



TRAFFIC IMPACT STUDY

Residential Development
Part of Lot 67, Uppers Lane
Thorold, Ontario

Prepared for FARZ Holdings Inc.

December 2018





December 5, 2018

FARZ Holdings Inc.

c/o - Mr. Aleks J. Todorovski
LARKIN+ land use planners inc.
849 Gorham Street
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Re: Traffic Impact Study, Proposed Residential Development, Part of Lot 67, Uppers Lane, Thorold, Ontario

TRANS-PLAN is pleased to submit this Transportation Study in support of the proposed residential development located within Part of Lot 67, Uppers Lane, Thorold, Ontario.

We have prepared a Traffic Impact Study (TIS) that includes analysis horizon years for existing conditions, a development case after three years, and five and ten-year traffic volume projections to review traffic operations after development. The TIS report contains an analysis of the intersection capacity and level of service for the boundary roadways. The study intersections surrounding the proposed site were targeted as well as the future road connections to the subject site. The study for the Rolling Meadows development with 2090 units has been incorporated in our analysis, as it encompasses our site and provides connection to the greater road network.

Our traffic analysis findings indicate that some improvements to the signal timing, traffic signals and intersection geometry for the study area intersections would improve background traffic conditions to acceptable levels. Most of the recommended improvements are the same as were recommended in the previous Rolling Meadows TIS. Considering the study area post improvements the traffic operations are well within acceptable levels.

Sincerely,

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Partner, Engineer

Trans-Plan Transportation Inc.
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1. INTRODUCTION

Trans-Plan has been retained by FARZ Holdings Inc. to complete a Traffic Impact Study (TIS) for a proposed residential development located within Part of Lot 67, Upper's Lane, Thorold. This study includes the following components:

Traffic Impact Study

- Review of the proposed development and site statistics including the greater background development surrounding the proposed site
- Review and assessment of the existing road network and study area intersections
- Assessment of future background conditions based on anticipated traffic growth, area developments and planned transportation improvements in the study area
- Assessment of the impact of site-generated traffic on the adjacent roadway network under future background and total traffic conditions for a three, five and ten-year study horizon
- Confirmation that the roadway and intersections can accommodate the proposed development for traffic capacity and level of service (LOS)
- Determination of roadway and intersection improvements, as required, to accommodate the proposed development, including future roadways / connections to the subject site

Prior to commencing these studies engineering staff at the City of Thorold, Niagara Region and the MTO were contacted to discuss the scope of the work and to request traffic data. This study reflects feedback received from the City, Region and MTO as well as standards set out in the Highway Capacity Manual (HCM), the Ontario Provincial Standards for Roads & Public Works (OPS) and both the MTO and Thorold Traffic Impact Study guidelines.

2. BACKGROUND

2.1 Site location

The proposed site is part of a larger neighbourhood development called "Rolling Meadows". This development is located within the area defined by Beaverdams Road to the north, Thorold Townline Road to the east, Lundy's Lane to the south and Davis Road to the west. The greater neighbourhood development will contain 2,434 units shared between single detached units and town home units. This TIS will focus on 344 units located in the north east corner of the development lands. This residential development is located in between the cities of Niagara Falls (to the east) and St. Catharines (to the north).

2.2 Development Proposal

The draft plan for the subdivision may be seen in Figure 2. The neighbourhood consists of a mix of single detached units and town home units. As well as space allocated for green space and parks. The development connects to the greater road network through the adjacent neighbourhood development and Upper's Lane which will run from Davis Road to Thorold Townline Road connecting to the south limit of the site.

Table 1 – Residential Site Statistics

Use	Breakdown	
Single Detached Lots	101	
Street Townhouse Lots	243	
Total	344	
Land Use	Area (sq.m.)	% Breakdown
Lots	90670	60.7
Roads	39520	26.4
Park	9830	6.6
Hedgerows	3420	2.3
Pipeline	5940	4.0
Total	149380	100

2.3 Roadways

The study area roadways in the immediate vicinity of the site can be described as follows:

Beaverdams Road is a minor arterial under the jurisdiction of the Region of Niagara. It runs in an east-west direction consisting of two travel lanes one in each direction. The roadway has a posted speed limit of 80 km/h.

Thorold Townline Road is a minor arterial under the jurisdiction of the Region of Niagara. It runs in a north-south direction consisting of two travel lanes, one in each direction. The roadway has a posted speed limit of 80 km/h.

Lundy's Lane is a Class 4 - Major Highway under the jurisdiction of the MTO. It runs in an east-west direction consisting of two travel lanes, one in each direction. The roadway has a posted speed limit of 80 km/h.

Davis Road is a Class 4 - Major Highway under the jurisdiction of the MTO. It runs in an east-west direction consisting of two travel lanes, one in each direction. The roadway has a posted speed limit of 80 km/h.

Uppers Lane is a local road under the jurisdiction of the City of Thorold. It runs in an east-west direction consisting of two travel lanes, one in each direction. The roadway has an assumed speed limit of 50 km/h. In future conditions Upper's lane is to be extended to connect Davis Road and Thorold Townline Road.

Barker Parkway is a local neighbourhood road under the jurisdiction of the City of Thorold. It runs in an east-west direction consisting of two travel lanes, one in each direction. The roadway has an assumed speed limit of 50 km/h.

The study area roadway characteristics are shown in Figure 3.

2.4 Transit Services

The current active transit connections in close proximity to the site are summed up in Table 2. The local transit connections service the proposed site however considering the nature of the site most trips would come from auto use and not transit connections. A map of the transit route may be found in Appendix A.

Table 2 – Transit Service Times

Route	No.	Approximate Service Times		Approximate Peak Service Frequency (min)		
		Weekdays	Weekends	AM	PM	SAT
Thorold South	322	06:30 – 18:30	06:30 – 18:30	30	30	30

3. TRANSPORTATION IMPACT STUDY COMPONENTS

This TIS was completed to analyse the impacts that the proposed development will have on the surrounding network. This analysis took a stepwise approach to making sure that the development would not cause surrounding conditions to deteriorate. First a model was constructed that mirrors the existing conditions to provide baseline judgement. This model was then taken and a growth rate was applied to yield future conditions for five- and ten-year horizons. Then site traffic was generated, distributed across the road network and added to the growth case to yield a total case that reflects the impacts of the site on the surrounding network.

3.1 Study Area Intersections

For the purposes of analysis a zone of review had to be selected that contained a logical snapshot of the surrounding traffic conditions. Through communication with the city of Thorold, the Region of Niagara and the MTO, the following intersections encompassing the proposed development were selected:

- Beaverdams Road & Davis Road
- Beaverdams Road & Thorold Townline Road
- Lundy's Lane & Davis Road
- Lundy's Lane & Thorold Townline Road
- Davis Road & Barker Parkway
- Davis Road & Upper's Lane

3.2 Traffic Counts

To determine existing operating conditions within the study area, Trans-Plan conducted a site visit and intersection turning movement counts (TMCs), as recent counts were not readily available. The traffic

counts were all conducted on a typical weekday to capture peak hour roadway traffic volumes (when the residential uses would likely peak). TMC diagrams are provided in Appendix A – Transit Route Map

Appendix B. The dates and times that TMCs were undertaken, as well as the peak hours obtained, are summarized in Table 3.

Table 3 – Weekday Turning Movement Count Details

Survey Dates	Survey Periods	Intersections	Peak Hours
Thursday November 1, 2018	Weekday AM 7:00 am – 9:30 am Weekday PM 4:00 pm – 6:30 pm	Beaverdams Road & Davis Road	AM 8:00 – 9:00 PM 16:45 – 17:45
		Beaverdams Road & Thorold Townline Road	AM 8:00 – 9:00 PM 16:15 – 17:15
		Lundy's Lane & Davis Road	AM 7:45 – 8:45 PM 16:30 – 17:30
		Lundy's Lane & Thorold Townline Road	AM 7:30 – 8:30 PM 16:45 – 17:45
		Davis Road & Barker Parkway	AM 7:45 – 8:45 PM 16:30 – 17:30
		Davis Road & Upper's Lane	AM 7:45 – 8:45 PM 16:15 – 17:15

The existing traffic volumes for the weekday AM and PM peak hours are shown in Figure 4. For the traffic analysis, roadway volumes were balanced (increased) to ensure consistency between the roadway traffic volumes.

3.3 Planned Background Developments

Based on correspondence with the City of Thorold there is a larger neighbourhood development currently under construction adjacent to the proposed site. This development is called Rolling Meadows and contains the following breakdown of uses.

Table 4 – Background Development Breakdown

Unit Type	Units	Space Breakdown
Single-unit Homes	1,184	56.6%
Townhomes	412	19.7%
Medium Density Blocks	172	8.2%
Mixed Use Blocks	167	8%
High Density Blocks	155	7.5%
Total	2090	100%

This development is represented / incorporated in the background traffic conditions and our modeling of future background traffic volumes. The developments model views may be seen in Figure 5. Further information including a site plan and trip distribution table can be found in Appendix C.

3.4 Background Traffic Growth

After discussion with the City of Thorold, a conservative growth rate of two percent (2%) per annum was selected based on the previous Rolling Meadows study that occupies the area surrounding the proposed site. This growth rate was applied to existing traffic volumes at all roads to obtain future background traffic volumes.

3.5 Development Phasing

The construction of the development is to occur in three years, however, this is contingent on the development of the larger Rolling Meadows neighbourhood and a successful approval process. The new site access 1, 2 and 3 as well as the internal road structure are the responsibility of the Rolling Meadows development. The selected development horizons will be accurate as long as the larger background development completes the connecting road structure in a timely fashion.

3.6 Trip Generation

In order to determine the impact of the proposed neighbourhood on the surrounding road network, trips were generated for the subject site so that these vehicles could be added to the adjacent intersections. The Institute of Transportation Engineers Trip Generation Manuals, 9th Edition, Volume 2, was used with Land Use Code (LUC) 210: Single Homes and LUC 230 Townhomes. The outputs can be found in Table 5.

Table 5 – Site Trip Generation for Residential Units

Dwelling Type	Size (Units)		AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Single Homes ITE Code 210	101	Dir. Distr.	25%	75%	100%	63%	37%	100%
		Equation	$T = 0.70 (X) + 9.74$			$\ln(T)=0.90\ln(X)+0.51$		
		Rate	0.20	0.59	0.79	0.66	0.39	1.05
		Trips	20	60	80	67	39	106

Dwelling Type	Size (Units)		AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Townhomes ITE Code 230	243	Dir. Distr.	17%	83%	100%	67%	33%	100%
		Equation	$T = 0.80 (X) + 0.26$			$\ln(T)=0.82\ln(X)+0.32$		
		Rate	0.14	0.67	0.80	0.34	0.17	0.51
		Trips	33	162	195	84	41	125

3.7 Trip Distribution and Assignment

The trips were distributed in a way that pointed them towards the largest potential draws (as well as based on a review of traffic patterns from the existing turning movement counts). The majority of site traffic was assigned towards St. Catharines, to the northwest, and towards Niagara, to the east, along the major highway routes. The trip distribution and assignment scheme can be seen in Figure 9.

3.8 Future Total Traffic Conditions

Site traffic volumes were added to the future background traffic volumes to obtain the future total traffic volumes for the three planning horizons. The future total traffic volumes for the horizon years 2021, 2026 and 2031 are provided in Figure 10, Figure 11 and Figure 12, respectively.

3.9 Capacity Analysis

A capacity analysis was performed for the study area intersections using Synchro software to analyse the intersections immediately around the proposed site. Output data sheets for the following cases can be found in Appendix D and Level of Service (LOS) Definitions are provided in Appendix E. The planning horizons assessed include:

- Existing conditions
- Future three-year conditions when development occurs (year 2021)
- Future five-year conditions after development (year 2026)
- Future ten-year conditions after development (year 2031)

The capacity tables for the existing conditions, three-year build out, five and ten year horizons years (thereafter) are provided in Table 6 through Table 9.

Table 6 - Existing Conditions Capacity Analysis Results



Intersection	2018 Existing Traffic Conditions					
	Weekday AM Peak Hour			Weekday PM Peak Hour		
	V/C	Delay	LOS	V/C	Delay	LOS
Niagara Falls Road & Davis Road	0.32	11	B	0.35	10	B
Eastbound Left / Through / Right	0.61	23	C	0.48	19	B
Westbound Left / Through / Right	0.26	17	B	0.42	18	B
Northbound Left	0.01	6	A	0.02	6	A
Northbound Through / Right	0.19	7	A	0.14	6	A
Southbound Left	0.16	7	A	0.29	8	A
Southbound Through	0.10	6	A	0.17	7	A
Southbound Right	0.03	6	A	0.08	6	A
Beaverdams Road & Thorold Townline Road						
Eastbound Left / Through / Right		10	A		11	B
Westbound Left / Through / Right		11	B		11	B
Northbound Left / Through / Right		10	A		11	B
Southbound Left / Through / Right		10	A		12	B
Barker Parkway & Davis Road						
Westbound Left / Right		9	A		9	A
Northbound Through		0	A		0	A
Northbound Right		0	A		0	A
Southbound Left		7	A		7	A
Southbound Through		0	A		0	A
Allanburg Road & Davis Road						
Eastbound Left / Through		11	B		12	B
Eastbound Right		11	B		12	B
Westbound Left / Through / Right		0	A		0	A
Northbound Left		8	A		8	A
Northbound Through / Right		0	A		0	A
Southbound Left		0	A		0	A
Southbound Through		0	A		0	A
Southbound Right		0	A		0	A
Lundy's Lane & Davis Road	0.42	12	B	0.59	18	B
Eastbound Left	0.40	12	B	0.49	13	B
Eastbound Through / Right	0.61	14	B	0.89	27	C
Westbound Left	0.11	10	B	0.24	11	B
Westbound Through	0.52	13	B	0.70	15	B
Westbound Right	0.04	10	A	0.05	9	A
Northbound Left	0.06	9	A	0.16	12	B
Northbound Through / Right	0.25	10	B	0.24	13	B
Southbound Left	0.09	9	A	0.17	12	B
Southbound Through	0.13	9	A	0.23	12	B
Southbound Right	0.06	9	A	0.08	11	B
Lundy's Lane & Thorold Townline Road	0.34	11	B	0.48	14	B
Eastbound Left	0.16	11	B	0.11	10	B
Eastbound Through	0.50	13	B	0.73	17	B
Eastbound Right	0.06	10	B	0.06	10	A
Westbound Left	0.10	10	B	0.23	11	B
Westbound Through / Right	0.52	13	B	0.62	14	B
Northbound Left	0.10	9	A	0.26	11	B
Northbound Through / Right	0.18	9	A	0.16	10	A
Southbound Left	0.02	8	A	0.03	9	A
Southbound Through / Right	0.11	9	A	0.20	10	A

Table 7 - 2021 Capacity Analysis Results

Intersection Movement	2021 Background Traffic Conditions						2021 Total Traffic Conditions					
	Weekday AM Peak Hour			Weekday PM Peak Hour			Weekday AM Peak Hour			Weekday PM Peak Hour		
	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS
Niagara Falls Road & Davis Road	0.49	11	B	0.54	11	B	0.53	11	B	0.57	11	B
Eastbound Left	0.54	21	C	0.50	22	C	0.54	21	C	0.50	22	C
Eastbound Through / Right	0.08	16	B	0.08	18	B	0.08	16	B	0.08	18	B
Westbound Left / Through / Right	0.47	19	B	0.52	22	C	0.52	19	B	0.52	22	C
Northbound Left	0.01	6	A	0.06	6	A	0.01	6	A	0.07	6	A
Northbound Through / Right	0.47	9	A	0.38	7	A	0.53	9	A	0.40	8	A
Southbound Left	0.32	10	A	0.52	13	B	0.38	12	B	0.55	14	B
Southbound Through	0.24	7	A	0.55	9	A	0.26	7	A	0.59	9	A
Southbound Right	0.03	6	A	0.09	6	A	0.03	6	A	0.09	6	A
Beaverdams Road & Thorold Townline Road												
Eastbound Left / Through / Right		10	B		14	B		10	B		14	B
Westbound Left / Through / Right		13	B		16	C		13	B		16	C
Northbound Left / Through / Right		12	B		13	B		12	B		14	B
Southbound Left / Through / Right		10	B		15	B		10	B		15	C
Barker Parkway & Davis Road	0.36	9	A	0.65	13	B	0.41	9	A	0.71	14	B
Westbound Left	0.01	11	B	0.04	26	C	0.01	10	B	0.04	26	C
Westbound Right	0.34	12	B	0.29	28	C	0.39	12	B	0.31	28	C
Northbound Through / Right	0.07	4	A	0.06	2	A	0.09	4	A	0.06	2	A
Southbound Left	0.37	6	A	0.71	9	A	0.41	7	A	0.77	11	B
Southbound Through	0.04	4	A	0.07	2	A	0.05	4	A	0.08	2	A
Allanburg Road & Davis Road	0.29	7	A	0.29	6	A	0.31	7	A	0.32	6	A
Eastbound Left / Through	0.27	13	B	0.18	12	B	0.28	12	B	0.19	12	B
Eastbound Right	0.03	12	B	0.03	12	B	0.03	11	B	0.03	12	B
Westbound Left / Through / Right	0.32	13	B	0.31	13	B	0.36	13	B	0.33	13	B
Northbound Left	0.07	3	A	0.12	4	A	0.07	4	A	0.13	4	A
Northbound Through / Right	0.28	4	A	0.28	4	A	0.29	5	A	0.28	4	A
Southbound Left	0.10	4	A	0.29	5	A	0.12	4	A	0.32	5	A
Southbound Through	0.13	4	A	0.22	4	A	0.13	4	A	0.22	4	A
Southbound Right	0.02	3	A	0.04	3	A	0.02	3	A	0.04	3	A
Lundy's Lane & Davis Road	0.48	17	B	0.55	23	C	0.49	17	B	0.56	23	C
Eastbound Left	0.52	15	B	0.63	19	B	0.54	15	B	0.66	20	B
Eastbound Through / Right	0.50	19	B	0.70	24	C	0.50	19	B	0.71	24	C
Westbound Left	0.39	16	B	0.52	23	C	0.44	17	B	0.56	24	C
Westbound Through	0.51	20	B	0.71	29	C	0.52	20	B	0.71	29	C
Westbound Right	0.05	17	B	0.05	22	C	0.05	17	B	0.05	22	C
Northbound Left	0.10	16	B	0.19	20	C	0.10	16	B	0.19	20	C
Northbound Through / Right	0.41	20	B	0.44	23	C	0.42	20	B	0.45	24	C
Southbound Left	0.13	12	B	0.22	15	B	0.13	12	B	0.22	15	B
Southbound Through	0.15	12	B	0.21	15	B	0.15	12	B	0.21	15	B
Southbound Right	0.10	12	B	0.12	14	B	0.11	12	B	0.13	15	B
Lundy's Lane & Thorold Townline Road	0.58	17	B	0.70	23	C	0.64	18	B	0.72	24	C
Eastbound Left	0.26	12	B	0.33	14	B	0.25	12	B	0.34	14	B
Eastbound Through	0.83	23	C	0.86	25	C	0.85	25	C	0.86	25	C
Eastbound Right	0.11	11	B	0.10	10	B	0.12	11	B	0.10	10	B
Westbound Left	0.30	13	B	0.44	15	B	0.33	13	B	0.44	15	B
Westbound Through	0.66	16	B	0.90	29	C	0.64	15	B	0.91	30	C
Westbound Right	0.06	11	B	0.12	11	B	0.06	10	B	0.13	10	B
Northbound Left	0.20	14	B	0.54	21	C	0.21	15	B	0.57	23	C
Northbound Through / Right	0.31	18	B	0.27	23	C	0.32	19	B	0.28	23	C
Southbound Left	0.33	15	B	0.37	20	C	0.41	16	B	0.40	21	C
Southbound Through	0.14	16	B	0.28	23	C	0.14	17	B	0.28	24	C
Southbound Right	0.02	15	B	0.03	21	C	0.02	16	B	0.03	21	C
Lundy's Lane & Site Access 1	0.49	10	A	0.58	10	B	0.54	10	A	0.60	11	B
Eastbound Left	0.14	9	A	0.54	13	B	0.16	9	A	0.59	15	B
Eastbound Through	0.43	10	A	0.51	9	A	0.43	10	A	0.51	9	A
Westbound Through	0.54	10	B	0.65	11	B	0.55	10	B	0.65	11	B
Westbound Right	0.08	8	A	0.22	8	A	0.09	8	A	0.24	8	A
Southbound Left / Through	0.45	9	A	0.51	14	B	0.54	10	A	0.55	14	B
Lundy's Lane & Site Access 2												
Eastbound Left		9	A		11	B		9	A		12	B
Eastbound Through		0	A		0	A		0	A		0	A
Westbound Through / Right		0	A		0	A		0	A		0	A
Southbound Left / Right		13	B		20	C		13	B		21	C
Site Access 3 & Thorold Townline Road												
Eastbound Left / Right		12	B		16	C		12	B		17	C
Northbound Left		8	A		8	A		8	A		9	A
Northbound Through		0	A		0	A		0	A		0	A
Southbound Through / Right		0	A		0	A		0	A		0	A

Table 8 - 2026 Capacity Analysis Results

Intersection	2026 Background Traffic Conditions						2026 Total Traffic Conditions					
	Weekday AM Peak Hour			Weekday PM Peak Hour			Weekday AM Peak Hour			Weekday PM Peak Hour		
	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS
Niagara Falls Road & Davis Road	0.54	11	B	0.60	11	B	0.58	12	B	0.62	12	B
Eastbound Left	0.64	25	C	0.60	26	C	0.64	25	C	0.60	26	C
Eastbound Through / Right	0.09	16	B	0.09	18	B	0.09	16	B	0.09	18	B
Westbound Left / Through / Right	0.56	20	B	0.60	23	C	0.61	21	C	0.60	23	C
Northbound Left	0.01	6	A	0.07	6	A	0.01	6	A	0.08	7	A
Northbound Through / Right	0.50	9	A	0.40	8	A	0.55	9	A	0.42	8	A
Southbound Left	0.38	12	B	0.60	16	B	0.45	14	B	0.63	18	B
Southbound Through	0.26	7	A	0.57	9	A	0.27	7	A	0.61	10	A
Southbound Right	0.03	6	A	0.10	6	A	0.03	6	A	0.10	6	A
Beaverdams Road & Thorold Townline Road												
Eastbound Left / Through / Right		11	B		16	C		11	B		16	C
Westbound Left / Through / Right		14	B		18	C		14	B		19	C
Northbound Left / Through / Right		13	B		15	C		13	B		16	C
Southbound Left / Through / Right		11	B		18	C		11	B		18	C
Barker Parkway & Davis Road	0.37	9	A	0.66	13	B	0.41	9	A	0.72	14	B
Westbound Left	0.01	11	B	0.04	26	C	0.01	11	B	0.05	26	C
Westbound Right	0.34	12	B	0.29	28	C	0.40	12	B	0.31	28	C
Northbound Through / Right	0.08	4	A	0.06	2	A	0.09	4	A	0.06	2	A
Southbound Left	0.38	6	A	0.72	9	A	0.42	7	A	0.78	11	B
Southbound Through	0.04	4	A	0.07	2	A	0.05	4	A	0.08	2	A
Allanburg Road & Davis Road	0.31	7	A	0.30	6	A	0.33	7	A	0.33	6	A
Eastbound Left / Through	0.29	13	B	0.20	12	B	0.31	13	B	0.21	12	B
Eastbound Right	0.04	11	B	0.03	12	B	0.04	11	B	0.03	12	B
Westbound Left / Through / Right	0.31	13	B	0.30	13	B	0.36	13	B	0.33	13	B
Northbound Left	0.08	3	A	0.14	4	A	0.08	4	A	0.14	4	A
Northbound Through / Right	0.31	5	A	0.30	4	A	0.32	5	A	0.31	4	A
Southbound Left	0.11	4	A	0.30	5	A	0.12	4	A	0.33	5	A
Southbound Through	0.14	4	A	0.24	4	A	0.15	4	A	0.24	4	A
Southbound Right	0.02	3	A	0.04	3	A	0.02	3	A	0.04	3	A
Lundy's Lane & Davis Road	0.54	18	B	0.60	24	C	0.55	18	B	0.62	25	C
Eastbound Left	0.59	17	B	0.70	22	C	0.61	17	B	0.73	24	C
Eastbound Through / Right	0.55	19	B	0.75	25	C	0.55	19	B	0.76	26	C
Westbound Left	0.43	17	B	0.60	26	C	0.49	17	B	0.64	29	C
Westbound Through	0.55	20	C	0.76	30	C	0.56	20	C	0.77	30	C
Westbound Right	0.05	17	B	0.05	22	C	0.05	17	B	0.05	22	C
Northbound Left	0.11	16	B	0.22	21	C	0.11	16	B	0.22	21	C
Northbound Through / Right	0.46	20	C	0.48	25	C	0.46	20	C	0.50	25	C
Southbound Left	0.15	12	B	0.26	15	B	0.15	12	B	0.26	15	B
Southbound Through	0.16	12	B	0.24	16	B	0.16	12	B	0.24	16	B
Southbound Right	0.11	12	B	0.13	15	B	0.12	12	B	0.13	15	B
Lundy's Lane & Thorold Townline Road	0.63	18	B	0.74	25	C	0.67	19	B	0.80	25	C
Eastbound Left	0.30	12	B	0.37	14	B	0.29	12	B	0.37	14	B
Eastbound Through	0.86	25	C	0.89	28	C	0.89	27	C	0.88	25	C
Eastbound Right	0.12	11	B	0.11	10	B	0.12	10	B	0.11	10	A
Westbound Left	0.37	14	B	0.55	20	B	0.38	14	B	0.55	19	B
Westbound Through	0.69	17	B	0.92	31	C	0.67	16	B	0.92	31	C
Westbound Right	0.06	10	B	0.12	10	B	0.06	10	B	0.13	10	A
Northbound Left	0.22	15	B	0.59	24	C	0.23	15	B	0.65	27	C
Northbound Through / Right	0.35	19	B	0.32	24	C	0.36	20	C	0.36	27	C
Southbound Left	0.35	15	B	0.39	21	C	0.43	17	B	0.42	22	C
Southbound Through	0.16	17	B	0.32	25	C	0.16	18	B	0.34	26	C
Southbound Right	0.02	16	B	0.03	22	C	0.02	17	B	0.03	23	C
Lundy's Lane & Site Access 1	0.50	10	A	0.60	11	B	0.56	10	B	0.62	11	B
Eastbound Left	0.15	9	A	0.55	13	B	0.16	9	A	0.61	16	B
Eastbound Through	0.46	10	A	0.54	10	A	0.46	10	A	0.54	9	A
Westbound Through	0.56	10	B	0.67	11	B	0.57	11	B	0.66	11	B
Westbound Right	0.08	8	A	0.22	8	A	0.09	8	A	0.24	8	A
Southbound Left / Through	0.45	9	A	0.52	14	B	0.55	10	B	0.56	15	B
Lundy's Lane & Site Access 2												
Eastbound Left		9	A		12	B		9	A		12	B
Eastbound Through		0	A		0	A		0	A		0	A
Westbound Through / Right		0	A		0	A		0	A		0	A
Southbound Left / Right		14	B		22	C		14	B		23	C
Site Access 3 & Thorold Townline Road												
Eastbound Left / Right		12	B		17	C		12	B		18	C
Northbound Left		8	A		9	A		8	A		9	A
Northbound Through		0	A		0	A		0	A		0	A
Southbound Through / Right		0	A		0	A		0	A		0	A

Table 9 - 2031 Capacity Analysis Results

Intersection	2031 Background Traffic Conditions						2031 Total Traffic Conditions					
	Weekday AM Peak Hour			Weekday PM Peak Hour			Weekday AM Peak Hour			Weekday PM Peak Hour		
	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS
Niagara Falls Road & Davis Road	0.60	13	B	0.70	13	B	0.64	13	B	0.73	13	B
Eastbound Left	0.76	35	C	0.72	35	C	0.76	35	C	0.72	35	C
Eastbound Through / Right	0.10	16	B	0.10	18	B	0.10	16	B	0.10	18	B
Westbound Left / Through / Right	0.65	22	C	0.69	26	C	0.69	23	C	0.69	26	C
Northbound Left	0.01	6	A	0.08	7	A	0.01	6	A	0.09	7	A
Northbound Through / Right	0.52	9	A	0.42	8	A	0.58	10	A	0.44	8	A
Southbound Left	0.45	14	B	0.70	21	C	0.54	18	B	0.74	24	C
Southbound Through	0.27	7	A	0.60	10	A	0.28	7	A	0.63	10	B
Southbound Right	0.04	6	A	0.11	6	A	0.04	6	A	0.11	6	A
Beaverdams Road & Thorold Townline Road												
Eastbound Left / Through / Right		12	B		20	C		12	B		21	C
Westbound Left / Through / Right		16	C		24	C		16	C		26	D
Northbound Left / Through / Right		14	B		19	C		15	C		20	C
Southbound Left / Through / Right		12	B		24	C		13	B		25	D
Barker Parkway & Davis Road	0.37	9	A	0.66	14	B	0.42	9	A	0.73	15	B
Westbound Left	0.01	11	B	0.05	26	C	0.01	10	B	0.05	26	C
Westbound Right	0.35	12	B	0.30	28	C	0.40	12	B	0.32	28	C
Northbound Through / Right	0.08	4	A	0.06	2	A	0.09	4	A	0.06	2	A
Southbound Left	0.38	6	A	0.72	9	A	0.43	7	A	0.79	12	B
Southbound Through	0.04	4	A	0.07	2	A	0.05	4	A	0.08	2	A
Allanburg Road & Davis Road	0.34	7	A	0.32	6	A	0.35	7	A	0.33	6	A
Eastbound Left / Through	0.32	13	B	0.22	12	B	0.33	13	B	0.22	12	B
Eastbound Right	0.04	11	B	0.04	12	B	0.04	11	B	0.04	12	B
Westbound Left / Through / Right	0.31	13	B	0.30	13	B	0.36	13	B	0.32	13	B
Northbound Left	0.09	4	A	0.16	4	A	0.09	4	A	0.16	4	A
Northbound Through / Right	0.35	5	A	0.33	5	A	0.35	5	A	0.34	5	A
Southbound Left	0.11	4	A	0.30	5	A	0.12	4	A	0.34	5	A
Southbound Through	0.16	4	A	0.27	4	A	0.16	4	A	0.27	4	A
Southbound Right	0.02	3	A	0.05	3	A	0.02	3	A	0.05	3	A
Lundy's Lane & Davis Road	0.61	19	B	0.65	26	C	0.63	19	B	0.66	27	C
Eastbound Left	0.69	21	C	0.75	25	C	0.71	22	C	0.77	27	C
Eastbound Through / Right	0.61	20	B	0.80	27	C	0.61	20	B	0.81	27	C
Westbound Left	0.49	17	B	0.68	33	C	0.55	19	B	0.71	36	D
Westbound Through	0.60	21	C	0.81	33	C	0.61	21	C	0.82	33	C
Westbound Right	0.06	17	B	0.06	22	C	0.06	17	B	0.06	22	C
Northbound Left	0.12	16	B	0.25	22	C	0.12	16	B	0.25	22	C
Northbound Through / Right	0.50	21	C	0.53	26	C	0.51	21	C	0.54	27	C
Southbound Left	0.17	12	B	0.30	16	B	0.17	12	B	0.31	16	B
Southbound Through	0.18	12	B	0.27	17	B	0.18	12	B	0.27	17	B
Southbound Right	0.12	12	B	0.14	15	B	0.13	12	B	0.14	15	B
Lundy's Lane & Thorold Townline Road	0.68	20	B	0.78	28	C	0.71	21	C	0.85	28	C
Eastbound Left	0.38	13	B	0.41	15	B	0.36	13	B	0.41	14	B
Eastbound Through	0.90	29	C	0.92	31	C	0.92	31	C	0.92	29	C
Eastbound Right	0.12	11	B	0.12	10	A	0.13	10	B	0.13	9	A
Westbound Left	0.41	14	B	0.62	25	C	0.42	14	B	0.62	25	C
Westbound Through	0.73	18	B	0.94	34	C	0.71	17	B	0.95	34	C
Westbound Right	0.06	10	B	0.12	10	A	0.06	10	A	0.14	9	A
Northbound Left	0.24	15	B	0.67	28	C	0.25	16	B	0.73	32	C
Northbound Through / Right	0.39	20	C	0.37	26	C	0.41	22	C	0.41	29	C
Southbound Left	0.37	16	B	0.42	23	C	0.45	18	B	0.47	24	C
Southbound Through	0.17	18	B	0.36	27	C	0.18	19	B	0.38	28	C
Southbound Right	0.02	16	B	0.04	23	C	0.02	17	B	0.04	24	C
Lundy's Lane & Site Access 1	0.52	10	A	0.62	11	B	0.57	10	B	0.64	11	B
Eastbound Left	0.16	9	A	0.56	14	B	0.17	9	A	0.63	17	B
Eastbound Through	0.49	10	A	0.57	10	A	0.49	10	A	0.57	10	A
Westbound Through	0.59	11	B	0.69	11	B	0.60	11	B	0.68	11	B
Westbound Right	0.08	8	A	0.22	8	A	0.09	8	A	0.24	8	A
Southbound Left / Through	0.46	9	A	0.53	15	B	0.55	11	B	0.58	16	B
Lundy's Lane & Site Access 2												
Eastbound Left		9	A		12	B		9	A		13	B
Eastbound Through		0	A		0	A		0	A		0	A
Westbound Through / Right		0	A		0	A		0	A		0	A
Southbound Left / Right		14	B		24	C		15	B		26	D
Site Access 3 & Thorold Townline Road												
Eastbound Left / Right		12	B		18	C		13	B		19	C
Northbound Left		8	A		9	A		8	A		9	A
Northbound Through		0	A		0	A		0	A		0	A
Southbound Through / Right		0	A		0	A		0	A		0	A

Niagara Falls Road & Davis Road

Existing Conditions

Under existing conditions, this intersection operates at, or above, an acceptable level of service of B with a maximum delay of 23 seconds.

