Study Area.

Figures 4-6 to **4-9** illustrate the 2021 and 2031 two-way and directional AADT and AADTT volumes along Essa Road based on the traffic forecasts in the study by Morrison Hershfield.

Figures 4-10 to **4-13** illustrate the 2021 and 2031 two-way and directional AADT and AADTT volumes along Essa Road based on the traffic forecasts in Ainley's Bryne Drive EA.

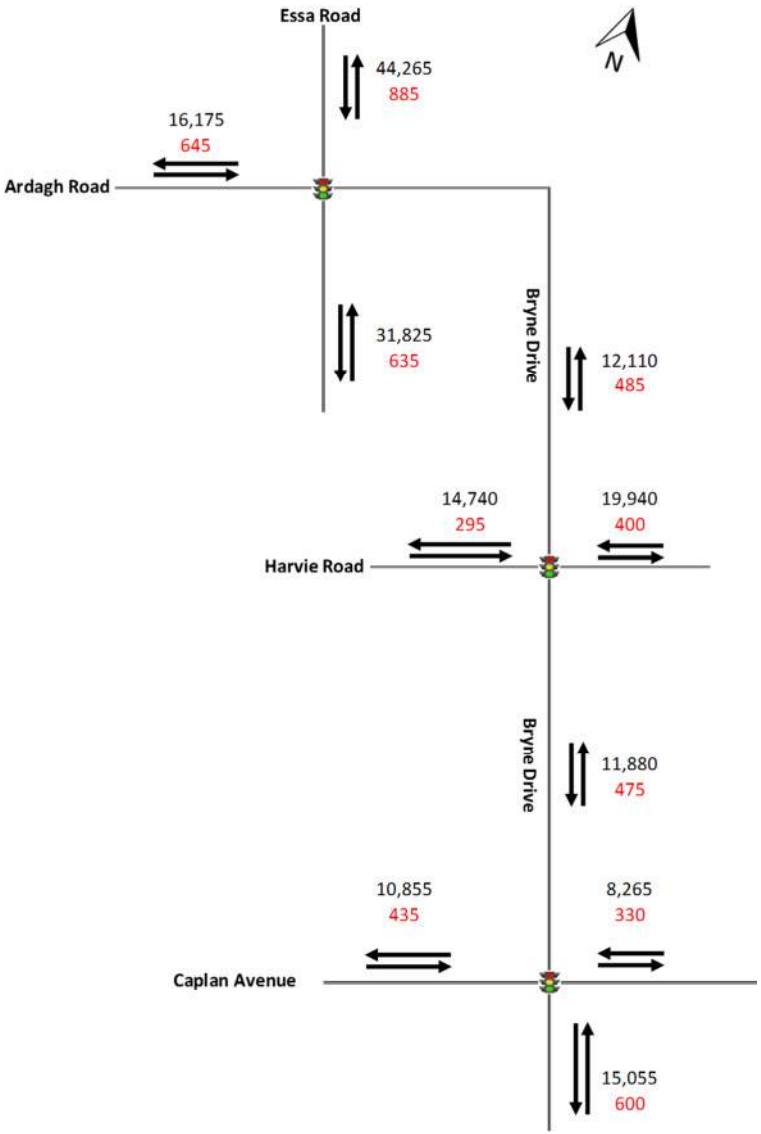


Figure 4-6 2021 Two-way AADT and AADTT (Morrison Hershfield)

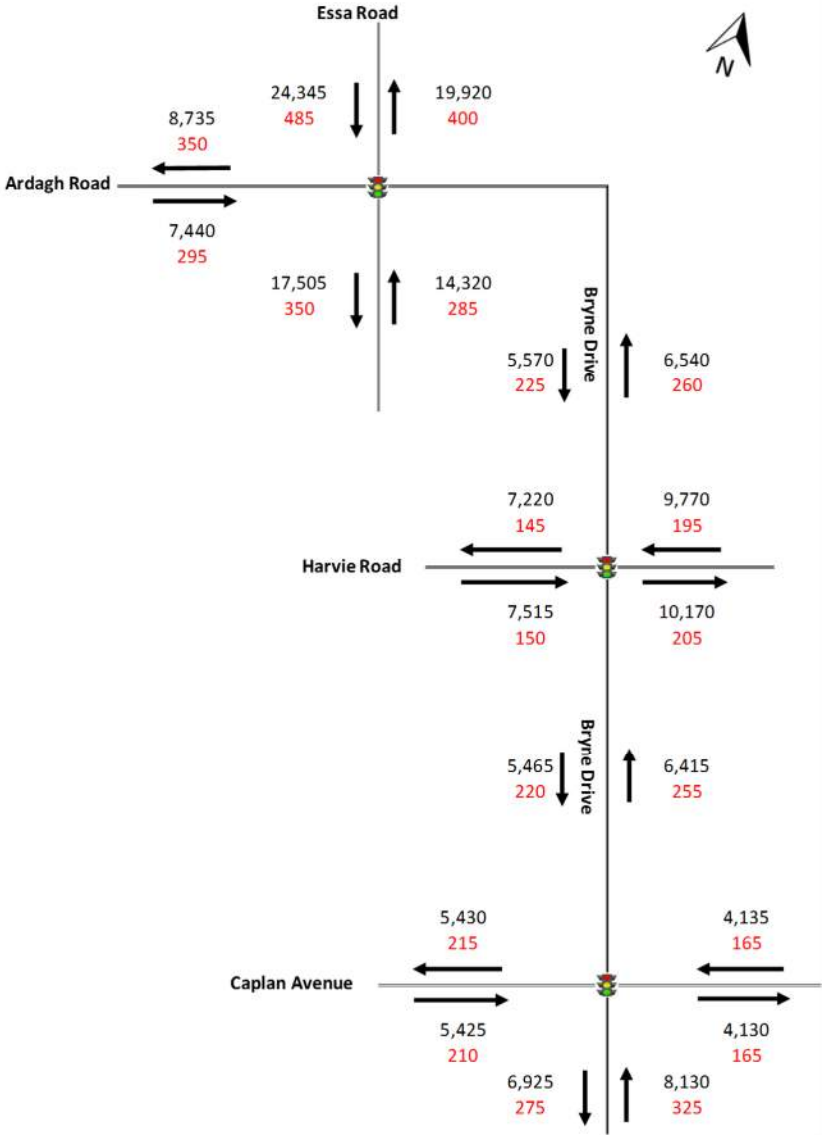


Figure 4-7 2021 AADT and AADTT By Direction (Morrison Hershfield)

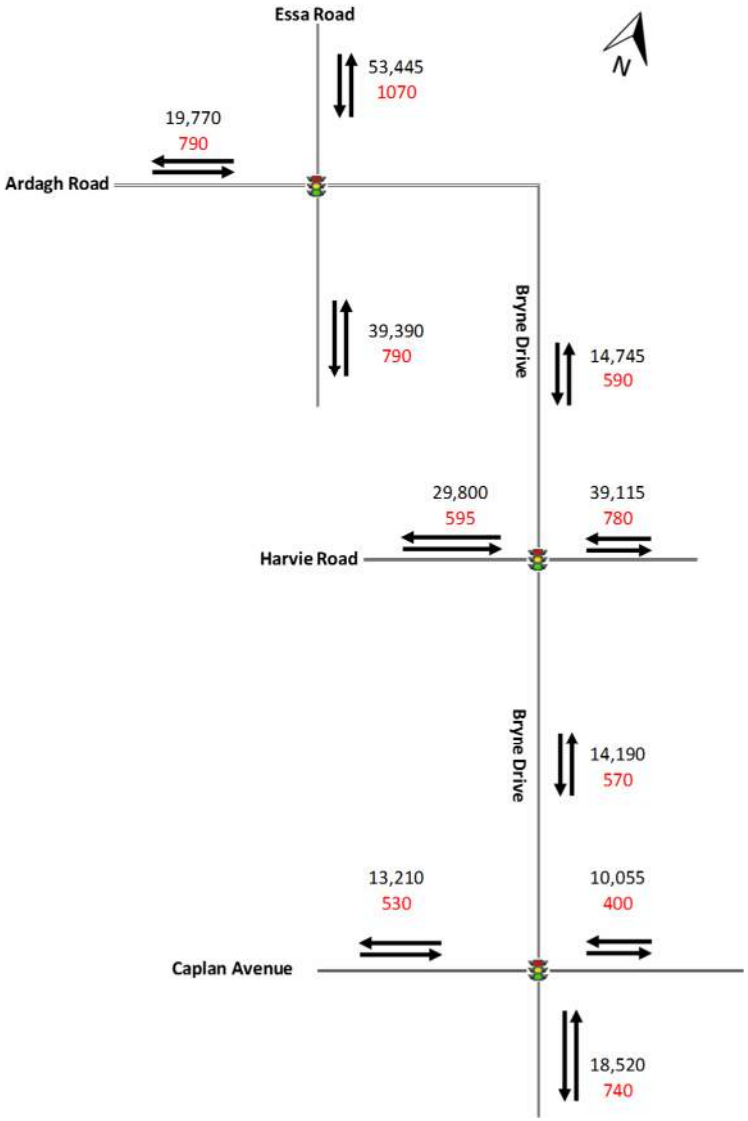


Figure 4-8 2031 Two-way AADT and AADTT (Morrison Hershfield)

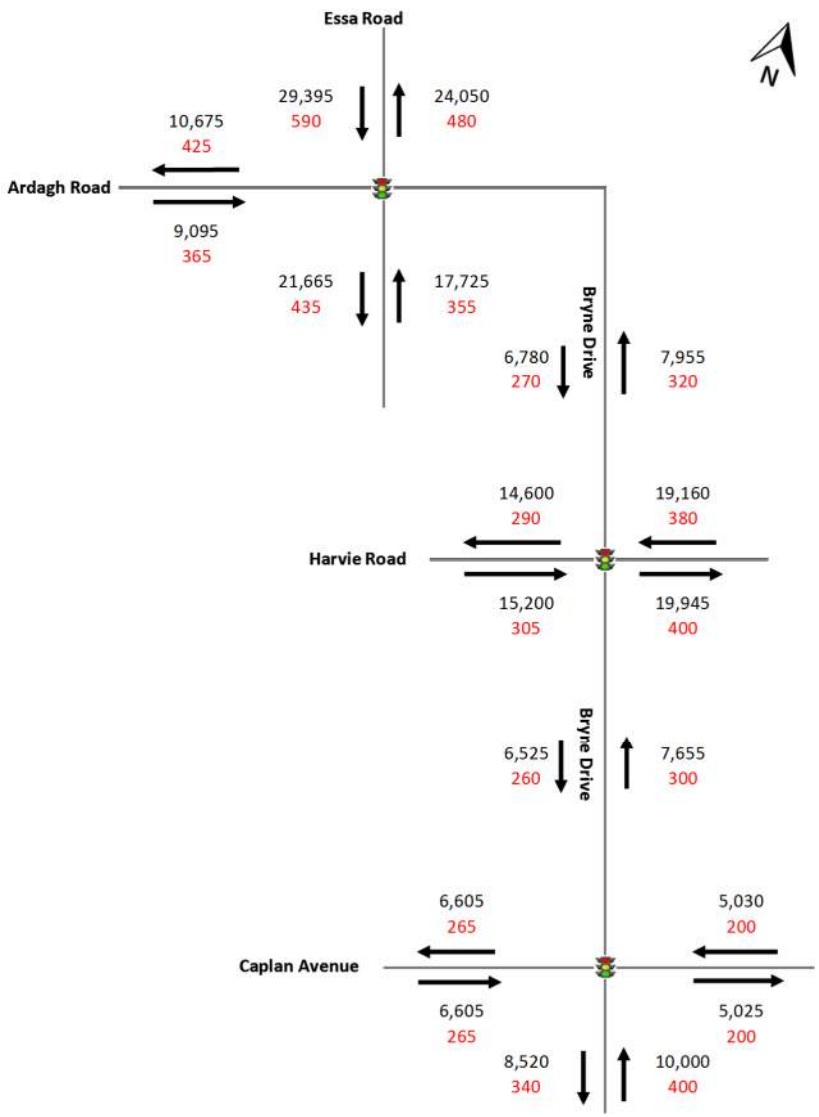


Figure 4-9 2031 AADT and AADTT By Direction (Morrison Hershfield)

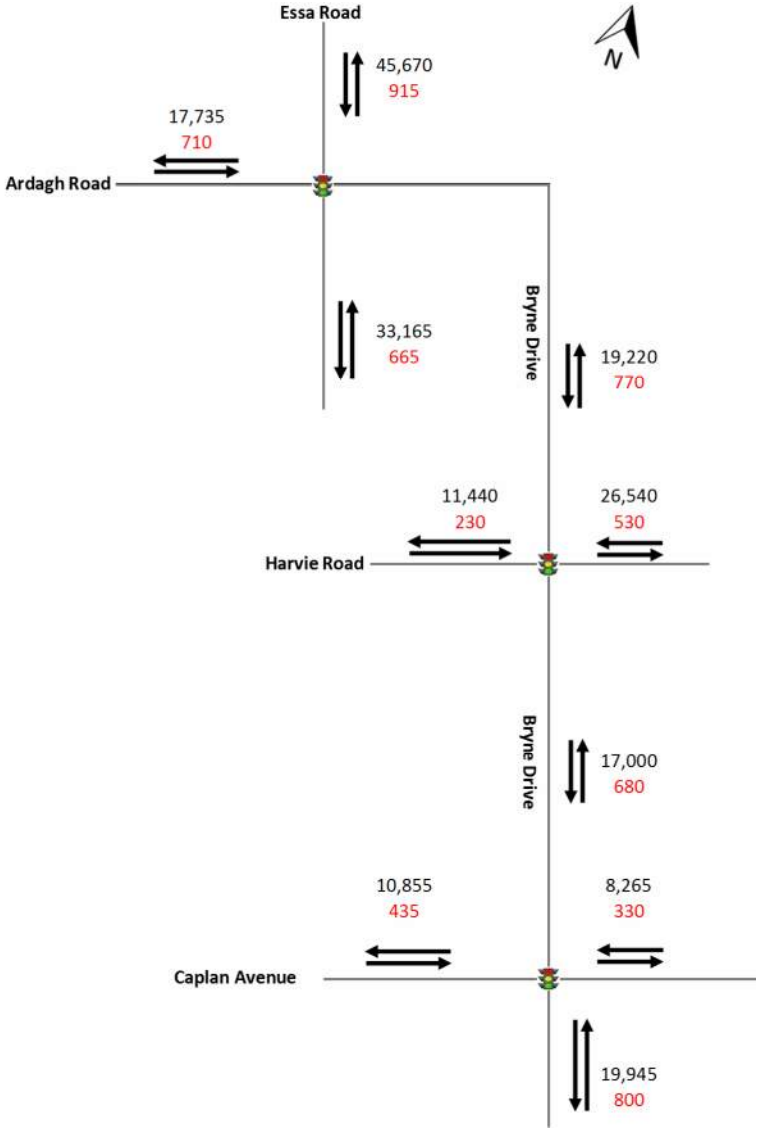


Figure 4-10 2021 Two-way AADT and AADTT (Ainley)

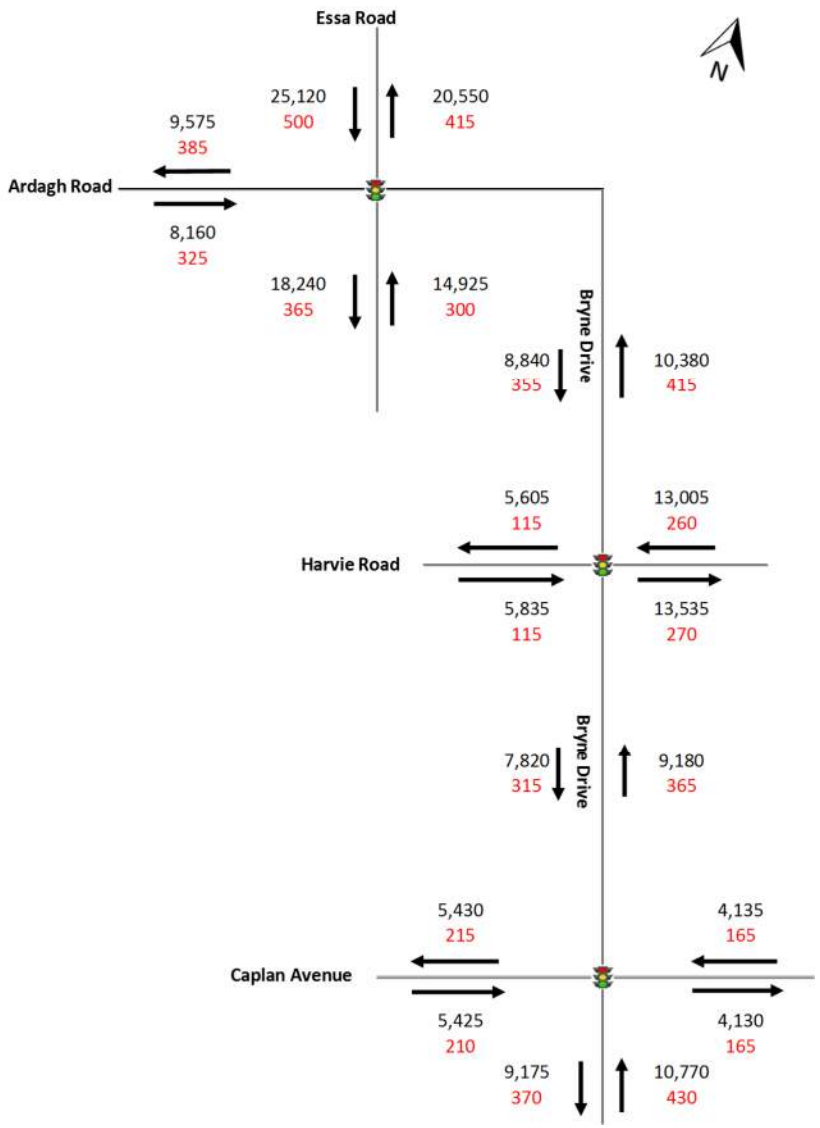


Figure 4-11 2021 AADT and AADTT By Direction (Ainley)

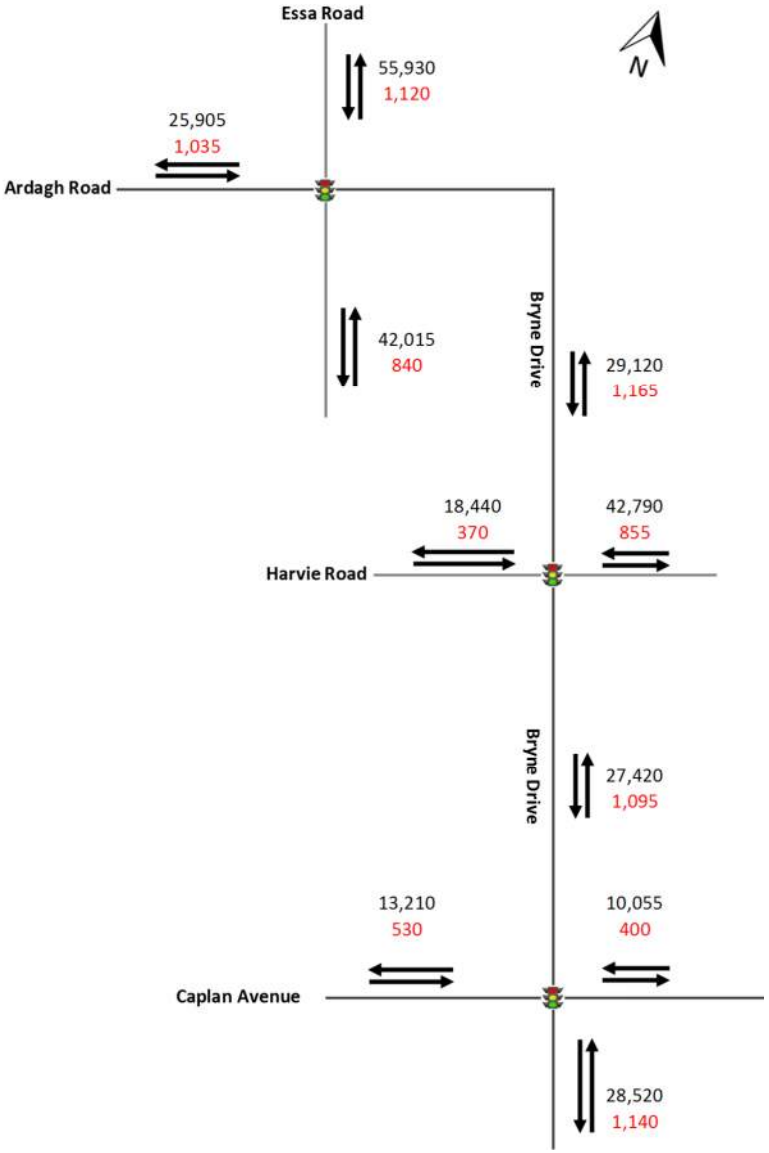


Figure 4-12 2031 Two-way AADT and AADTT (Ainley)

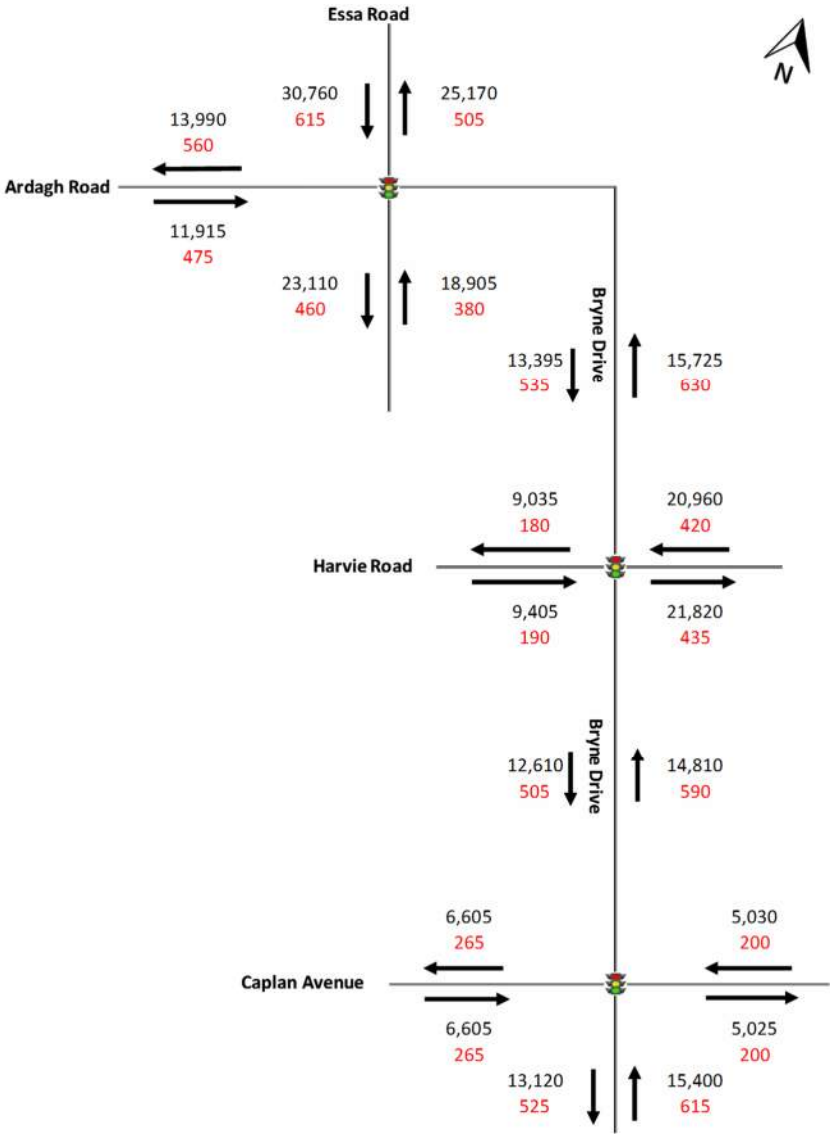


Figure 4-13 2031 AADT and AADTT By Direction (Ainley)

4.6 Future Year Collision Analysis

Collision prediction for the future 5-lane widening and extension of Bryne Drive, between Essa Road and Caplan Avenue, was completed using the Predictive Methodology for Urban and Suburban Arterials in the 2010 *Highway Safety Manual*. The predictive models in the HSM were used to estimate the average frequency of collisions by crash severity (Fatal and Injury, and PDO).

With the proposed Harvie Road crossing over Highway 400 to complete the connection between Harvie Road and Big Bay Point Road in 2021, there will be two road segments along Bryne Drive and a new intersection at Harvie Road. The predicted number of collisions along the road segments and at intersections in the Study Area and was calculated using the AADT forecasts, proposed lane configurations and traffic control parameters in the 2021 and 2031 horizon years. The AADT forecasts based on Morrison Hershfield's study were considered rather than the AADT based on Ainley's Bryne Drive EA, since the critical design hour was considered to be a "worst case" scenario. It was also assumed that the land adjacent to Bryne Drive will become developed in the future horizon years, resulting in commercial driveways fronting the roadway.

Table 4-12 provides a summary of the number of collisions that are predicted to occur along Bryne Drive in 2021 and 2031, following the proposed extension and widening to a 5-lane road between Essa Road and Caplan Avenue.

Table 4-12 HSM Predicted Collisions for Study Area Road Segments and Intersections

Location	Horizon Year	Fatal and Injury (collisions/yr)	Property Damage Only (collisions/yr)	Total (collisions/yr)
Road Segments				
Essa Road to Harvie Road	2021	1.4	3.4	**4.8**
	2031	1.8	4.2	**6.0**
Harvie Road to Caplan Avenue	2021	1.4	3.3	**4.7**
	2031	1.6	4.0	**5.6**
Intersections				
Bryne Drive and Essa Road	2021	2.1	3.7	**5.8**
	2031	2.8	4.8	**7.6**
Bryne Drive and Harvie Road	2021	1.0	2.1	**3.1**
	2031	2.3	4.3	**6.6**
Bryne Drive and Caplan Avenue	2021	1.0	1.8	**2.8**
	2031	1.3	2.3	**3.6**

As shown in **Table 4-12**, the predicted total collisions at locations within the Study Area increase between 2021 and 2031 due to the higher traffic volumes. PDO collisions are expected to occur more often than fatal or injury collisions. More collisions are expected to occur at the intersection of Bryne Drive and Essa Road than at the other two intersections; while both road segments are found likely to experience similar collision rates. In observing

these general trends in the above collision prediction values, a number of key issues should be noted:

- The HSM 2010 prediction methodology is based on regression models developed from observed collisions data collected from numerous studies at comparable sites with similar road typology and cross-sectional elements. The actual traffic conditions at these locations in 2021 and 2031 may be different in the future horizon years than has been assumed in the model.
- The purpose of the predicted collision rates is not to identify the exact number of collisions that will occur in the horizon years in the Study Area. Rather, the purpose is to estimate an approximate number of collisions of each severity that may occur based on projected traffic volumes, and expected road geometry and site conditions.
- A direct comparison is not drawn between the observed collision rates under existing conditions and predicted collision rates under future conditions due to the expected change in traffic patterns in the Study Area as a result of widening and extension of Bryne Drive. This precludes making any comparisons that could reflect the cumulative effects of potential uncertainty in future traffic, road and site conditions.

5. Roundabout Feasibility Assessment

Roundabouts were considered as an alternative to the existing traffic signal controls at the following intersections:

1. Bryne Drive / Ardagh Road and Essa Road
2. Bryne Drive and Harvie Road

In determining where roundabouts should be implemented, consideration was given to the potential for operational improvements, low volumes of pedestrians and cyclists, proximity of structures and traffic control, and adjacent land uses. Based on those criteria, a roundabout was not considered at the intersection of Bryne Drive and Caplan Avenue. This intersection operates at acceptable overall levels under existing conditions, and is also expected to operate with low to moderate delays and queues in the 2021 and 2031 horizon years after Bryne Drive is widened to 5 lanes and extended, under both sets of traffic forecasts used in this report. In addition, there are commercial establishments located within each quadrant of the existing intersection that would present property constraints for a potential roundabout.

Geometric constraints were also considered in selecting candidate locations for roundabouts, to ensure that there are no steep grades, drainage issues and sight distance restrictions that could impede the installation of a roundabout. In order to determine the feasibility of the construction of roundabouts, an assessment was completed for the two locations listed above. Details of each location and the evaluation of potential roundabouts are presented in the following sections.

5.1 Bryne Drive / Ardagh Road and Essa Road

The intersection of Bryne Drive and Essa Road is currently under signal control and located approximately 260m south of the signalized intersection of Ramp N-E/W with Essa Road at the Essa Road Interchange with Highway 400. The *Highway 400 Improvements – Class Environmental Assessment and Preliminary Design Study*, which is currently underway, is also considering a roundabout at the Ramp N-E/W terminal at Essa Road to improve operational safety of the Essa Road Interchange. As such the intersection of Bryne Drive and Essa Road may be considered for conversion to a two-lane roundabout, especially to assess any benefits afforded for the closely spaced intersections in maintaining short queue lengths and meeting driver expectations.

5.1.1 Operations

Capacity and LOS analysis was completed for the traffic demand projected to the 2021 and 2031 horizon years based on the Morrison Hershfield study. The analysis was completed using Sidra Intersection 5.1 traffic analysis software. The Roundabout Capacity Model implemented within the Sidra software is based on the US HCM 2010 model. Results of the overall operations are presented in **Table 5-1** and **Table 5-2**. Complete results are included in **Appendix G**.

Table 5-1 2021 Bryne Drive and Essa Road Roundabout Operations

Analysis Period	AM Peak	PM Peak
Intersection LOS	D	F
Control Delay (Average) (s)	33	132
Control Delay (Worst Lane) (s)	56	238
95th Queue (Worst Lane) (m)	95	978

Table 5-2 2031 Bryne Drive and Essa Road Roundabout Operations

Analysis Period	AM Peak	PM Peak
Intersection LOS	F	F
Control Delay (Average) (s)	88.1	221
Control Delay (Worst Lane) (s)	154.5	369
95th Queue (Worst Lane) (m)	439	1558

The analysis shows that the intersection in 2021 is expected to operate at LOS D during the AM peak hour and LOS F during the PM peak hour. In 2031 the intersection is expected to operate at LOS F during both AM and PM peak hours. Delays and queues at the roundabout in both horizon years are expected to be extensive. The queues on the southbound approach of the intersection are expected to be 978m in the 2021 PM peak hour and 1,558m in the 2031 PM peak hour, which will spill back to the Highway 400 N-S Off-ramp terminal at Essa Road located 260m upstream of this intersection.

The analysis was not repeated for traffic volumes projected for the critical design hours in 2021 and 2031, which represent “worst case” scenarios. The traffic operations under these forecasts will likely be worse than presented in **Tables 5-1** and **5-2**, indicating a two-lane roundabout to will be operationally infeasible in the critical design hour.

5.1.2 Safety

5.1.2.1 *Collision Summary for Signalized Intersection*

Based on a review of historical collision data provided by the City, there were 6 collisions reported at the signalized intersection of Bryne Drive / Ardagh Road and Essa Road between 2012 and 2016. This is equivalent to an average of 1.2 collisions per year.

All collisions were reported to be of "Unknown" severity and were assumed to be property damage only (PDO) type collisions. The impact types involved include:

- 2 rear end collisions (33%)
- 1 sideswipe collisions (17%)
- 3 other types of collisions (50%)
- No pedestrian or cyclist-involved collisions were identified

Most collisions occurred under clear conditions and daylight hours, during the midday or afternoon peak periods.

5.1.2.2 *Potential Benefits*

A study published in the American Journal of Public Health estimated the following reductions in motor vehicle crashes after the conversion of 24 intersections in the United States from stop or signal control to roundabouts:

- 38% reduction for all crashes
- 76% reduction for injury crashes
- 89% reduction in fatal and incapacitating injury crashes

To quantify the potential monetary benefit of reducing collisions at the intersection by installing a roundabout, societal collision values published by Transport Canada in 2007 were used.

- Injury collision - $82,000
- PDO collision - $8,000

The values above are adjusted based on Consumer Price Index of 2% per annum as follows:

- Injury collision - $99,960
- PDO collision – $9,750

Assuming a 35% reduction for all collision types, a proportional expectation of collision reduction is as follows:

- Overall collision reduction: (1.2 collision/year) x (35%) = 0.45 collision/year
    - PDO collision = 0.45 collision/year x (6/6) = 0.45 x ($9,750) = $4,390

The installation of a roundabout may provide an annual societal value of approx. $4,390 per year.

5.1.3 *Evaluation*

Table 5-3 provides a comparison between implementing roundabouts versus maintaining the signalized intersection configuration at the intersection of Bryne Drive and Essa Road.