Future Horizon Years

Under future conditions, this intersection operates at, or above, an acceptable level of service of C with a maximum delay of 35 seconds.

Beaverdams Road & Thorold Townline Road

Existing Conditions

Under existing conditions, this intersection operates at, or above, an acceptable level of service of B with a maximum delay of 12 seconds.

Future Horizon Years

Under future conditions, this intersection operates at, or above, an acceptable level of service of D with a maximum delay of 26 seconds.

Barker Parkway & Davis Road

Existing Conditions

Under existing conditions, this intersection operates at, or above, an acceptable level of service of A with a maximum delay of 9 seconds.

Future Horizon Years

Under future conditions, this intersection operates at, or above, an acceptable level of service of C with a maximum delay of 28 seconds.

Allanburg Road & Davis Road

Existing Conditions

Under existing conditions, this intersection operates at, or above, an acceptable level of service of B with a maximum delay of 12 seconds.

Future Horizon Years

Under future conditions, this intersection operates at, or above, an acceptable level of service of B with a maximum delay of 13 seconds.

Lundy's Lane & Davis Road

Existing Conditions

Under existing conditions, this intersection operates at, or above, an acceptable level of service of C with a maximum delay of 27 seconds.

Future Horizon Years

Under future conditions, this intersection operates at, or above, an acceptable level of service of D with a maximum delay of 37 seconds.

Lundy's Lane & Thorold Townline Road

Existing Conditions

Under existing conditions, this intersection operates at, or above, an acceptable level of service of B with a maximum delay of 17 seconds.

Future Horizon Years

Under future conditions with the suggested addition of a westbound right turn lane and a southbound right turn lane, this intersection operates at, or above, an acceptable level of service of D with a maximum delay of 35 seconds.

Before the suggested improvements were implemented the intersection operated at a level of service of F with a maximum delay of 100 seconds. The improvements were implemented to target the concerns with the westbound through movement and the northbound left movement. Before improvements the intersection capacity was 1.04 v/c with the highest capacity movement (westbound through) at 1.16. After the suggested changes the intersection capacity was 0.85 with the highest capacity movement (westbound through) at 0.95. Most of these concerns were due to the background growth and the Rolling Meadows Development, accounting for 97% of traffic through the intersection. Only 3% was due to the proposed site.

Lundy's Lane & Site Access 1

Future Horizon Years

Under future conditions, this intersection operates at, or above, an acceptable level of service of B with a maximum delay of 18 seconds.

Lundy's Lane & Site Access 2

Future Horizon Years

Under future conditions, this intersection operates at, or above, an acceptable level of service of D with a maximum delay of 26 seconds.

Site Access 3 & Thorold Townline Road

Future Horizon Years

Under future conditions, this intersection operates at, or above, an acceptable level of service of C with a maximum delay of 20 seconds.

3.10 Suggested Intersection Improvements

Between the existing and future conditions intersection and signal improvements are required to accommodate the increased traffic from both the proposed development and the larger background development. Most of these changes have been proposed in the previous Rolling Meadows Traffic impact study and these changes have been taken and applied to the model for this proposed development in the same fashion. These changes are as follows.

Table 10 – Site Trip Generation for Residential Units

Intersection	Improvement
Niagara Falls Road & Davis Road	Eastbound left turn lane
Beaverdams Road & Thorold Townline Road	No improvements recommended
Barker Parkway & Davis Road	Southbound left turn lane & northbound right turn lane
	Traffic Signalization
	Two lane westbound approach (westbound left turn lane)
	Widen Davis Road to 4 lanes between Barker Parkway and Niagara Falls Road / Beaverdams Road
Allanburg Road & Davis Road	Traffic Signals
Lundy's Lane & Davis Road	Widen Lundy's Lane to 4 lanes between Davis Road and Site Access 1
Lundy's Lane & Thorold Townline Road	No improvements recommended
Lundy's Lane & Site Access 1	Eastbound left turn lane & westbound right turn lane
	Traffic Signalization
Lundy's Lane & Site Access 2	Eastbound left turn lane
Site Access 3 & Thorold Townline Road	Northbound left turn lane

Additionally we recommend that southbound and westbound right turn lanes be added to the intersection of Lundy's Lane & Thorold Townline road to assist in dealing with the increased capacity of traffic.

The signal timing plans could be further optimized as more of the neighbourhood development is finished and becomes occupied. The signal timing plans presented in the synchro files represent optimal operations for the final operating conditions, based on our future traffic models.

4. CONCLUSIONS

4.1 Summary

- The proposal outlines a plan to build a new residential development in Uppers' Lane, Thorold, Ontario. This development of 344 units will become part of a larger development called Rolling Meadows. The total residential unit count is 2434 units.
- Through discussions with the City, Region and the MTO, the intersections that were considered in this analysis were:
 - Beaverdams Road & Davis Road
 - Beaverdams Road & Thorold Townline Road
 - Lundy's Lane & Davis Road
 - Lundy's Lane & Thorold Townline Road
 - Davis Road & Barker Parkway
 - Davis Road & Upper's Lane
- Traffic counts at the boundary road intersections were conducted during weekday AM and PM peak periods.
- A two percent (2%) per annum growth rate was used along the study area roadways to simulate growth of the surrounding area.
- Trips were generated for the site using the Institute of Transportation Engineers Trip Generation Manuals, 9th Edition, Volume 3, for single detached units and townhouse units.
- Trips were distributed to the study area road network, based on the existing TMCs and the location of adjacent municipalities / major travel routes and highways.
- The study horizons included in our traffic assessment include existing, three-year build-out condition and five, and ten-year horizon periods after build-out occurs. The existing and future conditions were analyzed using Synchro traffic software.
- Modified intersection geometry, traffic signals and signal timing plans were proposed to alleviate capacity concerns at several intersections. Most of these improvements were carried over from the larger Rolling Meadows development (considered as background improvements for the purpose of this study).
- One further improvement noted in the study, as a result of background conditions, is a southbound and a westbound right turn lane at the intersection of Lundy's Lane and Thorold Townline Road.

4.2 Conclusion

Considering the effects of local traffic the proposed development will impact the local traffic patterns however the impacts will be dealt with considering the proposed modifications. With the modifications all intersections are expected to operate at acceptable levels of service. The proposed development could be accommodated by the surrounding road network.

Respectfully submitted,



Anil Seegobin, P.Eng.
Partner, Engineer

&

Jeffrey Gorman
Traffic Assistant

Trans-Plan Transportation Inc.
Transportation Consultants

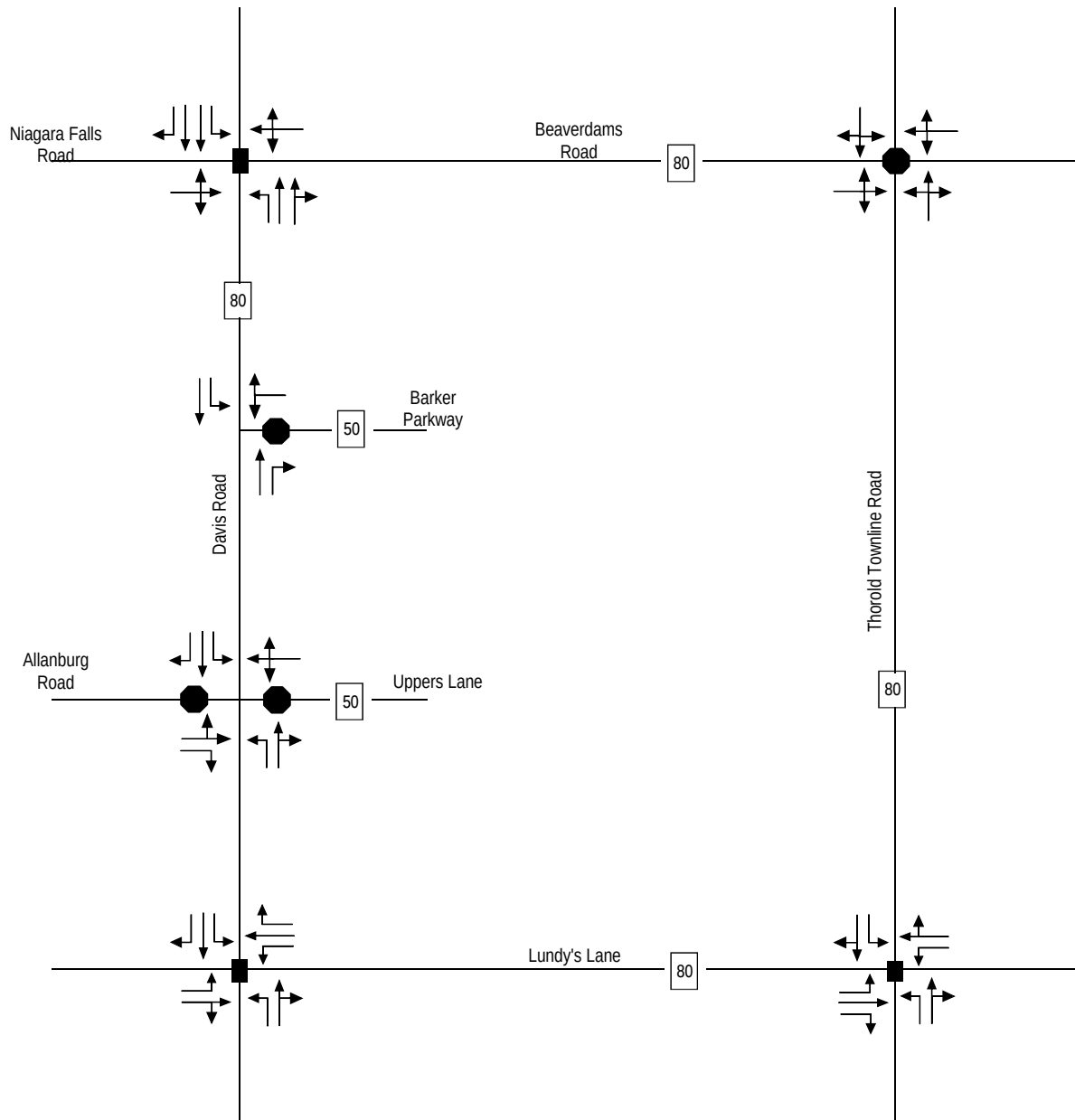
Figure 1 – Site Location



Source: Google Maps



Figure 3 - Existing Study Area Roadway Characteristics



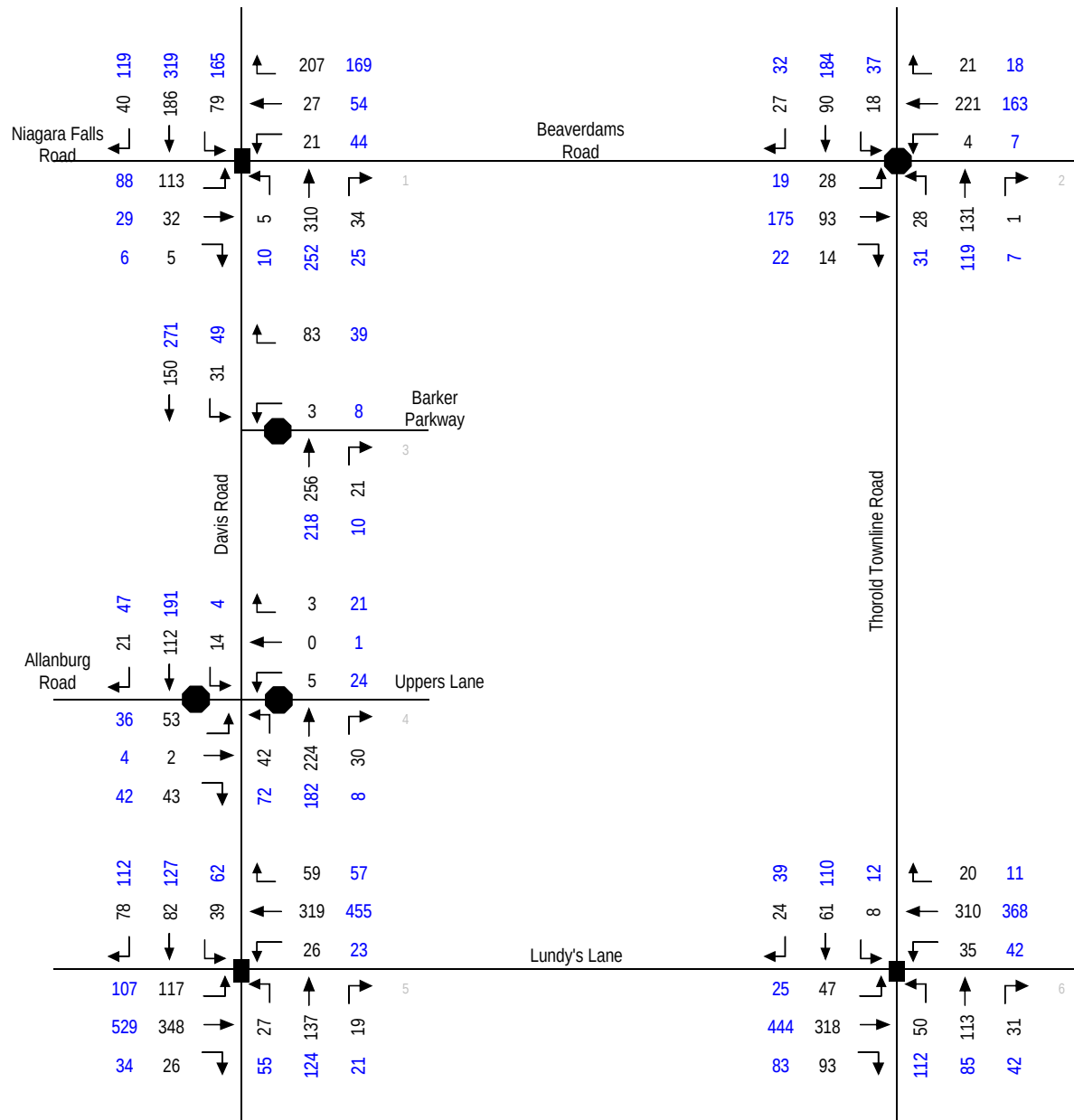
LEGEND

-  Traffic Signal
-  Stop Sign

xx xx AM / PM Peak Hour

Schematic; Not To Scale

Figure 4 - Existing Traffic Volumes, Weekday AM & PM Peak Hours

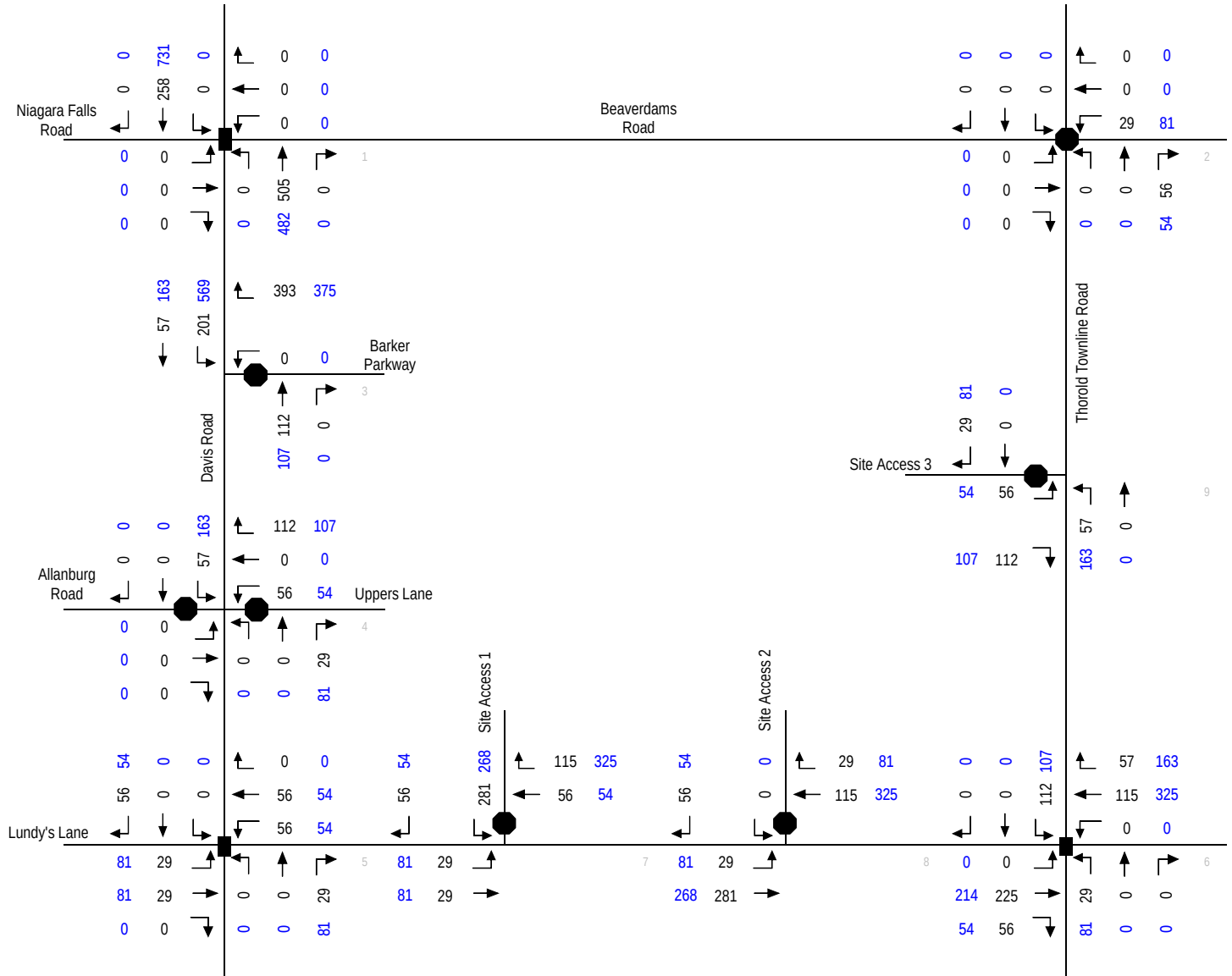


LEGEND

-  Traffic Signal
-  Stop Sign
- xx xx AM / PM Peak Hour

Schematic; Not To Scale

Figure 5 - Background Development Traffic Volumes, Weekday AM & PM Peak Hours



LEGEND

-  Traffic Signal
-  Stop Sign
- xx xx AM / PM Peak Hour

Schematic; Not To Scale

Figure 6 - 2021 Background Traffic Volumes, Weekday AM & PM Peak Hours

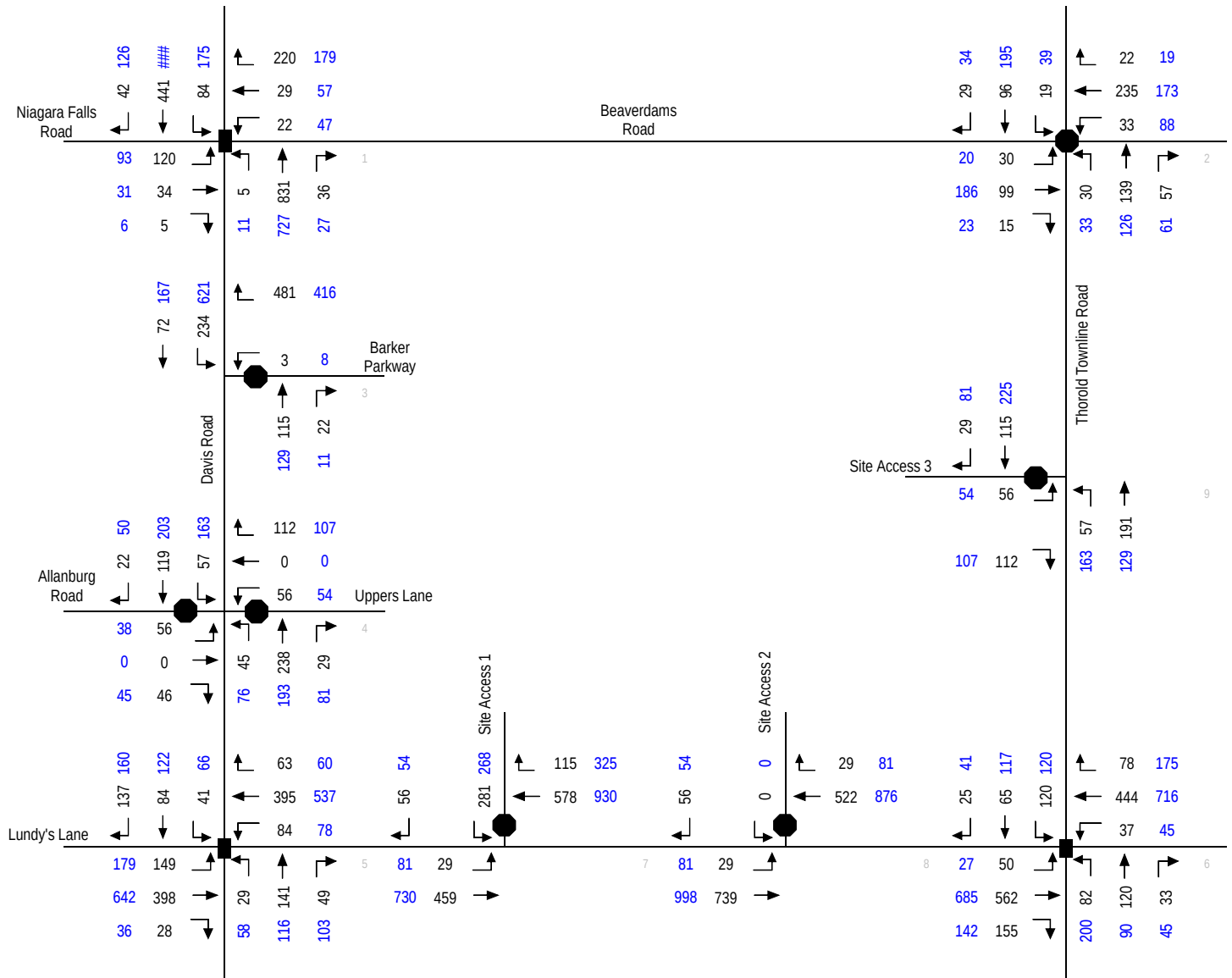


Figure 7 - 2026 Background Traffic Volumes, Weekday AM & PM Peak Hours

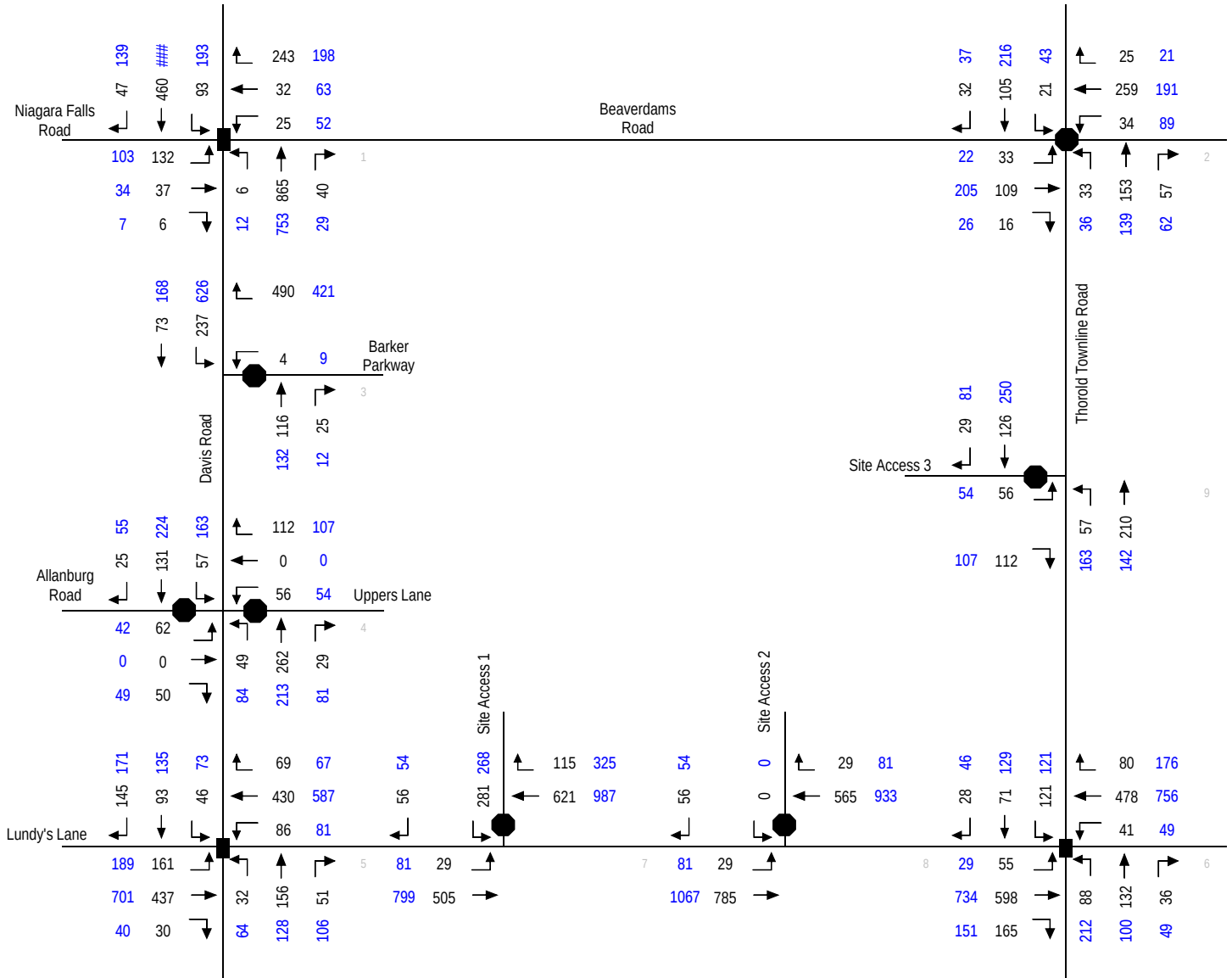


Figure 8 - 2031 Background Traffic Volumes, Weekday AM & PM Peak Hours

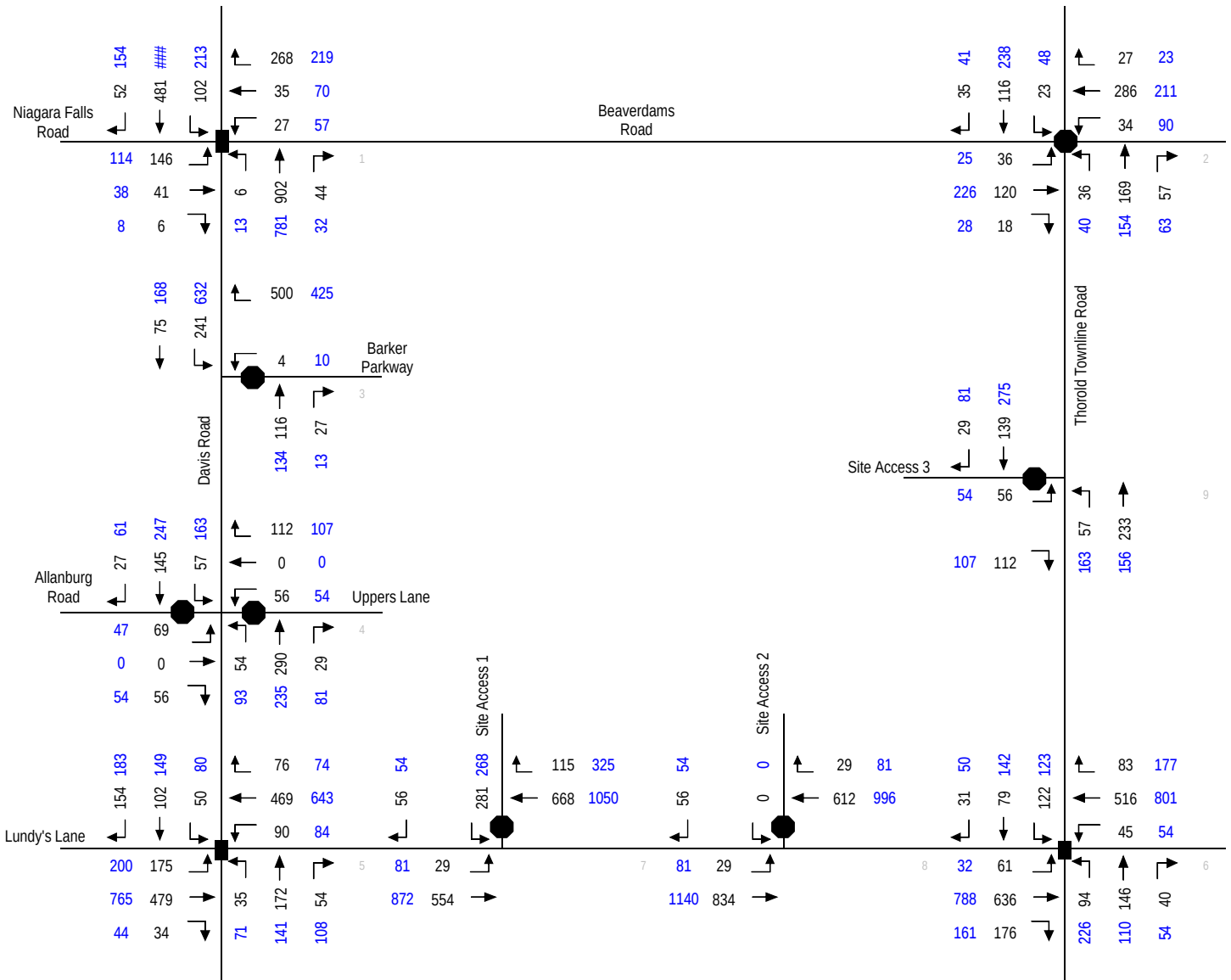
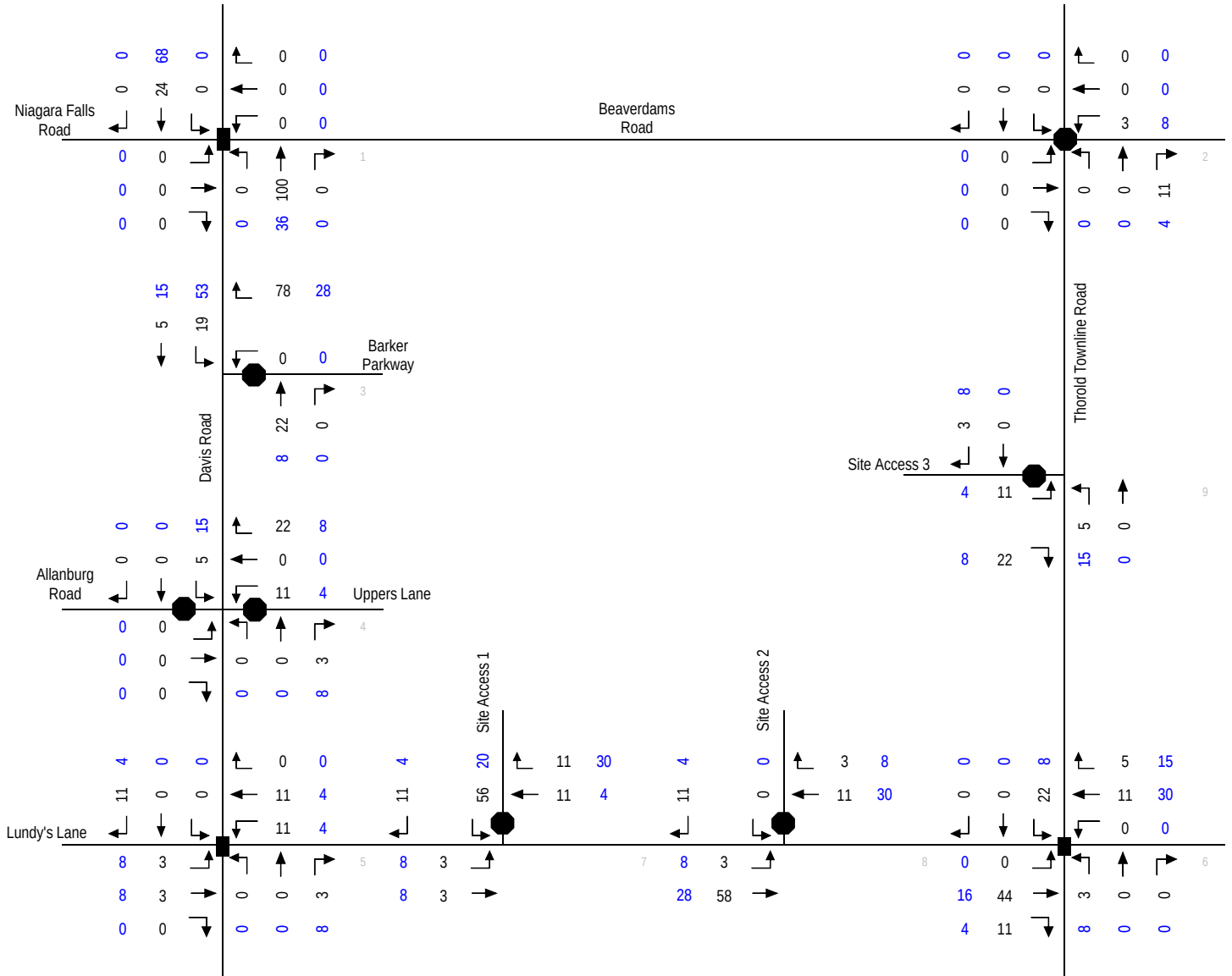


Figure 9 - Site Traffic Assignment, Weekday AM & PM Peak Hours



LEGEND

-  Traffic Signal
-  Stop Sign
- xx xx AM / PM Peak Hour

Schematic; Not To Scale

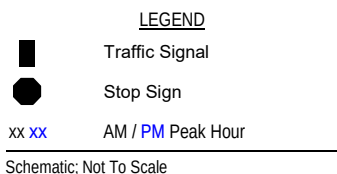
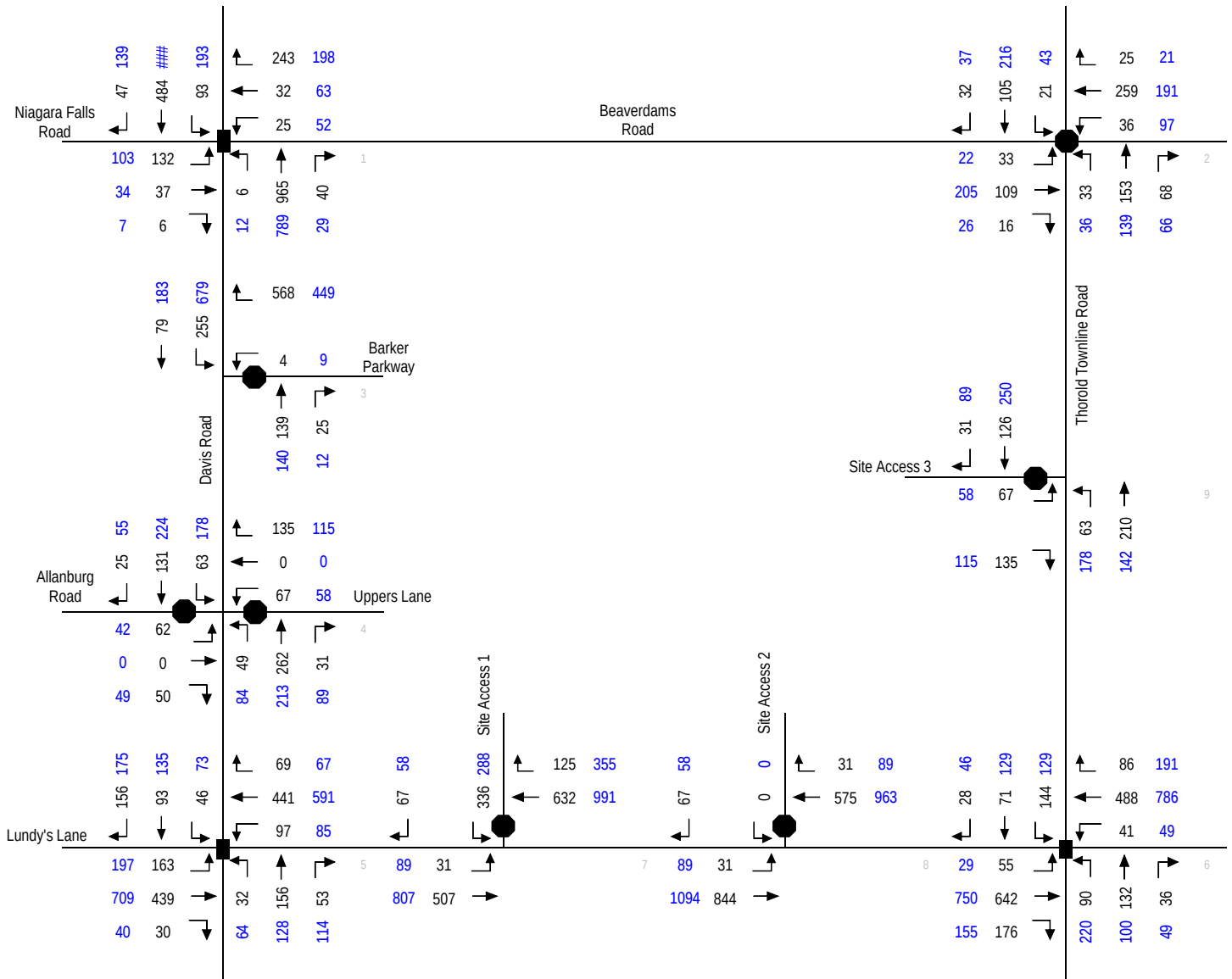
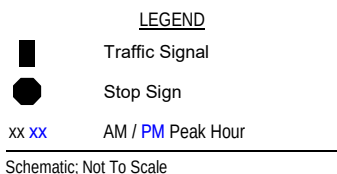


Figure 11 - 2026 Total Traffic Volumes, Weekday AM & PM Peak Hours





Appendices

Appendix A – Transit Route Map

Appendix B – TMC Counts

Appendix C – Background Development

Appendix D – Synchro Data Sheets

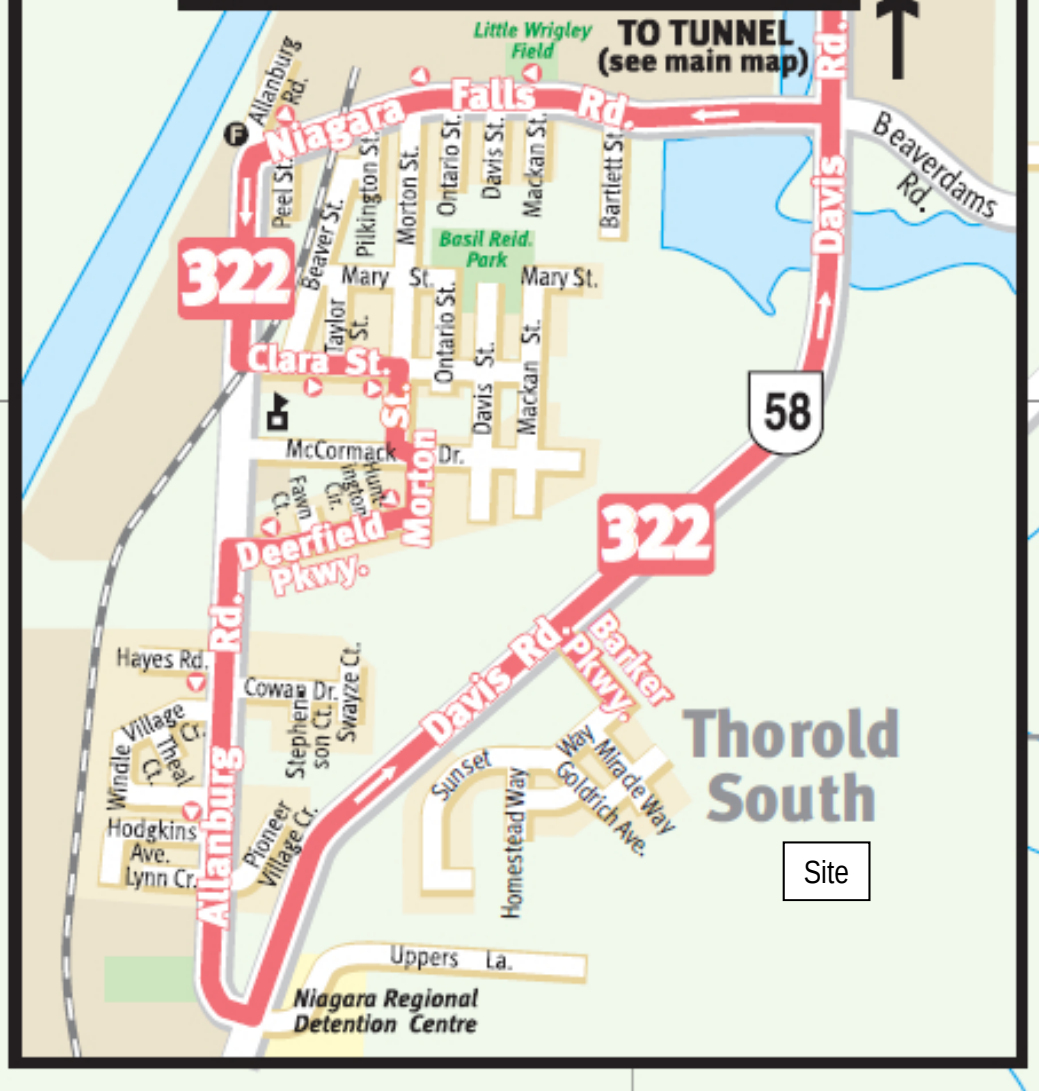
Appendix E – LOS Definitions



APPENDIX A

Transit Route Map

THOROLD SOUTH





APPENDIX B

TMC Counts



Turning Movement Count Diagram

Intersection: Davis Road & Upper's Lane

Municipality: Thorold, Ontario

Intersection ID:

Date: Thursday, November 1, 2018

AM Peak Hour: 7:45 to 8:45

MD Peak Hour: - to -

Davis Road									
North Total 427						East Total 54			
North Entering 147	Cyclists	0	0	0		East Entering 8			
North Receiving 280	Truck	3	13	1		East Receiving 46			
North Peds 0	Cars	18	99	13		East Peds 0			
					←	↓	→		
Uppers Lane	0	4	49	↑			3	0	0
	0	0	2	→		←	0	0	0
	0	1	42	↓		↙	4	1	0
					←	↑	→		
West Total 161			39	205	26	South Total 456			
West Entering 98		3	19	4		South Entering 296			
West Receiving 63		0	0	0		South Receiving 160			
West Peds 0						South Peds 0			

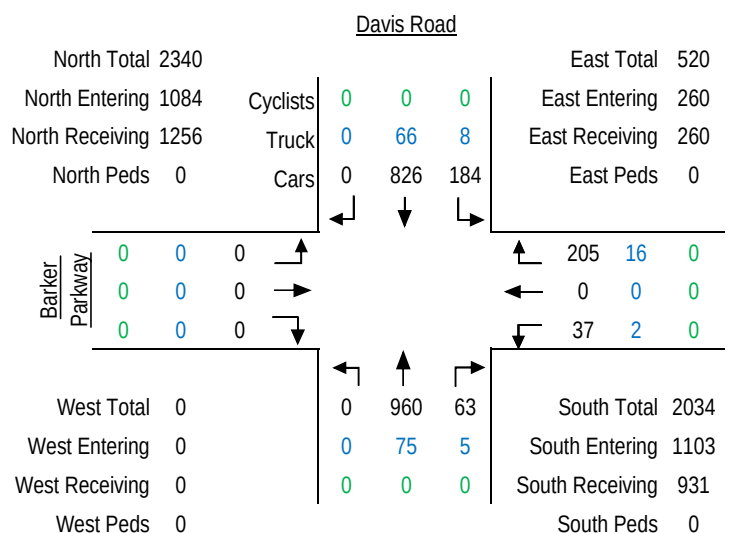
Davis Road											
North Total			0				East Total			0	
North Entering			0	Cyclists	0	0	0	East Entering			0
North Receiving			0	Truck	0	0	0	East Receiving			0
North Peds			0	Cars	0	0	0	East Peds			0
Uppers Lane	0	0	0	↖	↓	↗					
	0	0	0	→			↖	0	0	0	
	0	0	0	↘			↗	0	0	0	
West Total			0				South Total			0	
West Entering			0		0	0	0	South Entering			0
West Receiving			0		0	0	0	South Receiving			0
West Peds			0		0	0	0	South Peds			0

PM Peak Hour: 16:15 to 17:15

Total 5-Hour Count

Davis Road													
North Total 481							East Total 62						
North Entering 242		Cyclists	0	0	0			East Entering 46					
North Receiving 239		Truck	3	11	0			East Receiving 16					
North Peds 0		Cars	44	180	4			East Peds 0					
			⬅	⬇	➡								
Uppers Lane	0	3	33	⬆						⬆	21	0	0
	0	0	4	➡						➡	1	0	0
	0	0	42	⬇						⬇	24	0	0
			⬅	⬆	➡								
West Total 202				72	172	8	South Total 519						
West Entering 82				0	10	0	South Entering 262						
West Receiving 120				0	0	0	South Receiving 257						
West Peds 0							South Peds 0						

Davis Road													
North Total 1910						East Total 274							
North Entering 818		Cyclists	0	0	0	East Entering 124							
North Receiving 1092		Truck	10	52	3	East Receiving 150							
North Peds 0		Cars	153	564	36	East Peds 0							
			⬅	⬇	➡								
Uppers Lane	0	9	175	⬆						⬆	40	3	0
	0	2	21	➡						➡	7	1	0
	0	8	258	⬇						⬇	67	6	0
			⬅	⬆	➡								
West Total 888			239	801	84	South Total 2152							
West Entering 473			5	64	4	South Entering 1197							
West Receiving 415			0	0	0	South Receiving 955							
West Peds 0						South Peds 0							





Turning Movement Count Diagram

Intersection: Lundy's Lane & Thorold Townline Road

Municipality: Thorold, Ontario

Intersection ID:

Date: Thursday, November 1, 2018

AM Peak Hour: 7:30 to 8:30

MD Peak Hour: - to -

Thorold Townline Road									
North Total 273							East Total 722		
North Entering 93	Cyclists	0	0	0				East Entering 365	
North Receiving 180	Truck	2	5	2				East Receiving 357	
North Peds 0	Cars	22	56	6				East Peds 0	
		←	↓	→					
Lundy's Lane	0	5	42	↑				↑	19 1 0
	0	5	313	→				←	302 8 0
	0	1	92	↓				↙	35 0 0
		←	↑	→					
West Total 842				46	107	31	South Total 383		
West Entering 458		4	6	0				South Entering 194	
West Receiving 384		0	0	0				South Receiving 189	
West Peds 0								South Peds 0	

Thorold Townline Road													
North Total			0				East Total			0			
North Entering			0	Cyclists	0	0	0	East Entering			0		
North Receiving			0	Truck	0	0	0	East Receiving			0		
North Peds			0	Cars	0	0	0	East Peds			0		
Lundy's Lane	0	0	0	↖	↓	↗							
	0	0	0	→						↖	0	0	0
	0	0	0	↘						↘	0	0	0
West Total			0				South Total			0			
West Entering			0				South Entering			0			
West Receiving			0				South Receiving			0			
West Peds			0				South Peds			0			

PM Peak Hour: 16:45 to 17:45

Total 5-Hour Count

Thorold Townline Road									
North Total 282				East Total 919					
North Entering 161		Cyclists	0	0	0	East Entering 421			
North Receiving 121		Truck	0	2	1	East Receiving 498			
North Peds 0		Cars	39	108	11	East Peds 0			
			⬅	⬇	➡				
Lundy's Lane	0	3	22	⬆	⬆ 11 0 0				
	0	3	441	➡	⬅ 364 4 0				
	0	0	83	⬇	⬇ 42 0 0				
			⬅	⬆	➡				
West Total ###			111	83	42	South Total 474			
West Entering 552			1	2	0	South Entering 239			
West Receiving 519			0	0	0	South Receiving 235			
West Peds 0						South Peds 0			

Thorold Townline Road									
North Total 1169				East Total 3579					
North Entering 579		Cyclists	0	0	0	East Entering 1705			
North Receiving 590		Truck	4	17	6	East Receiving 1874			
North Peds 0		Cars	137	363	52	East Peds 0			
			⬅	⬇	➡				
Lundy's Lane	0	11	107	⬆	⬆ 64 2 0				
	0	19	1592	➡	⬅ 1451 30 0				
	0	9	317	⬇	⬇ 156 2 0				
			⬅	⬆	➡				
West Total 4035			345	380	203	South Total 1833			
West Entering 2055			13	26	2	South Entering 969			
West Receiving 1980			0	0	0	South Receiving 864			
West Peds 0						South Peds 0			



Turning Movement Count Diagram

Intersection: Beaverdams Road & Davis Road

Municipality: Thorold, Ontario

Intersection ID:

Date: Thursday, November 1, 2018

AM Peak Hour: 8:00 to 9:00

MD Peak Hour: - to -

Davis Road									
North Total 935						East Total 400			
North Entering 305	Cyclists	0	0	0		East Entering 255			
North Receiving 630	Truck	5	22	0		East Receiving 145			
North Peds 0	Cars	35	164	79		East Peds 0			
Beaverdams Road		←	↓	→					
	0	9	104	↑		↑	205	2	0
	0	0	32	→		←	24	3	0
	0	1	4	↓		↓	20	1	0
West Total 222			4	290	32	South Total 561			
West Entering 150		1	20	2		South Entering 349			
West Receiving 72		0	0	0		South Receiving 212			
West Peds 0						South Peds 0			

Davis Road												
North Total			0				East Total			0		
North Entering			0	Cyclists	0	0	0	East Entering			0	
North Receiving			0	Truck	0	0	0	East Receiving			0	
North Peds			0	Cars	0	0	0	East Peds			0	
Beaverdams Road					←	↓	↘					
	0	0	0	↗					↖	0	0	0
	0	0	0	→					←	0	0	0
	0	0	0	↘					↗	0	0	0
					↖	0	0	0				
West Total			0				South Total			0		
West Entering			0				South Entering			0		
West Receiving			0				South Receiving			0		
West Peds			0				South Peds			0		

PM Peak Hour: 16:45 to 17:45

Total 5-Hour Count

Davis Road											
North Total ###							East Total 486				
North Entering 603		Cyclists	0	0	0			East Entering 267			
North Receiving 509		Truck	5	9	2			East Receiving 219			
North Peds 0		Cars	114	310	163			East Peds 0			
			↙	↓	↘						
Beaverdam S Road	0	3	85	↗				↖	169	0	0
	0	1	28	→				←	53	1	0
	0	0	6	↘				↙	41	3	0
			↙	↑	↘						
West Total 306			9	249	23			South Total 656			
West Entering 123			1	3	2			South Entering 287			
West Receiving 183			0	0	0			South Receiving 369			
West Peds 0								South Peds 0			

Davis Road										
North Total 4640							East Total 1860			
North Entering 2086		Cyclists	0	0	0	East Entering 1049				
North Receiving 2554		Truck	28	76	7	East Receiving 811				
North Peds 1		Cars	382	1050	543	East Peds 0				
Beaverdam s Road	0	31	460	↖			↖	752	10	0
	1	4	121	→			←	136	8	0
	0	2	25	↘			↘	129	14	0
West Total 1228				26	1197	123	South Total 2762			
West Entering 644			4	104	12	South Entering 1466				
West Receiving 584			0	0	0	South Receiving 1296				
West Peds 0						South Peds 1				



Turning Movement Count Diagram

Intersection: Beaverdams Road & Thorold Townline Road

Municipality: Thorold, Ontario

Intersection ID:

Date: Thursday, November 1, 2018

AM Peak Hour: 8:00 to 9:00

MD Peak Hour: - to -

Thorold Townline Road													
North Total 315							East Total 358						
North Entering 135		Cyclists	0	0	0			East Entering 246					
North Receiving 180		Truck	2	18	0			East Receiving 112					
North Peds 0		Cars	25	72	18			East Peds 0					
			←	↓	→								
Beaverdams Road	0	4	24	↑						↑	20	1	0
	0	0	93	→						←	219	2	0
	0	0	14	↓						↓	4	0	0
			←	↑	→								
West Total 411				27	115	1				South Total 268			
West Entering 135			1	16	0				South Entering 160				
West Receiving 276			0	0	0				South Receiving 108				
West Peds 0									South Peds 0				

Thorold Townline Road													
North Total				0					East Total				0
North Entering				0	Cyclists	0	0	0	East Entering				0
North Receiving				0	Truck	0	0	0	East Receiving				0
North Peds				0	Cars	0	0	0	East Peds				0
					←	↓	→						
Beaverdams Road	0	0	0	↑					↑	0	0	0	
	0	0	0	→					←	0	0	0	
	0	0	0	↓					↓	0	0	0	
					←	↑	→						
West Total				0					South Total				0
West Entering				0					South Entering				0
West Receiving				0					South Receiving				0
West Peds				0					South Peds				0

PM Peak Hour: 16:15 to 17:15

Total 5-Hour Count

Thorold Townline Road													
North Total 409								East Total 407					
North Entering 253		Cyclists	0	0	0			East Entering 188					
North Receiving 156		Truck	1	11	0			East Receiving 219					
North Peds 1		Cars	31	173	37			East Peds 0					
			⬅	↓	➡								
Beaverdams Road	0	1	18	⬆						⬆	18	0	0
	0	0	175	➡						➡	161	2	0
	0	1	21	⬇						⬇	6	1	0
			⬅	⬆	➡								
West Total 442			31	106	7			South Total 370					
West Entering 216			0	13	0			South Entering 157					
West Receiving 226			0	0	0			South Receiving 213					
West Peds 0								South Peds 0					

Thorold Townline Road													
North Total 1549						East Total 1524							
North Entering 829		Cyclists	0	0	0	East Entering 831							
North Receiving 720		Truck	11	68	8	East Receiving 693							
North Peds 1		Cars	120	509	113	East Peds 0							
			⬅	⬇	➡								
Beaverdam s Road	0	10	78	⬆						⬆	85	4	0
	0	3	552	➡						➡	720	5	0
	0	1	85	⬇						⬇	16	1	0
			⬅	⬆	➡								
West Total 1698			111	475	17	South Total 1353							
West Entering 729			2	68	0	South Entering 673							
West Receiving 969			0	0	0	South Receiving 680							
West Peds 0						South Peds 0							



Turning Movement Count Diagram

Intersection: Lundy's Lane & Davis Road

Municipality: Thorold, Ontario

Intersection ID:

Date: Thursday, November 1, 2018

AM Peak Hour: 7:45 to 8:45

MD Peak Hour: - to -

Davis Road									
North Total 512					East Total 810				
North Entering 199	Cyclists	0	0	0	East Entering 404				
North Receiving 313	Truck	7	15	2	East Receiving 406				
North Peds 0	Cars	71	67	37	East Peds 0				
Lundy's Lane	0	13	104						
	0	9	339						
	0	4	22						
West Total 915					23	110	14	South Total 317	
West Entering 491					4	27	5	South Entering 183	
West Receiving 424					0	0	0	South Receiving 134	
West Peds 0					South Peds 0				

Davis Road										
North Total 0					East Total 0					
North Entering 0	Cyclists	0	0	0		East Entering 0				
North Receiving 0	Truck	0	0	0		East Receiving 0				
North Peds 0	Cars	0	0	0		East Peds 0				
Lundy's Lane	0	0	0	↗		↖	0	0	0	
	0	0	0	→		←	0	0	0	
	0	0	0	↘		↙	0	0	0	
West Total 0						South Total 0				
West Entering 0		0	0	0		South Entering 0				
West Receiving 0		0	0	0		South Receiving 0				
West Peds 0		0	0	0		South Peds 0				

PM Peak Hour: 16:30 to 17:30

Total 5-Hour Count

Davis Road									
North Total 589					East Total 1147				
North Entering 301	Cyclists	0	0	0	East Entering 535				
North Receiving 288	Truck	1	16	3	East Receiving 612				
North Peds 0	Cars	111	111	59	East Peds 0				
Lundy's Lane		↙	↓	↘					
	0	3	104	↗	↗	55	2	0	
	0	22	507	→	←	444	11	0	
	0	5	29	↘	↘	18	5	0	
					↙	↑	↘		
West Total ###					49	111	19	South Total 384	
West Entering 670					6	13	2	South Entering 200	
West Receiving 622					0	0	0	South Receiving 184	
West Peds 0					South Peds 0				

Davis Road									
North Total 2463					East Total 3983				
North Entering 1135	Cyclists	0	0	0	East Entering 1936				
North Receiving 1328	Truck	25	91	12	East Receiving 2047				
North Peds 0	Cars	374	395	238	East Peds 2				
Lundy's Lane	1	26	453	↗	↖	262	11	0	
	0	42	1668	→	←	1493	49	0	
	0	16	108	↘	↙	107	14	0	
West Total 4420		139	487	73	South Total 1558				
West Entering 2314		26	88	14	South Entering 827				
West Receiving 2106		0	0	0	South Receiving 731				
West Peds 0					South Peds 0				



APPENDIX C

Background Development



 UPPER CANADA CONSULTANTS INCORPORATED / ENTREPRISES	261 Marlindale Road 102 E. Scarborough, ON M1S 4T7 Phone: (905) 686-9400 Fax: (905) 686-5274
	DRAWING TITLE: REDLINE DRAFT PLAN OF SUBDIVISION ROLLING MEADOWS

The following trip generation tables were taken from the previous Rolling Meadows traffic impact study completed by the Rolling Meadows Land Development Corporation (August 2008).