Table 5-3 Bryne Drive and Essa Road Intersection Assessment

CRITERIA	ROUNDABOUT	SIGNALIZED
Configuration	- Two-lane roundabout - U turns	- Maintain traffic signal control - Maintains dual southbound left-turn lanes
	✓	✓
Traffic Safety	- Reduce overall frequency and severity of collisions	- More conflicting movements versus a roundabout
	✓	✗
Traffic Operation	- 2021 Overall LOS F - 2031 Overall LOS F	- 2021 Overall LOS C - 2031 Overall LOS C
	✗	✓
Environmental & Social Impacts	- Potential reduction in fuel consumption, noise and air quality impacts - Increased opportunities for aesthetic enhancements	
	✓	✗
Pedestrian Safety & Access	- Potential to reduce severity of collision impacts due to low entry speeds - Difficulties for visually impaired pedestrians	- Maintain four crosswalks
	✗	✓
Driveway Access	- Impact driveway access for 2 properties along Essa Road, adjacent to Ardagh Road and Bryne Drive - Impact to Morrow Road access	- No impacts to existing property access
	✗	✓
Property Requirement	- Will require additional properties beyond existing ROW - Significant impacts to commercial properties in southern and eastern quadrants of the intersection (TD Bank parking lot, Esso gas station, Zehr's market parking lot, BMW car dealership parking lot)	- No additional property required
	✗	✓

CRITERIA	ROUNDABOUT	SIGNALIZED
Constructability	- Full road reconstruction required - Extensive staging, may require detours and full closure of intersection	- No impacts to maintain existing configuration
	✗	✓
Construction Costs	- Approximately $2 M, includes roadway construction, illumination, landscaping and utility relocation (excludes property costs) - Costs to be refined	- Approximately $0.9M for all suggested improvements which may include addition of an eastbound left turn lane - Costs to be refined
	✗	✓
Maintenance Costs	- No costs for signal operating and maintenance	- Ongoing signal operating and maintenance costs
	✓	✗
Overall Assessment	**Less Preferred**	**More Preferred**

Based on a balanced evaluation of the criteria listed above, provision of a roundabout at the intersection of Bryne Drive and Essa Road is **not preferable** to traffic signal control at this intersection. A roundabout will not provide any operational improvements to the intersection, and will likely have major impacts on existing adjacent commercial properties as well as high construction costs.

5.2 Bryne Drive and Harvie Road

A new intersection of Bryne Drive and Harvie Road is expected to be built in 2021 as a result of the proposed 5-lane extension of Bryne Drive and the completion of a crossing over Highway 400 to connect Harvie Road and Big Bay Point Road. The Harvie/ Big Bay Point crossing project considered roundabouts as an alternative to conventional traffic signals at this new intersection. Modern roundabouts can offer benefits over conventional traffic signals when placed in the appropriate location with suitable traffic demand, such as improved vehicular safety and traffic flow.

5.2.1 Operations

In order to identify if the new intersection of Bryne Drive and Harvie Road will be a suitable location for installing a two-lane roundabout, a feasibility assessment was done for traffic volumes projected to 2021, and to 2031 based on the traffic study by Morrison Hershfield. The 2031 horizon year was investigated under two conditions – with and without the implementation of a partial interchange between Highway 400 and Harvie Road. For the purposes of the current study, it was assumed that an interchange will be built in 2031.

The operational analysis of a roundabout at this location was completed assuming two-lane entries, exits and circulation lanes, and a 50m inscribed circle diameter. In this configuration, left turns are being made by entering the roundabout from the inside lane, while right turns are made only from the outside lane. Through movements can be made from either entry

lane and completed using any circulatory travel lane. The capacity and LOS analysis for the two-lane roundabouts at the study intersections was done using Sidra Intersection 5.1 traffic analysis software. The Roundabout Capacity Model implemented within the Sidra software is based on the US HCM 2010 model.

Results of the overall operations of the two-lane roundabout at the intersection Bryne Drive and Harvie Road in the 2021 and 2031 horizon years are presented in **Table 5-4**. Complete results are included in **Appendix G**.

Table 5-4 Bryne Drive and Harvie Road Roundabout Operations

Horizon Year	2021	2031
Analysis Period	PM Peak	PM Peak
Intersection LOS	C	F
Control Delay (Average) (s)	18	111
Control Delay (Worst Lane) (s)	22	188
95th Queue (Worst Lane) (m)	30	657

The analysis shows that the intersection is expected to perform at an overall LOS C in 2021, with short delays and queues. However, in 2031, the intersection is expected to operate at unacceptable LOS F during the PM peak hour. There will be high delays and long queues at the roundabout when the interchange is in place, especially since the heavy through movements on the crossing and at the east-west approaches of the roundabout will contribute to the poor levels of service for the north-south approaches. Similar to the analysis for Bryne Drive and Essa Road, further analysis was not completed using the traffic forecasts based on Ainley's Bryne Drive EA.

5.2.2 Evaluation

Table 5-5 shows the evaluation of installing a roundabout at the new intersection of Bryne Drive and Harvie Road, compared to a conventional signalized intersection.

Table 5-5 Bryne Drive and Harvie Road Intersection Assessment

CRITERIA	ROUNDABOUT	SIGNALIZED
Configuration	- Two-lane roundabout with yield-control entry - U turns	- Approaches with dedicated turn lanes and traffic control to protect movements
	✓	✓
Traffic Safety	- Lower overall frequency and severity of collisions	- More conflicting movements versus a roundabout
	✓	✘
Traffic Operation	- 2021 Overall LOS C - 2031 Overall LOS F	- 2021 Overall LOS C - 2031 Overall LOS C
	✘	✓
Environmental & Social Impacts	- Less overall fuel consumption, noise and air quality impacts after implementation; impacts may be more	

CRITERIA	ROUNDABOUT	SIGNALIZED
	pronounced during peak hours when there is higher congestion - More opportunities for aesthetic enhancements	
	✓	✗
Pedestrian Safety & Access	- Potential to reduce severity of collision impacts due to low entry speeds - Difficulties for visually impaired pedestrians	- Provides four crosswalks with crossing time allocated to pedestrians
	✗	✓
Driveway Access	- No existing driveway accesses present in the vicinity of the intersection	- No existing driveway accesses present in the vicinity of the intersection
	✓	✓
Property Requirement	- Likely to have a bigger footprint	- Likely to have a smaller footprint
	✗	✓
Constructability	New construction	New construction
	✓	✓
Construction Costs	- Cost of new construction is comparable	- Cost of new construction is comparable
	✓	✓
Maintenance Costs	- No costs for signal operating and maintenance	- Ongoing signal operating and maintenance costs
	✓	✗
Overall Assessment	**Less Preferred**	**More Preferred**

Based on a balanced evaluation of the criteria listed above, installation of a roundabout at the intersection of Bryne Drive and Harvie Road is **less preferable** to a conventional signalized intersection. A roundabout will not be operationally feasible in 2031 due to the high traffic volume expected on Harvie Road when the proposed partial interchange at Highway 400 is in place.

6. Summary of Findings

The report investigated the traffic operations along Bryne Drive, between Essa Road and Caplan Avenue, under the existing conditions in 2017 and the projected conditions in the 2021 and 2031 future horizon years. Below is a summary of the findings:

6.1 2017 Existing Conditions

Intersection Operations

- Under existing conditions, all intersections along Bryne Drive in the Study Area operate at acceptable LOS on an overall basis.
- The intersection of Bryne Drive and Essa Road is approaching capacity in the AM peak hour.
- A few turning movements at the Study Area intersections are close to effective capacity. In particular, eastbound left turn movement at the intersection of Bryne Drive/Ardagh Road and Essa Road is found to be nearing capacity. This is due to the high volume of traffic turning left from a single lane on Ardagh Road in the AM peak hour, most likely to access the interchange at Highway 400 and Essa Road just north of the Study Area.

6.2 2021 Future Conditions

Midblock Capacity

- Based on the forecasted traffic volumes it is expected that the new extension of Bryne Drive from south of Essa Road to north of Caplan Avenue will exceed effective capacity in the PM peak hour if a 3-lane cross section is built.
- With a **5-lane wide extension**, the midblock section will operate within effective capacity, but will approach effective capacity in the critical design hour (v/c ratio 0.9).

Intersection Operations

- When the extension of Bryne Drive is built, there will be a new intersection within the Study Area at Bryne Drive and Harvie Road.
- All intersections in the Study Area are expected to operate at acceptable overall LOS, although the intersection of Bryne Drive and Essa Road will continue to operate close to capacity, similar to the existing conditions in 2017.
- Similar to the existing conditions, the eastbound left turn movement at the intersection of Bryne Drive and Essa Road will operate close to effective capacity in the AM peak hour with even higher traffic volumes expected in 2021 under the forecasts based on Morrison Hershfield's study. No movements are expected to operate below acceptable levels under the critical design hour as represented by the Weekday PM traffic forecasts in Ainley's Bryne Drive EA.
- The installation of a roundabout at Bryne Drive / Ardagh Road and Essa Road has been taken into consideration for 2021. Due to expected poor roundabout operations (LOS F) and other considerations such as distance to upstream ramp terminal, driveway access,

property requirements and constructability, maintaining traffic signal control at the intersection is more preferred.

- The installation of a roundabout at Bryne Drive and Harvie Road was found to be operationally feasible in 2021 (LOS C).

6.3 2031 Future Conditions

Midblock Capacity

- Based on the forecasted traffic volumes, it is expected that the midblock section of Bryne Drive from Harvie Road to Caplan Avenue will be approaching effective capacity in the AM peak hour when the extension has a 3-lane cross section. In the PM, both midblock sections of Bryne Drive in the Study Area will exceed effective capacity. The traffic volumes in the critical design hour are expected exceed the effective capacity of a 3-lane cross section by over two folds in both sections of Bryne Drive in the Study Area.

- With a **5-lane wide extension**, the midblock section of Bryne Drive will operate within effective capacity, although the section between Harvie Road and Caplan Avenue will operate at v/c ratio of 0.92, which is above the City's threshold of 0.85. In addition, during the critical design hour both sections of Bryne Drive will operate at effective capacity. However, no further expansion of Bryne Drive has been identified in the MMATMP beyond 2031.

Intersection Operations

- All intersections in the Study Area are expected to operate at acceptable overall LOS D or better under the traffic forecasts based on Morrison Hershfield's study, although the intersection of Bryne Drive and Essa Road will continue to operate close to capacity.

- The eastbound left turn movement at the intersection of Bryne Drive and Essa Road, and the eastbound through-right movement at the intersection of Bryne Drive and Caplan Avenue are expected to deteriorate to LOS E with the projected traffic in 2031 based on the Morrison Hershfield study. The following suggested improvements result in all individual turning movements at the signalized intersections of Bryne Drive in the Study Area to operate at acceptable levels in 2031:
    - Addition of a second eastbound left turn lane at the intersection of Bryne Drive and Essa Road
    - Increase in signal cycle length to 100 seconds at the intersection of Bryne Drive and Caplan Avenue
    - Optimization of signal timing splits at both intersections of Bryne Drive with Essa Road and with Caplan Avenue.

- In the critical design hour, the projected traffic volumes based on Ainley's Bryne Drive EA are high and result in the intersections along Bryne Drive in operating close to or at effective capacity, with several movements still experiencing high delays even with the following improvements:
    - Addition of a second southbound left turn lane and a second westbound left turn lane at the intersection of Bryne Drive and Harvie Road

  - Increase in signal cycle length to 115 seconds at the intersection of Bryne Drive and Essa Road; to 100 seconds at the intersection of Bryne Drive and Caplan Avenue; and to 140 seconds at the intersection of Bryne Drive and Harvie Road
  - Optimization of signal timing splits at all intersections

- Based on SimTraffic analysis, recommended storage lengths for the left and right auxiliary lanes at the intersections are identified to accommodate the projected 2031 traffic (refer to **Table 4-8**).

- The installation of a roundabout at Bryne Drive / Ardagh Road and Essa Road has been taken into consideration for 2031. As in 2021, due to expected poor roundabout operations (LOS F) and other considerations such as distance to upstream ramp terminal, driveway access, property requirements and constructability, maintaining traffic signal control at the intersection is more preferred.

- The installation of a roundabout at Bryne Drive and Harvie Road is not preferable in 2031 due to expected poor levels of operations (LOS F).

7. Conclusions

The traffic analysis in this report indicates that the extension of Bryne Drive between the current termini south of Essa Road and north of Caplan Avenue requires at least a 5-lane cross section to support projected traffic volumes in both 2021 and 2031. In the critical design hour, the projected volumes in 2031 will be higher than the effective capacity of a 5-lane Major Collector road, but this represents the “worst case” scenario. The traffic volumes in 2021 consider the impacts of the Harvie Road crossing over Highway 400 connecting to Big Bay Point Road. The traffic volumes in 2031 consider the impacts of the potential partial interchange at Harvie Road / Big Bay Point Road with Highway 400.

In 2021, the Bryne Drive extension is recommended to be constructed with two through lanes in each direction and a center two-way left turn lane (TWLTL). A new intersection at Harvie Road and Bryne Drive will be built in 2021 and it is recommended that the intersection be signalized. Although a new two-lane roundabout is feasible in 2021, it will not provide operational benefits in the long term when the construction of the interchange is expected to bring more traffic to the area. The new intersection is recommended to have two through lanes and one left and one right auxiliary turn lane at the north and south approaches. The east approach will include one through lane with a dedicated left turn lane and a shared through right lane. The west approach will include one through lane and one left and one right auxiliary turn lane. No improvements are required at the existing intersections of Bryne Drive with Essa Road and Caplan Avenue in the in 2021 horizon year.

In 2031, the intersection at Harvie Road and Bryne drive will be widened to include two through lanes and one left and one right auxiliary turn lane at each approach. A number of intersection improvements at Bryne Drive and Essa Road, and at Bryne Drive and Caplan Avenue are recommended to accommodate the traffic volumes based on the study by Morrison Hershfield as well as the critical design hour represented by the weekday PM traffic forecasts in Ainley’s Bryne Drive EA. These include:

- Addition of a second southbound left turn lane and a second westbound left turn lane at the intersection of Bryne Drive and Harvie Road.
- Increase in signal cycle length to 115 seconds at the intersection of Bryne Drive and Essa Road, to 100 seconds at the intersection of Bryne Drive and Caplan Avenue, and to 140 seconds at the intersection of Bryne Drive and Harvie Road.
- Optimization of signal timing splits at all intersections.

The need and timing for the identified improvements should be monitored as traffic volumes increase. Improvements should be implemented on an as-needed basis, particularly when the partial interchange at Harvie Road / Big Bay Point Road is constructed, due to its impact on induced traffic demand in the Study Area.

Appendices

Appendix A Existing Turning Movement Counts

Appendix B Synchro Results – 2017 Analysis

Appendix C 2021 and 2031 Traffic Forecasts

Appendix D Synchro Results – 2021 Analysis

Appendix E Synchro Results – 2031 Analysis

Appendix F SimTraffic Results

Appendix G Roundabout Analysis

Appendix A
Existing Traffic Data

Trans-Plan Transportation Inc.

Site ID Code:
Intersection Location: Essa Road and Bryne Drive
Municipality: Barrie, Ontario
Count Date: Thursday September 15, 2016
Weather and Temperature: Sunny
Surveyor: TP

AM	NORTH APPROACH											EAST APPROACH											SOUTH APPROACH											WEST APPROACH											Grand Total
	CAR			TRUCKS			HEAVIES			Peds	Total	CAR			TRUCKS			HEAVIES			Peds	Total	CAR			TRUCKS			HEAVIES			Peds	Total	CAR			TRUCKS			HEAVIES			Peds	Total	
	L	T	R	L	T	R	L	T	R			L	T	R	L	T	R	L	T	R			L	T	R	L	T	R	L	T	R			L	T	R	L	T	R	L	T	R			
7:15	22	82	55	0	1	1	2	1	1	0	165	7	4	16	0	0	1	0	1	0	2	29	12	165	5	0	1	1	0	0	0	1	184	94	25	5	2	0	0	1	0	0	1	127	505
7:30	17	86	87	3	4	1	1	2	0	1	201	9	9	19	0	0	1	0	0	1	0	39	20	200	9	0	4	0	1	2	0	2	236	114	25	13	0	0	2	2	0	0	0	156	632
7:45	26	116	85	0	4	2	1	0	3	0	237	9	4	41	0	0	0	0	0	3	1	57	15	224	9	3	4	0	0	0	0	1	255	104	40	12	1	0	1	2	0	0	0	160	709
8:00	40	127	107	2	2	0	2	0	0	0	280	7	10	38	0	0	2	0	0	1	0	58	22	194	8	0	0	0	0	0	0	1	224	108	55	14	4	1	0	2	1	1	0	186	748
8:15	38	144	96	1	4	1	0	1	0	0	285	14	10	22	0	1	0	0	0	1	0	48	23	208	10	0	9	0	1	0	0	0	251	106	22	9	1	1	1	1	0	0	0	141	725
8:30	26	142	89	1	6	3	0	2	1	0	270	9	5	25	0	0	1	0	0	1	0	41	17	202	6	2	4	0	0	1	0	0	232	113	30	14	2	0	0	1	0	1	0	161	704
8:45	31	119	68	0	1	1	0	3	1	0	224	12	6	30	1	0	2	0	1	0	1	52	23	242	17	0	4	0	0	2	0	3	288	102	35	15	3	0	0	1	0	0	0	156	720
9:00	38	120	101	1	2	3	1	0	3	0	269	13	15	21	0	1	2	0	0	0	0	52	25	209	7	2	3	0	1	2	0	0	249	108	46	15	2	1	0	0	1	0	0	173	743
MD																																													
11:15	58	124	73	2	1	1	0	3	3	0	265	23	25	44	3	1	0	0	0	0	0	96	24	137	13	0	1	1	0	6	0	0	182	66	28	15	1	0	1	4	0	0	0	115	658
11:30	75	144	83	0	1	2	2	0	1	0	308	30	23	59	0	1	1	0	0	0	1	114	23	136	24	0	0	2	2	1	0	1	188	68	24	27	1	1	0	1	0	1	2	123	733
11:45	58	144	83	2	4	1	0	1	2	1	295	34	23	44	0	1	1	0	0	1	0	104	15	167	28	1	5	1	0	2	0	0	219	63	15	20	3	0	1	2	0	0	0	104	722
12:00	65	152	84	2	2	6	0	1	2	0	314	30	22	51	0	0	1	0	0	0	0	104	18	165	29	2	2	0	1	3	0	3	220	65	25	20	2	1	0	0	0	0	0	113	751
12:15	45	160	75	0	2	0	0	1	2	0	285	28	29	62	0	2	2	1	1	0	2	125	19	164	29	0	3	0	1	0	0	4	216	62	39	31	1	0	0	3	1	1	0	138	764
12:30	49	133	94	1	1	2	0	5	1	0	286	24	24	67	0	0	2	0	0	0	2	117	29	142	29	0	2	1	1	1	0	1	205	73	33	24	4	0	0	2	0	0	0	136	744
12:45	58	162	78	0	5	3	0	1	5	1	312	37	29	48	0	1	1	0	0	0	0	116	31	120	34	0	4	1	1	2	0	1	193	65	36	19	0	1	1	1	0	1	0	124	745
13:00	58	141	85	1	1	4	1	0	1	1	292	30	30	75	1	1	0	0	0	0	0	137	35	136	40	1	2	1	0	2	0	2	217	64	28	15	1	0	0	4	0	0	1	112	758
13:15	52	187	89	0	4	3	2	2	1	0	340	33	21	71	0	0	2	0	0	0	0	127	14	169	21	0	3	0	0	2	0	1	209	69	35	24	2	0	0	3	0	0	1	133	809
13:30	80	153	85	0	1	3	1	3	0	0	326	30	33	51	0	1	0	0	0	0	0	115	26	137	30	2	1	0	0	3	0	1	199	70	20	10	1	3	2	2	0	0	0	108	748
13:45	62	183	99	2	3	0	1	2	2	1	354	32	24	59	0	0	0	0	0	1	2	116	21	154	19	1	6	0	0	0	0	1	201	58	31	17	1	1	1	1	0	0	0	110	781
14:00	49	154	85	2	5	3	0	4	2	0	304	26	28	66	0	1	1	1	0	1	1	124	19	159	22	1	5	0	0	4	0	3	210	74	18	19	2	0	0	1	0	1	0	115	753
PM																																													
15:15	62	186	125	0	6	3	0	4	2	0	388	40	33	67	0	1	0	0	0	1	0	142	16	174	26	1	2	0	0	3	0	3	222	82	30	16	3	0	0	2	0	1	0	134	886
15:30	75	191	125	1	5	3	0	1	3	0	404	43	45	71	0	2	2	0	1	2	0	166	17	196	32	1	0	0	1	0	1	2	248	74	25	16	3	0	0	3	0	2	0	123	941
15:45	53	205	121	0	2	0	2	2	3	0	388	37	43	68	1	0	2	0	0	1	3	152	18	196	32	0	10	0	1	1	0	2	258	86	42	31	1	1	2	1	0	0	0	164	962
16:00	54	224	173	1	2	3	0	0	1	1	458	40	33	75	0	0	0	0	1	0	1	149	23	170	30	3	4	0	0	0	0	0	230	62	26	19	5	0	2	0	0	0	0	114	951
16:15	69	217	135	0	2	4	0	1	2	0	430	44	36	57	0	1	1	0	1	0	0	140	15	180	16	0	2	1	0	0	0	1	214	92	34	28	1	0	1	1	0	0	0	157	941
16:30	64	234	132	1	0	3	0	0	1	1	435	40	37	53	0	0	0	0	0	0	1	130	16	197	23	0	3	0	0	1	0	0	240	74	27	26	1	0	0	0	0	0	0	128	933
16:45	70	238	149	0	2	1	0	0	2	1	462	35	34	43	1	0	0	0	0	0	1	113	18	207	20	0	1	0	0	0	0	1	246	73	38	29	0	0	4	0	0	0	0	144	965
17:00	60	253	163	0	2	0	0	0	1	0	479	44	31	51	0	0	1	0	0	1	0	128	17	182	21	1	3	1	0	0	0	1	225	66	24	18	1	0	0	0	0	0	0	109	941
17:15	60	252	156	0	2	1	0	0	1	0	472	30	41	49	0	0	0	0	0	0	1	120	19	235	26	0	2	0	0	0	0	1	282	64	25	29	0	0	0	0	0	0	0	118	992
17:30	40	314	154	0	0	1	0	0	0	0	509	37	30	40	0	0	0	0	0	0	0	107	21	210	21	0	2	0	0	0	0	2	254	54	28	20	0	0	1	0	0	0	0	103	973
17:45	50	253	138	0	2	0	0	0	2	0	445	34	31	50	0	0	0	0	0	0	0	115	20	213	32	0	3	0	0	0	0	2	268	61	25	20	1	0	1	1	1	0	0	110	938
18:00	38	221	134	0	2	1	0	0	0	0	396	30	34	40	0	0	0	0	0	0	0	104	25	203	26	0	0	1	1	1	0	1	257	57	26	22	0	0	0	0	0	0	0	105	862

Turning Movement Count Diagram

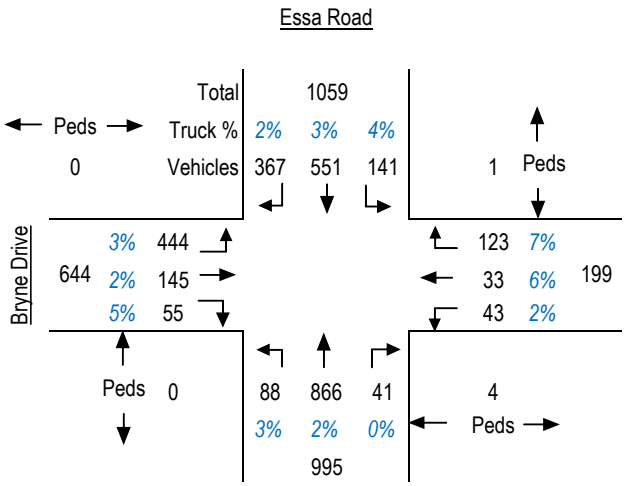
Intersection: Essa Road and Bryne Drive

Intersection ID:

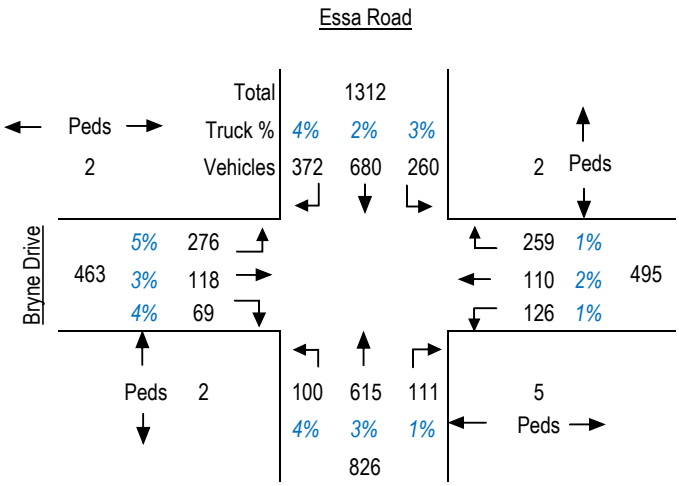
Municipality: Barrie, Ontario

Date: Thursday September 15, 2016

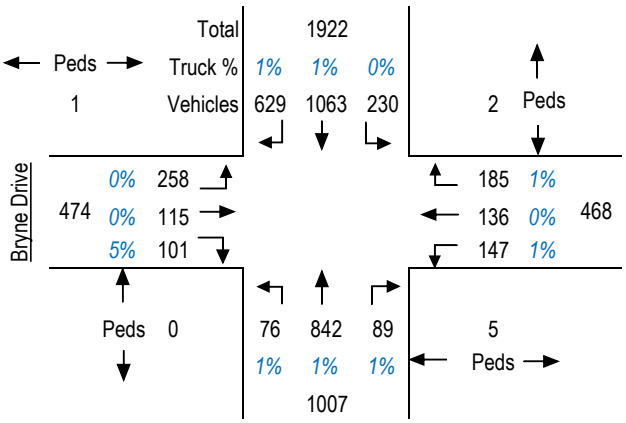
AM Peak Hour: 7:45 to 8:45



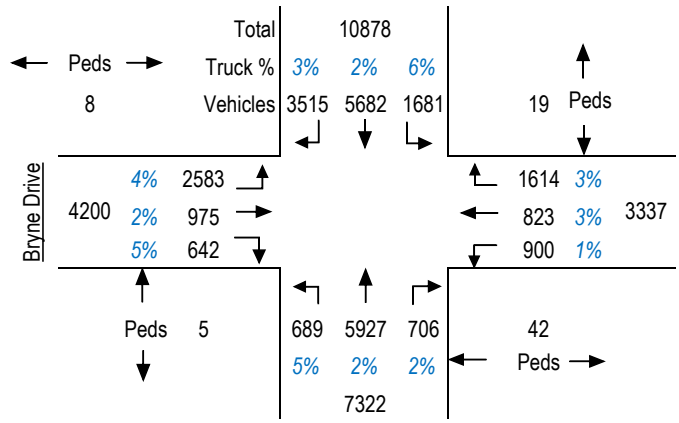
MD Peak Hour: 12:45 to 13:45



PM Peak Hour: 16:30 to 17:30



Total 8-Hour Count



Ontario Traffic Inc.

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 9:00:00

One Hour Peak
From: 8:00:00
To: 9:00:00

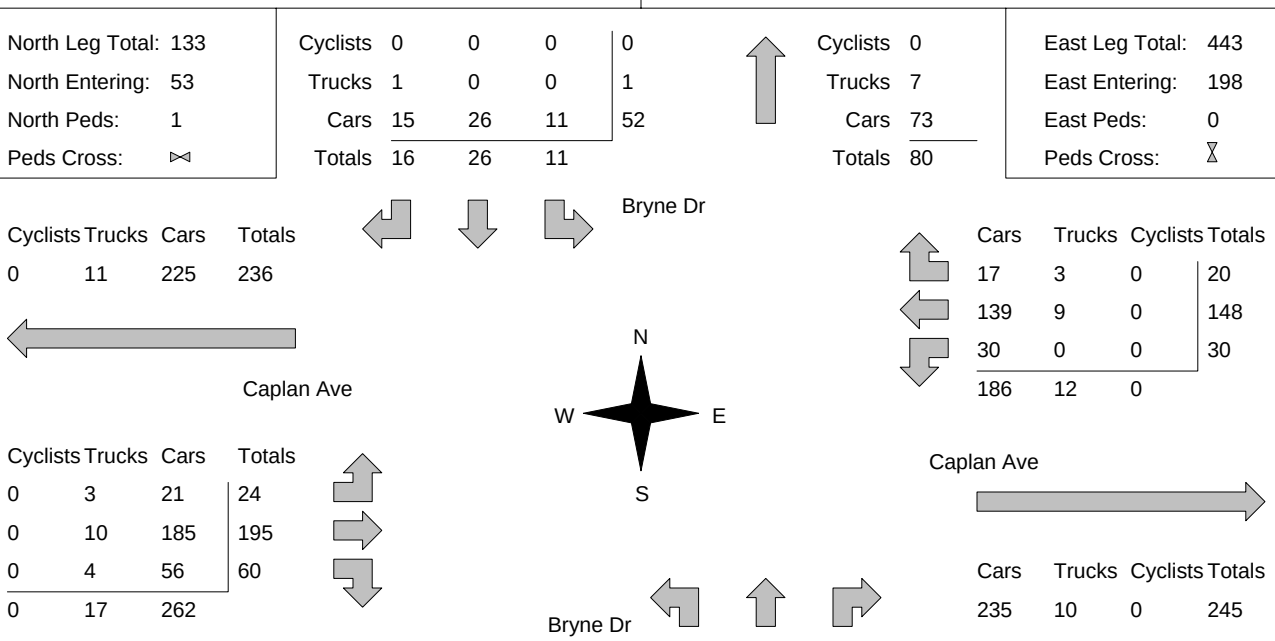
Municipality: Barrie
Site #: 1100900140
Intersection: Caplan Ave & Bryne Dr
TFR File #: 1
Count date: 6-Dec-11

Weather conditions:

Person(s) who counted:

**** Signalized Intersection ****

Major Road: Caplan Ave runs W/E



Comments

Ontario Traffic Inc.

Mid-day Peak Diagram

Specified Period
From: 11:00:00
To: 14:00:00

One Hour Peak
From: 12:00:00
To: 13:00:00

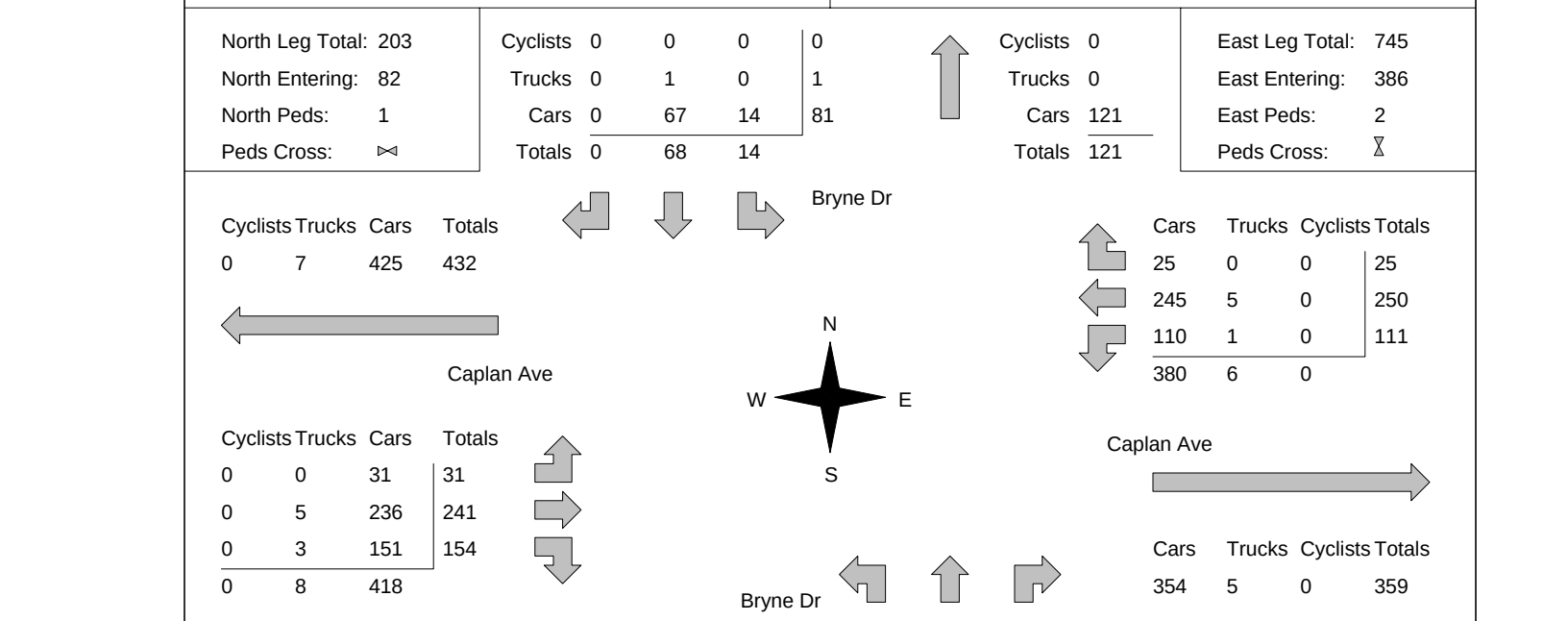
Municipality: Barrie
Site #: 1100900140
Intersection: Caplan Ave & Bryne Dr
TFR File #: 1
Count date: 6-Dec-11

Weather conditions:

Person(s) who counted:

**** Signalized Intersection ****

Major Road: Caplan Ave runs W/E



Comments

Ontario Traffic Inc.

Afternoon Peak Diagram

Specified Period
From: 15:00:00
To: 18:00:00

One Hour Peak
From: 15:00:00
To: 16:00:00

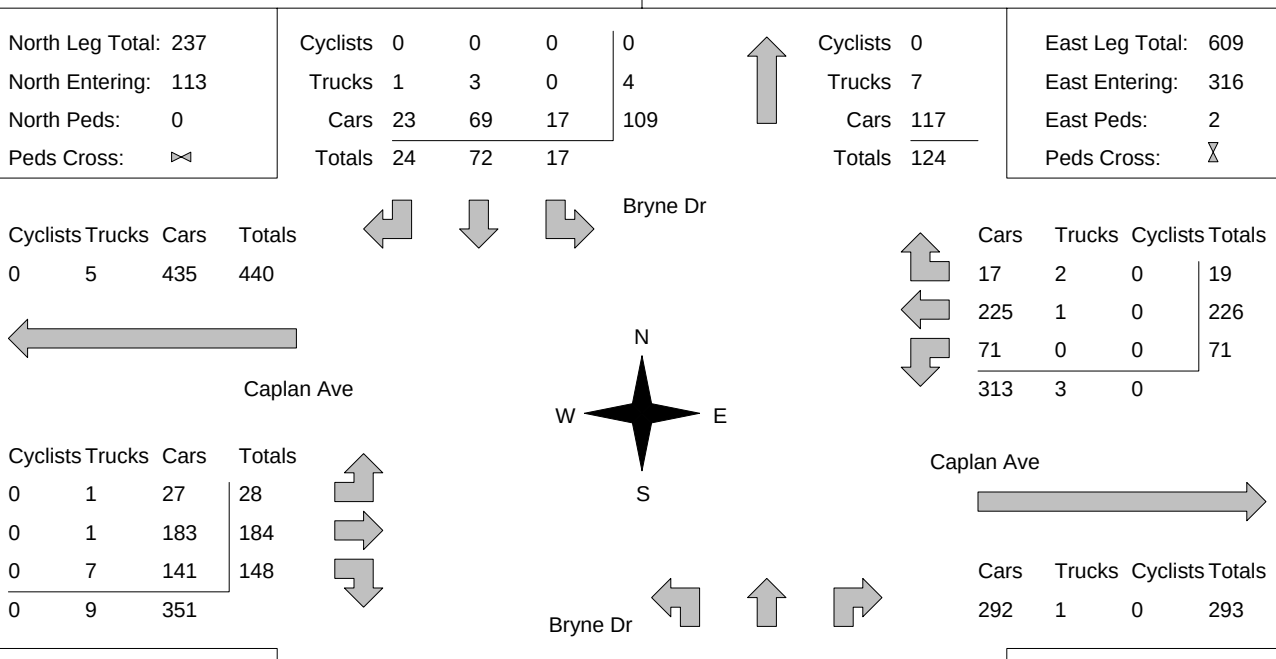
Municipality: Barrie
Site #: 1100900140
Intersection: Caplan Ave & Bryne Dr
TFR File #: 1
Count date: 6-Dec-11

Weather conditions:

Person(s) who counted:

**** Signalized Intersection ****

Major Road: Caplan Ave runs W/E



Comments

Ontario Traffic Inc.

Total Count Diagram

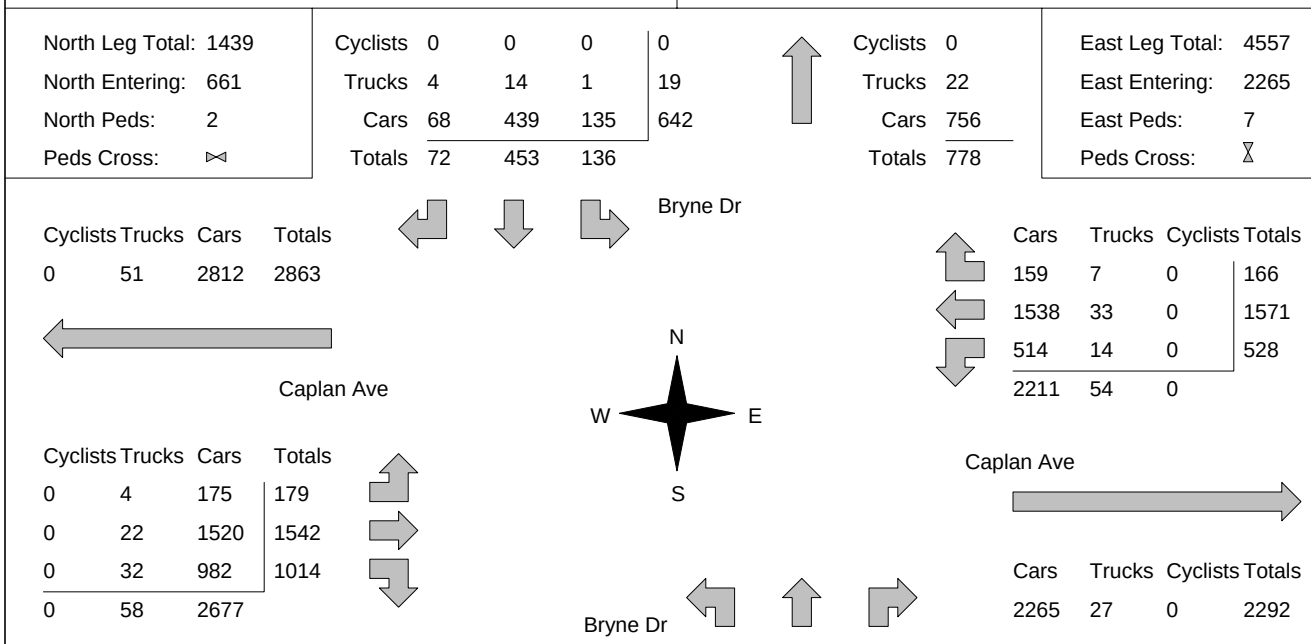
Municipality: Barrie
Site #: 1100900140
Intersection: Caplan Ave & Bryne Dr
TFR File #: 1
Count date: 6-Dec-11

Weather conditions:

Person(s) who counted:

**** Signalized Intersection ****

Major Road: Caplan Ave runs W/E



Comments

Ontario Traffic Inc.
Traffic Count Summary

Intersection: Caplan Ave & Bryne Dr | **Count Date:** 6-Dec-11 | **Municipality:** Barrie

North Approach Totals

Hour Ending	Includes Cars, Trucks, & Cyclists: Left	Thru	Right	Grand Total	Total Peds	North/South Total Approaches
7:00:00	0	0	0	0	0	0
8:00:00	2	5	2	9	0	101
9:00:00	11	26	16	53	1	200
11:00:00	1	3	0	4	0	12
12:00:00	24	74	0	98	0	394
13:00:00	14	68	0	82	1	433
14:00:00	32	77	0	109	0	413
15:00:00	0	1	0	1	0	17
16:00:00	17	72	24	113	0	472
17:00:00	17	73	7	97	0	426
18:00:00	18	54	23	95	0	459
Totals:	136	453	72	661	2	2927

South Approach Totals

Hour Ending	Includes Cars, Trucks, & Cyclists: Left	Thru	Right	Grand Total	Total Peds
7:00:00	0	0	0	0	0
8:00:00	58	8	26	92	1
9:00:00	72	36	39	147	0
11:00:00	4	3	1	8	0
12:00:00	132	83	81	296	1
13:00:00	182	65	104	351	1
14:00:00	154	61	89	304	0
15:00:00	9	4	3	16	0
16:00:00	190	77	92	359	0
17:00:00	187	49	93	329	0
18:00:00	232	47	85	364	1
Totals:	1220	433	613	2266	4

East Approach Totals

Hour Ending	Includes Cars, Trucks, & Cyclists: Left	Thru	Right	Grand Total	Total Peds	East/West Total Approaches
7:00:00	0	1	0	1	0	6
8:00:00	12	142	11	165	1	315
9:00:00	30	148	20	198	0	477
11:00:00	4	5	0	9	0	27
12:00:00	91	174	29	294	1	668
13:00:00	111	250	25	386	2	812
14:00:00	84	197	22	303	0	699
15:00:00	3	4	1	8	0	16
16:00:00	71	226	19	316	2	676
17:00:00	66	200	24	290	0	665
18:00:00	56	224	15	295	1	639
Totals:	528	1571	166	2265	7	5000

West Approach Totals

Hour Ending	Includes Cars, Trucks, & Cyclists: Left	Thru	Right	Grand Total	Total Peds
7:00:00	0	3	2	5	0
8:00:00	6	111	33	150	0
9:00:00	24	195	60	279	0
11:00:00	0	11	7	18	0
12:00:00	46	194	134	374	0
13:00:00	31	241	154	426	3
14:00:00	29	220	147	396	2
15:00:00	1	4	3	8	0
16:00:00	28	184	148	360	0
17:00:00	7	207	161	375	1
18:00:00	7	172	165	344	0
Totals:	179	1542	1014	2735	6

Calculated Values for Traffic Crossing Major Street

Hours Ending:	8:00	9:00	12:00	13:00	14:00	16:00	17:00	18:00
Crossing Values:	69	119	240	269	265	286	278	305

Ontario Traffic Inc.

Count Date: 6-Dec-11 Site #: 1100900140

Interval Time	Passenger Cars - North Approach						Trucks - North Approach						Cyclists - North Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		North Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45:00	0	0	3	2	1	1	1	1	0	0	1	1	0	0	0	0	0	0	0	0
8:00:00	1	1	4	1	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0
8:15:00	6	5	12	8	6	5	1	0	1	0	1	0	0	0	0	0	0	0	0	0
8:30:00	7	1	15	3	9	3	1	0	1	0	1	0	0	0	0	0	0	0	0	0
8:45:00	9	2	20	5	12	3	1	0	1	0	1	0	0	0	0	0	0	0	1	1
9:00:00	12	3	30	10	16	4	1	0	1	0	2	1	0	0	0	0	0	0	1	0
9:00:18	12	0	30	0	16	0	1	0	1	0	2	0	0	0	0	0	0	0	1	0
11:00:00	13	1	33	3	16	0	1	0	1	0	2	0	0	0	0	0	0	0	1	0
11:15:00	22	9	57	24	16	0	1	0	3	2	2	0	0	0	0	0	0	0	1	0
11:30:00	28	6	72	15	16	0	1	0	3	0	2	0	0	0	0	0	0	0	1	0
11:45:00	32	4	91	19	16	0	1	0	3	0	2	0	0	0	0	0	0	0	1	0
12:00:00	37	5	105	14	16	0	1	0	3	0	2	0	0	0	0	0	0	0	1	0
12:15:00	38	1	122	17	16	0	1	0	3	0	2	0	0	0	0	0	0	0	1	0
12:30:00	45	7	139	17	16	0	1	0	4	1	2	0	0	0	0	0	0	0	2	1
12:45:00	47	2	156	17	16	0	1	0	4	0	2	0	0	0	0	0	0	0	2	0
13:00:00	51	4	172	16	16	0	1	0	4	0	2	0	0	0	0	0	0	0	2	0
13:15:00	63	12	195	23	16	0	1	0	4	0	2	0	0	0	0	0	0	0	2	0
13:30:00	70	7	214	19	16	0	1	0	4	0	2	0	0	0	0	0	0	0	2	0
13:45:00	78	8	235	21	16	0	1	0	4	0	2	0	0	0	0	0	0	0	2	0
14:00:00	83	5	249	14	16	0	1	0	4	0	2	0	0	0	0	0	0	0	2	0
14:00:07	83	0	249	0	16	0	1	0	4	0	2	0	0	0	0	0	0	0	2	0
15:00:00	83	0	250	1	16	0	1	0	4	0	2	0	0	0	0	0	0	0	2	0
15:15:00	88	5	268	18	21	5	1	0	5	1	3	1	0	0	0	0	0	0	2	0
15:30:00	94	6	287	19	29	8	1	0	5	0	3	0	0	0	0	0	0	0	2	0
15:45:00	97	3	305	18	33	4	1	0	5	0	3	0	0	0	0	0	0	0	2	0
16:00:00	100	3	319	14	39	6	1	0	7	2	3	0	0	0	0	0	0	0	2	0
16:15:00	103	3	337	18	42	3	1	0	10	3	3	0	0	0	0	0	0	0	2	0
16:30:00	106	3	358	21	45	3	1	0	11	1	3	0	0	0	0	0	0	0	2	0
16:45:00	110	4	373	15	46	1	1	0	11	0	3	0	0	0	0	0	0	0	2	0
17:00:00	117	7	388	15	46	0	1	0	11	0	3	0	0	0	0	0	0	0	2	0
17:15:00	127	10	407	19	50	4	1	0	11	0	3	0	0	0	0	0	0	0	2	0
17:30:00	129	2	416	9	54	4	1	0	13	2	3	0	0	0	0	0	0	0	2	0
17:45:00	132	3	427	11	66	12	1	0	13	0	4	1	0	0	0	0	0	0	2	0
18:00:00	135	3	439	12	68	2	1	0	14	1	4	0	0	0	0	0	0	0	2	0
18:00:06	135	0	439	0	68	0	1	0	14	0	4	0	0	0	0	0	0	0	2	0

Ontario Traffic Inc.

Count Date: 6-Dec-11 Site #: 1100900140

Interval Time	Passenger Cars - East Approach						Trucks - East Approach						Cyclists - East Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		East Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	2	2	21	20	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30:00	5	3	59	38	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
7:45:00	8	3	90	31	8	6	1	0	0	0	0	0	0	0	0	0	0	0	1	1
8:00:00	10	2	141	51	11	3	2	1	2	2	0	0	0	0	0	0	0	0	1	0
8:15:00	16	6	178	37	14	3	2	0	3	1	0	0	0	0	0	0	0	0	1	0
8:30:00	21	5	214	36	19	5	2	0	3	0	1	1	0	0	0	0	0	0	1	0
8:45:00	30	9	248	34	22	3	2	0	7	4	2	1	0	0	0	0	0	0	1	0
9:00:00	40	10	280	32	28	6	2	0	11	4	3	1	0	0	0	0	0	0	1	0
9:00:18	41	1	280	0	28	0	2	0	11	0	3	0	0	0	0	0	0	0	1	0
11:00:00	44	3	285	5	28	0	2	0	11	0	3	0	0	0	0	0	0	0	1	0
11:15:00	65	21	331	46	33	5	3	1	14	3	4	1	0	0	0	0	0	0	1	0
11:30:00	89	24	367	36	41	8	4	1	15	1	4	0	0	0	0	0	0	0	1	0
11:45:00	113	24	413	46	45	4	5	1	15	0	4	0	0	0	0	0	0	0	2	1
12:00:00	132	19	454	41	56	11	5	0	16	1	4	0	0	0	0	0	0	0	2	0
12:15:00	170	38	518	64	58	2	6	1	17	1	4	0	0	0	0	0	0	0	3	1
12:30:00	189	19	567	49	66	8	6	0	18	1	4	0	0	0	0	0	0	0	4	1
12:45:00	212	23	637	70	74	8	6	0	21	3	4	0	0	0	0	0	0	0	4	0
13:00:00	242	30	699	62	81	7	6	0	21	0	4	0	0	0	0	0	0	0	4	0
13:15:00	267	25	745	46	85	4	8	2	23	2	4	0	0	0	0	0	0	0	4	0
13:30:00	280	13	791	46	90	5	8	0	25	2	4	0	0	0	0	0	0	0	4	0
13:45:00	294	14	835	44	98	8	10	2	26	1	4	0	0	0	0	0	0	0	4	0
14:00:00	319	25	890	55	102	4	13	3	27	1	5	1	0	0	0	0	0	0	4	0
14:00:07	319	0	890	0	103	1	13	0	27	0	5	0	0	0	0	0	0	0	4	0
15:00:00	322	3	894	4	103	0	13	0	27	0	5	0	0	0	0	0	0	0	4	0
15:15:00	344	22	951	57	104	1	13	0	28	1	5	0	0	0	0	0	0	0	5	1
15:30:00	355	11	1007	56	107	3	13	0	28	0	5	0	0	0	0	0	0	0	5	0
15:45:00	369	14	1069	62	116	9	13	0	28	0	6	1	0	0	0	0	0	0	6	1
16:00:00	393	24	1119	50	120	4	13	0	28	0	7	1	0	0	0	0	0	0	6	0
16:15:00	407	14	1167	48	124	4	14	1	28	0	7	0	0	0	0	0	0	0	6	0
16:30:00	426	19	1222	55	131	7	14	0	28	0	7	0	0	0	0	0	0	0	6	0
16:45:00	445	19	1277	55	137	6	14	0	29	1	7	0	0	0	0	0	0	0	6	0
17:00:00	458	13	1317	40	144	7	14	0	30	1	7	0	0	0	0	0	0	0	6	0
17:15:00	480	22	1368	51	145	1	14	0	31	1	7	0	0	0	0	0	0	0	7	1
17:30:00	497	17	1431	63	151	6	14	0	32	1	7	0	0	0	0	0	0	0	7	0
17:45:00	506	9	1491	60	155	4	14	0	32	0	7	0	0	0	0	0	0	0	7	0
18:00:00	514	8	1538	47	159	4	14	0	33	1	7	0	0	0	0	0	0	0	7	0
18:00:06	514	0	1538	0	159	0	14	0	33	0	7	0	0	0	0	0	0	0	7	0

Ontario Traffic Inc.

Count Date: 6-Dec-11 Site #: 1100900140

Interval Time	Passenger Cars - South Approach						Trucks - South Approach						Cyclists - South Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		South Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	9	9	1	1	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30:00	22	13	1	0	7	2	0	0	0	0	0	0	0	0	0	0	0	0	1	1
7:45:00	32	10	4	3	14	7	0	0	0	0	0	0	0	0	0	0	0	0	1	0
8:00:00	57	25	8	4	26	12	1	1	0	0	0	0	0	0	0	0	0	0	1	0
8:15:00	69	12	12	4	34	8	1	0	1	1	0	0	0	0	0	0	0	0	1	0
8:30:00	88	19	21	9	42	8	2	1	1	0	0	0	0	0	0	0	0	0	1	0
8:45:00	100	12	32	11	51	9	2	0	1	0	0	0	0	0	0	0	0	0	1	0
9:00:00	128	28	43	11	65	14	2	0	1	0	0	0	0	0	0	0	0	0	1	0
9:00:18	128	0	43	0	65	0	2	0	1	0	0	0	0	0	0	0	0	0	1	0
11:00:00	132	4	46	3	66	1	2	0	1	0	0	0	0	0	0	0	0	0	1	0
11:15:00	163	31	75	29	78	12	2	0	2	1	0	0	0	0	0	0	0	0	1	0
11:30:00	191	28	84	9	99	21	2	0	2	0	0	0	0	0	0	0	0	0	1	0
11:45:00	224	33	106	22	117	18	4	2	2	0	1	1	0	0	0	0	0	0	2	1
12:00:00	262	38	127	21	146	29	4	0	3	1	1	0	0	0	0	0	0	0	2	0
12:15:00	291	29	146	19	169	23	4	0	3	0	1	0	0	0	0	0	0	0	2	0
12:30:00	343	52	165	19	200	31	5	1	3	0	1	0	0	0	0	0	0	0	3	1
12:45:00	385	42	178	13	226	26	6	1	3	0	1	0	0	0	0	0	0	0	3	0
13:00:00	442	57	192	14	250	24	6	0	3	0	1	0	0	0	0	0	0	0	3	0
13:15:00	487	45	203	11	275	25	6	0	3	0	1	0	0	0	0	0	0	0	3	0
13:30:00	523	36	223	20	299	24	6	0	3	0	1	0	0	0	0	0	0	0	3	0
13:45:00	562	39	234	11	314	15	6	0	4	1	3	2	0	0	0	0	0	0	3	0
14:00:00	596	34	252	18	337	23	6	0	4	0	3	0	0	0	0	0	0	0	3	0
14:00:07	596	0	252	0	337	0	6	0	4	0	3	0	0	0	0	0	0	0	3	0
15:00:00	605	9	256	4	340	3	6	0	4	0	3	0	0	0	0	0	0	0	3	0
15:15:00	646	41	276	20	364	24	6	0	5	1	3	0	0	0	0	0	0	0	3	0
15:30:00	682	36	292	16	394	30	7	1	5	0	3	0	0	0	0	0	0	0	3	0
15:45:00	743	61	309	17	413	19	8	1	7	2	3	0	0	0	0	0	0	0	3	0
16:00:00	792	49	329	20	432	19	9	1	8	1	3	0	0	0	0	0	0	0	3	0
16:15:00	832	40	343	14	454	22	9	0	8	0	3	0	0	0	0	0	0	0	3	0
16:30:00	889	57	354	11	483	29	9	0	8	0	3	0	0	0	0	0	0	0	3	0
16:45:00	938	49	369	15	510	27	11	2	8	0	3	0	0	0	0	0	0	0	3	0
17:00:00	976	38	378	9	525	15	12	1	8	0	3	0	0	0	0	0	0	0	3	0
17:15:00	1033	57	390	12	541	16	12	0	9	1	3	0	0	0	0	0	0	0	3	0
17:30:00	1097	64	400	10	565	24	12	0	9	0	3	0	0	0	0	0	0	0	3	0
17:45:00	1158	61	416	16	591	26	13	1	11	2	4	1	0	0	0	0	0	0	3	0
18:00:00	1206	48	422	6	609	18	14	1	11	0	4	0	0	0	0	0	0	0	4	1
18:00:06	1206	0	422	0	610	1	14	0	11	0	4	0	0	0	0	0	0	0	4	0

Ontario Traffic Inc.

Count Date: 6-Dec-11 Site #: 1100900140

Interval Time	Passenger Cars - West Approach						Trucks - West Approach						Cyclists - West Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		West Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	3	3	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	1	1	27	24	6	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30:00	1	0	53	26	10	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45:00	3	2	81	28	19	9	0	0	0	0	1	1	0	0	0	0	0	0	0	0
8:00:00	6	3	114	33	33	14	0	0	0	0	2	1	0	0	0	0	0	0	0	0
8:15:00	12	6	150	36	41	8	0	0	1	1	2	0	0	0	0	0	0	0	0	0
8:30:00	20	8	184	34	61	20	0	0	7	6	3	1	0	0	0	0	0	0	0	0
8:45:00	23	3	238	54	71	10	1	1	9	2	5	2	0	0	0	0	0	0	0	0
9:00:00	27	4	299	61	89	18	3	2	10	1	6	1	0	0	0	0	0	0	0	0
9:00:18	27	0	301	2	91	2	3	0	10	0	6	0	0	0	0	0	0	0	0	0
11:00:00	27	0	310	9	96	5	3	0	10	0	6	0	0	0	0	0	0	0	0	0
11:15:00	40	13	346	36	128	32	3	0	10	0	7	1	0	0	0	0	0	0	0	0
11:30:00	46	6	400	54	155	27	3	0	12	2	7	0	0	0	0	0	0	0	0	0
11:45:00	56	10	458	58	183	28	3	0	12	0	7	0	0	0	0	0	0	0	0	0
12:00:00	73	17	502	44	227	44	3	0	12	0	9	2	0	0	0	0	0	0	0	0
12:15:00	82	9	563	61	276	49	3	0	13	1	9	0	0	0	0	0	0	0	0	0
12:30:00	88	6	619	56	315	39	3	0	15	2	10	1	0	0	0	0	0	0	3	3
12:45:00	94	6	668	49	345	30	3	0	17	2	12	2	0	0	0	0	0	0	3	0
13:00:00	104	10	738	70	378	33	3	0	17	0	12	0	0	0	0	0	0	0	3	0
13:15:00	108	4	784	46	416	38	3	0	18	1	13	1	0	0	0	0	0	0	3	0
13:30:00	116	8	831	47	454	38	3	0	18	0	14	1	0	0	0	0	0	0	5	2
13:45:00	120	4	888	57	486	32	3	0	18	0	14	0	0	0	0	0	0	0	5	0
14:00:00	133	13	955	67	521	35	3	0	20	2	16	2	0	0	0	0	0	0	5	0
14:00:07	133	0	955	0	521	0	3	0	20	0	16	0	0	0	0	0	0	0	5	0
15:00:00	134	1	959	4	524	3	3	0	20	0	16	0	0	0	0	0	0	0	5	0
15:15:00	141	7	1007	48	553	29	3	0	21	1	16	0	0	0	0	0	0	0	5	0
15:30:00	147	6	1047	40	595	42	3	0	21	0	17	1	0	0	0	0	0	0	5	0
15:45:00	156	9	1101	54	632	37	4	1	21	0	18	1	0	0	0	0	0	0	5	0
16:00:00	161	5	1142	41	665	33	4	0	21	0	23	5	0	0	0	0	0	0	5	0
16:15:00	162	1	1184	42	696	31	4	0	21	0	24	1	0	0	0	0	0	0	5	0
16:30:00	163	1	1236	52	735	39	4	0	21	0	26	2	0	0	0	0	0	0	5	0
16:45:00	166	3	1302	66	777	42	4	0	21	0	27	1	0	0	0	0	0	0	6	1
17:00:00	168	2	1349	47	822	45	4	0	21	0	27	0	0	0	0	0	0	0	6	0
17:15:00	169	1	1392	43	852	30	4	0	21	0	29	2	0	0	0	0	0	0	6	0
17:30:00	172	3	1438	46	904	52	4	0	22	1	29	0	0	0	0	0	0	0	6	0
17:45:00	174	2	1485	47	941	37	4	0	22	0	30	1	0	0	0	0	0	0	6	0
18:00:00	175	1	1520	35	982	41	4	0	22	0	32	2	0	0	0	0	0	0	6	0
18:00:06	175	0	1520	0	982	0	4	0	22	0	32	0	0	0	0	0	0	0	6	0

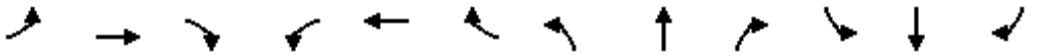
Appendix B

Synchro Results – 2017 Analysis

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	472	292	57	45	167	98	1015	70	180	611	435
v/c Ratio	0.89	0.33	0.16	0.10	0.48	0.45	0.87	0.11	0.43	0.48	0.51
Control Delay	42.8	24.1	18.1	30.4	10.7	38.1	34.2	1.6	34.7	22.1	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	42.8	24.1	18.1	30.4	10.7	38.1	34.2	1.6	34.7	22.1	4.7
Queue Length 50th (m)	56.5	17.2	5.3	3.0	0.0	13.4	71.4	0.0	12.6	37.3	0.0
Queue Length 95th (m)	#121.9	19.7	10.9	6.4	9.0	27.4	#106.6	0.0	19.2	56.1	15.6
Internal Link Dist (m)		68.1		189.6			145.5			135.2	
Turn Bay Length (m)	20.0		30.0			45.0			80.0		80.0
Base Capacity (vph)	532	1456	451	1435	733	276	1173	615	531	1262	850
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.89	0.20	0.13	0.03	0.23	0.36	0.87	0.11	0.34	0.48	0.51

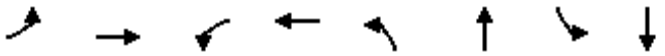
Intersection Summary

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



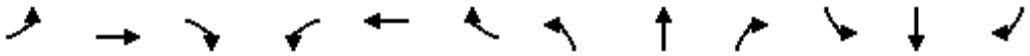
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	453	148	56	44	34	125	90	883	42	144	562	374
Future Volume (vph)	453	148	56	44	34	125	90	883	42	144	562	374
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1772	3445		1789	3444	1526	1772	3579	1633	3404	3544	1601
Flt Permitted	0.59	1.00		0.57	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1099	3445		1080	3444	1526	1772	3579	1633	3404	3544	1601
Peak-hour factor, PHF	0.96	0.64	0.92	0.77	0.75	0.75	0.92	0.87	0.60	0.80	0.92	0.86
Adj. Flow (vph)	472	231	61	57	45	167	98	1015	70	180	611	435
RTOR Reduction (vph)	0	26	0	0	0	142	0	0	47	0	0	285
Lane Group Flow (vph)	472	266	0	57	45	25	98	1015	23	180	611	150
Heavy Vehicles (%)	3%	2%	5%	2%	6%	7%	3%	2%	0%	4%	3%	2%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8			2			6
Actuated Green, G (s)	27.9	19.2		16.6	11.9	11.9	8.0	26.0	26.0	9.4	27.4	27.4
Effective Green, g (s)	28.9	19.2		16.6	11.9	11.9	8.0	26.0	26.0	9.4	27.4	27.4
Actuated g/C Ratio	0.36	0.24		0.21	0.15	0.15	0.10	0.33	0.33	0.12	0.35	0.35
Clearance Time (s)	4.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	510	834		268	516	228	178	1173	535	403	1224	553
v/s Ratio Prot	c0.15	0.08		0.01	0.01		c0.06	c0.28		0.05	0.17	
v/s Ratio Perm	c0.19			0.03		0.02			0.01			0.09
v/c Ratio	0.93	0.32		0.21	0.09	0.11	0.55	0.87	0.04	0.45	0.50	0.27
Uniform Delay, d1	23.0	24.7		25.6	29.0	29.1	33.9	25.0	18.2	32.5	20.5	18.7
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	22.8	0.2		0.4	0.1	0.2	3.7	8.6	0.2	0.8	1.5	1.2
Delay (s)	45.8	24.9		26.0	29.1	29.3	37.6	33.6	18.3	33.3	22.0	20.0
Level of Service	D	C		C	C	C	D	C	B	C	C	B
Approach Delay (s)		37.8			28.6			33.1			22.9	
Approach LOS		D			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	30.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	79.3	Sum of lost time (s)	20.0
Intersection Capacity Utilization	80.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	36	323	45	204	127	113	18	68
v/c Ratio	0.10	0.75	0.14	0.48	0.18	0.07	0.03	0.05
Control Delay	16.5	37.6	17.0	29.1	11.7	9.7	11.3	14.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.5	37.6	17.0	29.1	11.7	9.7	11.3	14.1
Queue Length 50th (m)	3.5	44.6	4.4	26.8	10.0	2.1	1.3	2.4
Queue Length 95th (m)	7.4	72.4	8.7	46.2	14.2	7.4	3.5	4.6
Internal Link Dist (m)		96.6		108.8		132.2		99.0
Turn Bay Length (m)	15.0		30.0		15.0		30.0	
Base Capacity (vph)	364	587	314	581	710	1541	714	1363
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.55	0.14	0.35	0.18	0.07	0.03	0.05

Intersection Summary

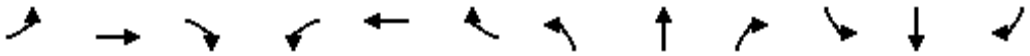


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	27	220	68	34	167	23	81	41	44	12	29	18
Future Volume (vph)	27	220	68	34	167	23	81	41	44	12	29	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.96		1.00	0.98		1.00	0.92		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1615	1738		1825	1746		1807	3301		1825	3396	
Flt Permitted	0.56	1.00		0.33	1.00		0.65	1.00		0.68	1.00	
Satd. Flow (perm)	959	1738		636	1746		1238	3301		1307	3396	
Peak-hour factor, PHF	0.75	0.97	0.71	0.75	0.97	0.71	0.64	0.82	0.70	0.65	0.65	0.80
Adj. Flow (vph)	36	227	96	45	172	32	127	50	63	18	45	22
RTOR Reduction (vph)	0	19	0	0	8	0	0	36	0	0	14	0
Lane Group Flow (vph)	36	304	0	45	196	0	127	77	0	18	54	0
Heavy Vehicles (%)	13%	5%	7%	0%	6%	15%	1%	3%	0%	0%	0%	6%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	21.8	18.1		21.8	18.1		39.9	34.6		34.1	31.7	
Effective Green, g (s)	21.8	18.1		21.8	18.1		39.9	34.6		34.1	31.7	
Actuated g/C Ratio	0.27	0.23		0.27	0.23		0.50	0.43		0.43	0.40	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	292	394		228	396		656	1431		574	1349	
v/s Ratio Prot	0.01	c0.18		c0.01	0.11		c0.01	0.02		0.00	0.02	
v/s Ratio Perm	0.03			0.04			c0.08			0.01		
v/c Ratio	0.12	0.77		0.20	0.50		0.19	0.05		0.03	0.04	
Uniform Delay, d1	21.6	28.9		22.0	26.9		10.8	13.1		13.2	14.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	9.1		0.4	1.0		0.1	0.1		0.0	0.1	
Delay (s)	21.8	38.0		22.4	27.9		10.9	13.2		13.2	14.8	
Level of Service	C	D		C	C		B	B		B	B	
Approach Delay (s)		36.4			26.9			12.0			14.5	
Approach LOS		D			C			B			B	

Intersection Summary			
HCM 2000 Control Delay	25.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	79.8	Sum of lost time (s)	21.0
Intersection Capacity Utilization	55.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group
Lane Group Flow (vph)
v/c Ratio
Control Delay
Queue Delay
Total Delay
Queue Length 50th (m)
Queue Length 95th (m)
Internal Link Dist (m)
Turn Bay Length (m)
Base Capacity (vph)
Starvation Cap Reductn
Spillback Cap Reductn
Storage Cap Reductn
Reduced v/c Ratio

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Frt												
Flt Protected												
Satd. Flow (prot)												
Flt Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type												
Protected Phases												
Permitted Phases												
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d1												
Progression Factor												
Incremental Delay, d2												
Delay (s)												
Level of Service												
Approach Delay (s)		0.0			0.0			0.0			0.0	
Approach LOS		A			A			A			A	

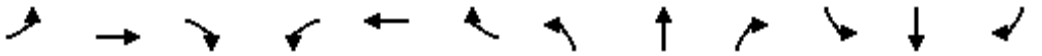
Intersection Summary			
HCM 2000 Control Delay	0.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.00		
Actuated Cycle Length (s)	3.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	299	288	179	167	217	87	965	106	287	1275	669
v/c Ratio	0.64	0.47	0.43	0.34	0.53	0.41	0.84	0.18	0.58	0.95	0.71
Control Delay	26.7	19.1	21.6	33.0	10.2	38.2	33.3	4.4	36.9	43.3	10.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.7	19.1	21.6	33.0	10.2	38.2	33.3	4.4	36.9	43.3	10.0
Queue Length 50th (m)	33.7	11.0	18.7	12.1	0.0	12.3	69.6	0.0	20.7	~100.5	12.9
Queue Length 95th (m)	53.3	16.9	30.6	19.2	16.0	25.3	#105.2	7.6	30.1	#149.1	56.8
Internal Link Dist (m)		68.1		189.6			145.5			135.2	
Turn Bay Length (m)	20.0		30.0			45.0			80.0		80.0
Base Capacity (vph)	476	1436	453	1494	789	276	1153	595	543	1337	939
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.63	0.20	0.40	0.11	0.28	0.32	0.84	0.18	0.53	0.95	0.71