Table 8: 2009 Trip Generation (Phase 1 of Development)

Land Use	LUC	Variable	Quantity	AM Peak Hour			PM Peak Hour		
				In	Out	Total	In	Out	Total
Single Family Residential	210	622	Dwelling Units	138	307	445	366	189	555

Table 9: 2012 Trip Generation (Phase 2 of Development)

Land Use	LUC	Variable	Quantity	AM Peak Hour			PM Peak Hour		
				In	Out	Total	In	Out	Total
Single Family Residential	210	622	Dwelling Units	138	307	445	366	189	555
Single Family Residential	210	147	Dwelling Units	35	78	113	100	52	152
Total Trip Generation				173	385	558	466	241	707

Table 10: 2016 Trip Generation (Phase 3 of Development)

Land Use	LUC	Variable	Quantity	AM Peak Hour			PM Peak Hour		
				In	Out	Total	In	Out	Total
Single Family Residential	210	622	Dwelling Units	138	307	445	366	189	555
Single Family Residential	210	147	Dwelling Units	35	78	113	100	52	152
Single Family Residential	210	491	Dwelling Units	109	244	353	296	153	449
Total Trip Generation				282	629	911	762	394	1156

Table 11: 2021 Trip Generation (Phase 4 of Development)

Land Use	LUC	Variable	Quantity	AM Peak Hour			PM Peak Hour		
				In	Out	Total	In	Out	Total
Single Family Residential	210	622	Dwelling Units	138	307	445	366	189	555
Single Family Residential	210	147	Dwelling Units	35	78	113	100	52	152
Single Family Residential	210	491	Dwelling Units	109	244	353	296	153	449
Single Family Residential	210	560	Dwelling Units	124	277	401	333	172	505
Mixed-Use Residential	220	331	Dwelling Units	35	131	166	130	70	200
Elementary School ¹	520	300	# of Students	55	45	100	32	39	71
Neighbourhood Commercial ²	820	45.2	1000 ft ²	59	38	97	178	193	371
Highway Commercial ³	820	195.6	1000 ft ²	143	91	234	468	507	975
Total Trip Generation				698	1211	1909	1903	1375	3278

Notes:

- 1 Assumed that 80% of trips to are internal to the site, 20% external;
- 2 Assumed that 90% of trips are internal to the site, 10% external; and
- 3 Assumed that 20% of trips are internal to site, 80% external.



APPENDIX D

Synchro Data Sheets

Timings
1: Niagara Falls Road & Davis Road

<2018 Existing> Weekday AM Peak Hour

2018-11-23

									
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	113	32	21	27	5	307	79	172	40
Turn Type	Perm		Perm		Perm		Perm		Perm
Protected Phases		4		8		2		6	
Permitted Phases	4		8		2		6		6
Detector Phase	4	4	8	8	2	2	6	6	6
Switch Phase									
Minimum Initial (s)	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	35.0	35.0	35.0	35.0	35.0
Total Split (%)	36.4%	36.4%	36.4%	36.4%	63.6%	63.6%	63.6%	63.6%	63.6%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)		14.5		14.5	30.9	30.9	30.9	30.9	30.9
Actuated g/C Ratio		0.26		0.26	0.55	0.55	0.55	0.55	0.55
v/c Ratio		0.62		0.48	0.01	0.19	0.16	0.10	0.05
Control Delay		30.0		7.6	6.0	6.2	7.4	6.4	2.5
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		30.0		7.6	6.0	6.2	7.4	6.4	2.5
LOS		C		A	A	A	A	A	A
Approach Delay		30.0		7.6		6.2		6.2	
Approach LOS		C		A		A		A	

Intersection Summary

Cycle Length: 55

Actuated Cycle Length: 56.5

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.62

Intersection Signal Delay: 10.0

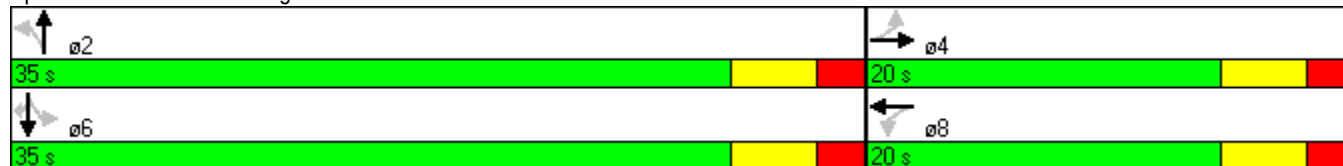
Intersection LOS: A

Intersection Capacity Utilization 69.9%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 1: Niagara Falls Road & Davis Road



HCM Signalized Intersection Capacity Analysis

1: Niagara Falls Road & Davis Road

<2018 Existing> Weekday AM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	32	5	21	27	207	5	307	34	79	172	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5			5.5		5.5	5.5		5.5	5.5	5.5
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frt		1.00			0.89		1.00	0.99		1.00	1.00	0.85
Flt Protected		0.96			1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1772			1671		1641	3497		1787	3505	1553
Flt Permitted		0.55			0.96		0.63	1.00		0.53	1.00	1.00
Satd. Flow (perm)		1018			1616		1095	3497		999	3505	1553
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)	123	35	5	23	29	225	5	334	37	86	187	43
RTOR Reduction (vph)	0	2	0	0	167	0	0	15	0	0	0	19
Lane Group Flow (vph)	0	161	0	0	110	0	5	356	0	86	187	24
Heavy Vehicles (%)	3%	3%	0%	7%	2%	0%	10%	1%	8%	1%	3%	4%
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)		14.5			14.5		30.9	30.9		30.9	30.9	30.9
Effective Green, g (s)		14.5			14.5		30.9	30.9		30.9	30.9	30.9
Actuated g/C Ratio		0.26			0.26		0.55	0.55		0.55	0.55	0.55
Clearance Time (s)		5.5			5.5		5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		262			415		600	1916		547	1920	851
v/s Ratio Prot								c0.10			0.05	
v/s Ratio Perm		c0.16			0.07		0.00			0.09		0.02
v/c Ratio		0.61			0.26		0.01	0.19		0.16	0.10	0.03
Uniform Delay, d1		18.5			16.7		5.8	6.4		6.3	6.1	5.9
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		4.2			0.3		0.0	0.2		0.6	0.1	0.1
Delay (s)		22.7			17.0		5.8	6.6		6.9	6.2	5.9
Level of Service		C			B		A	A		A	A	A
Approach Delay (s)		22.7			17.0			6.6			6.4	
Approach LOS		C			B			A			A	
Intersection Summary												
HCM Average Control Delay		11.4				HCM Level of Service		B				
HCM Volume to Capacity ratio		0.32										
Actuated Cycle Length (s)		56.4				Sum of lost time (s)		11.0				
Intersection Capacity Utilization		69.9%				ICU Level of Service		C				
Analysis Period (min)		15										
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis 2: Beaverdams Road & Thorold Townline Road

<2018 Existing> Weekday AM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	28	93	14	4	221	21	28	131	1	18	90	27
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	30	100	15	4	238	23	30	141	1	19	97	29
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	145	265	172	145								
Volume Left (vph)	30	4	30	19								
Volume Right (vph)	15	23	1	29								
Hadj (s)	0.01	-0.01	0.07	-0.06								
Departure Headway (s)	5.1	4.9	5.2	5.2								
Degree Utilization, x	0.21	0.36	0.25	0.21								
Capacity (veh/h)	639	683	631	632								
Control Delay (s)	9.5	10.7	10.0	9.5								
Approach Delay (s)	9.5	10.7	10.0	9.5								
Approach LOS	A	B	A	A								
Intersection Summary												
Delay				10.1								
HCM Level of Service				B								
Intersection Capacity Utilization				42.4%	ICU Level of Service	A						
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis

3: Barker Parkway & Davis Road

<2018 Existing> Weekday AM Peak Hour

2018-11-23

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	3	83	3	21	31	14
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	3	87	3	22	33	15
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	83	3			25	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	83	3			25	
tC, single (s)	6.4	6.3			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.4			2.3	
p0 queue free %	100	92			98	
cM capacity (veh/h)	904	1066			1564	
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	91	3	22	33	15	
Volume Left	3	0	0	33	0	
Volume Right	87	0	22	0	0	
cSH	1060	1700	1700	1564	1700	
Volume to Capacity	0.09	0.00	0.01	0.02	0.01	
Queue Length 95th (m)	2.2	0.0	0.0	0.5	0.0	
Control Delay (s)	8.7	0.0	0.0	7.4	0.0	
Lane LOS	A			A		
Approach Delay (s)	8.7	0.0		5.1		
Approach LOS	A					
Intersection Summary						
Average Delay			6.3			
Intersection Capacity Utilization			20.4%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

4: Allanburg Road & Davis Road

<2018 Existing> Weekday AM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	53	0	43	0	0	0	42	224	0	0	112	21
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	58	0	47	0	0	0	46	243	0	0	122	23
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)			6									
Median type								None			None	
Median storage veh												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	457	457	122	457	479	243	145			243		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	457	457	122	457	479	243	145			243		
tC, single (s)	7.2	6.5	6.2	7.3	6.5	6.2	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.7	4.0	3.3	2.3			2.3		
p0 queue free %	88	100	95	100	100	100	97			100		
cM capacity (veh/h)	492	487	929	449	473	800	1408			1294		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3					
Volume Total	104	0	46	243	0	122	23					
Volume Left	58	0	46	0	0	0	0					
Volume Right	47	0	0	0	0	0	23					
cSH	891	1700	1408	1700	1700	1700	1700					
Volume to Capacity	0.12	0.00	0.03	0.14	0.00	0.07	0.01					
Queue Length 95th (m)	3.2	0.0	0.8	0.0	0.0	0.0	0.0					
Control Delay (s)	11.4	0.0	7.6	0.0	0.0	0.0	0.0					
Lane LOS	B	A	A									
Approach Delay (s)	11.4	0.0	1.2		0.0							
Approach LOS	B	A										
Intersection Summary												
Average Delay			2.9									
Intersection Capacity Utilization			21.8%		ICU Level of Service					A		
Analysis Period (min)			15									

Timings
5: Lundy's Lane & Davis Road

<2018 Existing> Weekday AM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	113	348	26	319	59	27	133	39	79	76
Turn Type	Perm		Perm		Perm	Perm		Perm		Perm
Protected Phases		4		8			2		6	
Permitted Phases	4		8		8	2		6		6
Detector Phase	4	4	8	8	8	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Minimum Split (s)	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5
Total Split (s)	30.0	30.0	30.0	30.0	30.0	25.0	25.0	25.0	25.0	25.0
Total Split (%)	54.5%	54.5%	54.5%	54.5%	54.5%	45.5%	45.5%	45.5%	45.5%	45.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)	17.6	17.6	17.6	17.6	17.6	19.5	19.5	19.5	19.5	19.5
Actuated g/C Ratio	0.37	0.37	0.37	0.37	0.37	0.40	0.40	0.40	0.40	0.40
v/c Ratio	0.40	0.61	0.11	0.52	0.11	0.06	0.26	0.09	0.13	0.13
Control Delay	15.6	16.5	10.9	15.1	3.7	10.4	10.8	10.6	10.6	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.6	16.5	10.9	15.1	3.7	10.4	10.8	10.6	10.6	3.9
LOS	B	B	B	B	A	B	B	B	B	A
Approach Delay		16.3		13.1			10.7		7.9	
Approach LOS		B		B			B		A	

Intersection Summary

Cycle Length: 55

Actuated Cycle Length: 48.2

Natural Cycle: 45

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.61

Intersection Signal Delay: 13.2

Intersection LOS: B

Intersection Capacity Utilization 78.2%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 5: Lundy's Lane & Davis Road

			
25 s		30 s	
			
25 s		30 s	

HCM Signalized Intersection Capacity Analysis

5: Lundy's Lane & Davis Road

<2018 Existing> Weekday AM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	348	26	26	319	59	27	133	19	39	79	76
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5		5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1626	1811		1612	1827	1509	1570	1544		1719	1610	1482
Flt Permitted	0.50	1.00		0.42	1.00	1.00	0.70	1.00		0.65	1.00	1.00
Satd. Flow (perm)	849	1811		716	1827	1509	1158	1544		1180	1610	1482
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)	123	378	28	28	347	64	29	145	21	42	86	83
RTOR Reduction (vph)	0	6	0	0	0	41	0	9	0	0	0	49
Lane Group Flow (vph)	123	400	0	28	347	23	29	157	0	42	86	34
Heavy Vehicles (%)	11%	3%	15%	12%	4%	7%	15%	20%	26%	5%	18%	9%
Turn Type	Perm			Perm		Perm	Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		6
Actuated Green, G (s)	17.6	17.6		17.6	17.6	17.6	19.6	19.6		19.6	19.6	19.6
Effective Green, g (s)	17.6	17.6		17.6	17.6	17.6	19.6	19.6		19.6	19.6	19.6
Actuated g/C Ratio	0.37	0.37		0.37	0.37	0.37	0.41	0.41		0.41	0.41	0.41
Clearance Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	310	661		261	667	551	471	628		480	655	603
v/s Ratio Prot		c0.22			0.19			c0.10			0.05	
v/s Ratio Perm	0.14			0.04		0.02	0.03			0.04		0.02
v/c Ratio	0.40	0.61		0.11	0.52	0.04	0.06	0.25		0.09	0.13	0.06
Uniform Delay, d1	11.4	12.5		10.1	12.0	9.9	8.7	9.4		8.8	9.0	8.7
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.8	1.6		0.2	0.7	0.0	0.3	1.0		0.4	0.4	0.2
Delay (s)	12.2	14.0		10.3	12.7	9.9	9.0	10.4		9.2	9.4	8.9
Level of Service	B	B		B	B	A	A	B		A	A	A
Approach Delay (s)		13.6			12.2			10.2			9.1	
Approach LOS		B			B			B			A	
Intersection Summary												
HCM Average Control Delay	12.0			HCM Level of Service			B					
HCM Volume to Capacity ratio	0.42											
Actuated Cycle Length (s)	48.2			Sum of lost time (s)			11.0					
Intersection Capacity Utilization	78.2%			ICU Level of Service			D					
Analysis Period (min)	15											
c Critical Lane Group												

Timings
6: Lundy's Lane & Thorold Townline Road

<2018 Existing> Weekday AM Peak Hour

2018-11-23

									
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	47	318	93	35	310	50	113	8	61
Turn Type	Perm		Perm	Perm		Perm		Perm	
Protected Phases		4			8		2		6
Permitted Phases	4		4	8		2		6	
Detector Phase	4	4	4	8	8	2	2	6	6
Switch Phase									
Minimum Initial (s)	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Minimum Split (s)	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5
Total Split (s)	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	None	Max	Max	Max	Max
Act Effect Green (s)	16.7	16.7	16.7	16.7	16.7	19.5	19.5	19.5	19.5
Actuated g/C Ratio	0.35	0.35	0.35	0.35	0.35	0.41	0.41	0.41	0.41
v/c Ratio	0.16	0.50	0.15	0.10	0.52	0.10	0.20	0.02	0.12
Control Delay	11.9	15.1	3.6	11.1	15.2	9.6	8.2	9.0	7.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.9	15.1	3.6	11.1	15.2	9.6	8.2	9.0	7.5
LOS	B	B	A	B	B	A	A	A	A
Approach Delay		12.4			14.8		8.6		7.6
Approach LOS		B			B		A		A

Intersection Summary

Cycle Length: 50

Actuated Cycle Length: 47.2

Natural Cycle: 45

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.52

Intersection Signal Delay: 12.1

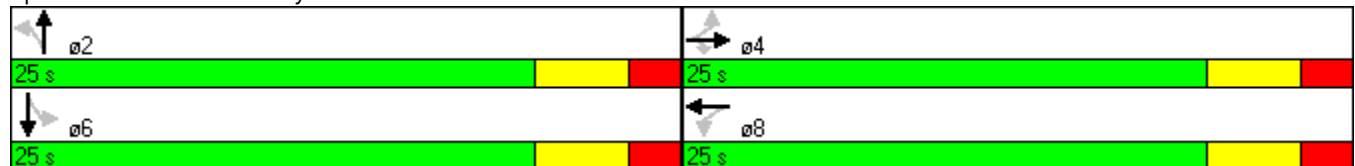
Intersection LOS: B

Intersection Capacity Utilization 57.9%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 6: Lundy's Lane & Thorold Townline Road



HCM Signalized Intersection Capacity Analysis

6: Lundy's Lane & Thorold Townline Road

<2018 Existing> Weekday AM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	47	318	93	35	310	20	50	113	31	8	61	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5		5.5	5.5		5.5	5.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.97		1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1626	1863	1599	1805	1825		1671	1769		1444	1684	
Flt Permitted	0.50	1.00	1.00	0.52	1.00		0.70	1.00		0.66	1.00	
Satd. Flow (perm)	859	1863	1599	986	1825		1231	1769		1007	1684	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	48	328	96	36	320	21	52	116	32	8	63	25
RTOR Reduction (vph)	0	0	62	0	5	0	0	19	0	0	15	0
Lane Group Flow (vph)	48	328	34	36	336	0	52	129	0	8	73	0
Heavy Vehicles (%)	11%	2%	1%	0%	3%	5%	8%	5%	0%	25%	8%	8%
Turn Type	Perm		Perm	Perm		Perm				Perm		
Protected Phases	4			8				2		6		
Permitted Phases	4		4	8				2		6		
Actuated Green, G (s)	16.7	16.7	16.7	16.7	16.7			19.5	19.5			19.5
Effective Green, g (s)	16.7	16.7	16.7	16.7	16.7			19.5	19.5			19.5
Actuated g/C Ratio	0.35	0.35	0.35	0.35	0.35			0.41	0.41			0.41
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5			5.5	5.5			5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0			3.0
Lane Grp Cap (vph)	304	659	566	349	646			509	731			416
v/s Ratio Prot	0.18			c0.18				c0.07		0.04		
v/s Ratio Perm	0.06		0.02	0.04			0.04				0.01	
v/c Ratio	0.16	0.50	0.06	0.10	0.52			0.10	0.18			0.02
Uniform Delay, d1	10.4	12.0	10.1	10.2	12.1			8.5	8.8			8.2
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00			1.00
Incremental Delay, d2	0.2	0.6	0.0	0.1	0.7			0.4	0.5			0.1
Delay (s)	10.7	12.6	10.1	10.4	12.8			8.9	9.3			8.3
Level of Service	B	B	B	B	B			A	A			A
Approach Delay (s)	11.9				12.6				9.2			
Approach LOS	B				B				A			
Intersection Summary												
HCM Average Control Delay			11.4		HCM Level of Service				B			
HCM Volume to Capacity ratio			0.34									
Actuated Cycle Length (s)			47.2		Sum of lost time (s)				11.0			
Intersection Capacity Utilization			57.9%		ICU Level of Service				B			
Analysis Period (min)			15									
c Critical Lane Group												

Timings
1: Niagara Falls Road & Davis Road

<2018 Existing> Weekday PM Peak Hour

2018-11-23

									
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	88	29	44	54	10	231	165	315	119
Turn Type	Perm		Perm		Perm		Perm		Perm
Protected Phases		4		8		2		6	
Permitted Phases	4		8		2		6		6
Detector Phase	4	4	8	8	2	2	6	6	6
Switch Phase									
Minimum Initial (s)	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	35.0	35.0	35.0	35.0	35.0
Total Split (%)	36.4%	36.4%	36.4%	36.4%	63.6%	63.6%	63.6%	63.6%	63.6%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)		14.6		14.6	31.3	31.3	31.3	31.3	31.3
Actuated g/C Ratio		0.26		0.26	0.55	0.55	0.55	0.55	0.55
v/c Ratio		0.49		0.55	0.02	0.14	0.29	0.17	0.14
Control Delay		23.8		12.7	6.2	5.9	8.7	6.7	1.9
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		23.8		12.7	6.2	5.9	8.7	6.7	1.9
LOS		C		B	A	A	A	A	A
Approach Delay		23.8		12.7		5.9		6.3	
Approach LOS		C		B		A		A	

Intersection Summary

Cycle Length: 55

Actuated Cycle Length: 56.9

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.55

Intersection Signal Delay: 9.3

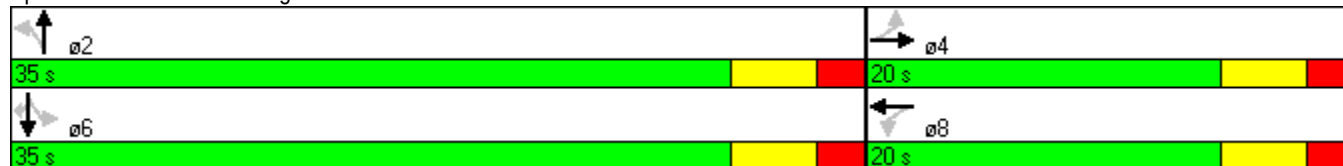
Intersection LOS: A

Intersection Capacity Utilization 59.9%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 1: Niagara Falls Road & Davis Road



HCM Signalized Intersection Capacity Analysis

1: Niagara Falls Road & Davis Road

<2018 Existing> Weekday PM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	88	29	6	44	54	169	10	231	25	165	315	119
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5			5.5		5.5	5.5		5.5	5.5	5.5
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frt		0.99			0.91		1.00	0.99		1.00	1.00	0.85
Flt Protected		0.97			0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1772			1697		1641	3497		1787	3505	1553
Flt Permitted		0.57			0.92		0.55	1.00		0.58	1.00	1.00
Satd. Flow (perm)		1040			1578		950	3497		1098	3505	1553
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	94	31	6	47	57	180	11	246	27	176	335	127
RTOR Reduction (vph)	0	3	0	0	114	0	0	12	0	0	0	57
Lane Group Flow (vph)	0	128	0	0	170	0	11	261	0	176	335	70
Heavy Vehicles (%)	3%	3%	0%	7%	2%	0%	10%	1%	8%	1%	3%	4%
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)		14.6			14.6		31.3	31.3		31.3	31.3	31.3
Effective Green, g (s)		14.6			14.6		31.3	31.3		31.3	31.3	31.3
Actuated g/C Ratio		0.26			0.26		0.55	0.55		0.55	0.55	0.55
Clearance Time (s)		5.5			5.5		5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		267			405		523	1924		604	1928	854
v/s Ratio Prot								0.07			0.10	
v/s Ratio Perm		c0.12			0.11		0.01			c0.16		0.04
v/c Ratio		0.48			0.42		0.02	0.14		0.29	0.17	0.08
Uniform Delay, d1		17.9			17.6		5.8	6.2		6.9	6.4	6.0
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		1.4			0.7		0.1	0.1		1.2	0.2	0.2
Delay (s)		19.3			18.3		5.9	6.4		8.1	6.6	6.2
Level of Service		B			B		A	A		A	A	A
Approach Delay (s)		19.3			18.3			6.4			6.9	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay		10.4				HCM Level of Service				B		
HCM Volume to Capacity ratio		0.35										
Actuated Cycle Length (s)		56.9				Sum of lost time (s)				11.0		
Intersection Capacity Utilization		59.9%				ICU Level of Service				B		
Analysis Period (min)		15										
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis 2: Beaverdams Road & Thorold Townline Road

<2018 Existing> Weekday PM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	19	175	22	7	163	18	31	119	7	37	184	32
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	20	186	23	7	173	19	33	127	7	39	196	34
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	230	200	167	269								
Volume Left (vph)	20	7	33	39								
Volume Right (vph)	23	19	7	34								
Hadj (s)	-0.03	-0.03	0.15	0.03								
Departure Headway (s)	5.5	5.5	5.7	5.4								
Degree Utilization, x	0.35	0.31	0.27	0.41								
Capacity (veh/h)	604	594	563	613								
Control Delay (s)	11.4	11.0	10.8	12.1								
Approach Delay (s)	11.4	11.0	10.8	12.1								
Approach LOS	B	B	B	B								
Intersection Summary												
Delay				11.4								
HCM Level of Service				B								
Intersection Capacity Utilization				42.0%	ICU Level of Service	A						
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis

3: Barker Parkway & Davis Road

<2018 Existing> Weekday PM Peak Hour

2018-11-23

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	8	39	21	10	49	4
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	9	42	23	11	53	4
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	132	23			33	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	132	23			33	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	96			97	
cM capacity (veh/h)	838	1046			1592	
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	51	23	11	53	4	
Volume Left	9	0	0	53	0	
Volume Right	42	0	11	0	0	
cSH	1003	1700	1700	1592	1700	
Volume to Capacity	0.05	0.01	0.01	0.03	0.00	
Queue Length 95th (m)	1.3	0.0	0.0	0.8	0.0	
Control Delay (s)	8.8	0.0	0.0	7.3	0.0	
Lane LOS	A			A		
Approach Delay (s)	8.8	0.0		6.8		
Approach LOS	A					
Intersection Summary						
Average Delay			5.9			
Intersection Capacity Utilization			19.4%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

4: Allanburg Road & Davis Road

<2018 Existing> Weekday PM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	36	0	42	0	0	0	72	182	0	0	191	47
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	41	0	48	0	0	0	82	207	0	0	217	53
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)			6									
Median type								None			None	
Median storage veh												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	588	588	217	588	641	207	270			207		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	588	588	217	588	641	207	270			207		
tC, single (s)	7.2	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	90	100	94	100	100	100	94			100		
cM capacity (veh/h)	392	398	828	380	371	839	1305			1376		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3					
Volume Total	89	0	82	207	0	217	53					
Volume Left	41	0	82	0	0	0	0					
Volume Right	48	0	0	0	0	0	53					
cSH	850	1700	1305	1700	1700	1700	1700					
Volume to Capacity	0.10	0.00	0.06	0.12	0.00	0.13	0.03					
Queue Length 95th (m)	2.8	0.0	1.6	0.0	0.0	0.0	0.0					
Control Delay (s)	12.2	0.0	7.9	0.0	0.0	0.0	0.0					
Lane LOS	B	A	A									
Approach Delay (s)	12.2	0.0	2.3		0.0							
Approach LOS	B	A										
Intersection Summary												
Average Delay			2.7									
Intersection Capacity Utilization			27.4%		ICU Level of Service					A		
Analysis Period (min)			15									

Timings
5: Lundy's Lane & Davis Road

<2018 Existing> Weekday PM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	92	529	23	455	57	55	109	62	115	100
Turn Type	Perm		Perm		Perm	Perm		Perm		Perm
Protected Phases		4		8			2		6	
Permitted Phases	4		8		8	2		6		6
Detector Phase	4	4	8	8	8	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Minimum Split (s)	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5
Total Split (s)	30.0	30.0	30.0	30.0	30.0	25.0	25.0	25.0	25.0	25.0
Total Split (%)	54.5%	54.5%	54.5%	54.5%	54.5%	45.5%	45.5%	45.5%	45.5%	45.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)	22.6	22.6	22.6	22.6	22.6	19.6	19.6	19.6	19.6	19.6
Actuated g/C Ratio	0.42	0.42	0.42	0.42	0.42	0.37	0.37	0.37	0.37	0.37
v/c Ratio	0.49	0.89	0.24	0.70	0.10	0.16	0.25	0.17	0.23	0.18
Control Delay	19.7	30.8	15.7	18.1	3.3	13.4	12.3	13.6	13.7	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.7	30.8	15.7	18.1	3.3	13.4	12.3	13.6	13.7	3.9
LOS	B	C	B	B	A	B	B	B	B	A
Approach Delay		29.3		16.4			12.6		10.1	
Approach LOS		C		B			B		B	

Intersection Summary

Cycle Length: 55

Actuated Cycle Length: 53.2

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.89

Intersection Signal Delay: 20.0

Intersection LOS: C

Intersection Capacity Utilization 88.2%

ICU Level of Service E

Analysis Period (min) 15

Splits and Phases: 5: Lundy's Lane & Davis Road

	
ø2	ø4
25 s	30 s
	
ø6	ø8
25 s	30 s

HCM Signalized Intersection Capacity Analysis

5: Lundy's Lane & Davis Road

<2018 Existing> Weekday PM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	92	529	34	23	455	57	55	109	21	62	115	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5		5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	1799		1480	1863	1553	1626	1685		1719	1681	1599
Flt Permitted	0.29	1.00		0.18	1.00	1.00	0.67	1.00		0.66	1.00	1.00
Satd. Flow (perm)	539	1799		276	1863	1553	1143	1685		1187	1681	1599
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	112	645	41	28	555	70	67	133	26	76	140	122
RTOR Reduction (vph)	0	5	0	0	0	40	0	13	0	0	0	77
Lane Group Flow (vph)	112	681	0	28	555	30	67	146	0	76	140	45
Heavy Vehicles (%)	3%	4%	15%	22%	2%	4%	11%	10%	10%	5%	13%	1%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	22.6	22.6		22.6	22.6	22.6	19.6	19.6		19.6	19.6	19.6
Effective Green, g (s)	22.6	22.6		22.6	22.6	22.6	19.6	19.6		19.6	19.6	19.6
Actuated g/C Ratio	0.42	0.42		0.42	0.42	0.42	0.37	0.37		0.37	0.37	0.37
Clearance Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	229	764		117	791	660	421	621		437	619	589
v/s Ratio Prot	c0.38			0.30			c0.09			0.08		
v/s Ratio Perm	0.21			0.10		0.02	0.06			0.06		0.03
v/c Ratio	0.49	0.89		0.24	0.70	0.05	0.16	0.24		0.17	0.23	0.08
Uniform Delay, d1	11.1	14.2		9.8	12.5	9.0	11.3	11.6		11.3	11.6	10.9
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.6	12.7		1.1	2.8	0.0	0.8	0.9		0.9	0.8	0.3
Delay (s)	12.8	26.9		10.9	15.4	9.0	12.1	12.5		12.2	12.4	11.2
Level of Service	B	C		B	B	A	B	B		B	B	B
Approach Delay (s)	24.9			14.5			12.4			11.9		
Approach LOS	C			B			B			B		
Intersection Summary												
HCM Average Control Delay			17.9	HCM Level of Service					B			
HCM Volume to Capacity ratio			0.59									
Actuated Cycle Length (s)			53.2	Sum of lost time (s)					11.0			
Intersection Capacity Utilization			88.2%	ICU Level of Service					E			
Analysis Period (min)			15									
c Critical Lane Group												