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

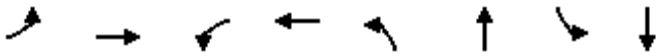
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	263	117	103	150	139	189	78	859	91	235	1084	642
Future Volume (vph)	263	117	103	150	139	189	78	859	91	235	1084	642
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1825	3318		1807	3650	1617	1800	3607	1610	3541	3607	1610
Flt Permitted	0.58	1.00		0.58	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1106	3318		1094	3650	1617	1800	3607	1610	3541	3607	1610
Peak-hour factor, PHF	0.88	0.76	0.77	0.84	0.83	0.87	0.90	0.89	0.86	0.82	0.85	0.96
Adj. Flow (vph)	299	154	134	179	167	217	87	965	106	287	1275	669
RTOR Reduction (vph)	0	114	0	0	0	188	0	0	71	0	0	344
Lane Group Flow (vph)	299	174	0	179	167	29	87	965	35	287	1275	325
Heavy Vehicles (%)	0%	0%	5%	1%	0%	1%	1%	1%	1%	0%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	1	1	1	0	1	1
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8			2			6
Actuated Green, G (s)	23.6	11.9		21.0	10.6	10.6	7.7	25.8	25.8	10.9	29.0	29.0
Effective Green, g (s)	23.6	11.9		21.0	10.6	10.6	7.7	25.8	25.8	10.9	29.0	29.0
Actuated g/C Ratio	0.30	0.15		0.27	0.13	0.13	0.10	0.33	0.33	0.14	0.37	0.37
Clearance Time (s)	4.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	436	499		384	489	216	175	1177	525	488	1324	591
v/s Ratio Prot	c0.10	0.05		0.06	0.05		0.05	0.27		c0.08	c0.35	
v/s Ratio Perm	c0.10			0.06		0.02			0.02			0.20
v/c Ratio	0.69	0.35		0.47	0.34	0.13	0.50	0.82	0.07	0.59	0.96	0.55
Uniform Delay, d1	23.2	30.1		23.6	31.0	30.2	33.8	24.5	18.3	31.9	24.5	19.8
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.4	0.4		0.9	0.4	0.3	2.2	6.4	0.2	1.8	17.3	3.6
Delay (s)	27.7	30.5		24.5	31.5	30.4	36.0	30.9	18.5	33.8	41.8	23.5
Level of Service	C	C		C	C	C	D	C	B	C	D	C
Approach Delay (s)		29.1			28.9			30.2			35.3	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	32.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	79.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		

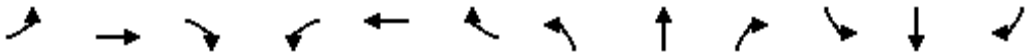
c Critical Lane Group



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	46	438	108	324	278	230	27	121
v/c Ratio	0.13	0.89	0.45	0.60	0.45	0.16	0.04	0.10
Control Delay	16.3	49.5	22.3	31.4	16.7	8.6	12.1	15.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.3	49.5	22.3	31.4	16.7	8.6	12.1	15.0
Queue Length 50th (m)	4.5	63.5	10.9	46.7	27.1	4.5	2.3	5.1
Queue Length 95th (m)	8.2	#102.4	16.8	73.9	35.7	13.6	4.9	11.0
Internal Link Dist (m)		96.6		108.8		132.2		99.0
Turn Bay Length (m)	15.0		30.0		15.0		30.0	
Base Capacity (vph)	344	535	240	579	619	1482	602	1191
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.13	0.82	0.45	0.56	0.45	0.16	0.04	0.10

Intersection Summary

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

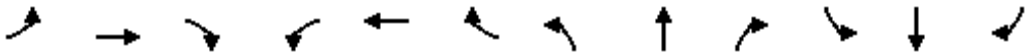


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	32	207	167	80	255	21	214	87	104	19	81	27
Future Volume (vph)	32	207	167	80	255	21	214	87	104	19	81	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.93		1.00	0.98		1.00	0.91		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1755	1745		1825	1839		1789	3261		1825	3353	
Flt Permitted	0.40	1.00		0.17	1.00		0.60	1.00		0.61	1.00	
Satd. Flow (perm)	740	1745		318	1839		1130	3261		1169	3353	
Peak-hour factor, PHF	0.70	0.85	0.86	0.74	0.91	0.48	0.77	0.92	0.77	0.71	0.95	0.75
Adj. Flow (vph)	46	244	194	108	280	44	278	95	135	27	85	36
RTOR Reduction (vph)	0	33	0	0	7	0	0	80	0	0	23	0
Lane Group Flow (vph)	46	405	0	108	317	0	278	150	0	27	98	0
Heavy Vehicles (%)	4%	1%	5%	0%	1%	11%	2%	5%	0%	0%	4%	4%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	26.8	22.8		29.6	24.2		42.9	36.2		34.5	31.8	
Effective Green, g (s)	26.8	22.8		29.6	24.2		42.9	36.2		34.5	31.8	
Actuated g/C Ratio	0.30	0.26		0.34	0.27		0.49	0.41		0.39	0.36	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	271	451		199	505		603	1339		477	1210	
v/s Ratio Prot	0.01	c0.23		c0.03	0.17		c0.04	0.05		0.00	0.03	
v/s Ratio Perm	0.04			0.15			c0.19			0.02		
v/c Ratio	0.17	0.90		0.54	0.63		0.46	0.11		0.06	0.08	
Uniform Delay, d1	22.2	31.5		22.4	28.0		14.3	16.0		16.5	18.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	20.0		3.0	2.5		0.6	0.2		0.0	0.1	
Delay (s)	22.5	51.6		25.4	30.5		14.8	16.2		16.6	18.7	
Level of Service	C	D		C	C		B	B		B	B	
Approach Delay (s)		48.8			29.2			15.4			18.3	
Approach LOS		D			C			B			B	

Intersection Summary			
HCM 2000 Control Delay	29.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	88.1	Sum of lost time (s)	21.0
Intersection Capacity Utilization	61.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group
Lane Group Flow (vph)
v/c Ratio
Control Delay
Queue Delay
Total Delay
Queue Length 50th (m)
Queue Length 95th (m)
Internal Link Dist (m)
Turn Bay Length (m)
Base Capacity (vph)
Starvation Cap Reductn
Spillback Cap Reductn
Storage Cap Reductn
Reduced v/c Ratio

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Frt												
Flt Protected												
Satd. Flow (prot)												
Flt Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type												
Protected Phases												
Permitted Phases												
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d1												
Progression Factor												
Incremental Delay, d2												
Delay (s)												
Level of Service												
Approach Delay (s)		0.0			0.0			0.0			0.0	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	0.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.00		
Actuated Cycle Length (s)	3.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Appendix C

2021 and 2031 Traffic Forecasts

City of Barrie EMME Model Traffic Forecasts

Forecast Auto Volumes - Scenario 76218 (2014-03-07): Page 13
2021 AM Ex+Cap+Ph2Imprv+McKayIC+BBPIC+HOV(S8L_F1)

2000 4000 6000 8000 10000

Forecast Auto Volumes - Scenario 76217 (2014-03-07): Page 13
2021 PM Ex+Cap+Ph2Imprv+McKayIC+BBPIC+HOV(S8L_F1)

2000 4000 6000 8000 10000

Forecast Auto Volumes - Scenario 91318 (2014-03-07): Page 13
2031 AM Ex+Cap+Imprv6+McKayIC+SalemC+BBPIC+HOV(S8M6Lan)-F1

2000 4000 6000 8000 10000

Forecast Auto Volumes - Scenario 91317 (2014-03-07): Page 13
2031 PM Ex+Cap+Imprv6+McKayIC+SalemC+BBPIC+HOV(S8M6Lan)-F1

2000 4000 6000 8000 10000

Morrison Hershfield's Traffic Forecast from the Harvie Road / Big Bay Point Road / Highway 400 Crossing Phase 3 & 4 Class EA Study

Figure 1 - 2031 AM Peak Hour Volumes with Future Potential Interchange

Figure 2 - 2031 PM Peak Hour Volumes with Future Potential Interchange

Ainley's forecast from the Bryne Drive Phase 1 & 2 Class EA Study

Adjusted Final Volumes

		2031 Wkdy AM	2031 Wkdy PM	2031 Friday PM	2031 Saturday	2021 Wkdy AM	2021 Wkdy PM	2021 Friday PM	2021 Saturday
Harvie & Bryne	EBL	76	48	47	89	47	30	29	55
	EBT	576	343	703	316	357	213	436	196
	EBR	306	118	118	216	190	73	73	134
	NBL	78	120	127	119	48	74	78	74
	NBT	447	791	934	1064	277	490	579	660
	NBR	386	678	631	633	239	421	391	393
	WBL	375	326	300	434	232	202	186	269
	WBT	216	703	539	647	134	436	334	401
	WBR	453	648	555	665	281	402	344	412
	SBL	477	725	852	758	296	449	528	470
	SBT	472	435	439	569	293	270	272	353
	SBR	223	143	141	154	138	89	87	96
Harvie & 400 SB ramps	EBT	955	1328	1395	1298	592	823	865	805
	EBR	484	418	792	409	300	259	491	253
	WBL[1]	398	378	410	348	247	234	254	216
	WBT	816	1452	1199	1483	506	900	743	920
	SBL	164	350	427	322	101	217	265	200
	SBR	227	224	194	261	141	139	121	162
Big Bay Point & 400 NB onramp	EBT	817	1572	1767	1515	506	974	1095	939
	EBR	302	106	55	105	187	66	34	65
	WBL[2]	341	117	16	108	212	73	10	67
	WBT	1214	1831	1609	1832	753	1135	998	1136
Big Bay Point & Fairview	EBL	102	108	110	104	64	67	68	64
	EBT	714	1464	1657	1411	443	908	1027	875
	NBL	398	622	348	631	247	385	216	391
	NBT	187	144	133	132	116	89	82	82
	NBR	396	738	388	679	245	458	241	421
	WBT	784	1093	983	1070	486	678	609	663
	WBR	483	719	784	661	299	446	486	410
	SBL	238	256	248	236	148	159	154	146
	SBR	374	233	293	239	232	145	182	148

[1] Leads to 400 SB via straight onramp
[2] Leads to 400 NB via loop onramp

Appendix D

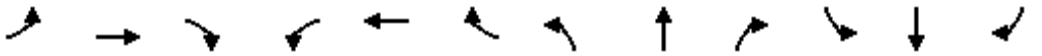
Synchro Results - 2021 Analysis

Morrison Hershfield's Traffic Forecast from the Harvie Road / Big Bay Point Road / Highway 400 Crossing Phase 3 & 4 Class EA Study

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	490	191	55	42	153	97	956	25	126	608	405
v/c Ratio	0.92	0.21	0.15	0.09	0.46	0.44	0.78	0.04	0.34	0.48	0.49
Control Delay	47.7	18.4	18.0	30.5	10.8	37.8	28.4	0.1	34.4	22.0	4.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.7	18.4	18.0	30.5	10.8	37.8	28.4	0.1	34.4	22.0	4.6
Queue Length 50th (m)	59.4	8.3	5.1	2.8	0.0	13.2	64.1	0.0	8.8	37.1	0.0
Queue Length 95th (m)	#128.7	17.8	12.6	7.4	15.5	27.0	90.5	0.0	16.7	55.3	18.2
Internal Link Dist (m)		68.1		189.6			145.5			135.2	
Turn Bay Length (m)	20.0		30.0			45.0			80.0		80.0
Base Capacity (vph)	532	1445	469	1438	726	277	1220	635	533	1262	830
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.92	0.13	0.12	0.03	0.21	0.35	0.78	0.04	0.24	0.48	0.49

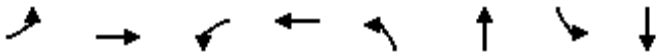
Intersection Summary

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



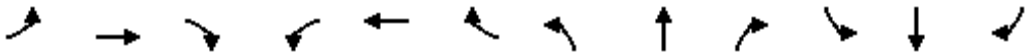
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	490	130	61	55	42	153	97	956	25	126	608	405
Future Volume (vph)	490	130	61	55	42	153	97	956	25	126	608	405
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1772	3375		1789	3444	1526	1772	3579	1633	3404	3544	1601
Flt Permitted	0.59	1.00		0.63	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1100	3375		1190	3444	1526	1772	3579	1633	3404	3544	1601
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	490	130	61	55	42	153	97	956	25	126	608	405
RTOR Reduction (vph)	0	46	0	0	0	130	0	0	16	0	0	265
Lane Group Flow (vph)	490	145	0	55	42	23	97	956	9	126	608	140
Heavy Vehicles (%)	3%	2%	5%	2%	6%	7%	3%	2%	0%	4%	3%	2%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8			2			6
Actuated Green, G (s)	27.8	19.2		16.4	11.8	11.8	8.0	27.0	27.0	8.3	27.3	27.3
Effective Green, g (s)	28.8	19.2		16.4	11.8	11.8	8.0	27.0	27.0	8.3	27.3	27.3
Actuated g/C Ratio	0.36	0.24		0.21	0.15	0.15	0.10	0.34	0.34	0.10	0.35	0.35
Clearance Time (s)	4.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	510	819		281	513	227	179	1221	557	357	1223	552
v/s Ratio Prot	c0.16	0.04		0.01	0.01		c0.05	c0.27		0.04	0.17	
v/s Ratio Perm	c0.19			0.03		0.01			0.01			0.09
v/c Ratio	0.96	0.18		0.20	0.08	0.10	0.54	0.78	0.02	0.35	0.50	0.25
Uniform Delay, d1	23.5	23.7		25.6	29.0	29.1	33.8	23.4	17.2	32.9	20.5	18.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	30.0	0.1		0.3	0.1	0.2	3.3	5.1	0.1	0.6	1.4	1.1
Delay (s)	53.5	23.8		26.0	29.1	29.3	37.1	28.5	17.3	33.5	21.9	19.7
Level of Service	D	C		C	C	C	D	C	B	C	C	B
Approach Delay (s)		45.1			28.5			29.0			22.4	
Approach LOS		D			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	30.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	79.1	Sum of lost time (s)	20.0
Intersection Capacity Utilization	84.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	29	312	37	206	88	112	13	340
v/c Ratio	0.08	0.74	0.12	0.45	0.15	0.07	0.02	0.23
Control Delay	16.3	37.9	16.7	26.9	11.4	10.0	11.4	18.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.3	37.9	16.7	26.9	11.4	10.0	11.4	18.4
Queue Length 50th (m)	2.8	43.6	3.6	22.2	6.6	2.6	1.0	19.5
Queue Length 95th (m)	7.7	70.6	9.1	46.8	15.3	9.4	3.9	32.1
Internal Link Dist (m)		96.6		108.8		132.2		99.0
Turn Bay Length (m)	15.0		30.0		15.0		30.0	
Base Capacity (vph)	375	593	315	615	588	1655	719	1450
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.53	0.12	0.33	0.15	0.07	0.02	0.23

Intersection Summary

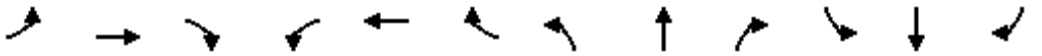


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	29	238	74	37	181	25	88	64	48	13	321	19
Future Volume (vph)	29	238	74	37	181	25	88	64	48	13	321	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.96		1.00	0.98		1.00	0.94		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1615	1757		1825	1761		1807	3358		1825	3607	
Flt Permitted	0.61	1.00		0.32	1.00		0.49	1.00		0.68	1.00	
Satd. Flow (perm)	1033	1757		624	1761		927	3358		1309	3607	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	29	238	74	37	181	25	88	64	48	13	321	19
RTOR Reduction (vph)	0	13	0	0	6	0	0	26	0	0	4	0
Lane Group Flow (vph)	29	299	0	37	200	0	88	86	0	13	336	0
Heavy Vehicles (%)	13%	5%	7%	0%	6%	15%	1%	3%	0%	0%	0%	6%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	20.6	18.2		23.2	19.5		41.8	36.6		33.7	32.5	
Effective Green, g (s)	20.6	18.2		23.2	19.5		41.8	36.6		33.7	32.5	
Actuated g/C Ratio	0.26	0.23		0.29	0.24		0.52	0.45		0.42	0.40	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	280	396		234	425		537	1522		554	1452	
v/s Ratio Prot	0.00	c0.17		c0.01	0.11		c0.01	0.03		0.00	c0.09	
v/s Ratio Perm	0.02			0.04			0.07			0.01		
v/c Ratio	0.10	0.75		0.16	0.47		0.16	0.06		0.02	0.23	
Uniform Delay, d1	22.8	29.2		21.4	26.2		10.0	12.4		13.8	15.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	8.0		0.3	0.8		0.1	0.1		0.0	0.4	
Delay (s)	23.0	37.1		21.7	27.0		10.1	12.4		13.8	16.2	
Level of Service	C	D		C	C		B	B		B	B	
Approach Delay (s)		35.9			26.2			11.4			16.2	
Approach LOS		D			C			B			B	

Intersection Summary			
HCM 2000 Control Delay	23.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	80.7	Sum of lost time (s)	21.0
Intersection Capacity Utilization	66.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	72	491	235	185	118	12	90	41	23	162	10
v/c Ratio	0.22	0.50	0.51	0.21	0.15	0.03	0.08	0.07	0.04	0.13	0.02
Control Delay	28.2	28.3	17.1	14.4	2.7	22.2	22.5	0.2	18.6	20.5	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.2	28.3	17.1	14.4	2.7	22.2	22.5	0.2	18.6	20.5	0.0
Queue Length 50th (m)	8.0	30.8	18.5	14.8	0.0	1.1	4.6	0.0	1.6	8.5	0.0
Queue Length 95th (m)	22.7	57.7	39.8	32.7	7.4	5.7	12.5	0.0	8.7	20.0	0.0
Internal Link Dist (m)		490.6		187.5			209.7			310.1	
Turn Bay Length (m)	100.0		125.0		50.0	50.0		30.0	50.0		30.0
Base Capacity (vph)	480	1411	565	1264	1113	415	1139	596	582	1220	616
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.35	0.42	0.15	0.11	0.03	0.08	0.07	0.04	0.13	0.02

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	72	447	44	235	185	118	12	90	41	23	162	10
Future Volume (vph)	72	447	44	235	185	118	12	90	41	23	162	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Total Lost time (s)	6.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1716	3386		1716	1807	1536	1716	3433	1536	1716	3433	1536
Flt Permitted	0.64	1.00		0.33	1.00	1.00	0.55	1.00	1.00	0.70	1.00	1.00
Satd. Flow (perm)	1158	3386		593	1807	1536	1000	3433	1536	1257	3433	1536
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	72	447	44	235	185	118	12	90	41	23	162	10
RTOR Reduction (vph)	0	7	0	0	0	63	0	0	28	0	0	7
Lane Group Flow (vph)	72	484	0	235	185	55	12	90	13	23	162	3
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
Turn Type	Perm	NA		pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		2		1	6		3	8		7	4	
Permitted Phases	2			6		6	8		8	4		4
Actuated Green, G (s)	24.5	24.5		40.9	40.9	40.9	28.3	28.3	28.3	32.3	30.3	30.3
Effective Green, g (s)	24.5	24.5		40.9	40.9	40.9	28.3	28.3	28.3	32.3	30.3	30.3
Actuated g/C Ratio	0.28	0.28		0.46	0.46	0.46	0.32	0.32	0.32	0.37	0.34	0.34
Clearance Time (s)	6.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	320	938		431	836	710	329	1099	491	475	1176	526
v/s Ratio Prot		0.14		c0.08	0.10		0.00	c0.03		0.00	c0.05	
v/s Ratio Perm	0.06			c0.18		0.04	0.01		0.01	0.02		0.00
v/c Ratio	0.23	0.52		0.55	0.22	0.08	0.04	0.08	0.03	0.05	0.14	0.01
Uniform Delay, d1	24.6	26.9		15.4	14.2	13.2	20.7	21.0	20.6	18.1	20.0	19.1
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.5		1.4	0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.0
Delay (s)	25.0	27.4		16.8	14.4	13.3	20.7	21.1	20.7	18.2	20.1	19.1
Level of Service	C	C		B	B	B	C	C	C	B	C	B
Approach Delay (s)		27.1			15.2			21.0			19.8	
Approach LOS		C			B			C			B	

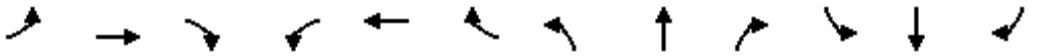
Intersection Summary			
HCM 2000 Control Delay	21.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	88.4	Sum of lost time (s)	20.0
Intersection Capacity Utilization	65.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	285	198	209	194	264	84	930	39	194	1173	695
v/c Ratio	0.60	0.33	0.46	0.37	0.58	0.40	0.80	0.06	0.45	0.91	0.72
Control Delay	24.5	15.7	21.3	32.4	9.8	38.0	30.9	0.2	35.3	37.6	8.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.5	15.7	21.3	32.4	9.8	38.0	30.9	0.2	35.3	37.6	8.8
Queue Length 50th (m)	30.3	6.0	21.2	13.7	0.0	11.5	63.4	0.0	13.6	86.7	8.4
Queue Length 95th (m)	51.8	15.2	38.2	23.7	19.0	25.2	#105.3	0.0	24.2	#150.5	49.6
Internal Link Dist (m)		68.1		189.6			145.5			135.2	
Turn Bay Length (m)	20.0		30.0			45.0			80.0		80.0
Base Capacity (vph)	488	1413	484	1513	825	280	1168	601	550	1296	970
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.58	0.14	0.43	0.13	0.32	0.30	0.80	0.06	0.35	0.91	0.72

Intersection Summary

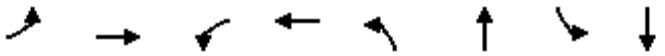
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	285	87	111	209	194	264	84	930	39	194	1173	695
Future Volume (vph)	285	87	111	209	194	264	84	930	39	194	1173	695
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.92		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1825	3252		1807	3650	1617	1800	3607	1610	3541	3607	1610
Flt Permitted	0.59	1.00		0.63	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1129	3252		1193	3650	1617	1800	3607	1610	3541	3607	1610
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	285	87	111	209	194	264	84	930	39	194	1173	695
RTOR Reduction (vph)	0	94	0	0	0	226	0	0	26	0	0	394
Lane Group Flow (vph)	285	104	0	209	194	38	84	930	13	194	1173	301
Heavy Vehicles (%)	0%	0%	5%	1%	0%	1%	1%	1%	1%	0%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	1	1	1	0	1	1
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8			2			6
Actuated Green, G (s)	23.6	12.0		22.0	11.2	11.2	7.6	25.9	25.9	9.5	27.8	27.8
Effective Green, g (s)	23.6	12.0		22.0	11.2	11.2	7.6	25.9	25.9	9.5	27.8	27.8
Actuated g/C Ratio	0.30	0.15		0.28	0.14	0.14	0.10	0.33	0.33	0.12	0.36	0.36
Clearance Time (s)	4.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	443	499		420	522	231	174	1194	533	430	1282	572
v/s Ratio Prot	c0.10	0.03		0.07	0.05		0.05	0.26		c0.05	c0.33	
v/s Ratio Perm	c0.10			0.07		0.02			0.01			0.19
v/c Ratio	0.64	0.21		0.50	0.37	0.16	0.48	0.78	0.02	0.45	0.91	0.53
Uniform Delay, d1	22.6	28.9		22.8	30.3	29.4	33.4	23.6	17.6	31.9	24.1	20.0
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.2	0.2		0.9	0.4	0.3	2.1	5.1	0.1	0.8	11.6	3.4
Delay (s)	25.8	29.2		23.8	30.8	29.7	35.5	28.6	17.7	32.7	35.7	23.4
Level of Service	C	C		C	C	C	D	C	B	C	D	C
Approach Delay (s)		27.2			28.2			28.8			31.3	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	29.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	78.2	Sum of lost time (s)	20.0
Intersection Capacity Utilization	79.0%	ICU Level of Service	D
Analysis Period (min)	15		

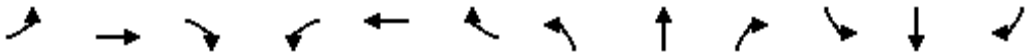
c Critical Lane Group



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	35	405	87	299	232	767	21	117
v/c Ratio	0.10	0.86	0.34	0.57	0.37	0.51	0.05	0.10
Control Delay	16.0	45.2	19.6	30.9	15.0	20.6	12.0	15.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.0	45.2	19.6	30.9	15.0	20.6	12.0	15.8
Queue Length 50th (m)	3.4	56.7	8.7	42.9	22.0	44.5	1.8	5.3
Queue Length 95th (m)	8.7	#101.1	17.5	68.2	36.3	75.4	5.3	11.1
Internal Link Dist (m)		96.6		108.8		132.2		99.0
Turn Bay Length (m)	15.0		30.0		15.0		30.0	
Base Capacity (vph)	355	542	258	581	630	1512	399	1214
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.75	0.34	0.51	0.37	0.51	0.05	0.10

Intersection Summary

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

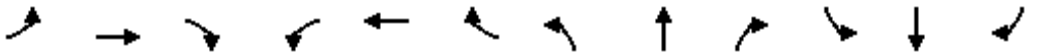


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	224	181	87	276	23	232	654	113	21	88	29
Future Volume (vph)	35	224	181	87	276	23	232	654	113	21	88	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.93		1.00	0.99		1.00	0.98		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1755	1744		1825	1866		1789	3423		1825	3379	
Flt Permitted	0.43	1.00		0.20	1.00		0.60	1.00		0.33	1.00	
Satd. Flow (perm)	801	1744		387	1866		1134	3423		624	3379	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	35	224	181	87	276	23	232	654	113	21	88	29
RTOR Reduction (vph)	0	34	0	0	4	0	0	14	0	0	18	0
Lane Group Flow (vph)	35	371	0	87	295	0	232	753	0	21	99	0
Heavy Vehicles (%)	4%	1%	5%	0%	1%	11%	2%	5%	0%	0%	4%	4%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	25.8	21.8		28.4	23.1		42.9	36.3		34.4	31.8	
Effective Green, g (s)	25.8	21.8		28.4	23.1		42.9	36.3		34.4	31.8	
Actuated g/C Ratio	0.30	0.25		0.33	0.27		0.49	0.42		0.40	0.37	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	281	437		213	495		612	1428		282	1235	
v/s Ratio Prot	0.01	c0.21		c0.02	0.16		c0.03	c0.22		0.00	0.03	
v/s Ratio Perm	0.03			0.11			0.16			0.03		
v/c Ratio	0.12	0.85		0.41	0.60		0.38	0.53		0.07	0.08	
Uniform Delay, d1	22.1	31.0		22.0	27.9		13.0	18.9		16.1	18.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	14.3		1.3	1.9		0.4	1.4		0.1	0.1	
Delay (s)	22.3	45.3		23.3	29.8		13.3	20.3		16.3	18.2	
Level of Service	C	D		C	C		B	C		B	B	
Approach Delay (s)		43.5			28.3			18.7			17.9	
Approach LOS		D			C			B			B	

Intersection Summary			
HCM 2000 Control Delay	26.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	87.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	64.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	43	537	178	392	227	109	500	216	63	48	98
v/c Ratio	0.17	0.59	0.47	0.50	0.29	0.24	0.42	0.33	0.17	0.04	0.17
Control Delay	30.3	33.5	20.4	22.3	3.3	23.4	25.8	7.0	25.7	24.0	5.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.3	33.5	20.4	22.3	3.3	23.4	25.8	7.0	25.7	24.0	5.2
Queue Length 50th (m)	6.2	45.4	19.7	51.9	0.0	13.4	36.7	3.4	7.8	3.1	0.0
Queue Length 95th (m)	15.3	64.7	33.0	76.9	12.4	27.7	56.0	20.0	18.3	7.7	9.7
Internal Link Dist (m)		490.6		187.5			209.7			310.1	
Turn Bay Length (m)	100.0		125.0		50.0	50.0		30.0	50.0		30.0
Base Capacity (vph)	352	1259	426	1037	978	465	1189	655	417	1189	603
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.12	0.43	0.42	0.38	0.23	0.23	0.42	0.33	0.15	0.04	0.16

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	43	519	18	178	392	227	109	500	216	63	48	98
Future Volume (vph)	43	519	18	178	392	227	109	500	216	63	48	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Total Lost time (s)	6.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1716	3415		1716	1807	1536	1716	3433	1536	1716	3433	1536
Flt Permitted	0.53	1.00		0.28	1.00	1.00	0.61	1.00	1.00	0.47	1.00	1.00
Satd. Flow (perm)	958	3415		509	1807	1536	1102	3433	1536	847	3433	1536
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	43	519	18	178	392	227	109	500	216	63	48	98
RTOR Reduction (vph)	0	2	0	0	0	130	0	0	123	0	0	66
Lane Group Flow (vph)	43	535	0	178	392	97	109	500	93	63	48	32
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
Turn Type	Perm	NA		pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		2		1	6		3	8		7	4	
Permitted Phases	2			6		6	8		8	4		4
Actuated Green, G (s)	24.8	24.8		40.2	40.2	40.2	32.2	32.2	32.2	32.8	30.8	30.8
Effective Green, g (s)	24.8	24.8		40.2	40.2	40.2	32.2	32.2	32.2	32.8	30.8	30.8
Actuated g/C Ratio	0.26	0.26		0.43	0.43	0.43	0.34	0.34	0.34	0.35	0.33	0.33
Clearance Time (s)	6.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	253	902		364	774	658	422	1178	527	346	1127	504
v/s Ratio Prot		c0.16		0.06	c0.22		0.02	c0.15		c0.01	0.01	
v/s Ratio Perm	0.04			0.15		0.06	0.07		0.06	0.05		0.02
v/c Ratio	0.17	0.59		0.49	0.51	0.15	0.26	0.42	0.18	0.18	0.04	0.06
Uniform Delay, d1	26.6	30.1		17.9	19.6	16.4	21.7	23.7	21.5	21.4	21.5	21.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	1.1		1.0	0.5	0.1	0.3	1.1	0.7	0.3	0.0	0.1
Delay (s)	26.9	31.1		18.9	20.1	16.5	22.0	24.8	22.3	21.7	21.5	21.7
Level of Service	C	C		B	C	B	C	C	C	C	C	C
Approach Delay (s)		30.8			18.8			23.8			21.6	
Approach LOS		C			B			C			C	

Intersection Summary			
HCM 2000 Control Delay	23.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	93.8	Sum of lost time (s)	20.0
Intersection Capacity Utilization	78.6%	ICU Level of Service	D
Analysis Period (min)	15		

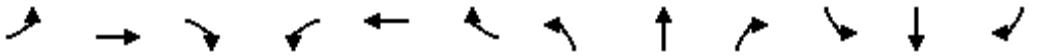
c Critical Lane Group

Ainley's forecast from the Bryne Drive Phase 1 & 2 Class EA Study

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	228	352	256	237	324	84	930	99	304	1173	695
v/c Ratio	0.61	0.57	0.81	0.40	0.68	0.49	0.66	0.14	0.71	0.73	0.70
Control Delay	30.5	28.0	44.8	32.6	15.6	47.3	24.2	3.3	45.9	24.2	10.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.5	28.0	44.8	32.6	15.6	47.3	24.2	3.3	45.9	24.2	10.7
Queue Length 50th (m)	27.5	20.8	31.5	17.7	9.3	12.4	59.6	0.0	23.4	78.7	20.1
Queue Length 95th (m)	45.2	33.2	#54.2	27.7	33.3	#28.7	94.3	7.2	#45.1	#126.2	74.2
Internal Link Dist (m)		68.1		189.6			145.5			135.2	
Turn Bay Length (m)	20.0		30.0			45.0			80.0		80.0
Base Capacity (vph)	371	1377	316	1417	785	174	1401	697	429	1598	987
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.61	0.26	0.81	0.17	0.41	0.48	0.66	0.14	0.71	0.73	0.70

Intersection Summary

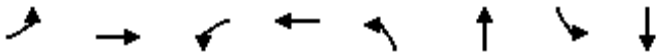
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	228	241	111	256	237	324	84	930	99	304	1173	695
Future Volume (vph)	228	241	111	256	237	324	84	930	99	304	1173	695
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1825	3423		1807	3650	1617	1800	3607	1610	3541	3607	1610
Flt Permitted	0.60	1.00		0.46	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1161	3423		874	3650	1617	1800	3607	1610	3541	3607	1610
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	228	241	111	256	237	324	84	930	99	304	1173	695
RTOR Reduction (vph)	0	65	0	0	0	216	0	0	60	0	0	276
Lane Group Flow (vph)	228	287	0	256	237	108	84	930	39	304	1173	419
Heavy Vehicles (%)	0%	0%	5%	1%	0%	1%	1%	1%	1%	0%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	1	1	1	0	1	1
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8			2			6
Actuated Green, G (s)	20.4	13.4		20.4	13.4	13.4	6.3	32.9	32.9	10.0	36.6	36.6
Effective Green, g (s)	20.4	13.4		20.4	13.4	13.4	6.3	32.9	32.9	10.0	36.6	36.6
Actuated g/C Ratio	0.24	0.16		0.24	0.16	0.16	0.08	0.39	0.39	0.12	0.44	0.44
Clearance Time (s)	4.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	340	550		292	587	260	136	1424	635	425	1584	707
v/s Ratio Prot	0.06	0.08		c0.07	0.06		0.05	0.26		c0.09	c0.33	
v/s Ratio Perm	0.11			c0.14		0.07			0.02			0.26
v/c Ratio	0.67	0.52		0.88	0.40	0.42	0.62	0.65	0.06	0.72	0.74	0.59
Uniform Delay, d1	27.3	32.0		28.8	31.4	31.4	37.3	20.5	15.6	35.3	19.4	17.7
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.1	0.9		24.2	0.5	1.1	8.1	2.3	0.2	5.6	3.2	3.6
Delay (s)	32.4	32.9		53.0	31.8	32.5	45.4	22.9	15.8	40.9	22.6	21.3
Level of Service	C	C		D	C	C	D	C	B	D	C	C
Approach Delay (s)		32.7			38.7			24.0			24.7	
Approach LOS		C			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	28.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	83.3	Sum of lost time (s)	20.0
Intersection Capacity Utilization	79.3%	ICU Level of Service	D
Analysis Period (min)	15		

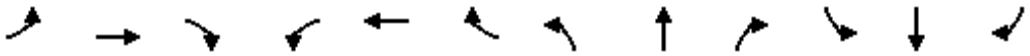
c Critical Lane Group



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	35	405	87	299	232	907	21	417
v/c Ratio	0.10	0.89	0.36	0.59	0.44	0.58	0.06	0.33
Control Delay	17.2	51.0	21.4	33.0	14.9	21.1	11.2	21.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.2	51.0	21.4	33.0	14.9	21.1	11.2	21.2
Queue Length 50th (m)	3.5	58.8	9.1	44.3	20.9	53.4	1.7	26.7
Queue Length 95th (m)	9.1	#108.3	18.3	70.6	34.4	90.1	5.0	38.5
Internal Link Dist (m)		96.6		108.8		132.2		99.0
Turn Bay Length (m)	15.0		30.0		15.0		30.0	
Base Capacity (vph)	339	491	240	540	528	1560	348	1252
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.82	0.36	0.55	0.44	0.58	0.06	0.33

Intersection Summary

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



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	224	181	87	276	23	232	794	113	21	388	29
Future Volume (vph)	35	224	181	87	276	23	232	794	113	21	388	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.93		1.00	0.99		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1755	1744		1825	1866		1789	3432		1825	3473	
Flt Permitted	0.42	1.00		0.18	1.00		0.44	1.00		0.26	1.00	
Satd. Flow (perm)	780	1744		343	1866		834	3432		496	3473	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	35	224	181	87	276	23	232	794	113	21	388	29
RTOR Reduction (vph)	0	33	0	0	4	0	0	11	0	0	6	0
Lane Group Flow (vph)	35	372	0	87	295	0	232	896	0	21	411	0
Heavy Vehicles (%)	4%	1%	5%	0%	1%	11%	2%	5%	0%	0%	4%	4%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	25.2	21.2		28.0	22.6		44.8	38.1		35.5	32.8	
Effective Green, g (s)	25.2	21.2		28.0	22.6		44.8	38.1		35.5	32.8	
Actuated g/C Ratio	0.29	0.24		0.32	0.26		0.51	0.43		0.40	0.37	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	266	418		199	477		509	1479		239	1288	
v/s Ratio Prot	0.01	c0.21		c0.03	0.16		c0.04	c0.26		0.00	0.12	
v/s Ratio Perm	0.03			0.11			0.19			0.03		
v/c Ratio	0.13	0.89		0.44	0.62		0.46	0.61		0.09	0.32	
Uniform Delay, d1	23.2	32.5		23.0	29.1		12.5	19.4		16.2	19.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	19.9		1.5	2.4		0.6	1.8		0.2	0.7	
Delay (s)	23.5	52.4		24.6	31.5		13.2	21.2		16.4	20.5	
Level of Service	C	D		C	C		B	C		B	C	
Approach Delay (s)		50.1			29.9			19.6			20.3	
Approach LOS		D			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	27.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	88.4	Sum of lost time (s)	21.0
Intersection Capacity Utilization	79.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Queues
Bryne Drive & Harvie Road

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	33	311	220	474	437	80	533	458	488	293	97
v/c Ratio	0.39	0.57	0.69	0.82	0.55	0.17	0.42	0.55	0.77	0.15	0.10
Control Delay	54.8	40.9	41.2	47.0	5.6	13.9	29.5	8.7	20.6	12.9	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	54.8	40.9	41.2	47.0	5.6	13.9	29.5	8.7	20.6	12.9	3.1
Queue Length 50th (m)	6.3	28.1	36.0	90.9	0.0	6.6	45.4	8.7	53.2	16.4	0.0
Queue Length 95th (m)	16.2	42.0	56.8	129.8	21.4	13.0	71.1	42.7	79.4	24.1	7.7
Internal Link Dist (m)		713.5		197.8			85.7			44.6	
Turn Bay Length (m)	50.0							50.0			50.0
Base Capacity (vph)	105	662	327	655	841	472	1278	827	773	1971	925
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.31	0.47	0.67	0.72	0.52	0.17	0.42	0.55	0.63	0.15	0.10

Intersection Summary

HCM Signalized Intersection Capacity Analysis

Bryne Drive & Harvie Road

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	213	73	202	436	402	74	490	421	449	270	89
Future Volume (vph)	30	213	73	202	436	402	74	490	421	449	270	89
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.96		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1789	3442		1789	1883	1601	1789	3579	1601	1789	3579	1601
Flt Permitted	0.30	1.00		0.30	1.00	1.00	0.57	1.00	1.00	0.32	1.00	1.00
Satd. Flow (perm)	574	3442		573	1883	1601	1078	3579	1601	605	3579	1601
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	232	79	220	474	437	80	533	458	488	293	97
RTOR Reduction (vph)	0	32	0	0	0	305	0	0	253	0	0	44
Lane Group Flow (vph)	33	279	0	220	474	132	80	533	205	488	293	53
Turn Type	Perm	NA		pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4			8		8	2		2	6		6
Actuated Green, G (s)	15.5	15.5		31.8	31.8	31.8	42.1	38.2	38.2	65.3	57.4	57.4
Effective Green, g (s)	15.5	15.5		31.8	31.8	31.8	42.1	38.2	38.2	65.3	57.4	57.4
Actuated g/C Ratio	0.15	0.15		0.30	0.30	0.30	0.40	0.36	0.36	0.62	0.55	0.55
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	84	507		315	569	484	458	1300	581	636	1954	874
v/s Ratio Prot		0.08		0.08	c0.25		0.01	0.15		c0.17	0.08	
v/s Ratio Perm	0.06			0.13		0.08	0.06		0.13	c0.31		0.03
v/c Ratio	0.39	0.55		0.70	0.83	0.27	0.17	0.41	0.35	0.77	0.15	0.06
Uniform Delay, d1	40.5	41.6		29.6	34.2	27.9	19.8	25.0	24.4	12.1	11.8	11.2
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.0	1.3		6.6	10.1	0.3	0.2	1.0	1.7	5.5	0.2	0.1
Delay (s)	43.6	42.9		36.2	44.3	28.2	19.9	26.0	26.1	17.6	12.0	11.3
Level of Service	D	D		D	D	C	B	C	C	B	B	B
Approach Delay (s)		42.9			36.5			25.6			15.0	
Approach LOS		D			D			C			B	

Intersection Summary			
HCM 2000 Control Delay	28.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	105.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Appendix E

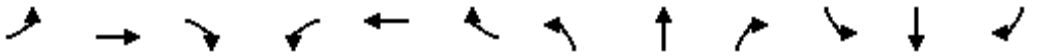
Synchro Results - 2031 Analysis

Morrison Hershfield's Traffic Forecast from the Harvie Road / Big Bay Point Road / Highway 400 Crossing Phase 3 & 4 Class EA Study

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	598	259	75	58	214	119	1165	55	140	742	493
v/c Ratio	0.99	0.33	0.21	0.13	0.55	0.52	0.95	0.09	0.37	0.59	0.56
Control Delay	57.6	22.4	18.7	30.8	10.8	40.0	43.4	0.3	35.1	24.3	5.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.6	22.4	18.7	30.8	10.8	40.0	43.4	0.3	35.1	24.3	5.0
Queue Length 50th (m)	77.2	13.2	7.2	4.0	0.0	16.5	85.5	0.0	10.0	48.5	0.0
Queue Length 95th (m)	#154.9	24.7	15.9	9.2	17.8	32.6	#137.9	0.3	18.3	70.9	20.0
Internal Link Dist (m)		68.1		189.6			145.5			135.2	
Turn Bay Length (m)	20.0		30.0			45.0			80.0		80.0
Base Capacity (vph)	607	1439	455	1423	756	274	1221	635	527	1249	883
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.99	0.18	0.16	0.04	0.28	0.43	0.95	0.09	0.27	0.59	0.56

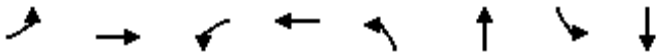
Intersection Summary

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



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	598	185	74	75	58	214	119	1165	55	140	742	493
Future Volume (vph)	598	185	74	75	58	214	119	1165	55	140	742	493
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	1.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.96		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1772	3397		1789	3444	1526	1772	3579	1633	3404	3544	1601
Flt Permitted	0.67	1.00		0.59	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1250	3397		1114	3444	1526	1772	3579	1633	3404	3544	1601
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	598	185	74	75	58	214	119	1165	55	140	742	493
RTOR Reduction (vph)	0	49	0	0	0	183	0	0	36	0	0	323
Lane Group Flow (vph)	598	210	0	75	58	31	119	1165	19	140	742	170
Heavy Vehicles (%)	3%	2%	5%	2%	6%	7%	3%	2%	0%	4%	3%	2%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8			2			6
Actuated Green, G (s)	27.3	16.8		17.8	11.3	11.3	8.6	27.3	27.3	8.6	27.3	27.3
Effective Green, g (s)	30.3	16.8		17.8	11.3	11.3	8.6	27.3	27.3	8.6	27.3	27.3
Actuated g/C Ratio	0.38	0.21		0.22	0.14	0.14	0.11	0.34	0.34	0.11	0.34	0.34
Clearance Time (s)	4.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	577	720		305	491	217	192	1233	562	369	1221	551
v/s Ratio Prot	c0.20	0.06		0.02	0.02		c0.07	c0.33		0.04	0.21	
v/s Ratio Perm	0.20			0.03		0.02			0.01			0.11
v/c Ratio	1.04	0.29		0.25	0.12	0.14	0.62	0.94	0.03	0.38	0.61	0.31
Uniform Delay, d1	23.3	26.2		24.8	29.6	29.7	33.7	25.2	17.2	32.8	21.5	19.0
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	47.2	0.2		0.4	0.1	0.3	5.9	15.4	0.1	0.7	2.3	1.5
Delay (s)	70.5	26.4		25.3	29.7	30.0	39.6	40.6	17.3	33.5	23.8	20.5
Level of Service	E	C		C	C	C	D	D	B	C	C	C
Approach Delay (s)		57.2			28.9			39.6			23.6	
Approach LOS		E			C			D			C	

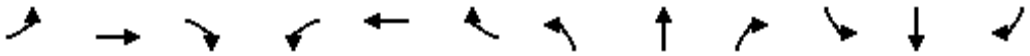
Intersection Summary			
HCM 2000 Control Delay	36.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	79.2	Sum of lost time (s)	20.0
Intersection Capacity Utilization	96.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	36	380	45	250	107	212	16	412
v/c Ratio	0.10	0.82	0.16	0.54	0.20	0.13	0.02	0.29
Control Delay	16.3	42.7	17.0	30.3	12.5	11.4	11.8	19.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.3	42.7	17.0	30.3	12.5	11.4	11.8	19.8
Queue Length 50th (m)	3.5	56.5	4.4	34.4	9.3	7.4	1.3	26.6
Queue Length 95th (m)	9.0	#97.9	10.5	56.8	17.9	17.3	4.4	38.6
Internal Link Dist (m)		96.6		108.8		132.2		99.0
Turn Bay Length (m)	15.0		30.0		15.0		30.0	
Base Capacity (vph)	346	574	284	570	541	1635	647	1401
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.66	0.16	0.44	0.20	0.13	0.02	0.29

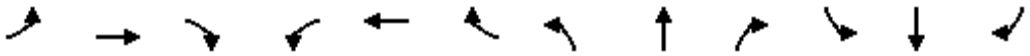
Intersection Summary

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



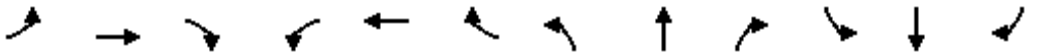
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	36	290	90	45	220	30	107	154	58	16	388	24
Future Volume (vph)	36	290	90	45	220	30	107	154	58	16	388	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.96		1.00	0.98		1.00	0.96		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1615	1757		1825	1762		1807	3426		1825	3606	
Flt Permitted	0.48	1.00		0.25	1.00		0.45	1.00		0.62	1.00	
Satd. Flow (perm)	819	1757		480	1762		864	3426		1189	3606	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	36	290	90	45	220	30	107	154	58	16	388	24
RTOR Reduction (vph)	0	13	0	0	6	0	0	32	0	0	5	0
Lane Group Flow (vph)	36	367	0	45	244	0	107	180	0	16	407	0
Heavy Vehicles (%)	13%	5%	7%	0%	6%	15%	1%	3%	0%	0%	0%	6%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	23.7	20.0		23.7	20.0		41.6	36.4		33.6	32.4	
Effective Green, g (s)	23.7	20.0		23.7	20.0		41.6	36.4		33.6	32.4	
Actuated g/C Ratio	0.29	0.24		0.29	0.24		0.51	0.44		0.41	0.39	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	271	426		198	428		496	1515		494	1419	
v/s Ratio Prot	0.01	c0.21		c0.01	0.14		c0.01	0.05		0.00	c0.11	
v/s Ratio Perm	0.03			0.05			0.10			0.01		
v/c Ratio	0.13	0.86		0.23	0.57		0.22	0.12		0.03	0.29	
Uniform Delay, d1	21.4	29.8		22.1	27.4		10.8	13.5		14.5	17.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	16.2		0.6	1.7		0.2	0.2		0.0	0.5	
Delay (s)	21.7	46.0		22.7	29.1		11.0	13.7		14.6	17.6	
Level of Service	C	D		C	C		B	B		B	B	
Approach Delay (s)		43.9			28.1			12.8			17.5	
Approach LOS		D			C			B			B	

Intersection Summary			
HCM 2000 Control Delay	26.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	82.3	Sum of lost time (s)	21.0
Intersection Capacity Utilization	70.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	97	734	59	235	653	166	16	121	143	54	218	14
v/c Ratio	0.44	0.70	0.10	0.65	0.39	0.20	0.05	0.12	0.26	0.11	0.19	0.02
Control Delay	34.9	33.6	0.3	22.9	16.1	2.7	27.2	27.7	6.8	25.7	25.2	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.9	33.6	0.3	22.9	16.1	2.7	27.2	27.7	6.8	25.7	25.2	0.1
Queue Length 50th (m)	14.4	63.4	0.0	24.2	39.4	0.0	2.0	8.4	0.0	5.6	12.7	0.0
Queue Length 95th (m)	31.0	87.6	0.0	38.8	51.5	9.2	7.8	18.1	14.8	18.6	29.8	0.0
Internal Link Dist (m)		490.6			187.5			209.7			310.1	
Turn Bay Length (m)	100.0		100.0	125.0		50.0	50.0		30.0	50.0		30.0
Base Capacity (vph)	302	1420	734	439	2241	1060	354	1008	552	503	1174	596
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.52	0.08	0.54	0.29	0.16	0.05	0.12	0.26	0.11	0.19	0.02

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	97	734	59	235	653	166	16	121	143	54	218	14
Future Volume (vph)	97	734	59	235	653	166	16	121	143	54	218	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Total Lost time (s)	6.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1716	3433	1536	1716	3433	1536	1716	3433	1536	1716	3433	1536
Flt Permitted	0.40	1.00	1.00	0.18	1.00	1.00	0.52	1.00	1.00	0.68	1.00	1.00
Satd. Flow (perm)	729	3433	1536	333	3433	1536	933	3433	1536	1220	3433	1536
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	97	734	59	235	653	166	16	121	143	54	218	14
RTOR Reduction (vph)	0	0	41	0	0	88	0	0	102	0	0	9
Lane Group Flow (vph)	97	734	18	235	653	78	16	121	41	54	218	5
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8		8	4		4
Actuated Green, G (s)	28.4	28.4	28.4	45.2	45.2	45.2	27.4	27.4	27.4	33.9	31.9	31.9
Effective Green, g (s)	28.4	28.4	28.4	45.2	45.2	45.2	27.4	27.4	27.4	33.9	31.9	31.9
Actuated g/C Ratio	0.30	0.30	0.30	0.47	0.47	0.47	0.29	0.29	0.29	0.35	0.33	0.33
Clearance Time (s)	6.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	216	1019	456	342	1623	726	287	983	440	468	1145	512
v/s Ratio Prot		0.21		c0.09	0.19		0.00	c0.04		0.01	c0.06	
v/s Ratio Perm	0.13		0.01	c0.23		0.05	0.01		0.03	0.03		0.00
v/c Ratio	0.45	0.72	0.04	0.69	0.40	0.11	0.06	0.12	0.09	0.12	0.19	0.01
Uniform Delay, d1	27.3	30.0	23.9	17.5	16.4	14.0	24.6	25.2	25.0	20.8	22.7	21.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.5	2.5	0.0	5.6	0.2	0.1	0.1	0.3	0.4	0.1	0.1	0.0
Delay (s)	28.7	32.6	23.9	23.2	16.6	14.1	24.7	25.5	25.4	20.9	22.7	21.3
Level of Service	C	C	C	C	B	B	C	C	C	C	C	C
Approach Delay (s)		31.6			17.7			25.4			22.3	
Approach LOS		C			B			C			C	

Intersection Summary			
HCM 2000 Control Delay	24.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	95.6	Sum of lost time (s)	20.0
Intersection Capacity Utilization	72.5%	ICU Level of Service	C
Analysis Period (min)	15		

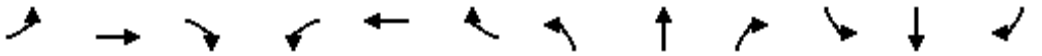
c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	347	270	229	212	289	103	1133	120	230	1430	847
v/c Ratio	0.72	0.43	0.51	0.40	0.60	0.47	0.95	0.20	0.51	1.01	0.90
Control Delay	30.0	17.4	22.6	33.0	9.8	39.8	44.1	5.6	36.4	54.4	23.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.0	17.4	22.6	33.0	9.8	39.8	44.1	5.6	36.4	54.4	23.9
Queue Length 50th (m)	39.2	9.5	24.0	15.3	0.0	14.4	84.6	0.1	16.5	~127.2	41.6
Queue Length 95th (m)	#65.5	20.2	41.7	25.5	19.8	29.9	#140.7	11.4	28.3	#187.8	#134.3
Internal Link Dist (m)		68.1		189.6			145.5			135.2	
Turn Bay Length (m)	20.0		30.0			45.0			80.0		80.0
Base Capacity (vph)	481	1421	467	1487	830	274	1193	593	541	1414	939
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.72	0.19	0.49	0.14	0.35	0.38	0.95	0.20	0.43	1.01	0.90

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

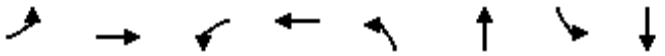
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	347	134	136	229	212	289	103	1133	120	230	1430	847
Future Volume (vph)	347	134	136	229	212	289	103	1133	120	230	1430	847
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0	6.0	4.0	5.0	6.0	4.0	3.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.92		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1825	3291		1807	3650	1617	1800	3607	1610	3541	3607	1610
Flt Permitted	0.57	1.00		0.59	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1103	3291		1114	3650	1617	1800	3607	1610	3541	3607	1610
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	347	134	136	229	212	289	103	1133	120	230	1430	847
RTOR Reduction (vph)	0	115	0	0	0	247	0	0	80	0	0	372
Lane Group Flow (vph)	347	155	0	229	212	42	103	1133	40	230	1430	475
Heavy Vehicles (%)	0%	0%	5%	1%	0%	1%	1%	1%	1%	0%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	1	1	1	0	1	1
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8			2			6
Actuated Green, G (s)	24.4	12.4		22.6	11.5	11.5	8.1	25.8	25.8	10.1	27.8	27.8
Effective Green, g (s)	24.4	12.4		22.6	11.5	11.5	8.1	26.8	25.8	10.1	30.8	27.8
Actuated g/C Ratio	0.31	0.16		0.28	0.14	0.14	0.10	0.34	0.32	0.13	0.39	0.35
Clearance Time (s)	4.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	448	513		413	528	234	183	1217	523	450	1399	563
v/s Ratio Prot	c0.12	0.05		0.08	0.06		0.06	0.31		c0.06	c0.40	
v/s Ratio Perm	c0.12			0.08		0.03			0.02			0.29
v/c Ratio	0.77	0.30		0.55	0.40	0.18	0.56	0.93	0.08	0.51	1.02	0.84
Uniform Delay, d1	23.6	29.7		23.3	30.8	29.8	34.0	25.4	18.5	32.3	24.3	23.8
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.2	0.3		1.6	0.5	0.4	3.9	13.8	0.3	1.0	29.8	14.3
Delay (s)	31.8	30.0		24.9	31.3	30.2	37.9	39.2	18.8	33.3	54.1	38.1
Level of Service	C	C		C	C	C	D	D	B	C	D	D
Approach Delay (s)		31.0			28.8			37.3			46.8	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	39.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	79.4	Sum of lost time (s)	19.0
Intersection Capacity Utilization	87.9%	ICU Level of Service	E
Analysis Period (min)	15		

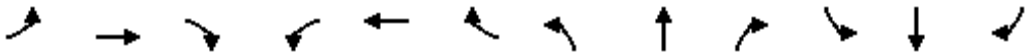
c Critical Lane Group



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	42	493	106	364	282	952	25	143
v/c Ratio	0.13	0.95	0.45	0.64	0.48	0.66	0.08	0.12
Control Delay	16.3	59.1	22.3	32.7	17.4	24.3	12.4	15.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.3	59.1	22.3	32.7	17.4	24.3	12.4	15.6
Queue Length 50th (m)	4.1	75.8	10.7	54.6	27.6	59.8	2.1	6.5
Queue Length 95th (m)	10.0	#137.0	20.5	84.8	44.2	#100.4	6.0	12.9
Internal Link Dist (m)		96.6		108.8		132.2		99.0
Turn Bay Length (m)	15.0		30.0		15.0		30.0	
Base Capacity (vph)	327	522	236	574	592	1446	301	1170
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.13	0.94	0.45	0.63	0.48	0.66	0.08	0.12

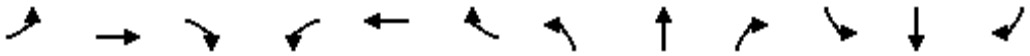
Intersection Summary

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



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	42	273	220	106	336	28	282	815	137	25	107	36
Future Volume (vph)	42	273	220	106	336	28	282	815	137	25	107	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.93		1.00	0.99		1.00	0.98		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1755	1744		1825	1866		1789	3425		1825	3377	
Flt Permitted	0.35	1.00		0.15	1.00		0.59	1.00		0.21	1.00	
Satd. Flow (perm)	645	1744		296	1866		1106	3425		405	3377	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	42	273	220	106	336	28	282	815	137	25	107	36
RTOR Reduction (vph)	0	33	0	0	4	0	0	14	0	0	23	0
Lane Group Flow (vph)	42	460	0	106	360	0	282	938	0	25	120	0
Heavy Vehicles (%)	4%	1%	5%	0%	1%	11%	2%	5%	0%	0%	4%	4%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	28.8	24.7		31.4	26.0		42.6	35.9		34.3	31.6	
Effective Green, g (s)	28.8	24.7		31.4	26.0		42.6	35.9		34.3	31.6	
Actuated g/C Ratio	0.32	0.28		0.35	0.29		0.47	0.40		0.38	0.35	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	257	480		195	540		578	1370		197	1189	
v/s Ratio Prot	0.01	c0.26		c0.03	0.19		c0.04	c0.27		0.00	0.04	
v/s Ratio Perm	0.04			0.16			0.19			0.04		
v/c Ratio	0.16	0.96		0.54	0.67		0.49	0.68		0.13	0.10	
Uniform Delay, d1	21.6	32.0		22.5	28.0		15.4	22.2		17.9	19.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	30.5		3.1	3.1		0.7	2.8		0.3	0.2	
Delay (s)	21.9	62.5		25.6	31.2		16.1	25.0		18.2	19.7	
Level of Service	C	E		C	C		B	C		B	B	
Approach Delay (s)		59.3			29.9			23.0			19.5	
Approach LOS		E			C			C			B	

Intersection Summary			
HCM 2000 Control Delay	32.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	89.7	Sum of lost time (s)	21.0
Intersection Capacity Utilization	86.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	58	917	24	178	1144	285	109	500	401	204	65	132
v/c Ratio	0.51	0.80	0.04	0.73	0.72	0.34	0.30	0.51	0.67	0.58	0.06	0.24
Control Delay	43.7	35.7	0.1	34.7	24.2	4.5	30.7	33.5	19.9	39.8	27.0	9.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.7	35.7	0.1	34.7	24.2	4.5	30.7	33.5	19.9	39.8	27.0	9.5
Queue Length 50th (m)	9.0	84.8	0.0	19.3	91.4	4.8	15.9	43.4	27.9	30.2	4.6	3.1
Queue Length 95th (m)	23.0	107.2	0.0	#45.0	113.8	18.2	32.6	66.2	68.1	55.4	10.6	17.7
Internal Link Dist (m)		490.6			187.5			209.7			310.1	
Turn Bay Length (m)	100.0		100.0	125.0		50.0	50.0		30.0	50.0		30.0
Base Capacity (vph)	148	1493	764	246	1945	974	364	972	603	370	1077	556
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.39	0.61	0.03	0.72	0.59	0.29	0.30	0.51	0.67	0.55	0.06	0.24

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	58	917	24	178	1144	285	109	500	401	204	65	132
Future Volume (vph)	58	917	24	178	1144	285	109	500	401	204	65	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Total Lost time (s)	6.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1716	3433	1536	1716	3433	1536	1716	3433	1536	1716	3433	1536
Flt Permitted	0.19	1.00	1.00	0.13	1.00	1.00	0.58	1.00	1.00	0.47	1.00	1.00
Satd. Flow (perm)	342	3433	1536	229	3433	1536	1044	3433	1536	847	3433	1536
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	58	917	24	178	1144	285	109	500	401	204	65	132
RTOR Reduction (vph)	0	0	16	0	0	128	0	0	168	0	0	76
Lane Group Flow (vph)	58	917	8	178	1144	157	109	500	233	204	65	56
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8		8	4		4
Actuated Green, G (s)	33.4	33.4	33.4	46.2	46.2	46.2	28.2	28.2	28.2	32.2	30.2	30.2
Effective Green, g (s)	33.4	33.4	33.4	46.2	46.2	46.2	28.2	28.2	28.2	32.2	30.2	30.2
Actuated g/C Ratio	0.34	0.34	0.34	0.46	0.46	0.46	0.28	0.28	0.28	0.32	0.30	0.30
Clearance Time (s)	6.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	114	1153	516	238	1595	713	343	973	435	353	1043	466
v/s Ratio Prot		0.27		0.07	c0.33		0.02	0.15		c0.05	0.02	
v/s Ratio Perm	0.17		0.01	c0.28		0.10	0.07		c0.15	c0.13		0.04
v/c Ratio	0.51	0.80	0.02	0.75	0.72	0.22	0.32	0.51	0.54	0.58	0.06	0.12
Uniform Delay, d1	26.4	29.9	22.0	19.5	21.4	15.9	27.3	29.9	30.1	29.9	24.6	25.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.5	3.9	0.0	12.1	1.6	0.2	0.5	1.9	4.7	2.3	0.0	0.1
Delay (s)	30.0	33.8	22.0	31.6	22.9	16.0	27.9	31.8	34.8	32.2	24.6	25.1
Level of Service	C	C	C	C	C	B	C	C	C	C	C	C
Approach Delay (s)		33.3			22.7			32.5			28.6	
Approach LOS		C			C			C			C	

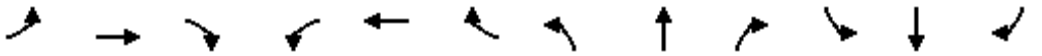
Intersection Summary			
HCM 2000 Control Delay	28.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	99.4	Sum of lost time (s)	20.0
Intersection Capacity Utilization	95.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	598	259	75	58	214	119	1165	55	140	742	493
v/c Ratio	0.87	0.31	0.22	0.12	0.59	0.61	0.90	0.08	0.47	0.61	0.57
Control Delay	46.2	20.8	18.5	30.8	15.1	49.2	35.1	0.2	40.5	24.8	5.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.2	20.8	18.5	30.8	15.1	49.2	35.1	0.2	40.5	24.8	5.0
Queue Length 50th (m)	44.9	13.0	7.3	4.1	4.5	17.3	84.5	0.0	10.5	47.9	0.0
Queue Length 95th (m)	#76.8	23.0	15.5	9.1	23.3	#39.1	#133.2	0.0	19.7	70.5	19.7
Internal Link Dist (m)		131.5		189.6			145.5			135.2	
Turn Bay Length (m)	100.0		30.0			45.0			80.0		80.0
Base Capacity (vph)	689	1611	358	1381	720	199	1300	696	298	1210	871
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.87	0.16	0.21	0.04	0.30	0.60	0.90	0.08	0.47	0.61	0.57

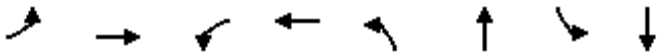
Intersection Summary

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



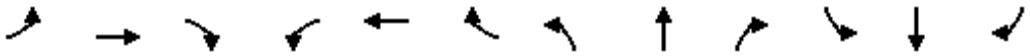
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	598	185	74	75	58	214	119	1165	55	140	742	493
Future Volume (vph)	598	185	74	75	58	214	119	1165	55	140	742	493
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	1.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Lane Util. Factor	0.97	0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.96		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3437	3397		1789	3444	1526	1772	3579	1633	3404	3544	1601
Flt Permitted	0.95	1.00		0.59	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3437	3397		1114	3444	1526	1772	3579	1633	3404	3544	1601
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	598	185	74	75	58	214	119	1165	55	140	742	493
RTOR Reduction (vph)	0	52	0	0	0	155	0	0	35	0	0	326
Lane Group Flow (vph)	598	207	0	75	58	59	119	1165	20	140	742	167
Heavy Vehicles (%)	3%	2%	5%	2%	6%	7%	3%	2%	0%	4%	3%	2%
Turn Type	Prot	NA		pm+pt	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)	13.0	18.5		17.7	11.6	11.6	8.8	29.1	29.1	7.0	27.3	27.3
Effective Green, g (s)	16.0	18.5		17.7	11.6	11.6	8.8	29.1	29.1	7.0	27.3	27.3
Actuated g/C Ratio	0.20	0.23		0.22	0.14	0.14	0.11	0.36	0.36	0.09	0.34	0.34
Clearance Time (s)	4.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	681	778		295	495	219	193	1290	588	295	1198	541
v/s Ratio Prot	c0.17	c0.06		0.02	0.02		c0.07	c0.33		0.04	0.21	
v/s Ratio Perm				0.04		0.04			0.01			0.10
v/c Ratio	0.88	0.27		0.25	0.12	0.27	0.62	0.90	0.03	0.47	0.62	0.31
Uniform Delay, d1	31.4	25.5		25.7	30.1	30.8	34.3	24.5	16.7	35.1	22.4	19.7
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	12.3	0.2		0.5	0.1	0.7	5.7	10.5	0.1	1.2	2.4	1.5
Delay (s)	43.7	25.7		26.1	30.2	31.4	40.1	34.9	16.8	36.3	24.8	21.2
Level of Service	D	C		C	C	C	D	C	B	D	C	C
Approach Delay (s)		38.3			30.1			34.7			24.7	
Approach LOS		D			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	31.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	80.7	Sum of lost time (s)	20.0
Intersection Capacity Utilization	80.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



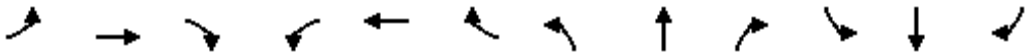
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	36	380	45	250	107	212	16	412
v/c Ratio	0.10	0.76	0.15	0.50	0.20	0.13	0.03	0.30
Control Delay	15.4	36.7	16.0	28.2	14.4	13.1	14.2	21.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.4	36.7	16.0	28.2	14.4	13.1	14.2	21.7
Queue Length 50th (m)	3.5	56.5	4.4	34.4	9.1	7.5	1.3	26.4
Queue Length 95th (m)	8.6	86.5	10.2	55.2	22.0	20.3	5.4	45.4
Internal Link Dist (m)		96.6		108.8		132.2		99.0
Turn Bay Length (m)	15.0		30.0		15.0		30.0	
Base Capacity (vph)	364	831	304	829	526	1598	631	1363
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.46	0.15	0.30	0.20	0.13	0.03	0.30

Intersection Summary



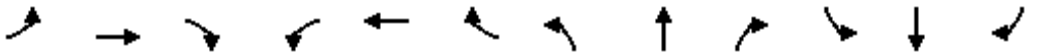
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	36	290	90	45	220	30	107	154	58	16	388	24
Future Volume (vph)	36	290	90	45	220	30	107	154	58	16	388	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.96		1.00	0.98		1.00	0.96		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1615	1757		1825	1762		1807	3426		1825	3606	
Flt Permitted	0.49	1.00		0.28	1.00		0.45	1.00		0.62	1.00	
Satd. Flow (perm)	839	1757		536	1762		860	3426		1189	3606	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	36	290	90	45	220	30	107	154	58	16	388	24
RTOR Reduction (vph)	0	13	0	0	6	0	0	31	0	0	4	0
Lane Group Flow (vph)	36	367	0	45	244	0	107	181	0	16	408	0
Heavy Vehicles (%)	13%	5%	7%	0%	6%	15%	1%	3%	0%	0%	0%	6%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	26.1	22.4		26.1	22.4		41.9	36.8		33.7	32.6	
Effective Green, g (s)	26.1	22.4		26.1	22.4		41.9	36.8		33.7	32.6	
Actuated g/C Ratio	0.31	0.26		0.31	0.26		0.49	0.43		0.40	0.38	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	291	463		220	464		482	1483		479	1383	
v/s Ratio Prot	0.01	c0.21		c0.01	0.14		c0.01	0.05		0.00	c0.11	
v/s Ratio Perm	0.03			0.05			0.10			0.01		
v/c Ratio	0.12	0.79		0.20	0.53		0.22	0.12		0.03	0.30	
Uniform Delay, d1	21.0	29.1		21.6	26.8		11.7	14.4		15.6	18.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	9.1		0.5	1.1		0.2	0.2		0.0	0.5	
Delay (s)	21.2	38.2		22.1	27.8		12.0	14.6		15.6	18.8	
Level of Service	C	D		C	C		B	B		B	B	
Approach Delay (s)		36.7			27.0			13.7			18.6	
Approach LOS		D			C			B			B	