Timings
6: Lundy's Lane & Thorold Townline Road

<2018 Existing> Weekday PM Peak Hour

2018-11-23

									
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	25	444	83	42	368	112	85	12	110
Turn Type	Perm		Perm	Perm		Perm		Perm	
Protected Phases		4			8		2		6
Permitted Phases	4		4	8		2		6	
Detector Phase	4	4	4	8	8	2	2	6	6
Switch Phase									
Minimum Initial (s)	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Minimum Split (s)	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5
Total Split (s)	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	None	Max	Max	Max	Max
Act Effect Green (s)	17.7	17.7	17.7	17.7	17.7	19.5	19.5	19.5	19.5
Actuated g/C Ratio	0.37	0.37	0.37	0.37	0.37	0.40	0.40	0.40	0.40
v/c Ratio	0.11	0.73	0.14	0.23	0.62	0.26	0.19	0.03	0.22
Control Delay	11.3	20.7	3.5	13.6	17.1	11.9	7.8	9.7	8.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.3	20.7	3.5	13.6	17.1	11.9	7.8	9.7	8.5
LOS	B	C	A	B	B	B	A	A	A
Approach Delay		17.7			16.7		9.7		8.6
Approach LOS		B			B		A		A

Intersection Summary

Cycle Length: 50

Actuated Cycle Length: 48.2

Natural Cycle: 45

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.73

Intersection Signal Delay: 14.9

Intersection LOS: B

Intersection Capacity Utilization 75.3%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 6: Lundy's Lane & Thorold Townline Road

					
25 s	25 s	25 s	25 s	25 s	25 s
					
25 s	25 s	25 s	25 s	25 s	25 s

HCM Signalized Intersection Capacity Analysis

6: Lundy's Lane & Thorold Townline Road

<2018 Existing> Weekday PM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	444	83	42	368	11	112	85	42	12	110	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5		5.5	5.5		5.5	5.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.95		1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1612	1881	1615	1805	1874		1787	1782		1671	1799	
Flt Permitted	0.39	1.00	1.00	0.31	1.00		0.65	1.00		0.66	1.00	
Satd. Flow (perm)	669	1881	1615	580	1874		1223	1782		1169	1799	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	28	505	94	48	418	12	127	97	48	14	125	44
RTOR Reduction (vph)	0	0	59	0	2	0	0	29	0	0	25	0
Lane Group Flow (vph)	28	505	35	48	428	0	127	116	0	14	144	0
Heavy Vehicles (%)	12%	1%	0%	0%	1%	0%	1%	2%	0%	8%	2%	0%
Turn Type	Perm		Perm	Perm			Perm			Perm		
Protected Phases	4				8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)	17.7	17.7	17.7	17.7	17.7		19.5	19.5		19.5	19.5	
Effective Green, g (s)	17.7	17.7	17.7	17.7	17.7		19.5	19.5		19.5	19.5	
Actuated g/C Ratio	0.37	0.37	0.37	0.37	0.37		0.40	0.40		0.40	0.40	
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5		5.5	5.5		5.5	5.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	246	691	593	213	688		495	721		473	728	
v/s Ratio Prot	c0.27				0.23			0.07			0.08	
v/s Ratio Perm	0.04		0.02	0.08			c0.10			0.01		
v/c Ratio	0.11	0.73	0.06	0.23	0.62		0.26	0.16		0.03	0.20	
Uniform Delay, d1	10.1	13.2	9.9	10.5	12.5		9.5	9.1		8.6	9.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	4.0	0.0	0.5	1.8		1.3	0.5		0.1	0.6	
Delay (s)	10.3	17.2	9.9	11.1	14.3		10.8	9.6		8.8	9.9	
Level of Service	B	B	A	B	B		B	A		A	A	
Approach Delay (s)	15.8				13.9			10.2			9.8	
Approach LOS	B				B			B			A	
Intersection Summary												
HCM Average Control Delay			13.5	HCM Level of Service			B					
HCM Volume to Capacity ratio			0.48									
Actuated Cycle Length (s)			48.2	Sum of lost time (s)			11.0					
Intersection Capacity Utilization			75.3%	ICU Level of Service			D					
Analysis Period (min)			15									
c Critical Lane Group												

Timings

<2021 Background> Weekday AM Peak Hour

1: Niagara Falls Road & Davis Road

2018-11-23



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	120	34	22	29	5	831	84	441	42
Turn Type	Perm		Perm		Perm		Perm		Perm
Protected Phases		4		8		2		6	
Permitted Phases	4		8		2		6		6
Detector Phase	4	4	8	8	2	2	6	6	6
Switch Phase									
Minimum Initial (s)	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	35.0	35.0	35.0	35.0	35.0
Total Split (%)	36.4%	36.4%	36.4%	36.4%	63.6%	63.6%	63.6%	63.6%	63.6%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)	14.5	14.5		14.5	31.2	31.2	31.2	31.2	31.2
Actuated g/C Ratio	0.26	0.26		0.26	0.55	0.55	0.55	0.55	0.55
v/c Ratio	0.55	0.09		0.56	0.01	0.47	0.32	0.24	0.05
Control Delay	27.8	14.6		14.7	6.2	8.7	11.2	7.1	2.5
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.8	14.6		14.7	6.2	8.7	11.2	7.1	2.5
LOS	C	B		B	A	A	B	A	A
Approach Delay		24.6		14.7		8.7		7.4	
Approach LOS		C		B		A		A	

Intersection Summary

Cycle Length: 55

Actuated Cycle Length: 56.8

Natural Cycle: 45

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.56

Intersection Signal Delay: 10.5

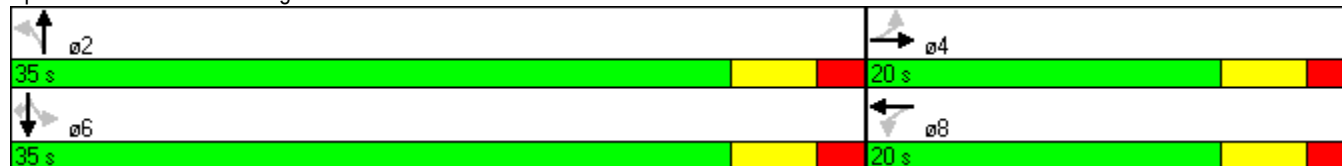
Intersection LOS: B

Intersection Capacity Utilization 82.9%

ICU Level of Service E

Analysis Period (min) 15

Splits and Phases: 1: Niagara Falls Road & Davis Road



HCM Signalized Intersection Capacity Analysis <2021 Background> Weekday AM Peak Hour

1: Niagara Falls Road & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	120	34	5	22	29	220	5	831	36	84	441	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5			5.5		5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.98			0.89		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	1817			1672		1641	3542		1787	3505	1553
Flt Permitted	0.49	1.00			0.97		0.48	1.00		0.27	1.00	1.00
Satd. Flow (perm)	913	1817			1637		834	3542		509	3505	1553
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	128	36	5	23	31	234	5	884	38	89	469	45
RTOR Reduction (vph)	0	4	0	0	92	0	0	5	0	0	0	20
Lane Group Flow (vph)	128	37	0	0	196	0	5	917	0	89	469	25
Heavy Vehicles (%)	3%	3%	0%	7%	2%	0%	10%	1%	8%	1%	3%	4%
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	14.6	14.6			14.6		31.2	31.2		31.2	31.2	31.2
Effective Green, g (s)	14.6	14.6			14.6		31.2	31.2		31.2	31.2	31.2
Actuated g/C Ratio	0.26	0.26			0.26		0.55	0.55		0.55	0.55	0.55
Clearance Time (s)	5.5	5.5			5.5		5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	235	467			421		458	1946		280	1925	853
v/s Ratio Prot		0.02						c0.26			0.13	
v/s Ratio Perm	c0.14				0.12		0.01			0.17		0.02
v/c Ratio	0.54	0.08			0.47		0.01	0.47		0.32	0.24	0.03
Uniform Delay, d1	18.2	16.0			17.8		5.8	7.8		7.0	6.7	5.9
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.6	0.1			0.8		0.0	0.8		3.0	0.3	0.1
Delay (s)	20.8	16.1			18.6		5.8	8.6		10.0	7.0	5.9
Level of Service	C	B			B		A	A		A	A	A
Approach Delay (s)		19.7			18.6			8.6			7.3	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay	10.6			HCM Level of Service			B					
HCM Volume to Capacity ratio	0.49											
Actuated Cycle Length (s)	56.8			Sum of lost time (s)			11.0					
Intersection Capacity Utilization	82.9%			ICU Level of Service			E					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis<2021 Background> Weekday AM Peak Hour

2: Beaverdams Road & Thorold Townline Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	30	99	15	33	235	22	30	139	57	19	96	29
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	32	105	16	35	250	23	32	148	61	20	102	31
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	153	309	240	153								
Volume Left (vph)	32	35	32	20								
Volume Right (vph)	16	23	61	31								
Hadj (s)	0.01	0.02	-0.01	-0.02								
Departure Headway (s)	5.5	5.3	5.4	5.6								
Degree Utilization, x	0.24	0.45	0.36	0.24								
Capacity (veh/h)	587	638	605	578								
Control Delay (s)	10.2	12.6	11.5	10.3								
Approach Delay (s)	10.2	12.6	11.5	10.3								
Approach LOS	B	B	B	B								
Intersection Summary												
Delay			11.5									
HCM Level of Service			B									
Intersection Capacity Utilization			41.3%		ICU Level of Service				A			
Analysis Period (min)			15									

Timings
3: Barker Parkway & Davis Road

<2021 Background> Weekday AM Peak Hour

2018-11-23

					
Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Configurations					
Volume (vph)	3	481	115	234	72
Turn Type		Perm		Perm	
Protected Phases	8		2		6
Permitted Phases		8		6	
Detector Phase	8	8	2	6	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	22.0	22.0	23.0	23.0	23.0
Total Split (%)	48.9%	48.9%	51.1%	51.1%	51.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	Max	Max	Max
Act Effect Green (s)	7.9	7.9	19.3	19.3	19.3
Actuated g/C Ratio	0.22	0.22	0.55	0.55	0.55
v/c Ratio	0.01	0.69	0.08	0.37	0.04
Control Delay	9.3	7.0	4.4	7.8	5.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	9.3	7.0	4.4	7.8	5.0
LOS	A	A	A	A	A
Approach Delay	7.0		4.4		7.1
Approach LOS	A		A		A

Intersection Summary

Cycle Length: 45

Actuated Cycle Length: 35.3

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.69

Intersection Signal Delay: 6.7

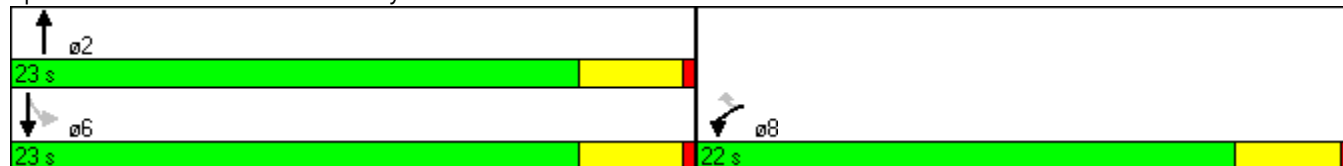
Intersection LOS: A

Intersection Capacity Utilization 40.3%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 3: Barker Parkway & Davis Road



HCM Signalized Intersection Capacity Analysis <2021 Background> Weekday AM Peak Hour

3: Barker Parkway & Davis Road

2018-11-23



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	3	481	115	22	234	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1538	3408		1805	3406
Flt Permitted	0.95	1.00	1.00		0.66	1.00
Satd. Flow (perm)	1805	1538	3408		1250	3406
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	3	517	124	24	252	77
RTOR Reduction (vph)	0	401	11	0	0	0
Lane Group Flow (vph)	3	116	137	0	252	77
Heavy Vehicles (%)	0%	5%	4%	0%	0%	6%
Turn Type	Perm		Perm			
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	7.9	7.9	19.3		19.3	19.3
Effective Green, g (s)	7.9	7.9	19.3		19.3	19.3
Actuated g/C Ratio	0.22	0.22	0.55		0.55	0.55
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	405	345	1869		685	1867
v/s Ratio Prot	0.00		0.04			0.02
v/s Ratio Perm		c0.08			c0.20	
v/c Ratio	0.01	0.34	0.07		0.37	0.04
Uniform Delay, d1	10.6	11.5	3.7		4.5	3.7
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.0	0.6	0.1		1.5	0.0
Delay (s)	10.6	12.0	3.8		6.0	3.7
Level of Service	B	B	A		A	A
Approach Delay (s)	12.0		3.8			5.5
Approach LOS	B		A			A
Intersection Summary						
HCM Average Control Delay			8.6	HCM Level of Service		A
HCM Volume to Capacity ratio			0.36			
Actuated Cycle Length (s)			35.2	Sum of lost time (s)		8.0
Intersection Capacity Utilization			40.3%	ICU Level of Service		A
Analysis Period (min)			15			

c Critical Lane Group

Timings
4: Allanburg Road & Davis Road

<2021 Background> Weekday AM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	56	0	46	56	0	45	238	57	119	22
Turn Type	Perm		Perm	Perm		Perm		Perm		Perm
Protected Phases		4			8		2		6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	4	4	4	8	8	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)		7.5	7.5		7.5	20.8	20.8	20.8	20.8	20.8
Actuated g/C Ratio		0.22	0.22		0.22	0.62	0.62	0.62	0.62	0.62
v/c Ratio		0.22	0.13		0.44	0.06	0.27	0.10	0.12	0.03
Control Delay		11.6	4.4		7.8	4.9	5.4	5.2	5.0	2.6
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		11.6	4.4		7.8	4.9	5.4	5.2	5.0	2.6
LOS		B	A		A	A	A	A	A	A
Approach Delay		8.4			7.8		5.3		4.8	
Approach LOS		A			A		A		A	

Intersection Summary

Cycle Length: 40

Actuated Cycle Length: 33.7

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.44

Intersection Signal Delay: 6.1

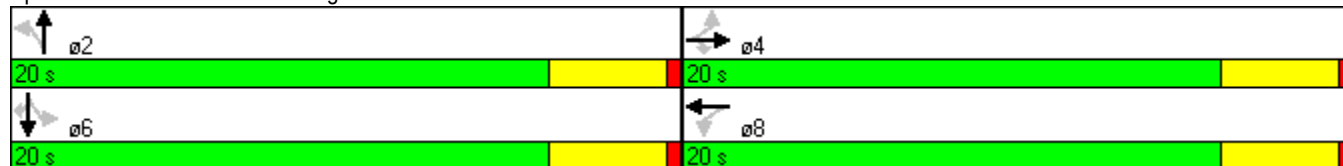
Intersection LOS: A

Intersection Capacity Utilization 44.3%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 4: Allanburg Road & Davis Road



HCM Signalized Intersection Capacity Analysis <2021 Background> Weekday AM Peak Hour

4: Allanburg Road & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	56	0	46	56	0	112	45	238	29	57	119	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.91		1.00	0.98		1.00	1.00	0.85
Flt Protected		0.95	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1671	1615		1701		1805	1789		1805	1792	1524
Flt Permitted		0.73	1.00		0.86		0.67	1.00		0.58	1.00	1.00
Satd. Flow (perm)		1286	1615		1493		1274	1789		1093	1792	1524
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	64	0	52	64	0	127	51	270	33	65	135	25
RTOR Reduction (vph)	0	0	42	0	103	0	0	8	0	0	0	10
Lane Group Flow (vph)	0	64	10	0	88	0	51	295	0	65	135	15
Heavy Vehicles (%)	8%	0%	0%	0%	0%	0%	0%	5%	0%	0%	6%	6%
Turn Type	Perm		Perm	Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		6.4	6.4		6.4		20.0	20.0		20.0	20.0	20.0
Effective Green, g (s)		6.4	6.4		6.4		20.0	20.0		20.0	20.0	20.0
Actuated g/C Ratio		0.19	0.19		0.19		0.58	0.58		0.58	0.58	0.58
Clearance Time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		239	300		278		741	1040		635	1042	886
v/s Ratio Prot							c0.17				0.08	
v/s Ratio Perm		0.05	0.01		c0.06		0.04			0.06		0.01
v/c Ratio		0.27	0.03		0.32		0.07	0.28		0.10	0.13	0.02
Uniform Delay, d1		12.0	11.5		12.1		3.1	3.6		3.2	3.3	3.0
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.6	0.0		0.7		0.2	0.7		0.3	0.3	0.0
Delay (s)		12.6	11.5		12.8		3.3	4.3		3.5	3.5	3.1
Level of Service		B	B		B		A	A		A	A	A
Approach Delay (s)		12.1			12.8			4.2			3.5	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay		6.9			HCM Level of Service			A				
HCM Volume to Capacity ratio		0.29										
Actuated Cycle Length (s)		34.4			Sum of lost time (s)			8.0				
Intersection Capacity Utilization		44.3%			ICU Level of Service			A				
Analysis Period (min)		15										
c Critical Lane Group												

Timings
5: Lundy's Lane & Davis Road

<2021 Background> Weekday AM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	149	398	84	395	63	29	141	41	84	137
Turn Type	pm+pt		pm+pt		Perm	Perm		pm+pt		Perm
Protected Phases	7	4	3	8			2	1	6	
Permitted Phases	4		8		8	2		6		6
Detector Phase	7	4	3	8	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	16.0	4.0	16.0	16.0	16.0	16.0	4.0	16.0	16.0
Minimum Split (s)	8.0	21.5	8.0	21.5	21.5	21.5	21.5	8.0	21.5	21.5
Total Split (s)	9.0	22.5	8.0	21.5	21.5	21.5	21.5	8.0	29.5	29.5
Total Split (%)	15.0%	37.5%	13.3%	35.8%	35.8%	35.8%	35.8%	13.3%	49.2%	49.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	2.0	0.5	2.0	2.0	2.0	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.5	4.0	5.5	5.5	5.5	5.5	4.0	5.5	5.5
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effect Green (s)	24.1	18.6	21.5	16.0	16.0	19.2	19.2	25.5	24.0	24.0
Actuated g/C Ratio	0.40	0.31	0.36	0.27	0.27	0.32	0.32	0.42	0.40	0.40
v/c Ratio	0.49	0.49	0.34	0.51	0.16	0.09	0.42	0.12	0.15	0.23
Control Delay	16.1	19.0	14.1	21.0	6.0	17.3	18.2	11.0	12.3	3.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.1	19.0	14.1	21.0	6.0	17.3	18.2	11.0	12.3	3.2
LOS	B	B	B	C	A	B	B	B	B	A
Approach Delay		18.2		18.2			18.1		7.4	
Approach LOS		B		B			B		A	

Intersection Summary

Cycle Length: 60

Actuated Cycle Length: 60

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.51

Intersection Signal Delay: 16.4

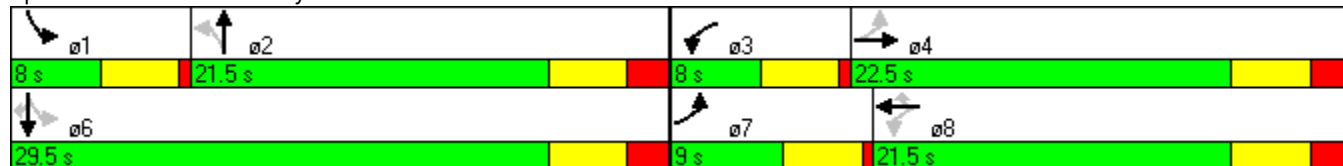
Intersection LOS: B

Intersection Capacity Utilization 65.3%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 5: Lundy's Lane & Davis Road



HCM Signalized Intersection Capacity Analysis <2021 Background> Weekday AM Peak Hour

5: Lundy's Lane & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	149	398	28	84	395	63	29	141	49	41	84	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	3413		1480	3539	1553	1626	1660		1719	1681	1599
Flt Permitted	0.38	1.00		0.45	1.00	1.00	0.69	1.00		0.48	1.00	1.00
Satd. Flow (perm)	701	3413		694	3539	1553	1183	1660		877	1681	1599
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	182	485	34	102	482	77	35	172	60	50	102	167
RTOR Reduction (vph)	0	8	0	0	0	56	0	20	0	0	0	98
Lane Group Flow (vph)	182	511	0	102	482	21	35	212	0	50	102	69
Heavy Vehicles (%)	3%	4%	15%	22%	2%	4%	11%	10%	10%	5%	13%	1%
Turn Type	pm+pt			pm+pt		Perm	Perm			pm+pt		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4			8		8	2			6		6
Actuated Green, G (s)	23.6	18.6		20.0	16.8	16.8	19.2	19.2		25.6	25.6	25.6
Effective Green, g (s)	23.6	18.6		20.0	16.8	16.8	19.2	19.2		25.6	25.6	25.6
Actuated g/C Ratio	0.38	0.30		0.32	0.27	0.27	0.31	0.31		0.41	0.41	0.41
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	349	1017		263	953	418	364	511		392	690	656
v/s Ratio Prot	c0.04	0.15		0.02	0.14			c0.13		0.00	c0.06	
v/s Ratio Perm	c0.16			0.10		0.01	0.03			0.05		0.04
v/c Ratio	0.52	0.50		0.39	0.51	0.05	0.10	0.41		0.13	0.15	0.10
Uniform Delay, d1	13.6	18.1		15.5	19.3	16.9	15.4	17.1		11.4	11.6	11.3
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.4	0.4		1.0	0.4	0.0	0.5	2.5		0.1	0.5	0.3
Delay (s)	15.0	18.5		16.4	19.7	16.9	15.9	19.6		11.5	12.0	11.7
Level of Service	B	B		B	B	B	B	B		B	B	B
Approach Delay (s)		17.6			18.9			19.1			11.7	
Approach LOS		B			B			B			B	
Intersection Summary												
HCM Average Control Delay			17.3			HCM Level of Service				B		
HCM Volume to Capacity ratio			0.48									
Actuated Cycle Length (s)			62.4			Sum of lost time (s)			19.0			
Intersection Capacity Utilization			65.3%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

Timings

<2021 Background> Weekday AM Peak Hour

6: Lundy's Lane & Thorold Townline Road

2018-11-23

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	50	562	155	37	444	78	82	120	120	65	25
Turn Type	Perm		Perm	Perm		Perm	pm+pt		pm+pt		Perm
Protected Phases		4			8		5	2	1	6	
Permitted Phases	4		4	8		8	2		6		6
Detector Phase	4	4	4	8	8	8	5	2	1	6	6
Switch Phase											
Minimum Initial (s)	16.0	16.0	16.0	16.0	16.0	16.0	4.0	16.0	4.0	16.0	16.0
Minimum Split (s)	21.5	21.5	21.5	21.5	21.5	21.5	8.0	21.5	8.0	21.5	21.5
Total Split (s)	35.0	35.0	35.0	35.0	35.0	35.0	8.0	22.0	8.0	22.0	22.0
Total Split (%)	53.8%	53.8%	53.8%	53.8%	53.8%	53.8%	12.3%	33.8%	12.3%	33.8%	33.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.5	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5	4.0	5.5	5.5
Lead/Lag							Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	None	Max	Max
Act Effect Green (s)	24.2	24.2	24.2	24.2	24.2	24.2	21.4	16.9	21.4	16.9	16.9
Actuated g/C Ratio	0.41	0.41	0.41	0.41	0.41	0.41	0.37	0.29	0.37	0.29	0.29
v/c Ratio	0.25	0.82	0.23	0.29	0.65	0.12	0.18	0.32	0.30	0.14	0.06
Control Delay	14.8	25.4	2.9	17.8	18.3	3.3	13.0	18.8	14.9	19.1	8.4
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	14.8	25.4	2.9	17.8	18.3	3.3	13.0	18.8	14.9	19.1	8.4
LOS	B	C	A	B	B	A	B	B	B	B	A
Approach Delay		20.2			16.1			16.8		15.4	
Approach LOS		C			B			B		B	

Intersection Summary

Cycle Length: 65

Actuated Cycle Length: 58.4

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.82

Intersection Signal Delay: 17.9

Intersection LOS: B

Intersection Capacity Utilization 74.0%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 6: Lundy's Lane & Thorold Townline Road

	ø1		ø2		ø4
8 s		22 s		35 s	
	ø5		ø6		ø8
8 s		22 s		35 s	

HCM Signalized Intersection Capacity Analysis <2021 Background> Weekday AM Peak Hour

6: Lundy's Lane & Thorold Townline Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	562	155	37	444	78	82	120	33	120	65	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1612	1881	1615	1805	1881	1615	1787	1809		1671	1863	1615
Flt Permitted	0.32	1.00	1.00	0.18	1.00	1.00	0.71	1.00		0.65	1.00	1.00
Satd. Flow (perm)	539	1881	1615	348	1881	1615	1333	1809		1139	1863	1615
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	57	639	176	42	505	89	93	136	38	136	74	28
RTOR Reduction (vph)	0	0	104	0	0	53	0	15	0	0	0	20
Lane Group Flow (vph)	57	639	72	42	505	36	93	159	0	136	74	8
Heavy Vehicles (%)	12%	1%	0%	0%	1%	0%	1%	2%	0%	8%	2%	0%
Turn Type	Perm		Perm	Perm		Perm	pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	24.2	24.2	24.2	24.2	24.2	24.2	19.9	16.9		19.9	16.9	16.9
Effective Green, g (s)	24.2	24.2	24.2	24.2	24.2	24.2	19.9	16.9		19.9	16.9	16.9
Actuated g/C Ratio	0.41	0.41	0.41	0.41	0.41	0.41	0.34	0.29		0.34	0.29	0.29
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
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)	221	770	661	142	770	661	472	517		411	533	462
v/s Ratio Prot		c0.34			0.27		0.01	0.09		c0.02	0.04	
v/s Ratio Perm	0.11		0.04	0.12		0.02	0.06			c0.09		0.00
v/c Ratio	0.26	0.83	0.11	0.30	0.66	0.06	0.20	0.31		0.33	0.14	0.02
Uniform Delay, d1	11.5	15.6	10.8	11.7	14.1	10.5	13.7	16.5		14.2	15.7	15.1
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	0.6	7.4	0.1	1.2	2.0	0.0	0.2	1.5		0.5	0.5	0.1
Delay (s)	12.1	23.0	10.9	12.9	16.1	10.6	13.9	18.1		14.6	16.2	15.2
Level of Service	B	C	B	B	B	B	B	B		B	B	B
Approach Delay (s)		19.8			15.1			16.6			15.2	
Approach LOS		B			B			B			B	
Intersection Summary												
HCM Average Control Delay			17.4			HCM Level of Service				B		
HCM Volume to Capacity ratio			0.58									
Actuated Cycle Length (s)			59.1			Sum of lost time (s)				13.5		
Intersection Capacity Utilization			74.0%			ICU Level of Service				D		
Analysis Period (min)			15									
c Critical Lane Group												

Timings
7: Lundy's Lane & Site Access 1

<2021 Background> Weekday AM Peak Hour

2018-11-23



Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Volume (vph)	29	459	578	115	281
Turn Type	Perm			Perm	
Protected Phases		4	8		6
Permitted Phases	4			8	
Detector Phase	4	4	8	8	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	Max
Act Effect Green (s)	11.8	11.8	11.8	11.8	16.1
Actuated g/C Ratio	0.33	0.33	0.33	0.33	0.45
v/c Ratio	0.14	0.43	0.54	0.21	0.46
Control Delay	9.8	10.5	11.6	3.2	9.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	9.8	10.5	11.6	3.2	9.4
LOS	A	B	B	A	A
Approach Delay		10.4	10.2		9.4
Approach LOS		B	B		A

Intersection Summary

Cycle Length: 40

Actuated Cycle Length: 35.9

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.54

Intersection Signal Delay: 10.1

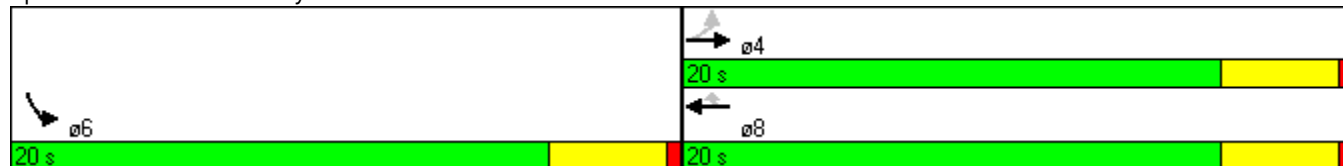
Intersection LOS: B

Intersection Capacity Utilization 48.3%

ICU Level of Service A

Analysis Period (min) 15

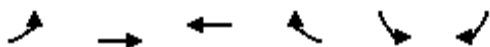
Splits and Phases: 7: Lundy's Lane & Site Access 1



HCM Signalized Intersection Capacity Analysis <2021 Background> Weekday AM Peak Hour