Intersection Summary			
HCM 2000 Control Delay	24.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	70.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	97	734	59	235	653	166	16	121	143	54	218	14
v/c Ratio	0.43	0.70	0.10	0.65	0.39	0.20	0.05	0.12	0.26	0.11	0.19	0.02
Control Delay	34.0	32.7	0.3	22.5	15.8	2.7	26.8	27.4	6.8	25.4	25.0	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.0	32.7	0.3	22.5	15.8	2.7	26.8	27.4	6.8	25.4	25.0	0.1
Queue Length 50th (m)	14.1	62.2	0.0	23.6	38.5	0.0	2.0	8.3	0.0	5.5	12.6	0.0
Queue Length 95th (m)	30.2	84.8	0.0	38.2	50.6	9.2	7.7	17.6	14.6	18.2	29.0	0.0
Internal Link Dist (m)		490.6			187.5			209.7			310.1	
Turn Bay Length (m)	100.0		100.0	125.0		50.0	50.0		30.0	50.0		30.0
Base Capacity (vph)	331	1559	789	416	2319	1091	348	988	544	498	1156	589
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.47	0.07	0.56	0.28	0.15	0.05	0.12	0.26	0.11	0.19	0.02

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	97	734	59	235	653	166	16	121	143	54	218	14
Future Volume (vph)	97	734	59	235	653	166	16	121	143	54	218	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Total Lost time (s)	6.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1716	3433	1536	1716	3433	1536	1716	3433	1536	1716	3433	1536
Flt Permitted	0.40	1.00	1.00	0.19	1.00	1.00	0.51	1.00	1.00	0.68	1.00	1.00
Satd. Flow (perm)	729	3433	1536	338	3433	1536	926	3433	1536	1220	3433	1536
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	97	734	59	235	653	166	16	121	143	54	218	14
RTOR Reduction (vph)	0	0	41	0	0	87	0	0	103	0	0	9
Lane Group Flow (vph)	97	734	18	235	653	79	16	121	40	54	218	5
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8		8	4		4
Actuated Green, G (s)	28.1	28.1	28.1	44.6	44.6	44.6	26.4	26.4	26.4	32.8	30.8	30.8
Effective Green, g (s)	28.1	28.1	28.1	44.6	44.6	44.6	26.4	26.4	26.4	32.8	30.8	30.8
Actuated g/C Ratio	0.30	0.30	0.30	0.47	0.47	0.47	0.28	0.28	0.28	0.35	0.33	0.33
Clearance Time (s)	6.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	218	1027	459	343	1630	729	281	965	431	462	1126	503
v/s Ratio Prot		0.21		c0.09	0.19		0.00	c0.04		0.01	c0.06	
v/s Ratio Perm	0.13		0.01	c0.23		0.05	0.01		0.03	0.03		0.00
v/c Ratio	0.44	0.71	0.04	0.69	0.40	0.11	0.06	0.13	0.09	0.12	0.19	0.01
Uniform Delay, d1	26.6	29.3	23.3	17.1	16.0	13.6	24.6	25.1	24.9	20.8	22.6	21.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4	2.4	0.0	5.6	0.2	0.1	0.1	0.3	0.4	0.1	0.1	0.0
Delay (s)	28.0	31.7	23.4	22.7	16.1	13.7	24.7	25.4	25.3	20.9	22.7	21.3
Level of Service	C	C	C	C	B	B	C	C	C	C	C	C
Approach Delay (s)		30.8			17.2			25.3			22.3	
Approach LOS		C			B			C			C	

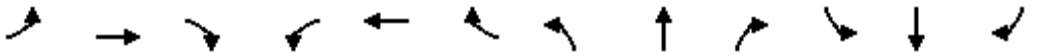
Intersection Summary			
HCM 2000 Control Delay	23.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	93.9	Sum of lost time (s)	20.0
Intersection Capacity Utilization	72.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	347	270	229	212	289	103	1133	120	230	1430	847
v/c Ratio	0.82	0.40	0.53	0.34	0.70	0.68	0.79	0.17	0.77	0.94	0.89
Control Delay	53.6	16.3	24.4	31.5	23.7	62.7	28.1	4.8	57.3	38.1	22.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	53.6	16.3	24.4	31.5	23.7	62.7	28.1	4.8	57.3	38.1	22.0
Queue Length 50th (m)	27.7	9.7	26.0	15.7	18.0	16.0	79.3	0.1	18.5	108.6	44.9
Queue Length 95th (m)	#55.7	19.6	42.6	25.0	42.8	#43.8	#133.2	11.0	#40.4	#185.1	#144.6
Internal Link Dist (m)		116.6		189.6			145.5			135.2	
Turn Bay Length (m)	60.0		30.0			45.0			80.0		80.0
Base Capacity (vph)	425	1348	433	1403	722	151	1430	692	297	1517	955
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.82	0.20	0.53	0.15	0.40	0.68	0.79	0.17	0.77	0.94	0.89

Intersection Summary

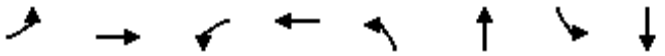
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	347	134	136	229	212	289	103	1133	120	230	1430	847
Future Volume (vph)	347	134	136	229	212	289	103	1133	120	230	1430	847
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0	6.0	4.0	5.0	6.0	4.0	3.0	6.0
Lane Util. Factor	0.97	0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.92		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3541	3291		1807	3650	1617	1800	3607	1610	3541	3607	1610
Flt Permitted	0.95	1.00		0.59	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3541	3291		1114	3650	1617	1800	3607	1610	3541	3607	1610
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	347	134	136	229	212	289	103	1133	120	230	1430	847
RTOR Reduction (vph)	0	112	0	0	0	136	0	0	73	0	0	336
Lane Group Flow (vph)	347	158	0	229	212	153	103	1133	47	230	1430	511
Heavy Vehicles (%)	0%	0%	5%	1%	0%	1%	1%	1%	1%	0%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	1	1	1	0	1	1
Turn Type	Prot	NA		pm+pt	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)	10.0	14.5		24.1	14.3	14.3	7.0	32.1	32.1	7.0	32.1	32.1
Effective Green, g (s)	10.0	14.5		24.1	14.3	14.3	7.0	33.1	32.1	7.0	35.1	32.1
Actuated g/C Ratio	0.12	0.17		0.29	0.17	0.17	0.08	0.40	0.38	0.08	0.42	0.38
Clearance Time (s)	4.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	424	572		403	625	277	151	1431	619	297	1518	619
v/s Ratio Prot	c0.10	0.05		0.07	0.06		0.06	0.31		c0.06	c0.40	
v/s Ratio Perm				c0.10		0.09			0.03			0.32
v/c Ratio	0.82	0.28		0.57	0.34	0.55	0.68	0.79	0.08	0.77	0.94	0.83
Uniform Delay, d1	35.8	29.9		24.1	30.4	31.6	37.1	22.1	16.3	37.4	23.2	23.1
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.7	0.3		1.8	0.3	2.4	12.0	4.6	0.2	11.9	12.9	12.0
Delay (s)	47.5	30.2		26.0	30.7	34.0	49.1	26.7	16.5	49.3	36.1	35.1
Level of Service	D	C		C	C	C	D	C	B	D	D	D
Approach Delay (s)		39.9			30.5			27.5			37.0	
Approach LOS		D			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	33.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	83.4	Sum of lost time (s)	19.0
Intersection Capacity Utilization	81.4%	ICU Level of Service	D
Analysis Period (min)	15		

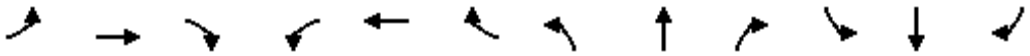
c Critical Lane Group



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	42	493	106	364	282	952	25	143
v/c Ratio	0.12	0.85	0.43	0.57	0.50	0.68	0.09	0.13
Control Delay	14.6	41.3	20.0	28.6	22.1	29.0	16.7	18.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.6	41.3	20.0	28.6	22.1	29.0	16.7	18.9
Queue Length 50th (m)	4.1	75.8	10.7	54.6	32.1	69.3	2.4	7.3
Queue Length 95th (m)	9.6	114.6	19.8	82.1	56.0	#133.1	7.5	15.2
Internal Link Dist (m)		96.6		108.8		132.2		99.0
Turn Bay Length (m)	15.0		30.0		15.0		30.0	
Base Capacity (vph)	361	728	249	753	567	1391	278	1118
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.12	0.68	0.43	0.48	0.50	0.68	0.09	0.13

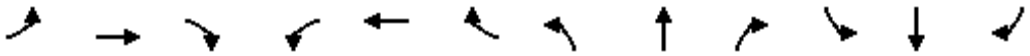
Intersection Summary

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



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	42	273	220	106	336	28	282	815	137	25	107	36
Future Volume (vph)	42	273	220	106	336	28	282	815	137	25	107	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.93		1.00	0.99		1.00	0.98		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1755	1744		1825	1866		1789	3425		1825	3377	
Flt Permitted	0.38	1.00		0.17	1.00		0.59	1.00		0.20	1.00	
Satd. Flow (perm)	705	1744		325	1866		1107	3425		381	3377	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	42	273	220	106	336	28	282	815	137	25	107	36
RTOR Reduction (vph)	0	31	0	0	3	0	0	12	0	0	24	0
Lane Group Flow (vph)	42	462	0	106	361	0	282	940	0	25	119	0
Heavy Vehicles (%)	4%	1%	5%	0%	1%	11%	2%	5%	0%	0%	4%	4%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	33.4	29.5		36.2	30.9		43.1	36.6		34.5	32.0	
Effective Green, g (s)	33.4	29.5		36.2	30.9		43.1	36.6		34.5	32.0	
Actuated g/C Ratio	0.35	0.31		0.38	0.33		0.45	0.39		0.36	0.34	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	291	542		207	607		553	1320		176	1138	
v/s Ratio Prot	0.01	c0.26		c0.03	0.19		c0.04	c0.27		0.00	0.04	
v/s Ratio Perm	0.04			0.17			0.19			0.05		
v/c Ratio	0.14	0.85		0.51	0.59		0.51	0.71		0.14	0.10	
Uniform Delay, d1	20.8	30.7		21.7	26.8		17.8	24.7		20.1	21.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	12.3		2.1	1.6		0.7	3.3		0.4	0.2	
Delay (s)	21.1	43.0		23.8	28.3		18.5	28.0		20.5	21.8	
Level of Service	C	D		C	C		B	C		C	C	
Approach Delay (s)		41.2			27.3			25.8			21.6	
Approach LOS		D			C			C			C	

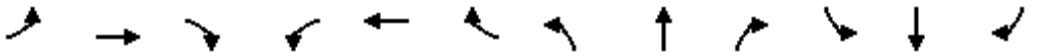
Intersection Summary			
HCM 2000 Control Delay	29.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	94.9	Sum of lost time (s)	21.0
Intersection Capacity Utilization	86.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	58	917	24	178	1144	285	109	500	401	204	65	132
v/c Ratio	0.51	0.80	0.04	0.74	0.72	0.34	0.29	0.50	0.66	0.61	0.07	0.25
Control Delay	44.2	36.0	0.1	35.2	24.4	4.5	29.8	32.7	19.7	42.3	28.4	7.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.2	36.0	0.1	35.2	24.4	4.5	29.8	32.7	19.7	42.3	28.4	7.4
Queue Length 50th (m)	9.0	84.8	0.0	19.3	91.4	4.8	15.7	42.7	28.3	31.2	4.8	0.7
Queue Length 95th (m)	23.0	107.2	0.0	#45.2	113.8	18.2	32.2	65.4	68.2	57.0	11.0	15.0
Internal Link Dist (m)		490.6			187.5			209.7			310.1	
Turn Bay Length (m)	100.0		100.0	125.0		50.0						200.0
Base Capacity (vph)	146	1485	760	244	1934	969	385	1001	610	347	1001	538
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.62	0.03	0.73	0.59	0.29	0.28	0.50	0.66	0.59	0.06	0.25

Intersection Summary

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



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	58	917	24	178	1144	285	109	500	401	204	65	132
Future Volume (vph)	58	917	24	178	1144	285	109	500	401	204	65	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Total Lost time (s)	6.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1716	3433	1536	1716	3433	1536	1716	3433	1536	1716	3433	1536
Flt Permitted	0.19	1.00	1.00	0.13	1.00	1.00	0.57	1.00	1.00	0.47	1.00	1.00
Satd. Flow (perm)	340	3433	1536	228	3433	1536	1038	3433	1536	847	3433	1536
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	58	917	24	178	1144	285	109	500	401	204	65	132
RTOR Reduction (vph)	0	0	16	0	0	128	0	0	163	0	0	90
Lane Group Flow (vph)	58	917	8	178	1144	157	109	500	238	204	65	42
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8		8	4		4
Actuated Green, G (s)	33.5	33.5	33.5	46.3	46.3	46.3	29.2	29.2	29.2	31.1	29.1	29.1
Effective Green, g (s)	33.5	33.5	33.5	46.3	46.3	46.3	29.2	29.2	29.2	31.1	29.1	29.1
Actuated g/C Ratio	0.34	0.34	0.34	0.46	0.46	0.46	0.29	0.29	0.29	0.31	0.29	0.29
Clearance Time (s)	6.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	114	1151	515	236	1591	711	361	1003	448	336	1000	447
v/s Ratio Prot		0.27		0.07	c0.33		0.03	0.15		c0.05	0.02	
v/s Ratio Perm	0.17		0.01	c0.28		0.10	0.06		c0.16	c0.14		0.03
v/c Ratio	0.51	0.80	0.02	0.75	0.72	0.22	0.30	0.50	0.53	0.61	0.07	0.09
Uniform Delay, d1	26.6	30.1	22.2	19.7	21.6	16.0	26.8	29.3	29.6	31.2	25.6	25.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.5	3.9	0.0	12.8	1.6	0.2	0.5	1.8	4.5	3.1	0.0	0.1
Delay (s)	30.1	34.0	22.2	32.5	23.2	16.2	27.3	31.1	34.1	34.3	25.6	25.9
Level of Service	C	C	C	C	C	B	C	C	C	C	C	C
Approach Delay (s)		33.5			22.9			31.9			30.1	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	28.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	99.9	Sum of lost time (s)	20.0
Intersection Capacity Utilization	95.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

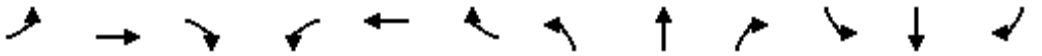
Ainley's forecast from the Bryne Drive Phase 1 & 2 Class EA Study

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	278	690	339	414	427	103	1133	220	360	1430	847
v/c Ratio	0.71	0.74	1.28	0.44	0.75	0.76	0.91	0.33	0.95	1.00	1.05
Control Delay	31.9	35.5	178.3	30.1	24.0	78.4	42.6	5.8	78.1	52.7	65.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.9	35.5	178.3	30.1	24.0	78.4	42.6	5.8	78.1	52.7	65.6
Queue Length 50th (m)	34.0	57.1	~56.2	32.6	35.5	18.5	101.4	1.3	33.6	132.2	~125.0
Queue Length 95th (m)	52.7	75.7	#109.5	45.6	68.8	#49.4	#161.0	17.5	#66.7	#207.1	#213.9
Internal Link Dist (m)		68.1		189.6			145.5			135.2	
Turn Bay Length (m)	20.0		30.0			45.0			80.0		80.0
Base Capacity (vph)	390	1226	264	1256	694	135	1240	676	380	1434	806
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.56	1.28	0.33	0.62	0.76	0.91	0.33	0.95	1.00	1.05

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

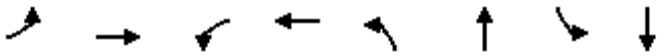
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	278	554	136	339	414	427	103	1133	220	360	1430	847
Future Volume (vph)	278	554	136	339	414	427	103	1133	220	360	1430	847
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0	6.0	4.0	5.0	6.0	4.0	3.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1825	3508		1807	3650	1617	1800	3607	1610	3541	3607	1610
Flt Permitted	0.44	1.00		0.20	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	836	3508		388	3650	1617	1800	3607	1610	3541	3607	1610
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	278	554	136	339	414	427	103	1133	220	360	1430	847
RTOR Reduction (vph)	0	23	0	0	0	156	0	0	139	0	0	218
Lane Group Flow (vph)	278	667	0	339	414	271	103	1133	81	360	1430	629
Heavy Vehicles (%)	0%	0%	5%	1%	0%	1%	1%	1%	1%	0%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	1	1	1	0	1	1
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8			2			6
Actuated Green, G (s)	32.1	24.1		32.1	24.1	24.1	7.0	31.1	31.1	10.0	34.1	34.1
Effective Green, g (s)	32.1	24.1		32.1	24.1	24.1	7.0	32.1	31.1	10.0	37.1	34.1
Actuated g/C Ratio	0.34	0.26		0.34	0.26	0.26	0.08	0.34	0.33	0.11	0.40	0.37
Clearance Time (s)	4.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	372	907		255	943	418	135	1242	537	379	1435	589
v/s Ratio Prot	0.06	0.19		c0.11	0.11		0.06	0.31		c0.10	c0.40	
v/s Ratio Perm	0.19			c0.34		0.17			0.05			c0.39
v/c Ratio	0.75	0.74		1.33	0.44	0.65	0.76	0.91	0.15	0.95	1.00	1.07
Uniform Delay, d1	24.9	31.6		27.0	28.9	30.8	42.3	29.2	21.8	41.4	28.0	29.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.0	3.1		172.7	0.3	3.4	22.2	11.6	0.6	33.0	22.9	56.8
Delay (s)	32.9	34.8		199.7	29.2	34.2	64.5	40.8	22.4	74.4	50.9	86.4
Level of Service	C	C		F	C	C	E	D	C	E	D	F
Approach Delay (s)		34.2			80.0			39.7			65.5	
Approach LOS		C			F			D			E	

Intersection Summary			
HCM 2000 Control Delay	57.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	93.2	Sum of lost time (s)	19.0
Intersection Capacity Utilization	98.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

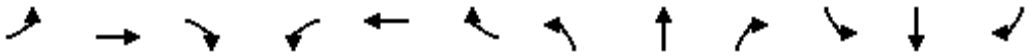


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	42	493	106	364	282	1352	25	643
v/c Ratio	0.14	1.02	0.45	0.69	0.69	0.89	0.10	0.54
Control Delay	17.7	79.2	23.6	36.5	23.1	33.2	11.9	25.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.7	79.2	23.6	36.5	23.1	33.2	11.9	25.3
Queue Length 50th (m)	4.3	~85.8	11.2	56.4	26.2	97.8	2.0	45.9
Queue Length 95th (m)	10.4	#144.3	21.4	#96.9	#46.4	#178.7	5.7	62.4
Internal Link Dist (m)		96.6		108.8		132.2		99.0
Turn Bay Length (m)	15.0		30.0		15.0		30.0	
Base Capacity (vph)	300	481	235	530	410	1525	240	1185
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	1.02	0.45	0.69	0.69	0.89	0.10	0.54

Intersection Summary

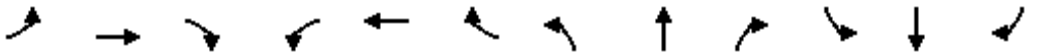
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	42	273	220	106	336	28	282	1215	137	25	607	36
Future Volume (vph)	42	273	220	106	336	28	282	1215	137	25	607	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.93		1.00	0.99		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1755	1744		1825	1866		1789	3440		1825	3480	
Flt Permitted	0.32	1.00		0.17	1.00		0.29	1.00		0.13	1.00	
Satd. Flow (perm)	598	1744		318	1866		541	3440		244	3480	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	42	273	220	106	336	28	282	1215	137	25	607	36
RTOR Reduction (vph)	0	33	0	0	4	0	0	9	0	0	5	0
Lane Group Flow (vph)	42	460	0	106	360	0	282	1343	0	25	638	0
Heavy Vehicles (%)	4%	1%	5%	0%	1%	11%	2%	5%	0%	0%	4%	4%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	26.9	22.8		29.7	24.2		44.5	37.8		34.2	31.5	
Effective Green, g (s)	26.9	22.8		29.7	24.2		44.5	37.8		34.2	31.5	
Actuated g/C Ratio	0.30	0.25		0.33	0.27		0.50	0.42		0.38	0.35	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	231	442		197	502		393	1448		140	1220	
v/s Ratio Prot	0.01	c0.26		c0.03	0.19		c0.07	c0.39		0.01	0.18	
v/s Ratio Perm	0.05			0.14			0.28			0.06		
v/c Ratio	0.18	1.04		0.54	0.72		0.72	0.93		0.18	0.52	
Uniform Delay, d1	23.1	33.5		23.8	29.7		14.5	24.7		19.9	23.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	53.9		2.8	4.9		6.1	11.7		0.6	1.6	
Delay (s)	23.4	87.4		26.6	34.6		20.7	36.4		20.5	24.8	
Level of Service	C	F		C	C		C	D		C	C	
Approach Delay (s)		82.4			32.8			33.7			24.6	
Approach LOS		F			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	39.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	89.8	Sum of lost time (s)	21.0
Intersection Capacity Utilization	95.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

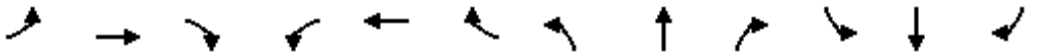


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	48	343	118	326	703	648	120	791	678	725	435	143
v/c Ratio	0.31	0.42	0.24	0.98	0.60	0.72	0.48	0.91	1.20	1.37	0.30	0.19
Control Delay	39.5	36.2	2.7	78.7	31.6	9.3	37.7	53.6	129.0	209.8	20.9	4.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.5	36.2	2.7	78.7	31.6	9.3	37.7	53.6	129.0	209.8	20.9	4.3
Queue Length 50th (m)	8.2	31.7	0.0	52.7	62.9	10.5	19.1	82.2	~129.7	~177.3	29.8	0.5
Queue Length 95th (m)	19.1	44.8	4.7	#107.4	81.3	48.4	36.1	#124.5	#208.8	#263.3	44.5	12.1
Internal Link Dist (m)		490.6			187.5			209.7			310.1	
Turn Bay Length (m)	100.0		100.0	125.0		50.0						200.0
Base Capacity (vph)	181	939	543	331	1295	937	252	874	567	528	1469	736
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.27	0.37	0.22	0.98	0.54	0.69	0.48	0.91	1.20	1.37	0.30	0.19

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	48	343	118	326	703	648	120	791	678	725	435	143
Future Volume (vph)	48	343	118	326	703	648	120	791	678	725	435	143
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Total Lost time (s)	6.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1716	3433	1536	1716	3433	1536	1716	3433	1536	1716	3433	1536
Flt Permitted	0.37	1.00	1.00	0.41	1.00	1.00	0.31	1.00	1.00	0.26	1.00	1.00
Satd. Flow (perm)	663	3433	1536	746	3433	1536	564	3433	1536	477	3433	1536
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	48	343	118	326	703	648	120	791	678	725	435	143
RTOR Reduction (vph)	0	0	90	0	0	379	0	0	176	0	0	80
Lane Group Flow (vph)	48	343	28	326	703	269	120	791	502	725	435	63
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8		8	4		4
Actuated Green, G (s)	25.0	25.0	25.0	36.0	36.0	36.0	27.0	27.0	27.0	47.4	45.4	45.4
Effective Green, g (s)	25.0	25.0	25.0	36.0	36.0	36.0	27.0	27.0	27.0	47.4	45.4	45.4
Actuated g/C Ratio	0.24	0.24	0.24	0.34	0.34	0.34	0.25	0.25	0.25	0.45	0.43	0.43
Clearance Time (s)	6.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	156	808	361	317	1164	521	237	873	390	529	1468	657
v/s Ratio Prot		0.10		c0.07	0.20		0.04	0.23		c0.35	0.13	
v/s Ratio Perm	0.07		0.02	c0.28		0.18	0.09		c0.33	c0.26		0.04
v/c Ratio	0.31	0.42	0.08	1.03	0.60	0.52	0.51	0.91	1.29	1.37	0.30	0.10
Uniform Delay, d1	33.4	34.4	31.6	34.4	29.1	28.1	32.0	38.3	39.5	31.6	19.9	18.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	0.4	0.1	58.0	0.9	0.9	1.7	14.7	147.4	178.5	0.1	0.1
Delay (s)	34.5	34.8	31.7	92.4	30.0	28.9	33.7	53.1	187.0	210.0	20.0	18.2
Level of Service	C	C	C	F	C	C	C	D	F	F	B	B
Approach Delay (s)		34.0			41.7			108.7			125.5	
Approach LOS		C			D			F			F	

Intersection Summary			
HCM 2000 Control Delay	83.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.30		
Actuated Cycle Length (s)	106.1	Sum of lost time (s)	20.0
Intersection Capacity Utilization	120.4%	ICU Level of Service	H
Analysis Period (min)	15		

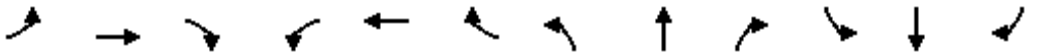
c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	278	690	339	414	427	103	1133	220	360	1430	847
v/c Ratio	0.62	0.79	0.98	0.41	0.69	0.50	0.98	0.35	0.86	1.04	1.00
Control Delay	27.3	44.7	71.1	33.9	21.0	25.8	61.0	9.1	68.4	70.5	50.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.3	44.7	71.1	33.9	21.0	25.8	61.0	9.1	68.4	70.5	50.4
Queue Length 50th (m)	38.1	70.4	53.7	38.3	34.9	11.9	127.8	6.1	39.9	~180.0	~118.2
Queue Length 95th (m)	57.2	91.2	#112.2	52.2	69.6	23.1	#185.1	25.0	#68.1	#236.1	#210.5
Internal Link Dist (m)		68.1		189.6			145.5			135.2	
Turn Bay Length (m)	20.0		30.0			45.0			80.0		80.0
Base Capacity (vph)	456	1041	347	1165	681	220	1151	623	420	1372	846
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.61	0.66	0.98	0.36	0.63	0.47	0.98	0.35	0.86	1.04	1.00

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

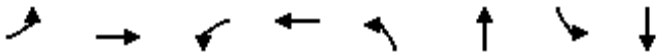
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	278	554	136	339	414	427	103	1133	220	360	1430	847
Future Volume (vph)	278	554	136	339	414	427	103	1133	220	360	1430	847
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0	6.0	4.0	5.0	6.0	4.0	3.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1825	3508		1807	3650	1617	1800	3607	1610	3541	3607	1610
Flt Permitted	0.48	1.00		0.15	1.00	1.00	0.12	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	921	3508		288	3650	1617	222	3607	1610	3541	3607	1610
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	278	554	136	339	414	427	103	1133	220	360	1430	847
RTOR Reduction (vph)	0	20	0	0	0	176	0	0	124	0	0	277
Lane Group Flow (vph)	278	670	0	339	414	251	103	1133	96	360	1430	570
Heavy Vehicles (%)	0%	0%	5%	1%	0%	1%	1%	1%	1%	0%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	1	1	1	0	1	1
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8	2		2			6
Actuated Green, G (s)	39.3	26.7		46.1	30.1	30.1	42.4	34.1	34.1	13.0	38.8	38.8
Effective Green, g (s)	39.3	26.7		46.1	30.1	30.1	42.4	35.1	34.1	13.0	41.8	38.8
Actuated g/C Ratio	0.36	0.24		0.42	0.27	0.27	0.39	0.32	0.31	0.12	0.38	0.35
Clearance Time (s)	4.0	6.0		4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	433	853		342	1000	443	205	1153	500	419	1373	568
v/s Ratio Prot	0.07	0.19		c0.14	0.11		0.04	0.31		c0.10	c0.40	
v/s Ratio Perm	0.16			c0.27		0.16	0.16		0.06			0.35
v/c Ratio	0.64	0.79		0.99	0.41	0.57	0.50	0.98	0.19	0.86	1.04	1.00
Uniform Delay, d1	26.7	38.9		28.8	32.6	34.2	26.3	37.0	27.7	47.5	34.0	35.5
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.2	4.8		46.1	0.3	1.7	1.9	22.7	0.9	15.9	35.8	38.5
Delay (s)	30.0	43.7		74.9	32.9	35.9	28.2	59.7	28.6	63.4	69.8	74.0
Level of Service	C	D		E	C	D	C	E	C	E	E	E
Approach Delay (s)		39.7			46.1			52.8			70.3	
Approach LOS		D			D			D			E	

Intersection Summary			
HCM 2000 Control Delay	56.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	109.8	Sum of lost time (s)	19.0
Intersection Capacity Utilization	98.8%	ICU Level of Service	F
Analysis Period (min)	15		

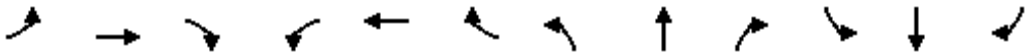
c Critical Lane Group



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	42	493	106	364	282	1352	25	643
v/c Ratio	0.13	0.90	0.49	0.61	0.68	0.91	0.12	0.60
Control Delay	17.2	50.3	24.9	32.7	25.3	38.3	15.4	31.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.2	50.3	24.9	32.7	25.3	38.3	15.4	31.7
Queue Length 50th (m)	4.6	82.9	11.9	59.5	32.6	120.0	2.5	56.4
Queue Length 95th (m)	10.6	#138.9	22.0	89.3	#52.8	#204.4	6.8	74.8
Internal Link Dist (m)		96.6		108.8		132.2		99.0
Turn Bay Length (m)	15.0		30.0		15.0		30.0	
Base Capacity (vph)	329	601	217	647	416	1489	217	1075
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.13	0.82	0.49	0.56	0.68	0.91	0.12	0.60

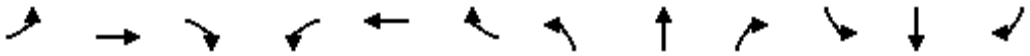
Intersection Summary

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



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	42	273	220	106	336	28	282	1215	137	25	607	36
Future Volume (vph)	42	273	220	106	336	28	282	1215	137	25	607	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.93		1.00	0.99		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1755	1744		1825	1866		1789	3440		1825	3480	
Flt Permitted	0.36	1.00		0.14	1.00		0.26	1.00		0.13	1.00	
Satd. Flow (perm)	660	1744		266	1866		498	3440		241	3480	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	42	273	220	106	336	28	282	1215	137	25	607	36
RTOR Reduction (vph)	0	30	0	0	3	0	0	8	0	0	4	0
Lane Group Flow (vph)	42	463	0	106	361	0	282	1344	0	25	639	0
Heavy Vehicles (%)	4%	1%	5%	0%	1%	11%	2%	5%	0%	0%	4%	4%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	33.2	29.2		36.0	30.6		47.7	41.0		34.6	31.9	
Effective Green, g (s)	33.2	29.2		36.0	30.6		47.7	41.0		34.6	31.9	
Actuated g/C Ratio	0.33	0.29		0.36	0.31		0.48	0.41		0.35	0.32	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	7.0		4.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	264	512		181	575		392	1420		127	1117	
v/s Ratio Prot	0.01	c0.27		c0.03	0.19		c0.09	c0.39		0.01	0.18	
v/s Ratio Perm	0.05			0.18			0.26			0.06		
v/c Ratio	0.16	0.90		0.59	0.63		0.72	0.95		0.20	0.57	
Uniform Delay, d1	23.1	33.7		24.1	29.5		17.2	28.1		23.9	28.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	19.4		4.8	2.2		6.2	14.2		0.8	2.1	
Delay (s)	23.4	53.1		28.9	31.6		23.4	42.3		24.7	30.2	
Level of Service	C	D		C	C		C	D		C	C	
Approach Delay (s)		50.7			31.0			39.0			29.9	
Approach LOS		D			C			D			C	

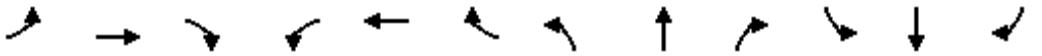
Intersection Summary			
HCM 2000 Control Delay	37.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	99.3	Sum of lost time (s)	21.0
Intersection Capacity Utilization	95.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	48	343	118	326	703	648	120	791	678	725	435	143
v/c Ratio	0.37	0.53	0.30	0.96	0.64	0.83	0.15	0.70	0.98	0.94	0.71	0.39
Control Delay	57.1	53.0	7.5	99.2	42.5	24.3	14.9	44.2	56.4	72.7	58.8	15.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.1	53.0	7.5	99.2	42.5	24.3	14.9	44.2	56.4	72.7	58.8	15.0
Queue Length 50th (m)	11.4	44.4	0.0	45.2	85.4	61.6	12.6	95.9	120.7	97.8	58.1	5.9
Queue Length 95th (m)	24.4	60.0	12.9	#77.7	106.1	118.5	23.0	124.8	#212.3	#140.4	73.6	23.8
Internal Link Dist (m)		490.6			187.5			209.7			310.1	
Turn Bay Length (m)	100.0		100.0	125.0		50.0						200.0
Base Capacity (vph)	147	729	430	341	1182	807	787	1131	692	780	1760	844
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.47	0.27	0.96	0.59	0.80	0.15	0.70	0.98	0.93	0.25	0.17

Intersection Summary

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



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	48	343	118	326	703	648	120	791	678	725	435	143
Future Volume (vph)	48	343	118	326	703	648	120	791	678	725	435	143
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Total Lost time (s)	6.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1716	3433	1536	3330	3433	1536	1716	3433	1536	3330	3433	1536
Flt Permitted	0.38	1.00	1.00	0.95	1.00	1.00	0.33	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	694	3433	1536	3330	3433	1536	596	3433	1536	3330	3433	1536
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	48	343	118	326	703	648	120	791	678	725	435	143
RTOR Reduction (vph)	0	0	96	0	0	288	0	0	186	0	0	96
Lane Group Flow (vph)	48	343	22	326	703	360	120	791	492	725	435	47
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
Turn Type	Perm	NA	Perm	Prot	NA	Perm	pm+pt	NA	Perm	Prot	NA	Perm
Protected Phases		2		1	6		3	8		7	4	
Permitted Phases	2		2			6	8		8			4
Actuated Green, G (s)	26.0	26.0	26.0	14.0	44.0	44.0	82.6	45.0	45.0	31.6	24.5	24.5
Effective Green, g (s)	26.0	26.0	26.0	14.0	44.0	44.0	82.6	45.0	45.0	31.6	24.5	24.5
Actuated g/C Ratio	0.19	0.19	0.19	0.10	0.32	0.32	0.60	0.33	0.33	0.23	0.18	0.18
Clearance Time (s)	6.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	132	653	292	341	1105	494	787	1130	506	770	615	275
v/s Ratio Prot		0.10		c0.10	0.20		0.06	0.23		c0.22	0.13	
v/s Ratio Perm	0.07		0.01			c0.23	0.03		c0.32			0.03
v/c Ratio	0.36	0.53	0.08	0.96	0.64	0.73	0.15	0.70	0.97	0.94	0.71	0.17
Uniform Delay, d1	48.1	49.7	45.4	61.0	39.5	41.0	17.5	39.9	45.2	51.6	52.7	47.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.7	0.8	0.1	36.9	1.2	5.3	0.1	3.6	33.5	19.5	3.7	0.3
Delay (s)	49.8	50.5	45.6	97.9	40.7	46.3	17.6	43.5	78.7	71.1	56.4	47.7
Level of Service	D	D	D	F	D	D	B	D	E	E	E	D
Approach Delay (s)		49.3			54.0			56.6			63.6	
Approach LOS		D			D			E			E	

Intersection Summary			
HCM 2000 Control Delay	56.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	136.6	Sum of lost time (s)	20.0
Intersection Capacity Utilization	100.9%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Appendix F

SimTraffic Results - 2031 Improved Scenario Analysis

Morrison Hershfield's Traffic Forecast from the Harvie Road / Big Bay Point Road / Highway 400 Crossing Phase 3 & 4 Class EA Study

Intersection: 1: Essa Road & Ardagh Road/Bryne Drive

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB
Directions Served	L	L	T	TR	L	T	T	R	L	T	T	R
Maximum Queue (m)	129.8	136.7	146.6	112.7	28.2	27.4	10.0	60.8	144.9	168.6	166.2	162.9
Average Queue (m)	115.7	127.6	104.4	31.2	10.7	8.6	1.4	26.4	55.2	132.4	123.9	47.6
95th Queue (m)	150.1	156.2	201.6	84.0	21.8	19.7	6.4	46.8	145.4	186.6	183.7	160.4
Link Distance (m)			136.8	136.8		197.5	197.5	197.5		157.2	157.2	157.2
Upstream Blk Time (%)		35	35	0						17	18	9
Queuing Penalty (veh)		0	0	0						0	0	0
Storage Bay Dist (m)	100.0	100.0			30.0				45.0			
Storage Blk Time (%)	36	72	0		1	0			0	61		
Queuing Penalty (veh)	33	66	2		0	0			2	73		

Intersection: 1: Essa Road & Ardagh Road/Bryne Drive

Movement	SB	SB	SB	SB	SB
Directions Served	L	L	T	T	R
Maximum Queue (m)	42.2	55.9	101.0	86.2	60.5
Average Queue (m)	5.3	27.5	61.6	47.5	28.4
95th Queue (m)	25.3	45.9	89.1	76.8	49.5
Link Distance (m)			143.0	143.0	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)	80.0	80.0			80.0
Storage Blk Time (%)			2	0	0
Queuing Penalty (veh)			2	0	0

Intersection: 2: Bryne Drive & Caplan Avenue

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	TR	L	T	TR	L	T	TR
Maximum Queue (m)	53.5	101.3	32.3	81.4	32.2	30.2	23.1	10.4	69.8	53.3
Average Queue (m)	9.5	50.9	10.0	32.2	14.0	13.7	10.3	2.6	34.9	17.8
95th Queue (m)	29.4	85.9	24.7	61.8	25.2	26.8	20.9	9.3	56.2	41.6
Link Distance (m)		109.8		121.6		148.5	148.5		115.8	115.8
Upstream Blk Time (%)		0								
Queuing Penalty (veh)		0								
Storage Bay Dist (m)	15.0		30.0		15.0			30.0		
Storage Blk Time (%)	5	40	0	11	10	10			13	
Queuing Penalty (veh)	17	14	0	5	7	11			2	

Intersection: 3: Bryne Drive & Harvie Road

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB
Directions Served	L	T	T	R	L	T	T	R	L	T	T	R
Maximum Queue (m)	44.5	69.4	68.8	18.8	64.1	57.1	50.8	30.6	13.3	32.2	16.8	29.4
Average Queue (m)	17.7	45.3	39.2	5.5	31.2	27.7	20.8	9.7	3.1	13.4	2.5	10.0
95th Queue (m)	36.1	65.6	62.2	13.7	52.7	48.2	41.2	21.1	9.4	26.8	10.6	21.6
Link Distance (m)		501.5	501.5			198.4	198.4			218.5	218.5	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (m)	100.0			100.0	125.0			50.0	50.0			30.0
Storage Blk Time (%)							0	0			0	0
Queuing Penalty (veh)							0	0			0	0

Intersection: 3: Bryne Drive & Harvie Road

Movement	SB	SB	SB	SB
Directions Served	L	T	T	R
Maximum Queue (m)	29.3	40.9	34.6	10.3
Average Queue (m)	10.2	21.4	9.8	1.6
95th Queue (m)	22.5	36.8	25.5	6.1
Link Distance (m)		318.9	318.9	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)	50.0			30.0
Storage Blk Time (%)		0	0	
Queuing Penalty (veh)		0	0	

Network Summary

Network wide Queuing Penalty: 237

Intersection: 1: Essa Road & Ardagh Road/Bryne Drive

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB
Directions Served	L	L	T	TR	L	T	T	R	L	T	T	R
Maximum Queue (m)	77.8	96.6	36.7	47.4	57.9	42.3	31.0	66.2	144.9	164.4	164.4	104.9
Average Queue (m)	46.9	61.7	10.1	20.8	28.1	19.2	11.1	34.6	48.6	127.6	117.0	38.7
95th Queue (m)	73.8	88.6	24.8	39.5	51.3	34.3	24.2	58.6	133.7	183.4	177.7	134.3
Link Distance (m)			120.1	120.1		197.5	197.5	197.5		157.2	157.2	157.2
Upstream Blk Time (%)		0								12	10	4
Queuing Penalty (veh)		0								0	0	0
Storage Bay Dist (m)	60.0	60.0			30.0				45.0			
Storage Blk Time (%)	1	13			8	2			1	59		
Queuing Penalty (veh)	1	9			8	5			3	60		

Intersection: 1: Essa Road & Ardagh Road/Bryne Drive

Movement	SB	SB	SB	SB	SB
Directions Served	L	L	T	T	R
Maximum Queue (m)	58.2	141.7	153.4	154.2	120.0
Average Queue (m)	17.7	106.9	144.9	146.6	118.9
95th Queue (m)	49.6	189.4	156.9	150.8	130.1
Link Distance (m)			141.7	141.7	
Upstream Blk Time (%)		0	31	34	
Queuing Penalty (veh)		0	0	0	
Storage Bay Dist (m)	80.0	80.0			80.0
Storage Blk Time (%)		0	60	46	31
Queuing Penalty (veh)		0	138	387	219

Intersection: 2: Bryne Drive & Caplan Avenue

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	TR	L	T	TR	L	T	TR
Maximum Queue (m)	59.8	115.8	32.3	95.4	44.8	130.4	115.4	16.9	38.2	23.0
Average Queue (m)	12.0	69.9	18.8	48.2	39.9	79.4	67.7	5.9	15.7	8.2
95th Queue (m)	35.4	115.1	35.7	82.7	54.7	125.0	106.7	15.1	29.2	18.8
Link Distance (m)		109.8		121.6		148.5	148.5		115.8	115.8
Upstream Blk Time (%)		3		0		0				
Queuing Penalty (veh)		0		0		0				
Storage Bay Dist (m)	15.0		30.0		15.0			30.0		
Storage Blk Time (%)	4	48	1	20	39	46			1	
Queuing Penalty (veh)	19	20	3	21	160	130			0	

Intersection: 3: Bryne Drive & Harvie Road

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB
Directions Served	L	T	T	R	L	T	T	R	L	T	T	R
Maximum Queue (m)	66.7	98.8	91.5	15.9	77.0	114.7	109.2	52.5	39.4	75.9	66.0	80.7
Average Queue (m)	22.2	63.9	57.9	2.6	29.8	70.3	63.4	29.3	18.7	50.8	38.9	41.7
95th Queue (m)	47.4	87.0	82.6	9.7	58.6	103.1	95.5	58.6	34.8	71.4	63.4	71.7
Link Distance (m)		501.5	501.5			198.4	198.4		218.6	218.6	218.6	218.6
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (m)	100.0			100.0	125.0			50.0				
Storage Blk Time (%)		0	0			0	7	1				
Queuing Penalty (veh)		0	0			0	20	3				

Intersection: 3: Bryne Drive & Harvie Road

Movement	SB	SB	SB	SB
Directions Served	L	T	T	R
Maximum Queue (m)	85.3	27.3	13.1	34.8
Average Queue (m)	41.2	8.9	1.9	11.2
95th Queue (m)	68.2	20.2	8.4	24.9
Link Distance (m)	318.9	318.9	318.9	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				200.0
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 1208

Ainley's forecast from the Bryne Drive Phase 1 & 2 Class EA Study

Intersection: 1: Essa Road & Ardagh Road/Bryne Drive

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	SB
Directions Served	L	T	TR	L	T	T	R	L	T	T	R	L
Maximum Queue (m)	74.7	78.8	79.6	89.7	155.3	120.5	90.8	145.0	167.7	169.4	168.2	83.9
Average Queue (m)	49.8	58.9	59.8	64.5	68.7	44.3	51.6	94.1	162.4	161.7	146.6	44.6
95th Queue (m)	81.7	84.4	84.8	101.2	143.9	108.0	85.8	196.7	173.9	179.5	222.1	75.4
Link Distance (m)		75.0	75.0		197.4	197.4	197.4		158.9	158.9	158.9	
Upstream Blk Time (%)	1	3	4						55	68	39	
Queuing Penalty (veh)	0	0	0						0	0	0	
Storage Bay Dist (m)	20.0			30.0				45.0				80.0
Storage Blk Time (%)	45	48		53	13			2	71			0
Queuing Penalty (veh)	124	133		110	45			8	74			0

Intersection: 1: Essa Road & Ardagh Road/Bryne Drive

Movement	SB	SB	SB	SB
Directions Served	L	T	T	R
Maximum Queue (m)	144.7	150.0	156.5	120.0
Average Queue (m)	125.5	146.5	149.6	119.5
95th Queue (m)	185.9	161.4	152.6	126.6
Link Distance (m)		144.8	144.8	
Upstream Blk Time (%)	1	23	32	
Queuing Penalty (veh)	0	0	0	
Storage Bay Dist (m)	80.0			80.0
Storage Blk Time (%)	1	55	41	39
Queuing Penalty (veh)	8	197	345	276

Intersection: 2: Bryne Drive & Caplan Avenue

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	TR	L	T	TR	L	T	TR
Maximum Queue (m)	59.9	121.8	32.3	112.3	44.9	165.0	162.0	17.8	92.1	77.7
Average Queue (m)	18.7	92.0	20.8	55.8	41.3	152.4	149.2	5.4	62.5	47.1
95th Queue (m)	55.2	136.9	37.4	98.3	53.2	168.2	174.8	14.4	87.5	73.1
Link Distance (m)		109.8		121.6		148.5	148.5		115.8	115.8
Upstream Blk Time (%)		23		0		45	43			
Queuing Penalty (veh)		0		0		0	0			
Storage Bay Dist (m)	15.0		30.0		15.0			30.0		
Storage Blk Time (%)	6	60	2	25	59	53			41	
Queuing Penalty (veh)	29	25	7	26	358	150			10	

Intersection: 3: Bryne Drive & Harvie Road

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	R	L	L	T	T	R	L	T	T
Maximum Queue (m)	38.2	67.2	59.0	23.3	110.2	123.5	177.7	206.3	52.5	74.8	215.3	228.5
Average Queue (m)	17.0	43.4	35.3	11.6	64.3	75.9	100.0	136.1	51.8	20.8	101.7	194.6
95th Queue (m)	32.8	63.3	57.6	20.2	98.0	111.6	162.8	224.6	57.3	54.4	172.0	289.5
Link Distance (m)		499.8	499.8				196.8	196.8		216.9	216.9	216.9
Upstream Blk Time (%)							0	6			0	32
Queuing Penalty (veh)							0	0			0	0
Storage Bay Dist (m)	100.0			100.0	125.0	125.0			50.0			
Storage Blk Time (%)					0	0	1	18	37			
Queuing Penalty (veh)					0	1	2	117	129			

Intersection: 3: Bryne Drive & Harvie Road

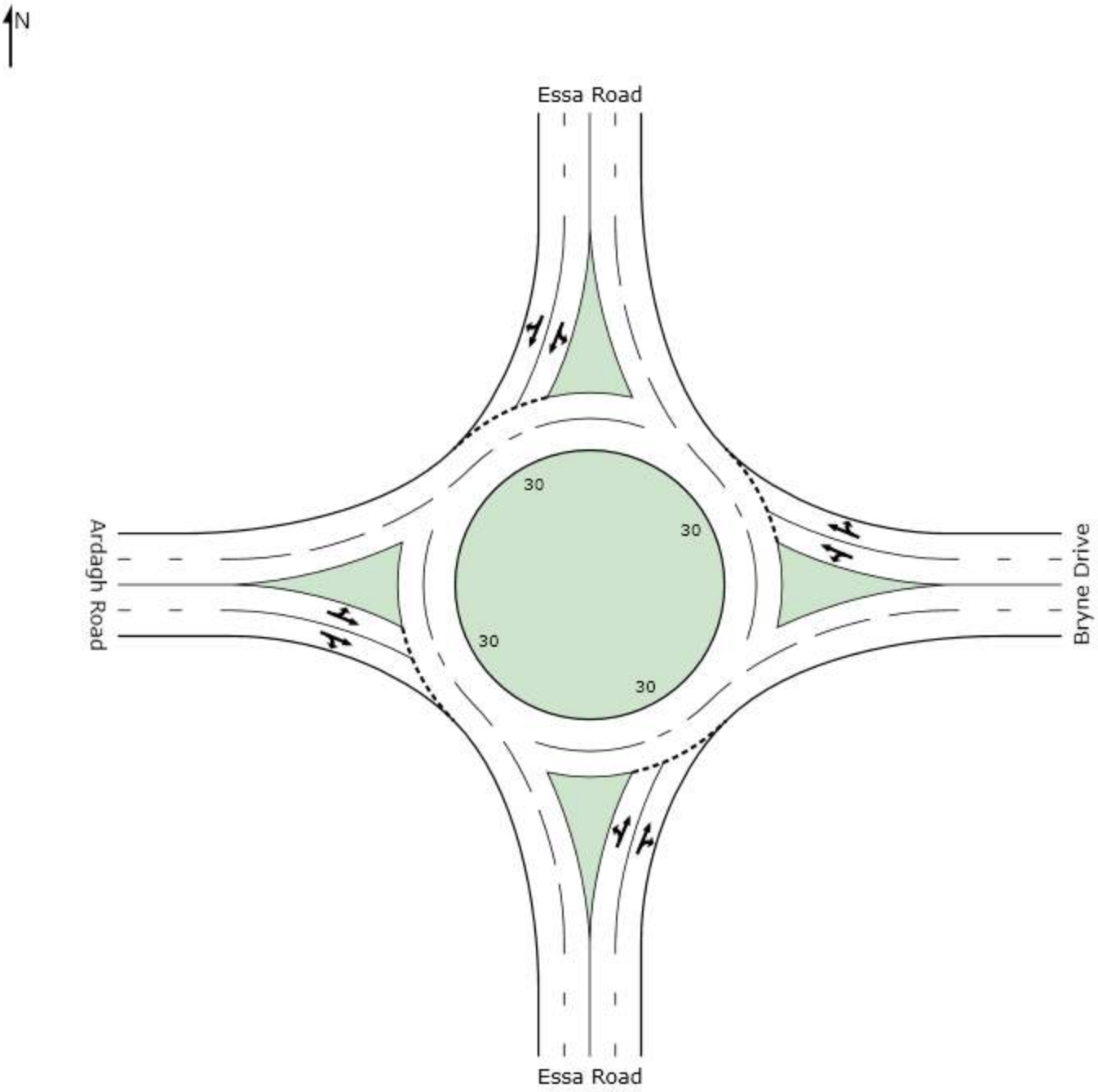
Movement	NB	SB	SB	SB	SB	SB
Directions Served	R	L	L	T	T	R
Maximum Queue (m)	232.2	191.7	180.0	88.8	80.5	28.8
Average Queue (m)	215.2	124.1	114.9	49.1	38.7	9.5
95th Queue (m)	264.9	199.4	189.4	78.3	70.2	21.0
Link Distance (m)	216.9	317.2	317.2	317.2	317.2	
Upstream Blk Time (%)	72					
Queuing Penalty (veh)	0					
Storage Bay Dist (m)						200.0
Storage Blk Time (%)						
Queuing Penalty (veh)						

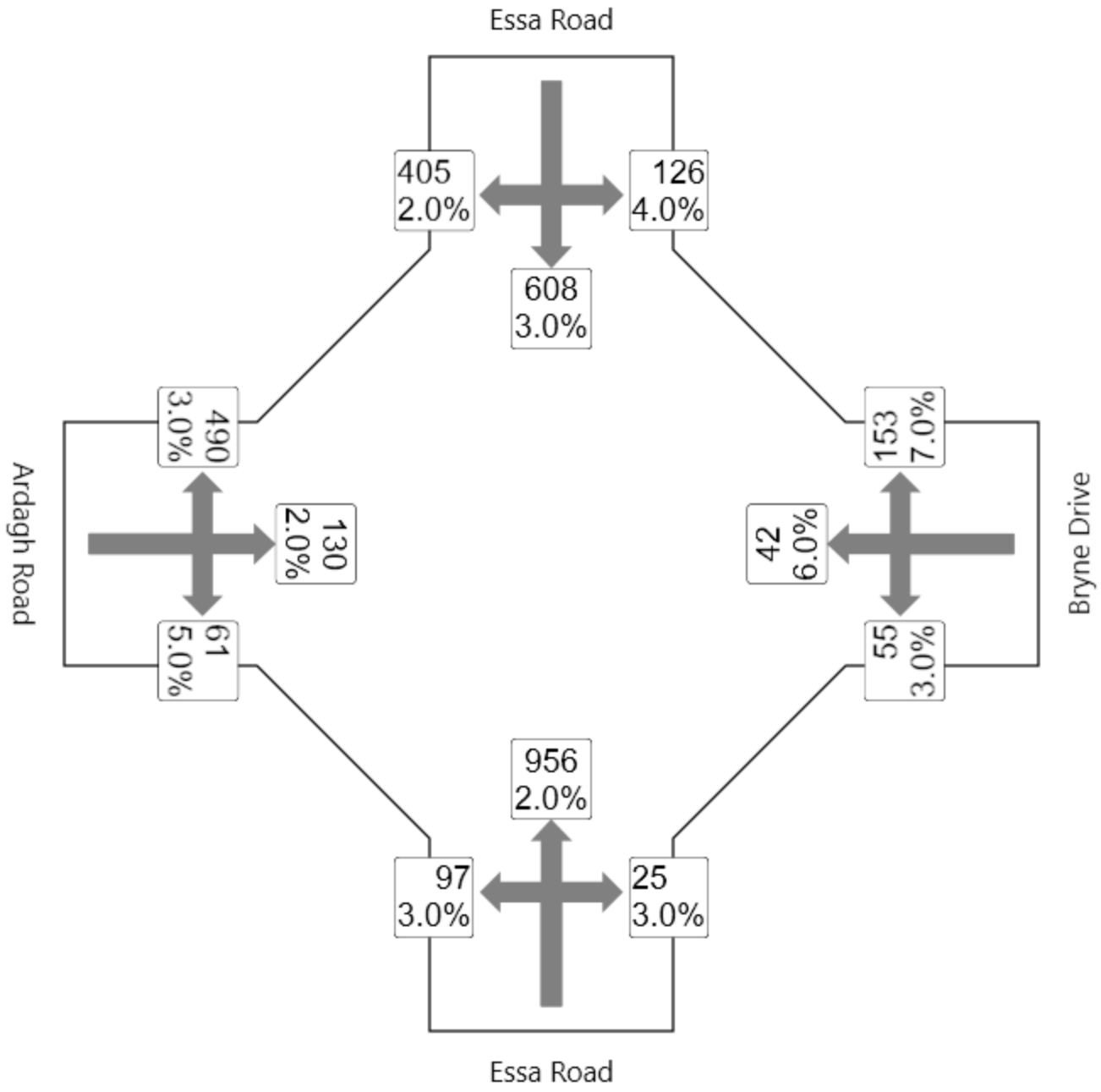
Network Summary

Network wide Queuing Penalty: 2174

Appendix G

Roundabout Analysis


N
Essa Road
Ardagh Road
Bryne Drive
Essa Road
30
30
30
30
7
7
7
7
7
7
7
7


Essa Road
405
2.0%
126
4.0%
608
3.0%
490
3.0%
Ardagh Road
130
2.0%
61
5.0%
153
7.0%
42
6.0%
55
3.0%
Bryne Drive
956
2.0%
97
3.0%
25
3.0%
Essa Road

INTERSECTION SUMMARY

Site: 2021_AM Peak

Essa Rd and Bryne Dr/Ardagh Rd
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	3422	veh/h	4106	pers/h
Percent Heavy Vehicles	2.8	%		
Degree of Saturation	0.970			
Practical Spare Capacity	-12.4	%		
Effective Intersection Capacity	3528	veh/h		
Control Delay (Total)	31.76	veh-h/h	38.12	pers-h/h
Control Delay (Average)	33.4	sec	33.4	sec
Control Delay (Worst Lane)	56.1	sec		
Control Delay (Worst Movement)	56.1	sec	56.1	sec
Geometric Delay (Average)	7.4	sec		
Stop-Line Delay (Average)	33.4	sec		
Intersection Level of Service (LOS)	LOS D			
95% Back of Queue - Vehicles (Worst Lane)	12.3	veh		
95% Back of Queue - Distance (Worst Lane)	94.8	m		
Total Effective Stops	3709	veh/h	4450	pers/h
Effective Stop Rate	1.08	per veh	1.08	per pers
Proportion Queued	0.74		0.74	
Performance Index	103.6		103.6	
Travel Distance (Total)	2187.2	veh-km/h	2624.6	pers-km/h
Travel Distance (Average)	639	m	639	m
Travel Time (Total)	72.3	veh-h/h	86.8	pers-h/h
Travel Time (Average)	76.1	sec	76.1	sec
Travel Speed	30.2	km/h	30.2	km/h
Cost (Total)	1334.82	$/h	1334.82	$/h
Fuel Consumption (Total)	315.1	L/h		
Carbon Dioxide (Total)	788.5	kg/h		
Hydrocarbons (Total)	1.366	kg/h		
Carbon Monoxide (Total)	60.22	kg/h		
NOx (Total)	1.838	kg/h		

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Model used. Geometric Delay not included.

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	1,642,435	veh/y	1,970,922	pers/y
Delay	15,246	veh-h/y	18,295	pers-h/y
Effective Stops	1,780,111	veh/y	2,136,133	pers/y
Travel Distance	1,049,846	veh-km/y	1,259,815	pers-km/y
Travel Time	34,720	veh-h/y	41,664	pers-h/y
Cost	640,714	$/y	640,714	$/y
Fuel Consumption	151,228	L/y		
Carbon Dioxide	378,501	kg/y		
Hydrocarbons	656	kg/y		
Carbon Monoxide	28,905	kg/y		
NOx	882	kg/y		

LANE SUMMARY

Site: 2021_AM Peak

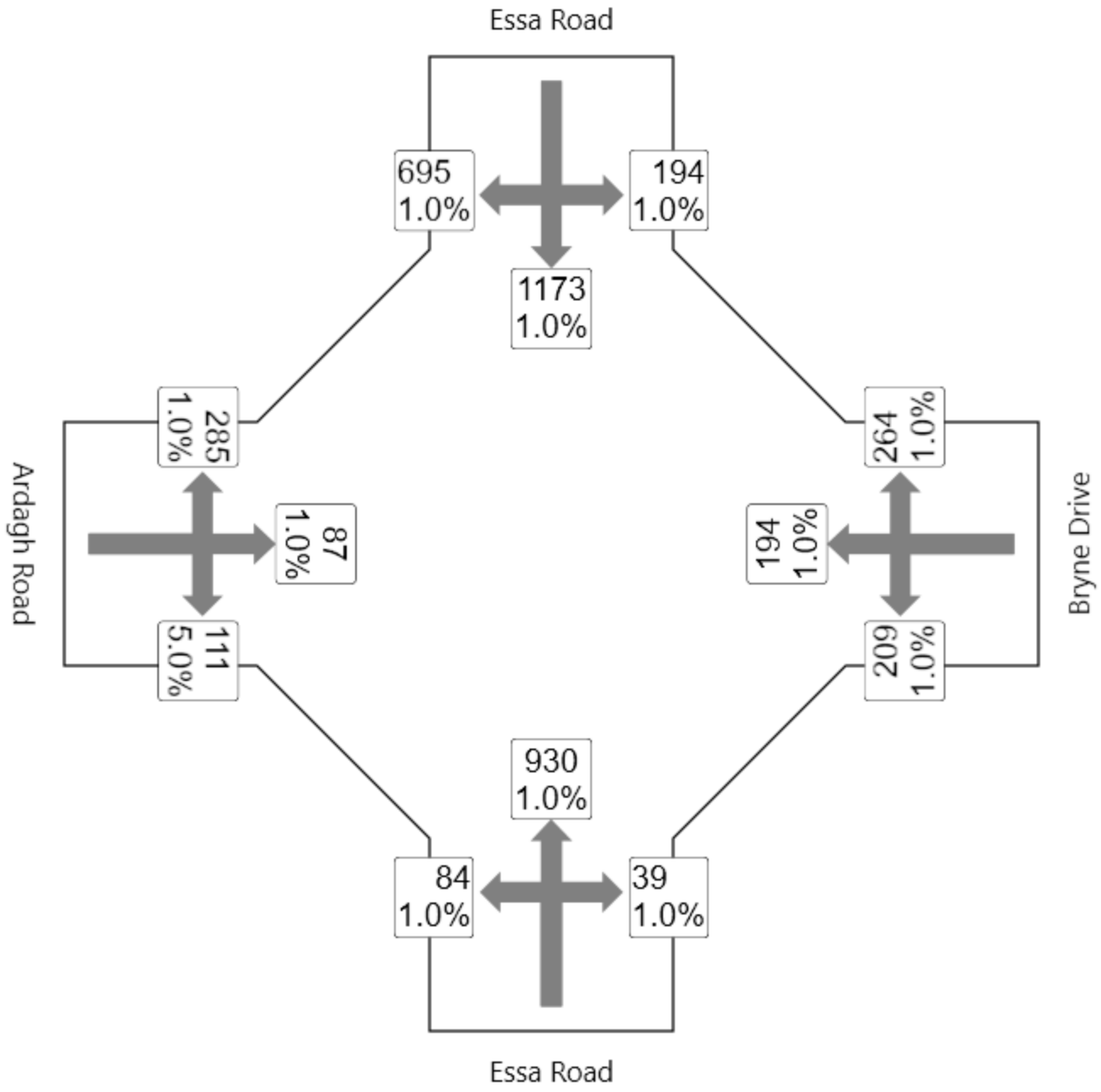
Essa Rd and Bryne Dr/Ardagh Rd
Roundabout

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Essa Road																
Lane 1	105	468	0	573	2.2	591	0.970	100	56.1	LOS F	12.3	94.8	500	–	0.0	0.0
Lane 2	0	571	27	598	2.0	617	0.970	100	54.8	LOS F	12.1	93.4	500	–	0.0	0.0
Approach	105	1039	27	1172	2.1		0.970		55.4	LOS F	12.3	94.8				
East: Bryne Drive																
Lane 1	60	46	0	105	4.3	299	0.353	67[5]	20.2	LOS C	1.0	7.9	500	–	0.0	0.0
Lane 2	0	0	166	166	7.0	317	0.524	100	25.8	LOS D	1.6	12.8	500	–	0.0	0.0
Approach	60	46	166	272	6.0		0.524		23.6	LOS C	1.6	12.8				
North: Essa Road																
Lane 1	137	476	0	613	3.2	929	0.660	100	14.3	LOS B	4.1	31.9	500	–	0.0	0.0
Lane 2	0	185	440	625	2.3	948	0.660	100	14.1	LOS B	3.9	30.5	500	–	0.0	0.0
Approach	137	661	440	1238	2.8		0.660		14.2	LOS B	4.1	31.9				
West: Ardagh Road																
Lane 1	533	0	0	533	3.0	591	0.902	100	42.9	LOS E	7.5	58.7	500	–	0.0	0.0
Lane 2	0	141	66	208	3.0	565	0.367	41[5]	11.9	LOS B	1.2	9.4	500	–	0.0	0.0
Approach	533	141	66	740	3.0		0.902		34.2	LOS D	7.5	58.7				
Intersection				3422	2.8		0.970		33.4	LOS D	12.3	94.8				

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Model used. Geometric Delay not included.

5 Lane underutilisation determined by program


Essa Road
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1.0%
194
1.0%
1173
1.0%
285
1.0%
264
1.0%
Ardagh Road
87
1.0%
194
1.0%
Bryne Drive
111
5.0%
209
1.0%
930
1.0%
84
1.0%
39
1.0%
Essa Road

INTERSECTION SUMMARY

Site: 2021_PM Peak

Essa Rd and Bryne Dr/Ardagh Rd
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	4636	veh/h	5563	pers/h
Percent Heavy Vehicles	1.1	%		
Degree of Saturation	1.476			
Practical Spare Capacity	-42.4	%		
Effective Intersection Capacity	3141	veh/h		
Control Delay (Total)	169.93	veh-h/h	203.92	pers-h/h
Control Delay (Average)	132.0	sec	132.0	sec
Control Delay (Worst Lane)	237.9	sec		
Control Delay (Worst Movement)	237.9	sec	237.9	sec
Geometric Delay (Average)	6.9	sec		
Stop-Line Delay (Average)	132.0	sec		
Intersection Level of Service (LOS)	LOS F			
95% Back of Queue - Vehicles (Worst Lane)	127.6	veh		
95% Back of Queue - Distance (Worst Lane)	977.7	m		
Total Effective Stops	13941	veh/h	16729	pers/h
Effective Stop Rate	3.01	per veh	3.01	per pers
Proportion Queued	0.91		0.91	
Performance Index	405.4		405.4	
Travel Distance (Total)	2948.5	veh-km/h	3538.2	pers-km/h
Travel Distance (Average)	636	m	636	m
Travel Time (Total)	224.2	veh-h/h	269.0	pers-h/h
Travel Time (Average)	174.1	sec	174.1	sec
Travel Speed	13.2	km/h	13.2	km/h
Cost (Total)	3589.24	$/h	3589.24	$/h
Fuel Consumption (Total)	634.4	L/h		
Carbon Dioxide (Total)	1586.7	kg/h		
Hydrocarbons (Total)	3.135	kg/h		
Carbon Monoxide (Total)	111.12	kg/h		
NOx (Total)	3.119	kg/h		

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Model used. Geometric Delay not included.