7: Lundy's Lane & Site Access 1

2018-11-23



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	29	459	578	115	281	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.98	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1770	3539	3539	1583	1748	
Flt Permitted	0.36	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	678	3539	3539	1583	1748	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	32	499	628	125	305	61
RTOR Reduction (vph)	0	0	0	84	17	0
Lane Group Flow (vph)	32	499	628	41	349	0
Turn Type	Perm		Perm			
Protected Phases	4		8		6	
Permitted Phases	4		8			
Actuated Green, G (s)	11.8	11.8	11.8	11.8	16.1	
Effective Green, g (s)	11.8	11.8	11.8	11.8	16.1	
Actuated g/C Ratio	0.33	0.33	0.33	0.33	0.45	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	223	1163	1163	520	784	
v/s Ratio Prot		0.14	c0.18		c0.20	
v/s Ratio Perm	0.05			0.03		
v/c Ratio	0.14	0.43	0.54	0.08	0.45	
Uniform Delay, d1	8.5	9.4	9.8	8.3	6.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.3	0.3	0.5	0.1	1.8	
Delay (s)	8.8	9.7	10.3	8.4	8.7	
Level of Service	A	A	B	A	A	
Approach Delay (s)		9.6	10.0		8.7	
Approach LOS		A	A		A	
Intersection Summary						
HCM Average Control Delay			9.6	HCM Level of Service		A
HCM Volume to Capacity ratio			0.49			
Actuated Cycle Length (s)			35.9	Sum of lost time (s)		8.0
Intersection Capacity Utilization			48.3%	ICU Level of Service		A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis<2021 Background> Weekday AM Peak Hour

8: Lundy's Lane & Site Access 2

2018-11-23



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	29	739	522	29	0	56
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	32	803	567	32	0	61
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (m)		204				
pX, platoon unblocked						
vC, conflicting volume	599				1449	583
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	599				1449	583
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				100	88
cM capacity (veh/h)	978				140	512
Direction, Lane #	EB 1	EB 2	WB 1	SB 1		
Volume Total	32	803	599	61		
Volume Left	32	0	0	0		
Volume Right	0	0	32	61		
cSH	978	1700	1700	512		
Volume to Capacity	0.03	0.47	0.35	0.12		
Queue Length 95th (m)	0.8	0.0	0.0	3.2		
Control Delay (s)	8.8	0.0	0.0	13.0		
Lane LOS	A			B		
Approach Delay (s)	0.3		0.0	13.0		
Approach LOS				B		
Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization			49.0%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis<2021 Background> Weekday AM Peak Hour

9: Site Access 3 & Thorold Townline Road

2018-11-23



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	56	112	57	191	115	29
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	61	122	62	208	125	32
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	472	141	157			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	472	141	157			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	88	87	96			
cM capacity (veh/h)	526	907	1423			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	183	62	208	157		
Volume Left	61	62	0	0		
Volume Right	122	0	0	32		
cSH	731	1423	1700	1700		
Volume to Capacity	0.25	0.04	0.12	0.09		
Queue Length 95th (m)	7.9	1.1	0.0	0.0		
Control Delay (s)	11.6	7.6	0.0	0.0		
Lane LOS	B	A				
Approach Delay (s)	11.6	1.8		0.0		
Approach LOS	B					
Intersection Summary						
Average Delay			4.2			
Intersection Capacity Utilization			31.1%		ICU Level of Service	A
Analysis Period (min)			15			

Timings
1: Niagara Falls Road & Davis Road

<2021 Background> Weekday PM Peak Hour

2018-11-23

									
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	93	31	47	57	11	727	175	1065	126
Turn Type	Perm		Perm		Perm		Perm		Perm
Protected Phases		4		8		2		6	
Permitted Phases	4		8		2		6		6
Detector Phase	4	4	8	8	2	2	6	6	6
Switch Phase									
Minimum Initial (s)	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	33.3%	33.3%	33.3%	33.3%	66.7%	66.7%	66.7%	66.7%	66.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)	14.5	14.5		14.5	36.0	36.0	36.0	36.0	36.0
Actuated g/C Ratio	0.24	0.24		0.24	0.58	0.58	0.58	0.58	0.58
v/c Ratio	0.50	0.09		0.62	0.06	0.39	0.52	0.55	0.14
Control Delay	29.8	16.4		17.6	6.5	7.5	14.3	9.2	1.7
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.8	16.4		17.6	6.5	7.5	14.3	9.2	1.7
LOS	C	B		B	A	A	B	A	A
Approach Delay		26.0		17.6		7.5		9.2	
Approach LOS		C		B		A		A	

Intersection Summary

Cycle Length: 60

Actuated Cycle Length: 61.6

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.62

Intersection Signal Delay: 10.4

Intersection LOS: B

Intersection Capacity Utilization 78.5%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 1: Niagara Falls Road & Davis Road



HCM Signalized Intersection Capacity Analysis <2021 Background> Weekday PM Peak Hour

1: Niagara Falls Road & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	93	31	6	47	57	179	11	727	27	175	1065	126
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5			5.5		5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.98			0.91		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	1810			1697		1641	3546		1787	3505	1553
Flt Permitted	0.45	1.00			0.94		0.20	1.00		0.33	1.00	1.00
Satd. Flow (perm)	836	1810			1605		348	3546		614	3505	1553
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	99	33	6	50	61	190	12	773	29	186	1133	134
RTOR Reduction (vph)	0	5	0	0	103	0	0	4	0	0	0	55
Lane Group Flow (vph)	99	34	0	0	198	0	12	798	0	186	1133	79
Heavy Vehicles (%)	3%	3%	0%	7%	2%	0%	10%	1%	8%	1%	3%	4%
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	14.5	14.5			14.5		36.1	36.1		36.1	36.1	36.1
Effective Green, g (s)	14.5	14.5			14.5		36.1	36.1		36.1	36.1	36.1
Actuated g/C Ratio	0.24	0.24			0.24		0.59	0.59		0.59	0.59	0.59
Clearance Time (s)	5.5	5.5			5.5		5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	197	426			378		204	2078		360	2054	910
v/s Ratio Prot		0.02						0.23			c0.32	
v/s Ratio Perm	0.12				c0.12		0.03			0.30		0.05
v/c Ratio	0.50	0.08			0.52		0.06	0.38		0.52	0.55	0.09
Uniform Delay, d1	20.4	18.4			20.5		5.5	6.8		7.6	7.8	5.6
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.0	0.1			1.3		0.6	0.5		5.2	1.1	0.2
Delay (s)	22.4	18.4			21.8		6.0	7.3		12.8	8.9	5.7
Level of Service	C	B			C		A	A		B	A	A
Approach Delay (s)		21.3			21.8			7.3			9.1	
Approach LOS		C			C			A			A	
Intersection Summary												
HCM Average Control Delay	10.6			HCM Level of Service			B					
HCM Volume to Capacity ratio	0.54											
Actuated Cycle Length (s)	61.6			Sum of lost time (s)			11.0					
Intersection Capacity Utilization	78.5%			ICU Level of Service			D					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis<2021 Background> Weekday PM Peak Hour

2: Beaverdams Road & Thorold Townline Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	20	186	23	88	173	19	33	126	61	39	195	34
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	21	198	24	94	184	20	35	134	65	41	207	36
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	244	298	234	285								
Volume Left (vph)	21	94	35	41								
Volume Right (vph)	24	20	65	36								
Hadj (s)	-0.03	0.11	-0.03	0.03								
Departure Headway (s)	6.2	6.2	6.2	6.2								
Degree Utilization, x	0.42	0.51	0.40	0.49								
Capacity (veh/h)	526	528	518	527								
Control Delay (s)	13.6	15.5	13.4	14.9								
Approach Delay (s)	13.6	15.5	13.4	14.9								
Approach LOS	B	C	B	B								
Intersection Summary												
Delay				14.4								
HCM Level of Service				B								
Intersection Capacity Utilization				56.6%	ICU Level of Service	B						
Analysis Period (min)				15								

Timings
3: Barker Parkway & Davis Road

<2021 Background> Weekday PM Peak Hour

2018-11-23

	←	↖	↑	↗	↓
Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Configurations	↖	↖	↕	↖	↕
Volume (vph)	8	416	129	621	167
Turn Type		Perm		Perm	
Protected Phases	8		2		6
Permitted Phases		8		6	
Detector Phase	8	8	2	6	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	55.0	55.0	55.0
Total Split (%)	26.7%	26.7%	73.3%	73.3%	73.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	Max	Max	Max
Act Effect Green (s)	8.4	8.4	51.3	51.3	51.3
Actuated g/C Ratio	0.12	0.12	0.76	0.76	0.76
v/c Ratio	0.04	0.77	0.06	0.71	0.07
Control Delay	25.0	12.7	2.5	11.2	2.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	25.0	12.7	2.5	11.2	2.7
LOS	C	B	A	B	A
Approach Delay	13.0		2.5		9.4
Approach LOS	B		A		A

Intersection Summary

Cycle Length: 75

Actuated Cycle Length: 67.7

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.77

Intersection Signal Delay: 9.8

Intersection LOS: A

Intersection Capacity Utilization 51.7%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 3: Barker Parkway & Davis Road



HCM Signalized Intersection Capacity Analysis <2021 Background> Weekday PM Peak Hour

3: Barker Parkway & Davis Road

2018-11-23



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	8	416	129	11	621	167
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1538	3440		1805	3406
Flt Permitted	0.95	1.00	1.00		0.66	1.00
Satd. Flow (perm)	1805	1538	3440		1247	3406
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	9	447	139	12	668	180
RTOR Reduction (vph)	0	392	3	0	0	0
Lane Group Flow (vph)	9	55	148	0	668	180
Heavy Vehicles (%)	0%	5%	4%	0%	0%	6%
Turn Type	Perm		Perm			
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	8.4	8.4	51.3		51.3	51.3
Effective Green, g (s)	8.4	8.4	51.3		51.3	51.3
Actuated g/C Ratio	0.12	0.12	0.76		0.76	0.76
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	224	191	2607		945	2581
v/s Ratio Prot	0.00		0.04			0.05
v/s Ratio Perm		c0.04			c0.54	
v/c Ratio	0.04	0.29	0.06		0.71	0.07
Uniform Delay, d1	26.1	26.9	2.1		4.3	2.1
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.1	0.8	0.0		4.4	0.1
Delay (s)	26.2	27.8	2.1		8.7	2.1
Level of Service	C	C	A		A	A
Approach Delay (s)	27.8		2.1			7.3
Approach LOS	C		A			A
Intersection Summary						
HCM Average Control Delay			13.2	HCM Level of Service		B
HCM Volume to Capacity ratio			0.65			
Actuated Cycle Length (s)			67.7	Sum of lost time (s)		8.0
Intersection Capacity Utilization			51.7%	ICU Level of Service		A
Analysis Period (min)			15			

c Critical Lane Group

Timings
4: Allanburg Road & Davis Road

<2021 Background> Weekday PM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	38	0	45	54	0	76	193	163	203	50
Turn Type	Perm		Perm	Perm		Perm		Perm		Perm
Protected Phases		4			8		2		6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	4	4	4	8	8	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)		7.3	7.3		7.3	21.2	21.2	21.2	21.2	21.2
Actuated g/C Ratio		0.22	0.22		0.22	0.63	0.63	0.63	0.63	0.63
v/c Ratio		0.15	0.13		0.43	0.12	0.28	0.27	0.21	0.06
Control Delay		10.7	4.5		7.8	5.1	4.6	6.3	5.2	2.1
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		10.7	4.5		7.8	5.1	4.6	6.3	5.2	2.1
LOS		B	A		A	A	A	A	A	A
Approach Delay		7.3			7.8		4.7		5.3	
Approach LOS		A			A		A		A	

Intersection Summary

Cycle Length: 40

Actuated Cycle Length: 33.9

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.43

Intersection Signal Delay: 5.6

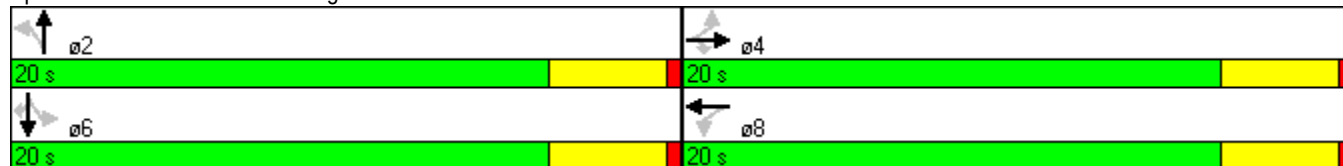
Intersection LOS: A

Intersection Capacity Utilization 50.4%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 4: Allanburg Road & Davis Road



HCM Signalized Intersection Capacity Analysis <2021 Background> Weekday PM Peak Hour

4: Allanburg Road & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	38	0	45	54	0	107	76	193	81	163	203	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.91		1.00	0.96		1.00	1.00	0.85
Flt Protected		0.95	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1671	1615		1701		1805	1754		1805	1792	1524
Flt Permitted		0.75	1.00		0.87		0.61	1.00		0.57	1.00	1.00
Satd. Flow (perm)		1312	1615		1508		1168	1754		1085	1792	1524
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	43	0	51	61	0	122	86	219	92	185	231	57
RTOR Reduction (vph)	0	0	42	0	100	0	0	26	0	0	0	23
Lane Group Flow (vph)	0	43	9	0	83	0	86	285	0	185	231	34
Heavy Vehicles (%)	8%	0%	0%	0%	0%	0%	0%	5%	0%	0%	6%	6%
Turn Type	Perm		Perm	Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		6.2	6.2		6.2		20.4	20.4		20.4	20.4	20.4
Effective Green, g (s)		6.2	6.2		6.2		20.4	20.4		20.4	20.4	20.4
Actuated g/C Ratio		0.18	0.18		0.18		0.59	0.59		0.59	0.59	0.59
Clearance Time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		235	289		270		689	1034		640	1057	899
v/s Ratio Prot								0.16			0.13	
v/s Ratio Perm		0.03	0.01		0.05		0.07			0.17		0.02
v/c Ratio		0.18	0.03		0.31		0.12	0.28		0.29	0.22	0.04
Uniform Delay, d1		12.1	11.7		12.3		3.1	3.5		3.5	3.3	3.0
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.4	0.0		0.6		0.4	0.7		1.1	0.5	0.1
Delay (s)		12.4	11.8		13.0		3.5	4.1		4.7	3.8	3.1
Level of Service		B	B		B		A	A		A	A	A
Approach Delay (s)		12.1			13.0			4.0			4.1	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay		6.1										
HCM Volume to Capacity ratio		0.29										
Actuated Cycle Length (s)		34.6										
Intersection Capacity Utilization		50.4%										
Analysis Period (min)		15										
c Critical Lane Group												

Timings
5: Lundy's Lane & Davis Road

<2021 Background> Weekday PM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	179	642	78	537	60	58	116	66	122	160
Turn Type	pm+pt		pm+pt		Perm	Perm		pm+pt		Perm
Protected Phases	7	4	3	8			2	1	6	
Permitted Phases	4		8		8	2		6		6
Detector Phase	7	4	3	8	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	16.0	4.0	16.0	16.0	16.0	16.0	4.0	16.0	16.0
Minimum Split (s)	8.0	21.5	8.0	21.5	21.5	21.5	21.5	8.0	21.5	21.5
Total Split (s)	15.0	34.0	9.0	28.0	28.0	29.0	29.0	8.0	37.0	37.0
Total Split (%)	18.8%	42.5%	11.3%	35.0%	35.0%	36.3%	36.3%	10.0%	46.3%	46.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	2.0	0.5	2.0	2.0	2.0	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.5	4.0	5.5	5.5	5.5	5.5	4.0	5.5	5.5
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effect Green (s)	35.1	26.5	25.9	19.4	19.4	25.3	25.3	33.1	31.6	31.6
Actuated g/C Ratio	0.46	0.35	0.34	0.25	0.25	0.33	0.33	0.43	0.41	0.41
v/c Ratio	0.61	0.69	0.45	0.73	0.16	0.19	0.47	0.20	0.21	0.25
Control Delay	20.3	25.1	20.0	31.2	6.9	22.5	20.5	15.4	16.4	3.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.3	25.1	20.0	31.2	6.9	22.5	20.5	15.4	16.4	3.5
LOS	C	C	B	C	A	C	C	B	B	A
Approach Delay		24.1		27.8			20.9		10.3	
Approach LOS		C		C			C		B	

Intersection Summary

Cycle Length: 80

Actuated Cycle Length: 76.2

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.73

Intersection Signal Delay: 22.6

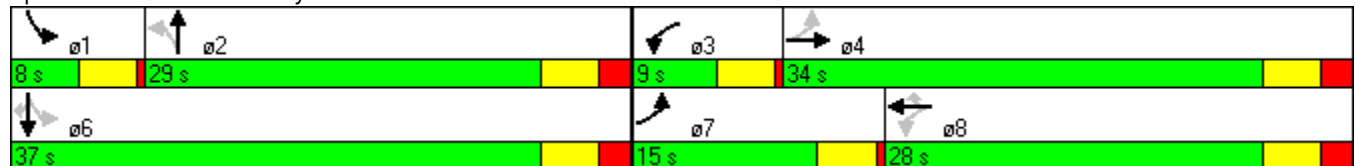
Intersection LOS: C

Intersection Capacity Utilization 68.5%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 5: Lundy's Lane & Davis Road



HCM Signalized Intersection Capacity Analysis <2021 Background> Weekday PM Peak Hour

5: Lundy's Lane & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	179	642	36	78	537	60	58	116	103	66	122	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Flt	1.00	0.99		1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	3424		1480	3539	1553	1626	1605		1719	1681	1599
Flt Permitted	0.20	1.00		0.26	1.00	1.00	0.66	1.00		0.44	1.00	1.00
Satd. Flow (perm)	372	3424		411	3539	1553	1134	1605		795	1681	1599
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	218	783	44	95	655	73	71	141	126	80	149	195
RTOR Reduction (vph)	0	5	0	0	0	54	0	38	0	0	0	114
Lane Group Flow (vph)	218	822	0	95	655	19	71	229	0	80	149	81
Heavy Vehicles (%)	3%	4%	15%	22%	2%	4%	11%	10%	10%	5%	13%	1%
Turn Type	pm+pt			pm+pt		Perm	Perm			pm+pt		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4			8		8	2			6		6
Actuated Green, G (s)	34.5	26.6		24.2	20.3	20.3	25.3	25.3		32.4	32.4	32.4
Effective Green, g (s)	34.5	26.6		24.2	20.3	20.3	25.3	25.3		32.4	32.4	32.4
Actuated g/C Ratio	0.44	0.34		0.31	0.26	0.26	0.32	0.32		0.42	0.42	0.42
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	345	1169		181	922	405	368	521		367	699	665
v/s Ratio Prot	c0.08	c0.24		0.03	0.19			c0.14		0.01	c0.09	
v/s Ratio Perm	0.20			0.14		0.01	0.06			0.08		0.05
v/c Ratio	0.63	0.70		0.52	0.71	0.05	0.19	0.44		0.22	0.21	0.12
Uniform Delay, d1	15.1	22.2		19.9	26.1	21.6	18.9	20.7		14.3	14.6	14.0
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.7	1.9		2.7	2.6	0.0	1.2	2.7		0.3	0.7	0.4
Delay (s)	18.9	24.2		22.7	28.7	21.6	20.1	23.4		14.6	15.3	14.4
Level of Service	B	C		C	C	C	C	C		B	B	B
Approach Delay (s)		23.1			27.4			22.7			14.7	
Approach LOS		C			C			C			B	
Intersection Summary												
HCM Average Control Delay			23.0			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.55									
Actuated Cycle Length (s)			77.9			Sum of lost time (s)			15.0			
Intersection Capacity Utilization			68.5%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

Timings

<2021 Background> Weekday PM Peak Hour

6: Lundy's Lane & Thorold Townline Road

2018-11-23

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	27	685	142	45	716	175	200	90	120	117	41
Turn Type	Perm		Perm	Perm		Perm	pm+pt		pm+pt		Perm
Protected Phases		4			8		5	2	1	6	
Permitted Phases	4		4	8		8	2		6		6
Detector Phase	4	4	4	8	8	8	5	2	1	6	6
Switch Phase											
Minimum Initial (s)	16.0	16.0	16.0	16.0	16.0	16.0	4.0	16.0	4.0	16.0	16.0
Minimum Split (s)	21.5	21.5	21.5	21.5	21.5	21.5	8.0	21.5	8.0	21.5	21.5
Total Split (s)	49.0	49.0	49.0	49.0	49.0	49.0	8.0	23.0	8.0	23.0	23.0
Total Split (%)	61.3%	61.3%	61.3%	61.3%	61.3%	61.3%	10.0%	28.8%	10.0%	28.8%	28.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.5	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5	4.0	5.5	5.5
Lead/Lag							Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	None	Max	Max
Act Effect Green (s)	35.2	35.2	35.2	35.2	35.2	35.2	24.3	19.7	23.3	17.7	17.7
Actuated g/C Ratio	0.49	0.49	0.49	0.49	0.49	0.49	0.34	0.27	0.32	0.25	0.25
v/c Ratio	0.33	0.85	0.18	0.44	0.89	0.22	0.52	0.30	0.34	0.29	0.11
Control Delay	21.7	25.7	2.2	24.8	29.2	2.2	25.4	22.2	21.6	26.8	9.0
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	21.7	25.7	2.2	24.8	29.2	2.2	25.4	22.2	21.6	26.8	9.0
LOS	C	C	A	C	C	A	C	C	C	C	A
Approach Delay		21.6			23.9			24.1		21.9	
Approach LOS		C			C			C		C	

Intersection Summary

Cycle Length: 80

Actuated Cycle Length: 72.2

Natural Cycle: 70

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.89

Intersection Signal Delay: 22.9

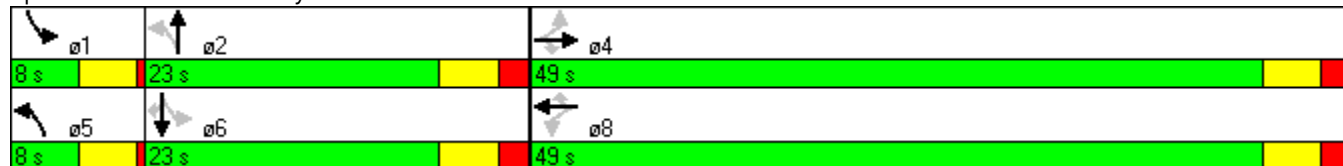
Intersection LOS: C

Intersection Capacity Utilization 74.6%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 6: Lundy's Lane & Thorold Townline Road



HCM Signalized Intersection Capacity Analysis <2021 Background> Weekday PM Peak Hour

6: Lundy's Lane & Thorold Townline Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	27	685	142	45	716	175	200	90	45	120	117	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1612	1881	1615	1805	1881	1615	1787	1781		1671	1863	1615
Flt Permitted	0.11	1.00	1.00	0.13	1.00	1.00	0.64	1.00		0.66	1.00	1.00
Satd. Flow (perm)	192	1881	1615	240	1881	1615	1200	1781		1161	1863	1615
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	31	778	161	51	814	199	227	102	51	136	133	47
RTOR Reduction (vph)	0	0	83	0	0	103	0	21	0	0	0	35
Lane Group Flow (vph)	31	778	78	51	814	96	227	132	0	136	133	12
Heavy Vehicles (%)	12%	1%	0%	0%	1%	0%	1%	2%	0%	8%	2%	0%
Turn Type	Perm		Perm	Perm		Perm	pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	35.3	35.3	35.3	35.3	35.3	35.3	23.8	19.7		21.8	18.7	18.7
Effective Green, g (s)	35.3	35.3	35.3	35.3	35.3	35.3	23.8	19.7		21.8	18.7	18.7
Actuated g/C Ratio	0.48	0.48	0.48	0.48	0.48	0.48	0.33	0.27		0.30	0.26	0.26
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
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)	93	908	780	116	908	780	424	480		368	477	413
v/s Ratio Prot		0.41			c0.43		c0.03	0.07		0.02	0.07	
v/s Ratio Perm	0.16		0.05	0.21		0.06	c0.14			0.09		0.01
v/c Ratio	0.33	0.86	0.10	0.44	0.90	0.12	0.54	0.27		0.37	0.28	0.03
Uniform Delay, d1	11.6	16.7	10.3	12.4	17.2	10.4	19.6	21.1		19.7	21.8	20.4
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	2.1	8.0	0.1	2.7	11.4	0.1	1.3	1.4		0.6	1.5	0.1
Delay (s)	13.8	24.7	10.3	15.1	28.6	10.5	20.9	22.5		20.3	23.2	20.5
Level of Service	B	C	B	B	C	B	C	C		C	C	C
Approach Delay (s)		22.0			24.6			21.6			21.6	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM Average Control Delay			22.9			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.70									
Actuated Cycle Length (s)			73.1			Sum of lost time (s)				9.5		
Intersection Capacity Utilization			74.6%			ICU Level of Service				D		
Analysis Period (min)			15									
c Critical Lane Group												

Timings
7: Lundy's Lane & Site Access 1

<2021 Background> Weekday PM Peak Hour

2018-11-23



Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Volume (vph)	81	730	930	325	268
Turn Type	Perm			Perm	
Protected Phases		4	8		6
Permitted Phases	4			8	
Detector Phase	4	4	8	8	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	34.0	34.0	34.0	34.0	21.0
Total Split (%)	61.8%	61.8%	61.8%	61.8%	38.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	Max
Act Effect Green (s)	20.1	20.1	20.1	20.1	17.3
Actuated g/C Ratio	0.44	0.44	0.44	0.44	0.38
v/c Ratio	0.54	0.51	0.65	0.39	0.52
Control Delay	22.3	10.0	11.7	2.4	15.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	22.3	10.0	11.7	2.4	15.5
LOS	C	A	B	A	B
Approach Delay		11.2	9.3		15.5
Approach LOS		B	A		B

Intersection Summary

Cycle Length: 55

Actuated Cycle Length: 45.5

Natural Cycle: 50

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.65

Intersection Signal Delay: 10.8

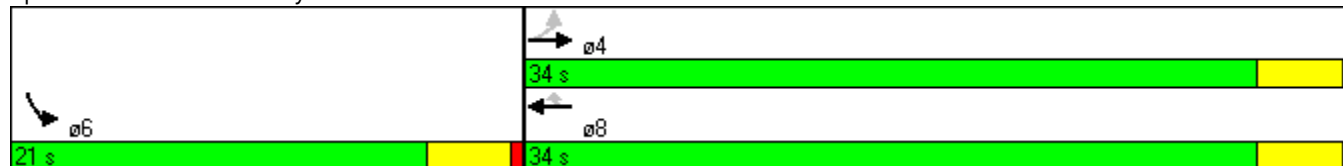
Intersection LOS: B

Intersection Capacity Utilization 58.3%

ICU Level of Service B

Analysis Period (min) 15

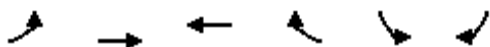
Splits and Phases: 7: Lundy's Lane & Site Access 1



HCM Signalized Intersection Capacity Analysis <2021 Background> Weekday PM Peak Hour

7: Lundy's Lane & Site Access 1

2018-11-23

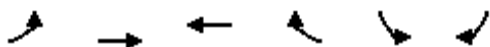


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	81	730	930	325	268	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.98	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1770	3539	3539	1583	1748	
Flt Permitted	0.20	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	371	3539	3539	1583	1748	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	88	793	1011	353	291	59
RTOR Reduction (vph)	0	0	0	197	12	0
Lane Group Flow (vph)	88	793	1011	156	338	0
Turn Type	Perm		Perm			
Protected Phases	4		8	6		
Permitted Phases	4		8			
Actuated Green, G (s)	20.1	20.1	20.1	20.1	17.3	
Effective Green, g (s)	20.1	20.1	20.1	20.1	17.3	
Actuated g/C Ratio	0.44	0.44	0.44	0.44	0.38	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	164	1567	1567	701	666	
v/s Ratio Prot		0.22	c0.29		c0.19	
v/s Ratio Perm	0.24			0.10		
v/c Ratio	0.54	0.51	0.65	0.22	0.51	
Uniform Delay, d1	9.2	9.1	9.9	7.8	10.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	3.4	0.3	0.9	0.2	2.8	
Delay (s)	12.6	9.3	10.8	8.0	13.5	
Level of Service	B	A	B	A	B	
Approach Delay (s)		9.7	10.1		13.5	
Approach LOS		A	B		B	
Intersection Summary						
HCM Average Control Delay			10.4	HCM Level of Service		B
HCM Volume to Capacity ratio			0.58			
Actuated Cycle Length (s)			45.4	Sum of lost time (s)		8.0
Intersection Capacity Utilization			58.3%	ICU Level of Service		B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis<2021 Background> Weekday PM Peak Hour

8: Lundy's Lane & Site Access 2

2018-11-23



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	81	998	876	81	0	54
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	88	1085	952	88	0	59
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (m)		204				
pX, platoon unblocked						
vC, conflicting volume	1040				2257	996
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1040				2257	996
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	87				100	80
cM capacity (veh/h)	668				39	297
Direction, Lane #	EB 1	EB 2	WB 1	SB 1		
Volume Total	88	1085	1040	59		
Volume Left	88	0	0	0		
Volume Right	0	0	88	59		
cSH	668	1700	1700	297		
Volume to Capacity	0.13	0.64	0.61	0.20		
Queue Length 95th (m)	3.6	0.0	0.0	5.8		
Control Delay (s)	11.2	0.0	0.0	20.1		
Lane LOS	B			C		
Approach Delay (s)	0.8		0.0	20.1		
Approach LOS				C		
Intersection Summary						
Average Delay			1.0			
Intersection Capacity Utilization			68.8%		ICU Level of Service	C
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis<2021 Background> Weekday PM Peak Hour

9: Site Access 3 & Thorold Townline Road

2018-11-23



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	54	107	163	129	225	81
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	59	116	177	140	245	88
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	783	289	333			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	783	289	333			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	81	85	86			
cM capacity (veh/h)	310	751	1227			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	175	177	140	333		
Volume Left	59	177	0	0		
Volume Right	116	0	0	88		
cSH	508	1227	1700	1700		
Volume to Capacity	0.34	0.14	0.08	0.20		
Queue Length 95th (m)	12.2	4.0	0.0	0.0		
Control Delay (s)	15.8	8.4	0.0	0.0		
Lane LOS	C	A				
Approach Delay (s)	15.8	4.7		0.0		
Approach LOS	C					
Intersection Summary						
Average Delay			5.2			
Intersection Capacity Utilization		45.4%		ICU Level of Service		A
Analysis Period (min)		15				