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	2,225,218	veh/y	2,670,261	pers/y
Delay	81,566	veh-h/y	97,880	pers-h/y
Effective Stops	6,691,473	veh/y	8,029,768	pers/y
Travel Distance	1,415,286	veh-km/y	1,698,343	pers-km/y
Travel Time	107,611	veh-h/y	129,133	pers-h/y
Cost	1,722,836	$/y	1,722,836	$/y
Fuel Consumption	304,518	L/y		
Carbon Dioxide	761,621	kg/y		
Hydrocarbons	1,505	kg/y		
Carbon Monoxide	53,336	kg/y		
NOx	1,497	kg/y		

LANE SUMMARY

Site: 2021_PM Peak

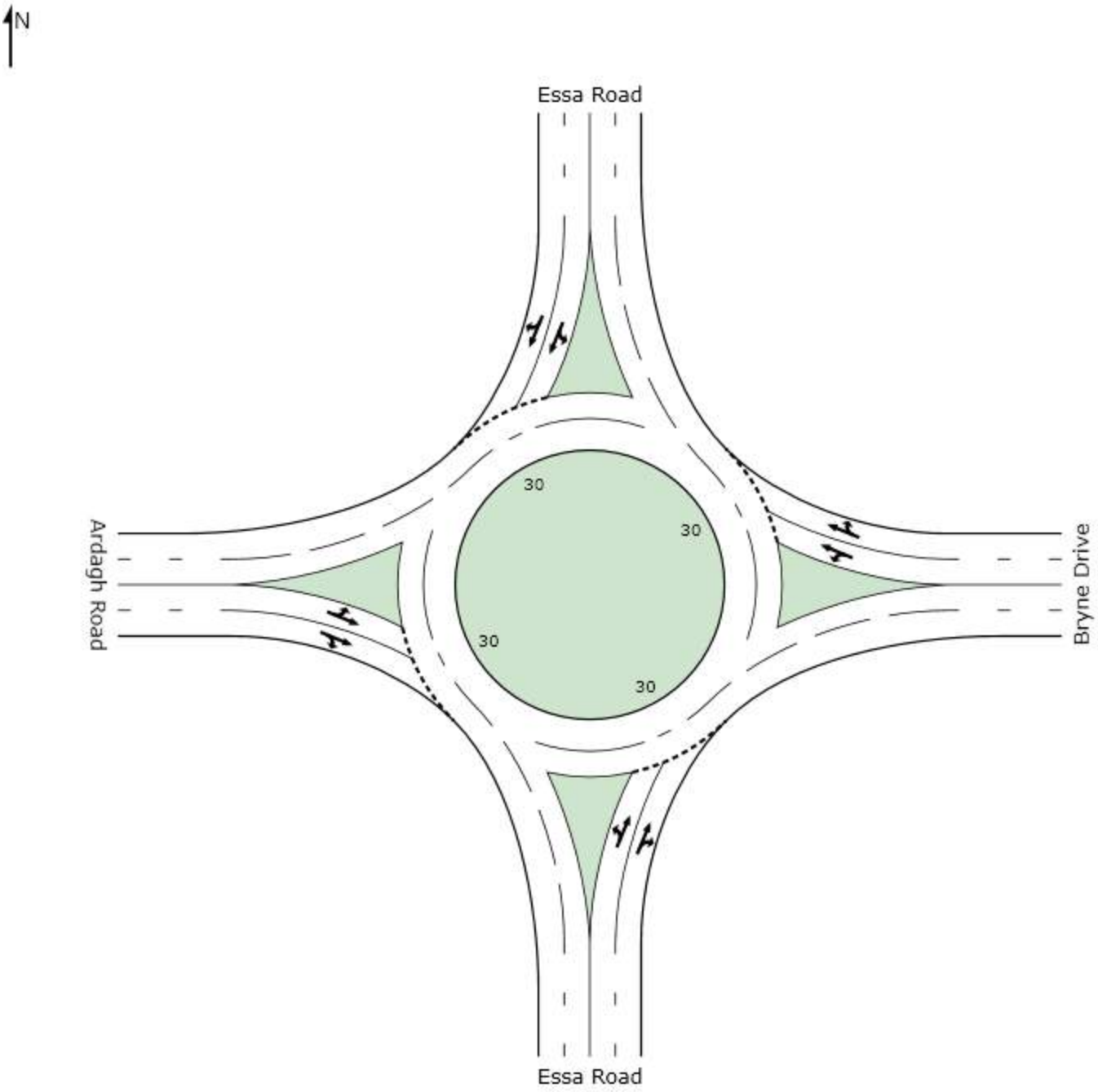
Essa Rd and Bryne Dr/Ardagh Rd
Roundabout

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Essa Road																
Lane 1	91	473	0	564	1.0	739	0.764	100	22.6	LOS C	5.4	41.6	500	–	0.0	0.0
Lane 2	0	538	42	580	1.0	760	0.764	100	22.1	LOS C	5.2	40.0	500	–	0.0	0.0
Approach	91	1011	42	1145	1.0		0.764		22.4	LOS C	5.4	41.6				
East: Bryne Drive																
Lane 1	227	122	0	350	1.0	384	0.911	100	59.0	LOS F	6.3	48.4	500	–	0.0	0.0
Lane 2	0	88	287	375	1.0	412	0.911	100	56.3	LOS F	6.2	47.9	500	–	0.0	0.0
Approach	227	211	287	725	1.0		0.911		57.6	LOS F	6.3	48.4				
North: Essa Road																
Lane 1	211	895	0	1106	1.0	749	1.476	100	237.9	LOS F	124.8	956.1	500	–	0.0	29.8
Lane 2	0	380	755	1136	1.0	770	1.476	100	237.4	LOS F	127.6	977.7	500	–	0.0	31.0
Approach	211	1275	755	2241	1.0		1.476		237.6	LOS F	127.6	977.7				
West: Ardagh Road																
Lane 1	310	0	0	310	1.0	468	0.663	100	24.9	LOS C	2.8	21.5	500	–	0.0	0.0
Lane 2	0	95	121	215	3.2	430	0.501	76[5]	19.0	LOS C	1.8	13.7	500	–	0.0	0.0
Approach	310	95	121	525	1.9		0.663		22.5	LOS C	2.8	21.5				
Intersection				4636	1.1		1.476		132.0	LOS F	127.6	977.7				

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Model used. Geometric Delay not included.

5 Lane underutilisation determined by program


N
Essa Road
Ardagh Road
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Essa Road
30
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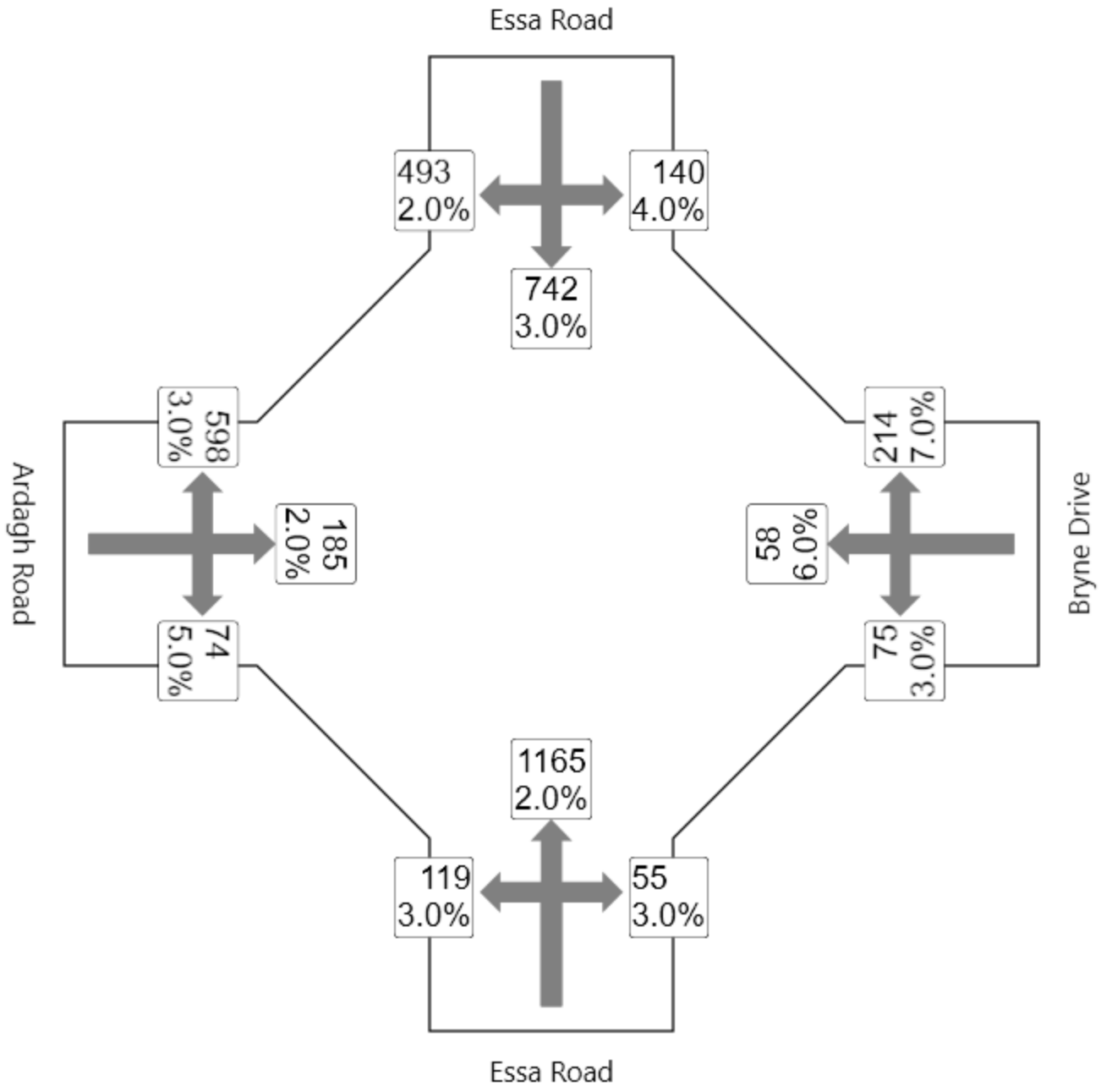

Essa Road
493
2.0%
140
4.0%
742
3.0%
598
3.0%
214
7.0%
Ardagh Road
185
2.0%
58
6.0%
Bryne Drive
74
5.0%
75
3.0%
1165
2.0%
119
3.0%
55
3.0%
Essa Road

INTERSECTION SUMMARY

Site: 2031_AM Peak

Essa Rd and Bryne Dr/Ardagh Rd
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	4259	veh/h	5110	pers/h
Percent Heavy Vehicles	2.9	%		
Degree of Saturation	1.260			
Practical Spare Capacity	-32.5	%		
Effective Intersection Capacity	3381	veh/h		
Control Delay (Total)	104.17	veh-h/h	125.00	pers-h/h
Control Delay (Average)	88.1	sec	88.1	sec
Control Delay (Worst Lane)	154.5	sec		
Control Delay (Worst Movement)	154.5	sec	154.5	sec
Geometric Delay (Average)	7.3	sec		
Stop-Line Delay (Average)	88.1	sec		
Intersection Level of Service (LOS)	LOS F			
95% Back of Queue - Vehicles (Worst Lane)	56.8	veh		
95% Back of Queue - Distance (Worst Lane)	439.2	m		
Total Effective Stops	9506	veh/h	11407	pers/h
Effective Stop Rate	2.23	per veh	2.23	per pers
Proportion Queued	0.88		0.88	
Performance Index	272.5		272.5	
Travel Distance (Total)	2720.8	veh-km/h	3264.9	pers-km/h
Travel Distance (Average)	639	m	639	m
Travel Time (Total)	154.6	veh-h/h	185.5	pers-h/h
Travel Time (Average)	130.7	sec	130.7	sec
Travel Speed	17.6	km/h	17.6	km/h
Cost (Total)	2589.64	$/h	2589.64	$/h
Fuel Consumption (Total)	508.5	L/h		
Carbon Dioxide (Total)	1272.7	kg/h		
Hydrocarbons (Total)	2.372	kg/h		
Carbon Monoxide (Total)	91.75	kg/h		
NOx (Total)	2.687	kg/h		

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Model used. Geometric Delay not included.

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	2,044,174	veh/y	2,453,009	pers/y
Delay	50,002	veh-h/y	60,002	pers-h/y
Effective Stops	4,562,929	veh/y	5,475,515	pers/y
Travel Distance	1,305,968	veh-km/y	1,567,162	pers-km/y
Travel Time	74,211	veh-h/y	89,053	pers-h/y
Cost	1,243,027	$/y	1,243,027	$/y
Fuel Consumption	244,089	L/y		
Carbon Dioxide	610,905	kg/y		
Hydrocarbons	1,139	kg/y		
Carbon Monoxide	44,039	kg/y		
NOx	1,290	kg/y		

LANE SUMMARY

Site: 2031_AM Peak

Essa Rd and Bryne Dr/Ardagh Rd
Roundabout

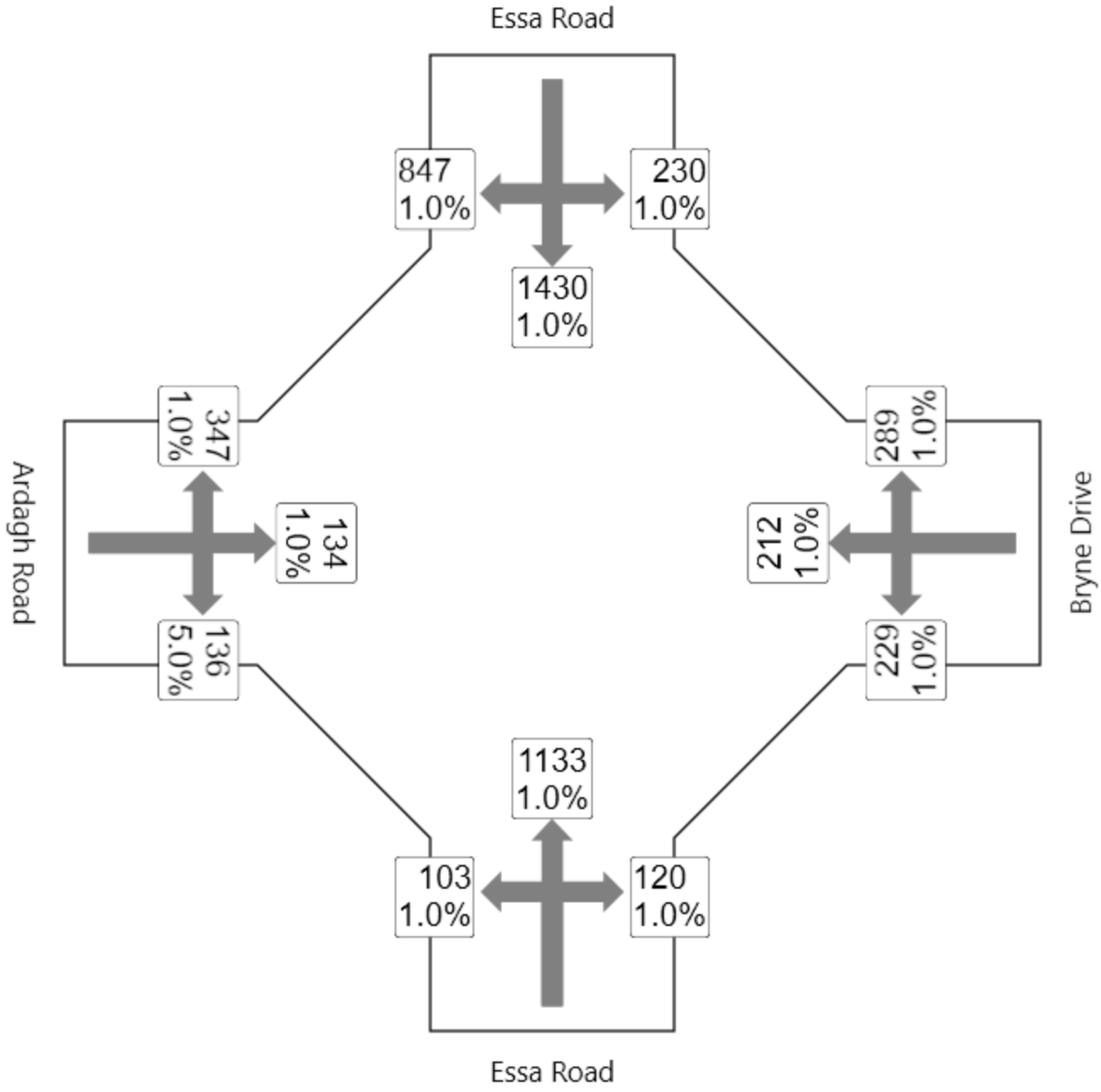
Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Essa Road																
Lane 1	129	582	0	711	2.2	565	1.260	100	153.6	LOS F	54.8	424.1	500	–	0.0	0.3
Lane 2	0	685	60	744	2.1	591	1.260	100	152.3	LOS F	56.8	439.2	500	–	0.0	1.3
Approach	129	1266	60	1455	2.1		1.260		153.0	LOS F	56.8	439.2				
East: Bryne Drive																
Lane 1	82	63	0	145	4.3	311	0.465	66[5]	23.6	LOS C	1.4	11.3	500	–	0.0	0.0
Lane 2	0	0	233	233	7.0	329	0.706	100	36.9	LOS E	2.6	21.0	500	–	0.0	0.0
Approach	82	63	233	377	6.0		0.706		31.8	LOS D	2.6	21.0				
North: Essa Road																
Lane 1	152	587	0	739	3.2	903	0.818	100	23.2	LOS C	8.1	63.2	500	–	0.0	0.0
Lane 2	0	220	536	755	2.3	923	0.818	100	22.9	LOS C	7.9	61.0	500	–	0.0	0.0
Approach	152	807	536	1495	2.7		0.818		23.0	LOS C	8.1	63.2				
West: Ardagh Road																
Lane 1	650	0	0	650	3.0	518	1.256	100	154.5	LOS F	49.2	383.2	500	–	0.0	0.0
Lane 2	0	201	80	282	2.9	491	0.573	46[5]	19.6	LOS C	2.3	17.8	500	–	0.0	0.0
Approach	650	201	80	932	3.0		1.256		113.7	LOS F	49.2	383.2				
Intersection				4259	2.9		1.260		88.1	LOS F	56.8	439.2				

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Model used. Geometric Delay not included.

5 Lane underutilisation determined by program

SIDRA INTERSECTION


Essa Road
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347
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Ardagh Road
134
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212
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Bryne Drive
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229
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1133
1.0%
103
1.0%
120
1.0%
Essa Road

INTERSECTION SUMMARY

Site: 2031_PM Peak

Essa Rd and Bryne Dr/Ardagh Rd
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	5663	veh/h	6796	pers/h
Percent Heavy Vehicles	1.1	%		
Degree of Saturation	1.774			
Practical Spare Capacity	-52.1	%		
Effective Intersection Capacity	3192	veh/h		
Control Delay (Total)	347.73	veh-h/h	417.28	pers-h/h
Control Delay (Average)	221.1	sec	221.1	sec
Control Delay (Worst Lane)	368.8	sec		
Control Delay (Worst Movement)	368.8	sec	368.8	sec
Geometric Delay (Average)	6.9	sec		
Stop-Line Delay (Average)	221.1	sec		
Intersection Level of Service (LOS)	LOS F			
95% Back of Queue - Vehicles (Worst Lane)	203.2	veh		
95% Back of Queue - Distance (Worst Lane)	1557.5	m		
Total Effective Stops	23404	veh/h	28085	pers/h
Effective Stop Rate	4.13	per veh	4.13	per pers
Proportion Queued	0.98		0.98	
Performance Index	740.4		740.4	
Travel Distance (Total)	3599.9	veh-km/h	4319.9	pers-km/h
Travel Distance (Average)	636	m	636	m
Travel Time (Total)	413.9	veh-h/h	496.7	pers-h/h
Travel Time (Average)	263.1	sec	263.1	sec
Travel Speed	8.7	km/h	8.7	km/h
Cost (Total)	6343.06	$/h	6343.06	$/h
Fuel Consumption (Total)	1003.3	L/h		
Carbon Dioxide (Total)	2509.4	kg/h		
Hydrocarbons (Total)	5.168	kg/h		
Carbon Monoxide (Total)	161.80	kg/h		
NOx (Total)	4.448	kg/h		

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Model used. Geometric Delay not included.

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	2,718,261	veh/y	3,261,913	pers/y
Delay	166,912	veh-h/y	200,294	pers-h/y
Effective Stops	11,234,140	veh/y	13,480,970	pers/y
Travel Distance	1,727,952	veh-km/y	2,073,543	pers-km/y
Travel Time	198,686	veh-h/y	238,423	pers-h/y
Cost	3,044,669	$/y	3,044,669	$/y
Fuel Consumption	481,593	L/y		
Carbon Dioxide	1,204,491	kg/y		
Hydrocarbons	2,481	kg/y		
Carbon Monoxide	77,663	kg/y		
NOx	2,135	kg/y		

LANE SUMMARY

Site: 2031_PM Peak

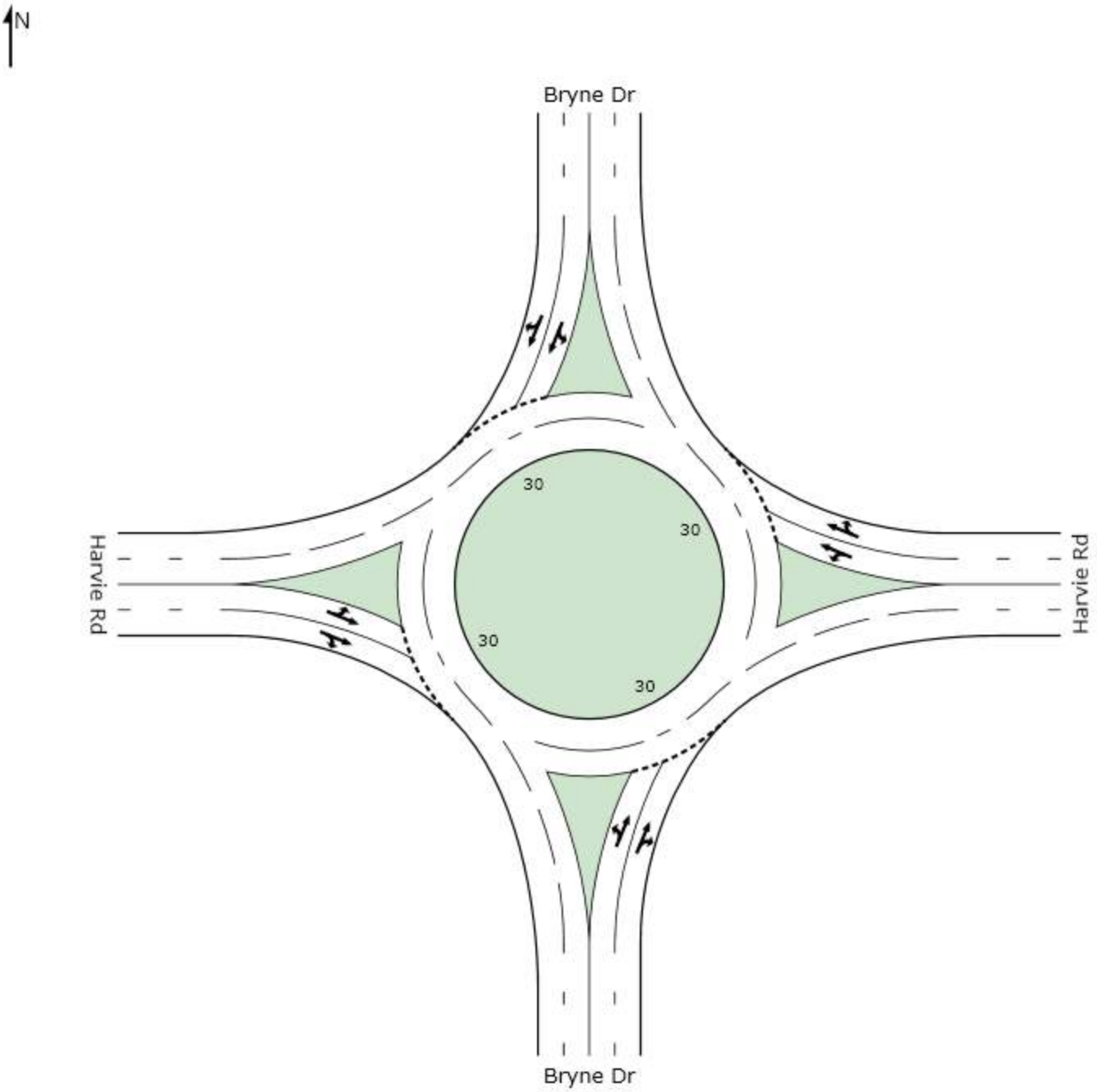
Essa Rd and Bryne Dr/Ardagh Rd
Roundabout

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Essa Road																
Lane 1	112	613	0	725	1.0	677	1.071	100	79.3	LOS F	28.4	217.7	500	–	0.0	0.0
Lane 2	0	619	130	749	1.0	700	1.071	100	78.3	LOS F	28.6	219.4	500	–	0.0	0.0
Approach	112	1232	130	1474	1.0		1.071		78.8	LOS F	28.6	219.4				
East: Bryne Drive																
Lane 1	249	131	0	380	1.0	325	1.170	100	139.9	LOS F	23.7	181.7	500	–	0.0	0.0
Lane 2	0	99	314	413	1.0	353	1.170	100	136.3	LOS F	25.2	192.8	500	–	0.0	0.0
Approach	249	230	314	793	1.0		1.170		138.0	LOS F	25.2	192.8				
North: Essa Road																
Lane 1	250	1095	0	1345	1.0	758	1.774	100	368.8	LOS F	198.6	1522.0	500	–	0.0	100.0
Lane 2	0	460	921	1380	1.0	778	1.774	100	368.4	LOS F	203.2	1557.5	500	–	0.0	100.0
Approach	250	1554	921	2725	1.0		1.774		368.6	LOS F	203.2	1557.5				
West: Ardagh Road																
Lane 1	377	0	0	377	1.0	469	0.804	100	36.3	LOS E	4.3	33.2	500	–	0.0	0.0
Lane 2	0	146	148	293	3.0	432	0.679	84[5]	27.6	LOS D	2.9	22.9	500	–	0.0	0.0
Approach	377	146	148	671	1.9		0.804		32.5	LOS D	4.3	33.2				
Intersection				5663	1.1		1.774		221.1	LOS F	203.2	1557.5				

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Model used. Geometric Delay not included.

5 Lane underutilisation determined by program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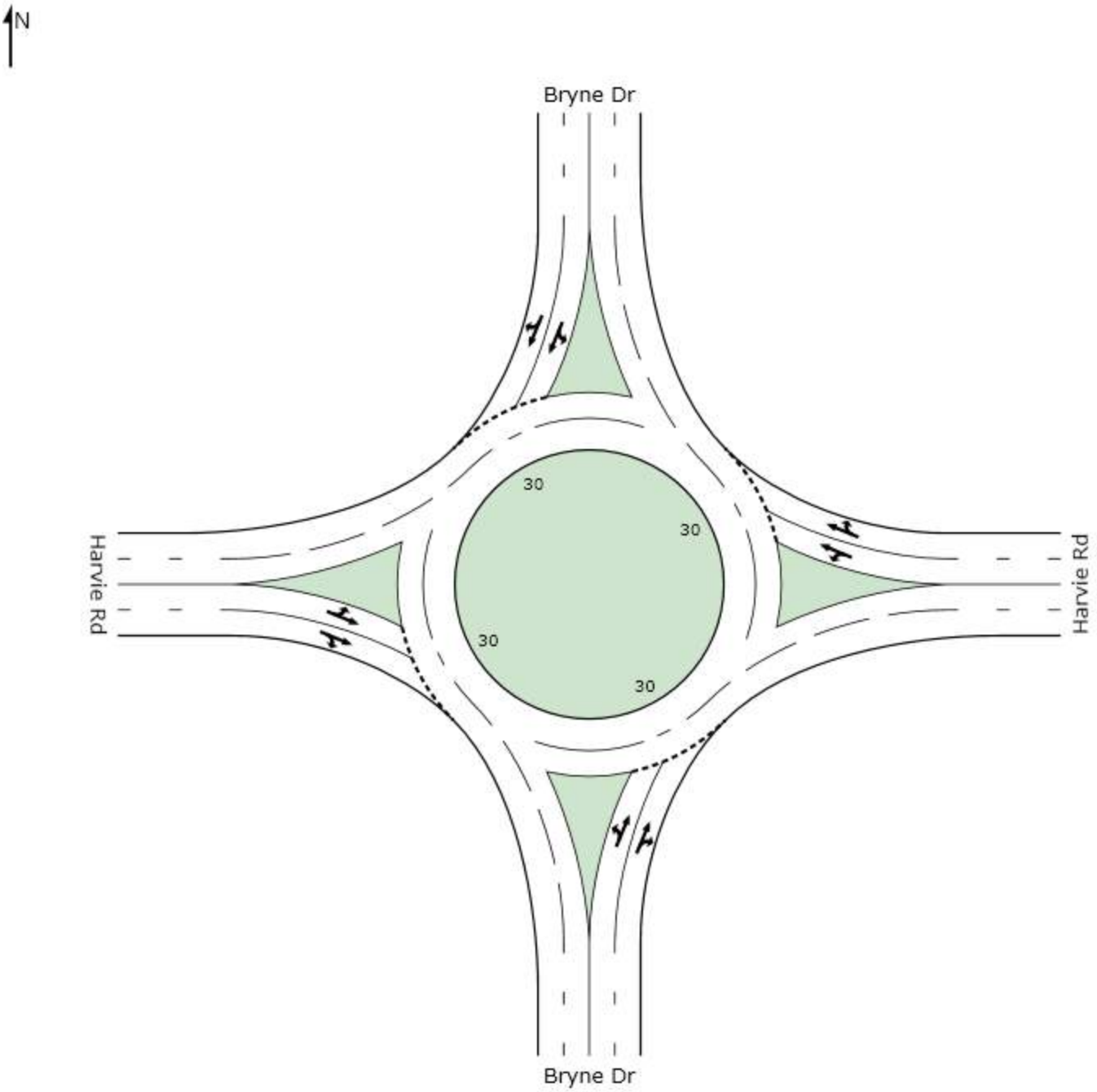
INTERSECTION SUMMARY

Harvie Rd & Bryne Dr
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	2621	veh/h	3145	pers/h
Percent Heavy Vehicles	6.0	%		
Degree of Saturation	0.709			
Practical Spare Capacity	19.9	%		
Effective Intersection Capacity	3697	veh/h		
Control Delay (Total)	12.74	veh-h/h	15.29	pers-h/h
Control Delay (Average)	17.5	sec	17.5	sec
Control Delay (Worst Lane)	22.2	sec		
Control Delay (Worst Movement)	22.2	sec	22.2	sec
Geometric Delay (Average)	6.9	sec		
Stop-Line Delay (Average)	17.5	sec		
Intersection Level of Service (LOS)	LOS C			
95% Back of Queue - Vehicles (Worst Lane)	3.8	veh		
95% Back of Queue - Distance (Worst Lane)	30.2	m		
Total Effective Stops	2283	veh/h	2739	pers/h
Effective Stop Rate	0.87	per veh	0.87	per pers
Proportion Queued	0.61		0.61	
Performance Index	58.3		58.3	
Travel Distance (Total)	1665.1	veh-km/h	1998.1	pers-km/h
Travel Distance (Average)	635	m	635	m
Travel Time (Total)	43.3	veh-h/h	51.9	pers-h/h
Travel Time (Average)	59.4	sec	59.4	sec
Travel Speed	38.5	km/h	38.5	km/h
Cost (Total)	881.65	$/h	881.65	$/h
Fuel Consumption (Total)	236.7	L/h		
Carbon Dioxide (Total)	593.2	kg/h		
Hydrocarbons (Total)	0.955	kg/h		
Carbon Monoxide (Total)	46.67	kg/h		
NOx (Total)	1.456	kg/h		

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Model used. Geometric Delay not included.

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	1,257,913	veh/y	1,509,496	pers/y
Delay	6,116	veh-h/y	7,340	pers-h/y
Effective Stops	1,095,639	veh/y	1,314,767	pers/y
Travel Distance	799,241	veh-km/y	959,089	pers-km/y
Travel Time	20,771	veh-h/y	24,925	pers-h/y
Cost	423,190	$/y	423,190	$/y
Fuel Consumption	113,626	L/y		
Carbon Dioxide	284,748	kg/y		
Hydrocarbons	459	kg/y		
Carbon Monoxide	22,402	kg/y		
NOx	699	kg/y		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Harvie Rd
Harvie Rd
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INTERSECTION SUMMARY

Site: 2031 PM w IC_Harvie and Bryne

Harvie Rd & Bryne Dr
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	4165	veh/h	4998	pers/h
Percent Heavy Vehicles	6.0	%		
Degree of Saturation	1.351			
Practical Spare Capacity	-37.1	%		
Effective Intersection Capacity	3083	veh/h		
Control Delay (Total)	127.89	veh-h/h	153.46	pers-h/h
Control Delay (Average)	110.5	sec	110.5	sec
Control Delay (Worst Lane)	188.1	sec		
Control Delay (Worst Movement)	188.1	sec	188.1	sec
Geometric Delay (Average)	6.7	sec		
Stop-Line Delay (Average)	110.5	sec		
Intersection Level of Service (LOS)	LOS F			
95% Back of Queue - Vehicles (Worst Lane)	82.3	veh		
95% Back of Queue - Distance (Worst Lane)	656.8	m		
Total Effective Stops	11213	veh/h	13455	pers/h
Effective Stop Rate	2.69	per veh	2.69	per pers
Proportion Queued	0.88		0.88	
Performance Index	319.3		319.3	
Travel Distance (Total)	2644.2	veh-km/h	3173.1	pers-km/h
Travel Distance (Average)	635	m	635	m
Travel Time (Total)	176.1	veh-h/h	211.4	pers-h/h
Travel Time (Average)	152.2	sec	152.2	sec
Travel Speed	15.0	km/h	15.0	km/h
Cost (Total)	2975.22	$/h	2975.22	$/h
Fuel Consumption (Total)	583.5	L/h		
Carbon Dioxide (Total)	1462.4	kg/h		
Hydrocarbons (Total)	2.686	kg/h		
Carbon Monoxide (Total)	106.66	kg/h		
NOx (Total)	3.111	kg/h		

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Model used. Geometric Delay not included.

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	1,999,304	veh/y	2,399,165	pers/y
Delay	61,385	veh-h/y	73,662	pers-h/y
Effective Stops	5,382,107	veh/y	6,458,528	pers/y
Travel Distance	1,269,220	veh-km/y	1,523,064	pers-km/y
Travel Time	84,546	veh-h/y	101,455	pers-h/y
Cost	1,428,107	$/y	1,428,107	$/y
Fuel Consumption	280,101	L/y		
Carbon Dioxide	701,934	kg/y		
Hydrocarbons	1,289	kg/y		
Carbon Monoxide	51,196	kg/y		
NOx	1,493	kg/y		