Timings

<2026 Background> Weekday AM Peak Hour

1: Niagara Falls Road & Davis Road

2018-11-23



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	132	37	25	32	6	865	93	460	47
Turn Type	Perm		Perm		Perm		Perm		Perm
Protected Phases		4		8		2		6	
Permitted Phases	4		8		2		6		6
Detector Phase	4	4	8	8	2	2	6	6	6
Switch Phase									
Minimum Initial (s)	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	35.0	35.0	35.0	35.0	35.0
Total Split (%)	36.4%	36.4%	36.4%	36.4%	63.6%	63.6%	63.6%	63.6%	63.6%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)	14.5	14.5		14.5	30.6	30.6	30.6	30.6	30.6
Actuated g/C Ratio	0.26	0.26		0.26	0.55	0.55	0.55	0.55	0.55
v/c Ratio	0.64	0.09		0.63	0.01	0.50	0.38	0.26	0.06
Control Delay	34.9	14.5		17.9	6.2	9.0	12.9	7.2	2.4
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.9	14.5		17.9	6.2	9.0	12.9	7.2	2.4
LOS	C	B		B	A	A	B	A	A
Approach Delay		30.0		17.9		9.0		7.8	
Approach LOS		C		B		A		A	

Intersection Summary

Cycle Length: 55

Actuated Cycle Length: 56.1

Natural Cycle: 55

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.64

Intersection Signal Delay: 11.8

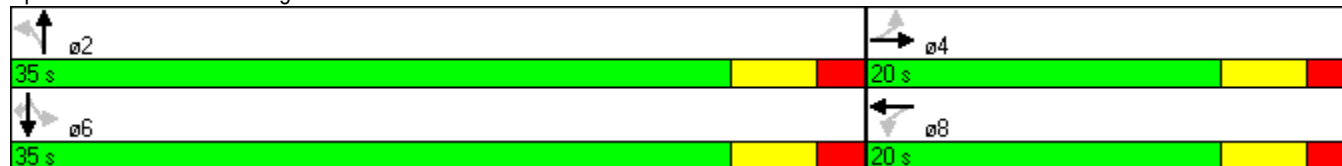
Intersection LOS: B

Intersection Capacity Utilization 85.7%

ICU Level of Service E

Analysis Period (min) 15

Splits and Phases: 1: Niagara Falls Road & Davis Road



HCM Signalized Intersection Capacity Analysis <2026 Background> Weekday AM Peak Hour

1: Niagara Falls Road & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	132	37	6	25	32	243	6	865	40	93	460	47
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5			5.5		5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.98			0.89		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	1815			1672		1641	3539		1787	3505	1553
Flt Permitted	0.46	1.00			0.97		0.47	1.00		0.25	1.00	1.00
Satd. Flow (perm)	842	1815			1632		818	3539		477	3505	1553
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	140	39	6	27	34	259	6	920	43	99	489	50
RTOR Reduction (vph)	0	4	0	0	84	0	0	6	0	0	0	23
Lane Group Flow (vph)	140	41	0	0	236	0	6	957	0	99	489	27
Heavy Vehicles (%)	3%	3%	0%	7%	2%	0%	10%	1%	8%	1%	3%	4%
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	14.5	14.5			14.5		30.5	30.5		30.5	30.5	30.5
Effective Green, g (s)	14.5	14.5			14.5		30.5	30.5		30.5	30.5	30.5
Actuated g/C Ratio	0.26	0.26			0.26		0.54	0.54		0.54	0.54	0.54
Clearance Time (s)	5.5	5.5			5.5		5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	218	470			423		446	1927		260	1909	846
v/s Ratio Prot		0.02						c0.27			0.14	
v/s Ratio Perm	c0.17				0.14		0.01			0.21		0.02
v/c Ratio	0.64	0.09			0.56		0.01	0.50		0.38	0.26	0.03
Uniform Delay, d1	18.4	15.7			18.0		5.8	8.0		7.3	6.7	5.9
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.3	0.1			1.6		0.1	0.9		4.2	0.3	0.1
Delay (s)	24.8	15.8			19.6		5.9	8.9		11.5	7.1	6.0
Level of Service	C	B			B		A	A		B	A	A
Approach Delay (s)		22.6			19.6			8.9			7.7	
Approach LOS		C			B			A			A	
Intersection Summary												
HCM Average Control Delay	11.3			HCM Level of Service			B					
HCM Volume to Capacity ratio	0.54											
Actuated Cycle Length (s)	56.0			Sum of lost time (s)			11.0					
Intersection Capacity Utilization	85.7%			ICU Level of Service			E					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis<2026 Background> Weekday AM Peak Hour

2: Beaverdams Road & Thorold Townline Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	33	109	16	34	259	25	33	153	57	21	105	32
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	35	116	17	36	276	27	35	163	61	22	112	34
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	168	338	259	168								
Volume Left (vph)	35	36	35	22								
Volume Right (vph)	17	27	61	34								
Hadj (s)	0.01	0.01	0.00	-0.02								
Departure Headway (s)	5.8	5.5	5.7	5.8								
Degree Utilization, x	0.27	0.51	0.41	0.27								
Capacity (veh/h)	558	618	581	550								
Control Delay (s)	10.9	14.1	12.5	11.0								
Approach Delay (s)	10.9	14.1	12.5	11.0								
Approach LOS	B	B	B	B								
Intersection Summary												
Delay			12.5									
HCM Level of Service			B									
Intersection Capacity Utilization			44.1%	ICU Level of Service					A			
Analysis Period (min)			15									

Timings 3: Barker Parkway & Davis Road

<2026 Background> Weekday AM Peak Hour

2018-11-23

					
Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Configurations					
Volume (vph)	4	490	116	237	73
Turn Type	Perm		Perm		
Protected Phases	8		2		6
Permitted Phases		8		6	
Detector Phase	8	8	2	6	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	22.0	22.0	23.0	23.0	23.0
Total Split (%)	48.9%	48.9%	51.1%	51.1%	51.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	Max	Max	Max
Act Effect Green (s)	8.1	8.1	19.3	19.3	19.3
Actuated g/C Ratio	0.23	0.23	0.54	0.54	0.54
v/c Ratio	0.01	0.70	0.08	0.38	0.04
Control Delay	9.2	6.9	4.6	8.1	5.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	9.2	6.9	4.6	8.1	5.3
LOS	A	A	A	A	A
Approach Delay	6.9		4.6		7.4
Approach LOS	A		A		A

Intersection Summary

Cycle Length: 45

Actuated Cycle Length: 35.5

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.70

Intersection Signal Delay: 6.7

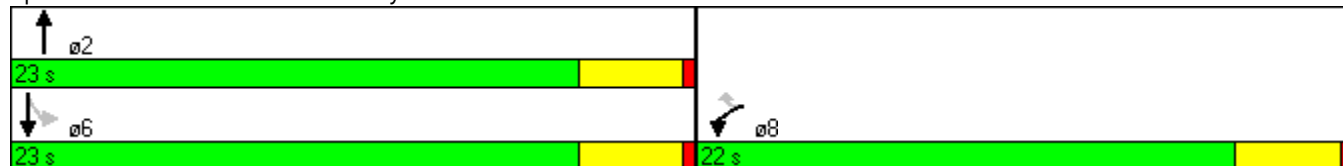
Intersection LOS: A

Intersection Capacity Utilization 41.0%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 3: Barker Parkway & Davis Road



HCM Signalized Intersection Capacity Analysis <2026 Background> Weekday AM Peak Hour

3: Barker Parkway & Davis Road

2018-11-23



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	4	490	116	25	237	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.97		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1538	3402		1805	3406
Flt Permitted	0.95	1.00	1.00		0.66	1.00
Satd. Flow (perm)	1805	1538	3402		1246	3406
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	4	527	125	27	255	78
RTOR Reduction (vph)	0	406	12	0	0	0
Lane Group Flow (vph)	4	121	140	0	255	78
Heavy Vehicles (%)	0%	5%	4%	0%	0%	6%
Turn Type	Perm		Perm			
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	8.1	8.1	19.3		19.3	19.3
Effective Green, g (s)	8.1	8.1	19.3		19.3	19.3
Actuated g/C Ratio	0.23	0.23	0.55		0.55	0.55
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	413	352	1855		679	1857
v/s Ratio Prot	0.00		0.04			0.02
v/s Ratio Perm		c0.08			c0.20	
v/c Ratio	0.01	0.34	0.08		0.38	0.04
Uniform Delay, d1	10.6	11.4	3.8		4.6	3.7
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.0	0.6	0.1		1.6	0.0
Delay (s)	10.6	12.0	3.9		6.2	3.8
Level of Service	B	B	A		A	A
Approach Delay (s)	12.0		3.9			5.6
Approach LOS	B		A			A
Intersection Summary						
HCM Average Control Delay			8.7	HCM Level of Service		A
HCM Volume to Capacity ratio			0.37			
Actuated Cycle Length (s)			35.4	Sum of lost time (s)		8.0
Intersection Capacity Utilization			41.0%	ICU Level of Service		A
Analysis Period (min)			15			

c Critical Lane Group

Timings
4: Allanburg Road & Davis Road

<2026 Background> Weekday AM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	62	0	50	56	0	49	262	57	131	25
Turn Type	Perm		Perm	Perm		Perm		Perm		Perm
Protected Phases		4			8		2		6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	4	4	4	8	8	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)		7.5	7.5		7.5	20.6	20.6	20.6	20.6	20.6
Actuated g/C Ratio		0.22	0.22		0.22	0.61	0.61	0.61	0.61	0.61
v/c Ratio		0.24	0.14		0.44	0.07	0.30	0.10	0.14	0.03
Control Delay		11.9	4.4		7.7	5.0	5.6	5.2	5.1	2.6
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		11.9	4.4		7.7	5.0	5.6	5.2	5.1	2.6
LOS		B	A		A	A	A	A	A	A
Approach Delay		8.5			7.7		5.5		4.8	
Approach LOS		A			A		A		A	

Intersection Summary

Cycle Length: 40

Actuated Cycle Length: 33.6

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.44

Intersection Signal Delay: 6.2

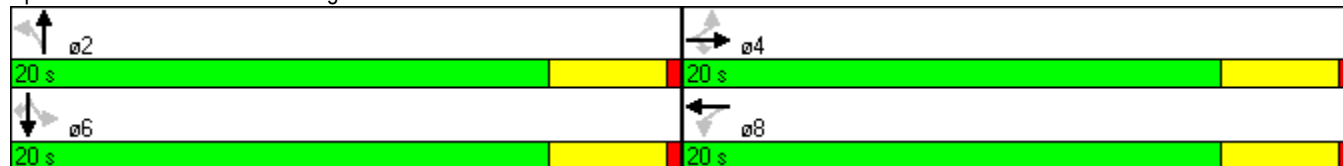
Intersection LOS: A

Intersection Capacity Utilization 45.5%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 4: Allanburg Road & Davis Road



HCM Signalized Intersection Capacity Analysis <2026 Background> Weekday AM Peak Hour

4: Allanburg Road & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	62	0	50	56	0	112	49	262	29	57	131	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.91		1.00	0.99		1.00	1.00	0.85
Flt Protected		0.95	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1671	1615		1701		1805	1791		1805	1792	1524
Flt Permitted		0.73	1.00		0.86		0.66	1.00		0.56	1.00	1.00
Satd. Flow (perm)		1286	1615		1489		1258	1791		1066	1792	1524
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	70	0	57	64	0	127	56	298	33	65	149	28
RTOR Reduction (vph)	0	0	46	0	103	0	0	7	0	0	0	12
Lane Group Flow (vph)	0	70	11	0	88	0	56	324	0	65	149	16
Heavy Vehicles (%)	8%	0%	0%	0%	0%	0%	0%	5%	0%	0%	6%	6%
Turn Type	Perm		Perm	Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		6.5	6.5		6.5		19.9	19.9		19.9	19.9	19.9
Effective Green, g (s)		6.5	6.5		6.5		19.9	19.9		19.9	19.9	19.9
Actuated g/C Ratio		0.19	0.19		0.19		0.58	0.58		0.58	0.58	0.58
Clearance Time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		243	305		281		728	1036		617	1037	882
v/s Ratio Prot							c0.18				0.08	
v/s Ratio Perm		0.05	0.01		c0.06		0.04			0.06		0.01
v/c Ratio		0.29	0.04		0.31		0.08	0.31		0.11	0.14	0.02
Uniform Delay, d1		12.0	11.4		12.0		3.2	3.7		3.3	3.3	3.1
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.7	0.0		0.6		0.2	0.8		0.3	0.3	0.0
Delay (s)		12.6	11.4		12.7		3.4	4.5		3.6	3.6	3.1
Level of Service		B	B		B		A	A		A	A	A
Approach Delay (s)		12.1			12.7			4.4			3.6	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay		6.9										
HCM Volume to Capacity ratio		0.31										
Actuated Cycle Length (s)		34.4										
Intersection Capacity Utilization		45.5%										
Analysis Period (min)		15										
c Critical Lane Group												

Timings
5: Lundy's Lane & Davis Road

<2026 Background> Weekday AM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	161	437	86	430	69	32	156	46	93	145
Turn Type	pm+pt		pm+pt		Perm	Perm		pm+pt		Perm
Protected Phases	7	4	3	8			2	1	6	
Permitted Phases	4		8		8	2		6		6
Detector Phase	7	4	3	8	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	16.0	4.0	16.0	16.0	16.0	16.0	4.0	16.0	16.0
Minimum Split (s)	8.0	21.5	8.0	21.5	21.5	21.5	21.5	8.0	21.5	21.5
Total Split (s)	9.0	22.5	8.0	21.5	21.5	21.5	21.5	8.0	29.5	29.5
Total Split (%)	15.0%	37.5%	13.3%	35.8%	35.8%	35.8%	35.8%	13.3%	49.2%	49.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	2.0	0.5	2.0	2.0	2.0	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.5	4.0	5.5	5.5	5.5	5.5	4.0	5.5	5.5
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effect Green (s)	24.1	18.6	21.5	16.0	16.0	19.2	19.2	25.5	24.0	24.0
Actuated g/C Ratio	0.40	0.31	0.36	0.27	0.27	0.32	0.32	0.42	0.40	0.40
v/c Ratio	0.56	0.53	0.38	0.56	0.18	0.10	0.46	0.14	0.17	0.24
Control Delay	18.3	19.7	15.0	21.6	5.9	17.4	19.1	11.2	12.5	3.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.3	19.7	15.0	21.6	5.9	17.4	19.1	11.2	12.5	3.2
LOS	B	B	B	C	A	B	B	B	B	A
Approach Delay		19.3		18.8			18.9		7.5	
Approach LOS		B		B			B		A	

Intersection Summary

Cycle Length: 60

Actuated Cycle Length: 60

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.56

Intersection Signal Delay: 17.1

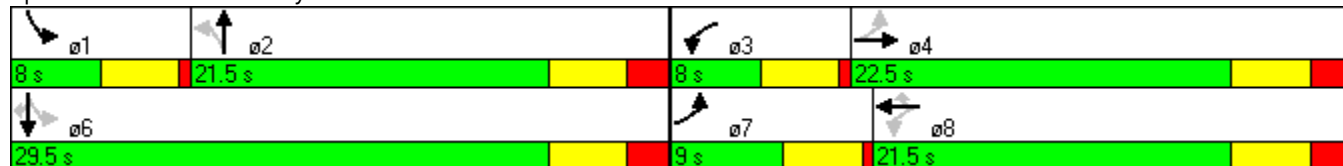
Intersection LOS: B

Intersection Capacity Utilization 66.0%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 5: Lundy's Lane & Davis Road



HCM Signalized Intersection Capacity Analysis <2026 Background> Weekday AM Peak Hour

5: Lundy's Lane & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	161	437	30	86	430	69	32	156	51	46	93	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	3414		1480	3539	1553	1626	1664		1719	1681	1599
Flt Permitted	0.35	1.00		0.40	1.00	1.00	0.68	1.00		0.46	1.00	1.00
Satd. Flow (perm)	638	3414		622	3539	1553	1171	1664		831	1681	1599
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	196	533	37	105	524	84	39	190	62	56	113	177
RTOR Reduction (vph)	0	8	0	0	0	61	0	19	0	0	0	104
Lane Group Flow (vph)	196	562	0	105	524	23	39	233	0	56	113	73
Heavy Vehicles (%)	3%	4%	15%	22%	2%	4%	11%	10%	10%	5%	13%	1%
Turn Type	pm+pt			pm+pt		Perm	Perm			pm+pt		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4			8		8	2			6		6
Actuated Green, G (s)	23.6	18.6		20.0	16.8	16.8	19.2	19.2		25.6	25.6	25.6
Effective Green, g (s)	23.6	18.6		20.0	16.8	16.8	19.2	19.2		25.6	25.6	25.6
Actuated g/C Ratio	0.38	0.30		0.32	0.27	0.27	0.31	0.31		0.41	0.41	0.41
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	331	1018		243	953	418	360	512		375	690	656
v/s Ratio Prot	c0.05	0.16		0.02	0.15			c0.14		0.01	c0.07	
v/s Ratio Perm	c0.18			0.12		0.01	0.03			0.06		0.05
v/c Ratio	0.59	0.55		0.43	0.55	0.05	0.11	0.46		0.15	0.16	0.11
Uniform Delay, d1	13.8	18.4		15.5	19.6	16.9	15.5	17.4		11.5	11.6	11.4
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.8	0.7		1.2	0.7	0.1	0.6	2.9		0.2	0.5	0.3
Delay (s)	16.6	19.0		16.8	20.2	17.0	16.1	20.3		11.7	12.1	11.7
Level of Service	B	B		B	C	B	B	C		B	B	B
Approach Delay (s)		18.4			19.3			19.7			11.8	
Approach LOS		B			B			B			B	
Intersection Summary												
HCM Average Control Delay			17.8			HCM Level of Service				B		
HCM Volume to Capacity ratio			0.54									
Actuated Cycle Length (s)			62.4			Sum of lost time (s)				19.0		
Intersection Capacity Utilization			66.0%			ICU Level of Service				C		
Analysis Period (min)			15									
c Critical Lane Group												

Timings

<2026 Background> Weekday AM Peak Hour

6: Lundy's Lane & Thorold Townline Road

2018-11-23

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	55	598	165	41	478	80	88	132	121	71	28
Turn Type	Perm		Perm	Perm		Perm	pm+pt		pm+pt		Perm
Protected Phases		4			8		5	2	1	6	
Permitted Phases	4		4	8		8	2		6		6
Detector Phase	4	4	4	8	8	8	5	2	1	6	6
Switch Phase											
Minimum Initial (s)	16.0	16.0	16.0	16.0	16.0	16.0	4.0	16.0	4.0	16.0	16.0
Minimum Split (s)	21.5	21.5	21.5	21.5	21.5	21.5	8.0	21.5	8.0	21.5	21.5
Total Split (s)	35.0	35.0	35.0	35.0	35.0	35.0	8.0	22.0	8.0	22.0	22.0
Total Split (%)	53.8%	53.8%	53.8%	53.8%	53.8%	53.8%	12.3%	33.8%	12.3%	33.8%	33.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.5	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5	4.0	5.5	5.5
Lead/Lag							Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	None	Max	Max
Act Effect Green (s)	25.4	25.4	25.4	25.4	25.4	25.4	21.4	16.9	21.4	16.9	16.9
Actuated g/C Ratio	0.43	0.43	0.43	0.43	0.43	0.43	0.36	0.28	0.36	0.28	0.28
v/c Ratio	0.30	0.85	0.24	0.37	0.68	0.12	0.20	0.36	0.31	0.15	0.07
Control Delay	16.0	27.5	2.8	21.8	18.9	3.2	13.6	19.9	15.5	19.6	8.1
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	16.0	27.5	2.8	21.8	18.9	3.2	13.6	19.9	15.5	19.6	8.1
LOS	B	C	A	C	B	A	B	B	B	B	A
Approach Delay		21.8			17.0			17.7		15.9	
Approach LOS		C			B			B		B	

Intersection Summary

Cycle Length: 65

Actuated Cycle Length: 59.5

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.85

Intersection Signal Delay: 19.0

Intersection LOS: B

Intersection Capacity Utilization 78.2%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 6: Lundy's Lane & Thorold Townline Road

 ø1	 ø2	 ø4
8 s	22 s	35 s
 ø5	 ø6	 ø8
8 s	22 s	35 s

HCM Signalized Intersection Capacity Analysis <2026 Background> Weekday AM Peak Hour

6: Lundy's Lane & Thorold Townline Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	598	165	41	478	80	88	132	36	121	71	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Flt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1612	1881	1615	1805	1881	1615	1787	1810		1671	1863	1615
Flt Permitted	0.29	1.00	1.00	0.16	1.00	1.00	0.70	1.00		0.64	1.00	1.00
Satd. Flow (perm)	488	1881	1615	299	1881	1615	1325	1810		1121	1863	1615
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	62	680	188	47	543	91	100	150	41	138	81	32
RTOR Reduction (vph)	0	0	109	0	0	53	0	14	0	0	0	23
Lane Group Flow (vph)	62	680	79	47	543	38	100	177	0	138	81	9
Heavy Vehicles (%)	12%	1%	0%	0%	1%	0%	1%	2%	0%	8%	2%	0%
Turn Type	Perm		Perm	Perm		Perm	pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	25.4	25.4	25.4	25.4	25.4	25.4	19.9	16.9		19.9	16.9	16.9
Effective Green, g (s)	25.4	25.4	25.4	25.4	25.4	25.4	19.9	16.9		19.9	16.9	16.9
Actuated g/C Ratio	0.42	0.42	0.42	0.42	0.42	0.42	0.33	0.28		0.33	0.28	0.28
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
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)	206	792	680	126	792	680	460	507		397	522	453
v/s Ratio Prot		c0.36			0.29		0.01	c0.10		c0.02	0.04	
v/s Ratio Perm	0.13		0.05	0.16		0.02	0.06			0.10		0.01
v/c Ratio	0.30	0.86	0.12	0.37	0.69	0.06	0.22	0.35		0.35	0.16	0.02
Uniform Delay, d1	11.6	15.8	10.6	12.0	14.2	10.3	14.3	17.3		14.8	16.3	15.7
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	0.8	9.2	0.1	1.9	2.5	0.0	0.2	1.9		0.5	0.6	0.1
Delay (s)	12.4	25.0	10.7	13.8	16.7	10.4	14.6	19.2		15.3	17.0	15.8
Level of Service	B	C	B	B	B	B	B	B		B	B	B
Approach Delay (s)		21.3			15.6			17.6			15.9	
Approach LOS		C			B			B			B	
Intersection Summary												
HCM Average Control Delay			18.4			HCM Level of Service				B		
HCM Volume to Capacity ratio			0.63									
Actuated Cycle Length (s)			60.3			Sum of lost time (s)				15.0		
Intersection Capacity Utilization			78.2%			ICU Level of Service				D		
Analysis Period (min)			15									
c Critical Lane Group												

Timings
7: Lundy's Lane & Site Access 1

<2026 Background> Weekday AM Peak Hour

2018-11-23



Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Volume (vph)	29	505	621	115	281
Turn Type	Perm			Perm	
Protected Phases		4	8		6
Permitted Phases	4			8	
Detector Phase	4	4	8	8	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	Max
Act Effect Green (s)	12.4	12.4	12.4	12.4	16.1
Actuated g/C Ratio	0.34	0.34	0.34	0.34	0.44
v/c Ratio	0.15	0.46	0.56	0.20	0.46
Control Delay	9.9	10.6	11.7	3.1	9.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	9.9	10.6	11.7	3.1	9.8
LOS	A	B	B	A	A
Approach Delay		10.6	10.4		9.8
Approach LOS		B	B		A

Intersection Summary

Cycle Length: 40

Actuated Cycle Length: 36.5

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.56

Intersection Signal Delay: 10.3

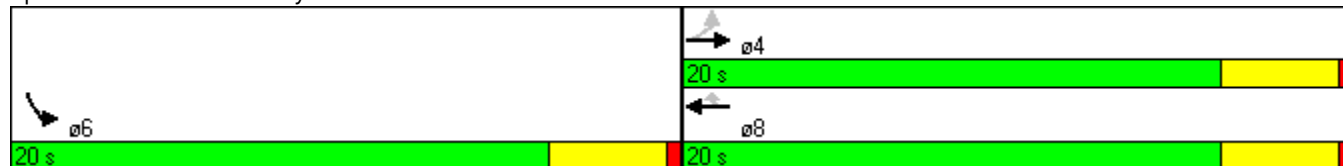
Intersection LOS: B

Intersection Capacity Utilization 49.5%

ICU Level of Service A

Analysis Period (min) 15

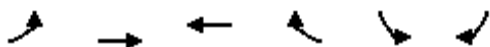
Splits and Phases: 7: Lundy's Lane & Site Access 1



HCM Signalized Intersection Capacity Analysis <2026 Background> Weekday AM Peak Hour

7: Lundy's Lane & Site Access 1

2018-11-23



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	29	505	621	115	281	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.98	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1770	3539	3539	1583	1748	
Flt Permitted	0.33	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	622	3539	3539	1583	1748	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	32	549	675	125	305	61
RTOR Reduction (vph)	0	0	0	83	17	0
Lane Group Flow (vph)	32	549	675	42	349	0
Turn Type	Perm		Perm			
Protected Phases	4		8		6	
Permitted Phases	4		8			
Actuated Green, G (s)	12.4	12.4	12.4	12.4	16.1	
Effective Green, g (s)	12.4	12.4	12.4	12.4	16.1	
Actuated g/C Ratio	0.34	0.34	0.34	0.34	0.44	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	211	1202	1202	538	771	
v/s Ratio Prot		0.16	c0.19		c0.20	
v/s Ratio Perm	0.05			0.03		
v/c Ratio	0.15	0.46	0.56	0.08	0.45	
Uniform Delay, d1	8.4	9.4	9.8	8.2	7.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.3	0.3	0.6	0.1	1.9	
Delay (s)	8.7	9.7	10.4	8.2	9.0	
Level of Service	A	A	B	A	A	
Approach Delay (s)		9.6	10.1		9.0	
Approach LOS		A	B		A	
Intersection Summary						
HCM Average Control Delay			9.7	HCM Level of Service		A
HCM Volume to Capacity ratio			0.50			
Actuated Cycle Length (s)			36.5	Sum of lost time (s)		8.0
Intersection Capacity Utilization			49.5%	ICU Level of Service		A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis<2026 Background> Weekday AM Peak Hour

8: Lundy's Lane & Site Access 2

2018-11-23



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	29	785	565	29	0	56
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	32	853	614	32	0	61
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (m)		204				
pX, platoon unblocked						
vC, conflicting volume	646				1546	630
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	646				1546	630
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				100	87
cM capacity (veh/h)	940				122	482
Direction, Lane #	EB 1	EB 2	WB 1	SB 1		
Volume Total	32	853	646	61		
Volume Left	32	0	0	0		
Volume Right	0	0	32	61		
cSH	940	1700	1700	482		
Volume to Capacity	0.03	0.50	0.38	0.13		
Queue Length 95th (m)	0.8	0.0	0.0	3.4		
Control Delay (s)	9.0	0.0	0.0	13.6		
Lane LOS	A			B		
Approach Delay (s)	0.3		0.0	13.6		
Approach LOS				B		
Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization			51.4%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis<2026 Background> Weekday AM Peak Hour

9: Site Access 3 & Thorold Townline Road

2018-11-23



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	56	112	57	210	126	29
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	61	122	62	228	137	32
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	505	153	168			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	505	153	168			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	88	86	96			
cM capacity (veh/h)	504	893	1409			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	183	62	228	168		
Volume Left	61	62	0	0		
Volume Right	122	0	0	32		
cSH	710	1409	1700	1700		
Volume to Capacity	0.26	0.04	0.13	0.10		
Queue Length 95th (m)	8.2	1.1	0.0	0.0		
Control Delay (s)	11.8	7.7	0.0	0.0		
Lane LOS	B	A				
Approach Delay (s)	11.8	1.6		0.0		
Approach LOS	B					
Intersection Summary						
Average Delay			4.1			
Intersection Capacity Utilization			31.7%		ICU Level of Service	A
Analysis Period (min)			15			

Timings
1: Niagara Falls Road & Davis Road

<2026 Background> Weekday PM Peak Hour

2018-11-23

									
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	103	34	52	63	12	753	193	1100	139
Turn Type	Perm		Perm		Perm		Perm		Perm
Protected Phases		4		8		2		6	
Permitted Phases	4		8		2		6		6
Detector Phase	4	4	8	8	2	2	6	6	6
Switch Phase									
Minimum Initial (s)	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	33.3%	33.3%	33.3%	33.3%	66.7%	66.7%	66.7%	66.7%	66.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)	14.5	14.5		14.5	35.4	35.4	35.4	35.4	35.4
Actuated g/C Ratio	0.24	0.24		0.24	0.58	0.58	0.58	0.58	0.58
v/c Ratio	0.60	0.10		0.69	0.07	0.40	0.60	0.57	0.15
Control Delay	36.9	16.3		20.7	6.8	7.6	17.7	9.5	1.7
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.9	16.3		20.7	6.8	7.6	17.7	9.5	1.7
LOS	D	B		C	A	A	B	A	A
Approach Delay		31.1		20.7		7.6		9.8	
Approach LOS		C		C		A		A	

Intersection Summary

Cycle Length: 60

Actuated Cycle Length: 60.9

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.69

Intersection Signal Delay: 11.6

Intersection LOS: B

Intersection Capacity Utilization 81.3%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 1: Niagara Falls Road & Davis Road

			
40 s	20 s	20 s	20 s
			
40 s	20 s	20 s	20 s

HCM Signalized Intersection Capacity Analysis <2026 Background> Weekday PM Peak Hour

1: Niagara Falls Road & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	103	34	7	52	63	198	12	753	29	193	1100	139
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5			5.5		5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.98			0.91		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	1808			1697		1641	3545		1787	3505	1553
Flt Permitted	0.42	1.00			0.94		0.19	1.00		0.31	1.00	1.00
Satd. Flow (perm)	771	1808			1602		326	3545		588	3505	1553
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	110	36	7	55	67	211	13	801	31	205	1170	148
RTOR Reduction (vph)	0	5	0	0	104	0	0	5	0	0	0	62
Lane Group Flow (vph)	110	38	0	0	229	0	13	827	0	205	1170	86
Heavy Vehicles (%)	3%	3%	0%	7%	2%	0%	10%	1%	8%	1%	3%	4%
Turn Type	Perm		Perm			Perm			Perm			Perm
Protected Phases	4		8			2			6			6
Permitted Phases	4		8			2			6			6
Actuated Green, G (s)	14.5	14.5			14.5		35.4	35.4		35.4	35.4	35.4
Effective Green, g (s)	14.5	14.5			14.5		35.4	35.4		35.4	35.4	35.4
Actuated g/C Ratio	0.24	0.24			0.24		0.58	0.58		0.58	0.58	0.58
Clearance Time (s)	5.5	5.5			5.5		5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	184	430			381		189	2061		342	2037	903
v/s Ratio Prot		0.02						0.23			0.33	
v/s Ratio Perm	0.14				0.14		0.04			0.35		0.06
v/c Ratio	0.60	0.09			0.60		0.07	0.40		0.60	0.57	0.10
Uniform Delay, d1	20.6	18.1			20.6		5.6	7.0		8.2	8.0	5.7
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.1	0.1			2.7		0.7	0.6		7.6	1.2	0.2
Delay (s)	25.8	18.1			23.3		6.3	7.5		15.8	9.2	5.9
Level of Service	C	B			C		A	A		B	A	A
Approach Delay (s)		23.6			23.3			7.5			9.8	
Approach LOS		C			C			A			A	
Intersection Summary												
HCM Average Control Delay	11.4			HCM Level of Service			B					
HCM Volume to Capacity ratio	0.60											
Actuated Cycle Length (s)	60.9			Sum of lost time (s)			11.0					
Intersection Capacity Utilization	81.3%			ICU Level of Service			D					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis<2026 Background> Weekday PM Peak Hour

2: Beaverdams Road & Thorold Townline Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	22	205	26	89	191	21	36	139	62	43	216	37
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	23	218	28	95	203	22	38	148	66	46	230	39
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	269	320	252	315								
Volume Left (vph)	23	95	38	46								
Volume Right (vph)	28	22	66	39								
Hadj (s)	-0.03	0.10	-0.02	0.03								
Departure Headway (s)	6.6	6.6	6.7	6.5								
Degree Utilization, x	0.49	0.58	0.47	0.57								
Capacity (veh/h)	488	499	481	499								
Control Delay (s)	15.8	18.4	15.3	17.9								
Approach Delay (s)	15.8	18.4	15.3	17.9								
Approach LOS	C	C	C	C								
Intersection Summary												
Delay			17.0									
HCM Level of Service			C									
Intersection Capacity Utilization			61.0%		ICU Level of Service				B			
Analysis Period (min)			15									

Timings
3: Barker Parkway & Davis Road

<2026 Background> Weekday PM Peak Hour

2018-11-23

	←	↖	↑	↗	↓
Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Configurations	↖	↖	↕	↖	↕
Volume (vph)	9	421	132	626	168
Turn Type		Perm		Perm	
Protected Phases	8		2		6
Permitted Phases		8		6	
Detector Phase	8	8	2	6	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	55.0	55.0	55.0
Total Split (%)	26.7%	26.7%	73.3%	73.3%	73.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	Max	Max	Max
Act Effect Green (s)	8.4	8.4	51.2	51.2	51.2
Actuated g/C Ratio	0.12	0.12	0.76	0.76	0.76
v/c Ratio	0.04	0.77	0.06	0.72	0.07
Control Delay	25.1	12.8	2.5	11.5	2.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	25.1	12.8	2.5	11.5	2.7
LOS	C	B	A	B	A
Approach Delay	13.1		2.5		9.6
Approach LOS	B		A		A

Intersection Summary

Cycle Length: 75

Actuated Cycle Length: 67.6

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.77

Intersection Signal Delay: 10.0

Intersection LOS: A

Intersection Capacity Utilization 52.0%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 3: Barker Parkway & Davis Road



HCM Signalized Intersection Capacity Analysis <2026 Background> Weekday PM Peak Hour

3: Barker Parkway & Davis Road

2018-11-23



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	9	421	132	12	626	168
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1538	3439		1805	3406
Flt Permitted	0.95	1.00	1.00		0.65	1.00
Satd. Flow (perm)	1805	1538	3439		1242	3406
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	10	453	142	13	673	181
RTOR Reduction (vph)	0	397	3	0	0	0
Lane Group Flow (vph)	10	56	152	0	673	181
Heavy Vehicles (%)	0%	5%	4%	0%	0%	6%
Turn Type	Perm				Perm	
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	8.4	8.4	51.2		51.2	51.2
Effective Green, g (s)	8.4	8.4	51.2		51.2	51.2
Actuated g/C Ratio	0.12	0.12	0.76		0.76	0.76
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	224	191	2605		941	2580
v/s Ratio Prot	0.01		0.04			0.05
v/s Ratio Perm		c0.04			c0.54	
v/c Ratio	0.04	0.29	0.06		0.72	0.07
Uniform Delay, d1	26.1	26.9	2.1		4.3	2.1
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.1	0.9	0.0		4.6	0.1
Delay (s)	26.1	27.8	2.1		9.0	2.2
Level of Service	C	C	A		A	A
Approach Delay (s)	27.7		2.1			7.5
Approach LOS	C		A			A
Intersection Summary						
HCM Average Control Delay			13.3		HCM Level of Service	B
HCM Volume to Capacity ratio			0.66			
Actuated Cycle Length (s)			67.6		Sum of lost time (s)	8.0
Intersection Capacity Utilization			52.0%		ICU Level of Service	A
Analysis Period (min)			15			

c Critical Lane Group

Timings 4: Allanburg Road & Davis Road

<2026 Background> Weekday PM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	42	0	49	54	0	84	213	163	224	55
Turn Type	Perm		Perm	Perm		Perm		Perm		Perm
Protected Phases		4			8		2		6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	4	4	4	8	8	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)		7.3	7.3		7.3	21.1	21.1	21.1	21.1	21.1
Actuated g/C Ratio		0.22	0.22		0.22	0.62	0.62	0.62	0.62	0.62
v/c Ratio		0.17	0.14		0.43	0.13	0.30	0.28	0.23	0.06
Control Delay		10.9	4.4		7.7	5.3	4.9	6.5	5.3	2.1
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		10.9	4.4		7.7	5.3	4.9	6.5	5.3	2.1
LOS		B	A		A	A	A	A	A	A
Approach Delay		7.4			7.7		5.0		5.3	
Approach LOS		A			A		A		A	

Intersection Summary

Cycle Length: 40

Actuated Cycle Length: 33.8

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.43

Intersection Signal Delay: 5.7

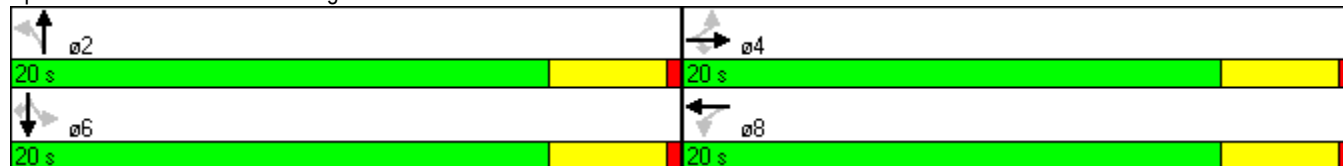
Intersection LOS: A

Intersection Capacity Utilization 51.4%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 4: Allanburg Road & Davis Road



HCM Signalized Intersection Capacity Analysis <2026 Background> Weekday PM Peak Hour

4: Allanburg Road & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	42	0	49	54	0	107	84	213	81	163	224	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.91		1.00	0.96		1.00	1.00	0.85
Flt Protected		0.95	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1671	1615		1701		1805	1758		1805	1792	1524
Flt Permitted		0.75	1.00		0.87		0.60	1.00		0.56	1.00	1.00
Satd. Flow (perm)		1312	1615		1504		1142	1758		1063	1792	1524
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	48	0	56	61	0	122	95	242	92	185	255	62
RTOR Reduction (vph)	0	0	46	0	100	0	0	24	0	0	0	26
Lane Group Flow (vph)	0	48	10	0	83	0	95	310	0	185	255	36
Heavy Vehicles (%)	8%	0%	0%	0%	0%	0%	0%	5%	0%	0%	6%	6%
Turn Type	Perm		Perm	Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		6.3	6.3		6.3		20.3	20.3		20.3	20.3	20.3
Effective Green, g (s)		6.3	6.3		6.3		20.3	20.3		20.3	20.3	20.3
Actuated g/C Ratio		0.18	0.18		0.18		0.59	0.59		0.59	0.59	0.59
Clearance Time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		239	294		274		670	1031		624	1051	894
v/s Ratio Prot							c0.18				0.14	
v/s Ratio Perm		0.04	0.01		c0.06		0.08			0.17		0.02
v/c Ratio		0.20	0.03		0.30		0.14	0.30		0.30	0.24	0.04
Uniform Delay, d1		12.0	11.6		12.3		3.2	3.6		3.6	3.4	3.0
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.4	0.0		0.6		0.4	0.8		1.2	0.5	0.1
Delay (s)		12.4	11.7		12.9		3.7	4.3		4.8	4.0	3.1
Level of Service		B	B		B		A	A		A	A	A
Approach Delay (s)		12.0			12.9			4.2			4.2	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay		6.2			HCM Level of Service			A				
HCM Volume to Capacity ratio		0.30										
Actuated Cycle Length (s)		34.6			Sum of lost time (s)			8.0				
Intersection Capacity Utilization		51.4%			ICU Level of Service			A				
Analysis Period (min)		15										
c Critical Lane Group												

Timings 5: Lundy's Lane & Davis Road

<2026 Background> Weekday PM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	189	701	81	587	67	64	128	73	135	171
Turn Type	pm+pt		pm+pt		Perm	Perm		pm+pt		Perm
Protected Phases	7	4	3	8			2	1	6	
Permitted Phases	4		8		8	2		6		6
Detector Phase	7	4	3	8	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	16.0	4.0	16.0	16.0	16.0	16.0	4.0	16.0	16.0
Minimum Split (s)	8.0	21.5	8.0	21.5	21.5	21.5	21.5	8.0	21.5	21.5
Total Split (s)	15.0	34.0	9.0	28.0	28.0	29.0	29.0	8.0	37.0	37.0
Total Split (%)	18.8%	42.5%	11.3%	35.0%	35.0%	36.3%	36.3%	10.0%	46.3%	46.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	2.0	0.5	2.0	2.0	2.0	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.5	4.0	5.5	5.5	5.5	5.5	4.0	5.5	5.5
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effect Green (s)	35.9	27.3	26.6	20.1	20.1	25.3	25.3	33.1	31.6	31.6
Actuated g/C Ratio	0.47	0.35	0.35	0.26	0.26	0.33	0.33	0.43	0.41	0.41
v/c Ratio	0.68	0.74	0.52	0.78	0.18	0.21	0.51	0.24	0.24	0.27
Control Delay	24.1	26.4	23.2	33.0	6.7	23.2	22.1	16.1	16.9	3.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.1	26.4	23.2	33.0	6.7	23.2	22.1	16.1	16.9	3.5
LOS	C	C	C	C	A	C	C	B	B	A
Approach Delay		25.9		29.5			22.3		10.7	
Approach LOS		C		C			C		B	

Intersection Summary

Cycle Length: 80

Actuated Cycle Length: 77

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.78

Intersection Signal Delay: 24.1

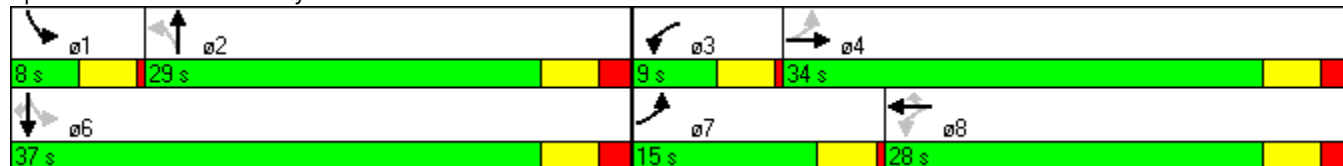
Intersection LOS: C

Intersection Capacity Utilization 70.4%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 5: Lundy's Lane & Davis Road



HCM Signalized Intersection Capacity Analysis <2026 Background> Weekday PM Peak Hour

5: Lundy's Lane & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	189	701	40	81	587	67	64	128	106	73	135	171
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	3423		1480	3539	1553	1626	1610		1719	1681	1599
Flt Permitted	0.17	1.00		0.22	1.00	1.00	0.65	1.00		0.41	1.00	1.00
Satd. Flow (perm)	314	3423		338	3539	1553	1117	1610		750	1681	1599
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	230	855	49	99	716	82	78	156	129	89	165	209
RTOR Reduction (vph)	0	5	0	0	0	60	0	36	0	0	0	123
Lane Group Flow (vph)	230	899	0	99	716	22	78	249	0	89	165	86
Heavy Vehicles (%)	3%	4%	15%	22%	2%	4%	11%	10%	10%	5%	13%	1%
Turn Type	pm+pt			pm+pt		Perm	Perm			pm+pt		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4			8		8	2			6		6
Actuated Green, G (s)	35.3	27.4		24.9	21.0	21.0	25.3	25.3		32.4	32.4	32.4
Effective Green, g (s)	35.3	27.4		24.9	21.0	21.0	25.3	25.3		32.4	32.4	32.4
Actuated g/C Ratio	0.45	0.35		0.32	0.27	0.27	0.32	0.32		0.41	0.41	0.41
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	329	1192		164	944	414	359	518		347	692	658
v/s Ratio Prot	c0.09	c0.26		0.03	0.20			c0.15		0.01	c0.10	
v/s Ratio Perm	0.22			0.16		0.01	0.07			0.10		0.05
v/c Ratio	0.70	0.75		0.60	0.76	0.05	0.22	0.48		0.26	0.24	0.13
Uniform Delay, d1	15.6	22.7		20.0	26.5	21.5	19.5	21.4		14.9	15.1	14.4
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.4	2.8		6.1	3.5	0.1	1.4	3.2		0.4	0.8	0.4
Delay (s)	21.9	25.4		26.2	30.1	21.5	20.9	24.6		15.3	15.9	14.8
Level of Service	C	C		C	C	C	C	C		B	B	B
Approach Delay (s)		24.7			28.8			23.8			15.3	
Approach LOS		C			C			C			B	
Intersection Summary												
HCM Average Control Delay			24.4			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.60									
Actuated Cycle Length (s)			78.7			Sum of lost time (s)			15.0			
Intersection Capacity Utilization			70.4%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

Timings

<2026 Background> Weekday PM Peak Hour

6: Lundy's Lane & Thorold Townline Road

2018-11-23

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	29	734	151	49	756	176	212	100	121	129	46
Turn Type	Perm		Perm	Perm		Perm	pm+pt		pm+pt		Perm
Protected Phases		4			8		5	2	1	6	
Permitted Phases	4		4	8		8	2		6		6
Detector Phase	4	4	4	8	8	8	5	2	1	6	6
Switch Phase											
Minimum Initial (s)	16.0	16.0	16.0	16.0	16.0	16.0	4.0	16.0	4.0	16.0	16.0
Minimum Split (s)	21.5	21.5	21.5	21.5	21.5	21.5	8.0	21.5	8.0	21.5	21.5
Total Split (s)	49.0	49.0	49.0	49.0	49.0	49.0	8.0	23.0	8.0	23.0	23.0
Total Split (%)	61.3%	61.3%	61.3%	61.3%	61.3%	61.3%	10.0%	28.8%	10.0%	28.8%	28.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.5	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5	4.0	5.5	5.5
Lead/Lag							Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	None	Max	Max
Act Effect Green (s)	37.3	37.3	37.3	37.3	37.3	37.3	24.2	19.6	23.2	17.7	17.7
Actuated g/C Ratio	0.50	0.50	0.50	0.50	0.50	0.50	0.33	0.26	0.31	0.24	0.24
v/c Ratio	0.36	0.88	0.19	0.55	0.91	0.22	0.57	0.35	0.36	0.33	0.12
Control Delay	23.6	28.5	2.2	36.0	31.4	2.1	27.8	23.8	22.6	27.9	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	23.6	28.5	2.2	36.0	31.4	2.1	27.8	23.8	22.6	27.9	8.8
LOS	C	C	A	D	C	A	C	C	C	C	A
Approach Delay		24.0			26.4			26.1		22.8	
Approach LOS		C			C			C		C	

Intersection Summary

Cycle Length: 80

Actuated Cycle Length: 74.2

Natural Cycle: 70

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.91

Intersection Signal Delay: 25.1

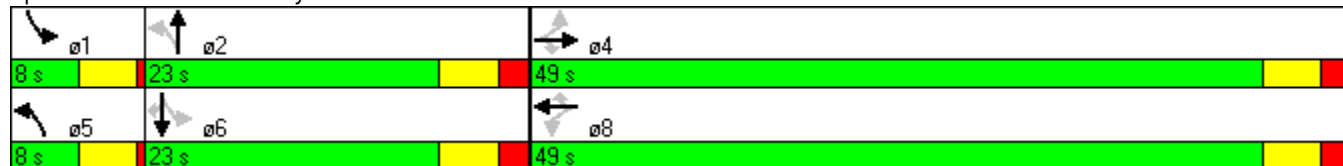
Intersection LOS: C

Intersection Capacity Utilization 78.3%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 6: Lundy's Lane & Thorold Townline Road



HCM Signalized Intersection Capacity Analysis <2026 Background> Weekday PM Peak Hour

6: Lundy's Lane & Thorold Townline Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	29	734	151	49	756	176	212	100	49	121	129	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1612	1881	1615	1805	1881	1615	1787	1782		1671	1863	1615
Flt Permitted	0.11	1.00	1.00	0.11	1.00	1.00	0.63	1.00		0.65	1.00	1.00
Satd. Flow (perm)	181	1881	1615	203	1881	1615	1191	1782		1143	1863	1615
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	33	834	172	56	859	200	241	114	56	138	147	52
RTOR Reduction (vph)	0	0	86	0	0	100	0	21	0	0	0	39
Lane Group Flow (vph)	33	834	86	56	859	100	241	149	0	138	147	13
Heavy Vehicles (%)	12%	1%	0%	0%	1%	0%	1%	2%	0%	8%	2%	0%
Turn Type	Perm		Perm	Perm		Perm	pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	37.4	37.4	37.4	37.4	37.4	37.4	23.6	19.6		21.8	18.7	18.7
Effective Green, g (s)	37.4	37.4	37.4	37.4	37.4	37.4	23.6	19.6		21.8	18.7	18.7
Actuated g/C Ratio	0.50	0.50	0.50	0.50	0.50	0.50	0.31	0.26		0.29	0.25	0.25
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
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)	90	937	804	101	937	804	406	465		354	464	402
v/s Ratio Prot		0.44			c0.46		c0.03	0.08		0.02	0.08	
v/s Ratio Perm	0.18		0.05	0.28		0.06	c0.15			0.10		0.01
v/c Ratio	0.37	0.89	0.11	0.55	0.92	0.12	0.59	0.32		0.39	0.32	0.03
Uniform Delay, d1	11.6	17.0	10.0	13.1	17.4	10.1	21.2	22.4		20.7	23.0	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
Incremental Delay, d2	2.5	10.6	0.1	6.4	13.4	0.1	2.3	1.8		0.7	1.8	0.1
Delay (s)	14.1	27.6	10.1	19.5	30.8	10.2	23.5	24.2		21.4	24.8	21.5
Level of Service	B	C	B	B	C	B	C	C		C	C	C
Approach Delay (s)		24.2			26.5			23.8			22.9	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM Average Control Delay			24.9			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.74									
Actuated Cycle Length (s)			75.1			Sum of lost time (s)				9.5		
Intersection Capacity Utilization			78.3%			ICU Level of Service				D		
Analysis Period (min)			15									
c Critical Lane Group												

Timings
7: Lundy's Lane & Site Access 1

<2026 Background> Weekday PM Peak Hour

2018-11-23



Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Volume (vph)	81	799	987	325	268
Turn Type	Perm			Perm	
Protected Phases		4	8		6
Permitted Phases	4			8	
Detector Phase	4	4	8	8	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	34.0	34.0	34.0	34.0	21.0
Total Split (%)	61.8%	61.8%	61.8%	61.8%	38.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	Max
Act Effect Green (s)	21.0	21.0	21.0	21.0	17.3
Actuated g/C Ratio	0.45	0.45	0.45	0.45	0.37
v/c Ratio	0.55	0.54	0.67	0.39	0.53
Control Delay	23.2	10.2	11.9	2.3	16.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	23.2	10.2	11.9	2.3	16.1
LOS	C	B	B	A	B
Approach Delay		11.4	9.5		16.1
Approach LOS		B	A		B

Intersection Summary

Cycle Length: 55

Actuated Cycle Length: 46.4

Natural Cycle: 50

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.67

Intersection Signal Delay: 11.0

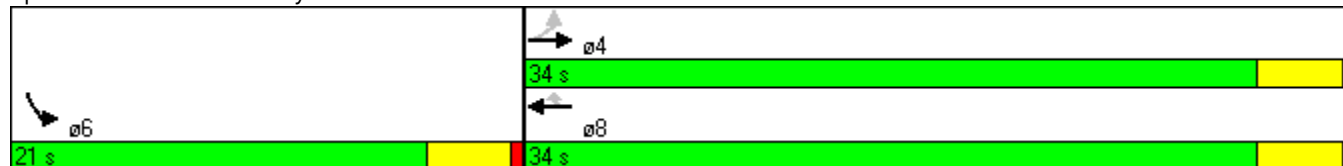
Intersection LOS: B

Intersection Capacity Utilization 59.9%

ICU Level of Service B

Analysis Period (min) 15

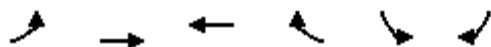
Splits and Phases: 7: Lundy's Lane & Site Access 1



HCM Signalized Intersection Capacity Analysis <2026 Background> Weekday PM Peak Hour

7: Lundy's Lane & Site Access 1

2018-11-23

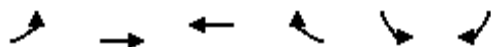


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	81	799	987	325	268	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.98	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1770	3539	3539	1583	1748	
Flt Permitted	0.19	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	355	3539	3539	1583	1748	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	88	868	1073	353	291	59
RTOR Reduction (vph)	0	0	0	193	12	0
Lane Group Flow (vph)	88	868	1073	160	338	0
Turn Type	Perm		Perm			
Protected Phases	4		8	6		
Permitted Phases	4		8			
Actuated Green, G (s)	21.0	21.0	21.0	21.0	17.3	
Effective Green, g (s)	21.0	21.0	21.0	21.0	17.3	
Actuated g/C Ratio	0.45	0.45	0.45	0.45	0.37	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	161	1605	1605	718	653	
v/s Ratio Prot		0.25	c0.30		c0.19	
v/s Ratio Perm	0.25			0.10		
v/c Ratio	0.55	0.54	0.67	0.22	0.52	
Uniform Delay, d1	9.2	9.2	9.9	7.7	11.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	3.8	0.4	1.1	0.2	2.9	
Delay (s)	12.9	9.5	11.0	7.8	14.2	
Level of Service	B	A	B	A	B	
Approach Delay (s)		9.8	10.2		14.2	
Approach LOS		A	B		B	
Intersection Summary						
HCM Average Control Delay			10.6	HCM Level of Service		B
HCM Volume to Capacity ratio			0.60			
Actuated Cycle Length (s)			46.3	Sum of lost time (s)		8.0
Intersection Capacity Utilization			59.9%	ICU Level of Service		B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis<2026 Background> Weekday PM Peak Hour

8: Lundy's Lane & Site Access 2

2018-11-23



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	81	1067	933	81	0	54
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	88	1160	1014	88	0	59
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (m)		204				
pX, platoon unblocked						
vC, conflicting volume	1102				2394	1058
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1102				2394	1058
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	86				100	78
cM capacity (veh/h)	633				32	273
Direction, Lane #	EB 1	EB 2	WB 1	SB 1		
Volume Total	88	1160	1102	59		
Volume Left	88	0	0	0		
Volume Right	0	0	88	59		
cSH	633	1700	1700	273		
Volume to Capacity	0.14	0.68	0.65	0.22		
Queue Length 95th (m)	3.8	0.0	0.0	6.4		
Control Delay (s)	11.6	0.0	0.0	21.8		
Lane LOS	B			C		
Approach Delay (s)	0.8		0.0	21.8		
Approach LOS				C		
Intersection Summary						
Average Delay			1.0			
Intersection Capacity Utilization			71.8%		ICU Level of Service	C
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis<2026 Background> Weekday PM Peak Hour

9: Site Access 3 & Thorold Townline Road

2018-11-23



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	54	107	163	142	250	81
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	59	116	177	154	272	88
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	824	316	360			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	824	316	360			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	80	84	85			
cM capacity (veh/h)	292	725	1199			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	175	177	154	360		
Volume Left	59	177	0	0		
Volume Right	116	0	0	88		
cSH	484	1199	1700	1700		
Volume to Capacity	0.36	0.15	0.09	0.21		
Queue Length 95th (m)	13.0	4.1	0.0	0.0		
Control Delay (s)	16.6	8.5	0.0	0.0		
Lane LOS	C	A				
Approach Delay (s)	16.6	4.6		0.0		
Approach LOS	C					
Intersection Summary						
Average Delay			5.1			
Intersection Capacity Utilization			46.7%		ICU Level of Service	A
Analysis Period (min)			15			

Timings
1: Niagara Falls Road & Davis Road

<2031 Background> Weekday AM Peak Hour

2018-11-23

									
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	146	41	27	35	6	902	102	481	52
Turn Type	Perm		Perm		Perm		Perm		Perm
Protected Phases		4		8		2		6	
Permitted Phases	4		8		2		6		6
Detector Phase	4	4	8	8	2	2	6	6	6
Switch Phase									
Minimum Initial (s)	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	35.0	35.0	35.0	35.0	35.0
Total Split (%)	36.4%	36.4%	36.4%	36.4%	63.6%	63.6%	63.6%	63.6%	63.6%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)	14.5	14.5		14.5	30.0	30.0	30.0	30.0	30.0
Actuated g/C Ratio	0.26	0.26		0.26	0.54	0.54	0.54	0.54	0.54
v/c Ratio	0.76	0.10		0.70	0.01	0.52	0.45	0.27	0.06
Control Delay	46.9	14.7		22.2	6.2	9.3	15.6	7.4	2.4
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.9	14.7		22.2	6.2	9.3	15.6	7.4	2.4
LOS	D	B		C	A	A	B	A	A
Approach Delay		39.1		22.2		9.3		8.3	
Approach LOS		D		C		A		A	

Intersection Summary

Cycle Length: 55

Actuated Cycle Length: 55.5

Natural Cycle: 55

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.76

Intersection Signal Delay: 13.7

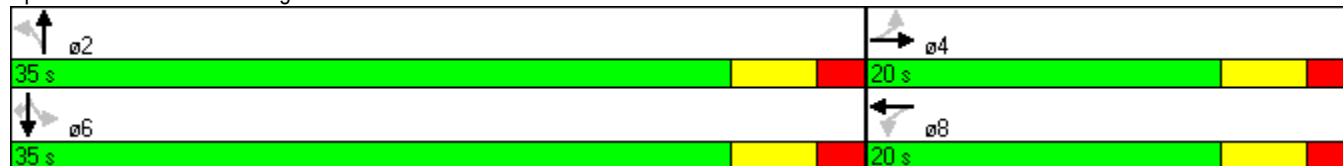
Intersection LOS: B

Intersection Capacity Utilization 88.7%

ICU Level of Service E

Analysis Period (min) 15

Splits and Phases: 1: Niagara Falls Road & Davis Road



HCM Signalized Intersection Capacity Analysis <2031 Background> Weekday AM Peak Hour

1: Niagara Falls Road & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	146	41	6	27	35	268	6	902	44	102	481	52
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5			5.5		5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.98			0.89		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	1818			1672		1641	3538		1787	3505	1553
Flt Permitted	0.42	1.00			0.97		0.46	1.00		0.24	1.00	1.00
Satd. Flow (perm)	777	1818			1631		800	3538		444	3505	1553
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	155	44	6	29	37	285	6	960	47	109	512	55
RTOR Reduction (vph)	0	4	0	0	75	0	0	6	0	0	0	25
Lane Group Flow (vph)	155	46	0	0	276	0	6	1001	0	109	512	30
Heavy Vehicles (%)	3%	3%	0%	7%	2%	0%	10%	1%	8%	1%	3%	4%
Turn Type	Perm		Perm			Perm			Perm		Perm	
Protected Phases	4		8			2			6		6	
Permitted Phases	4		8			2			6		6	
Actuated Green, G (s)	14.5	14.5	14.5			30.0			30.0			30.0
Effective Green, g (s)	14.5	14.5	14.5			30.0			30.0			30.0
Actuated g/C Ratio	0.26	0.26	0.26			0.54			0.54			0.54
Clearance Time (s)	5.5	5.5	5.5			5.5			5.5			5.5
Vehicle Extension (s)	3.0	3.0	3.0			3.0			3.0			3.0
Lane Grp Cap (vph)	203	475	426			432			1912			240
v/s Ratio Prot	0.03					c0.28					0.15	
v/s Ratio Perm	c0.20		0.17			0.01			0.25		0.02	
v/c Ratio	0.76	0.10	0.65			0.01			0.52			0.45
Uniform Delay, d1	18.9	15.5	18.2			5.9			8.2			7.8
Progression Factor	1.00	1.00	1.00			1.00			1.00			1.00
Incremental Delay, d2	15.6	0.1	3.4			0.1			1.0			6.1
Delay (s)	34.5	15.6	21.6			6.0			9.2			13.9
Level of Service	C	B	C			A			A			B
Approach Delay (s)	29.9		21.6			9.2					8.2	
Approach LOS	C		C			A					A	
Intersection Summary												
HCM Average Control Delay			12.7		HCM Level of Service				B			
HCM Volume to Capacity ratio			0.60									
Actuated Cycle Length (s)			55.5		Sum of lost time (s)				11.0			
Intersection Capacity Utilization			88.7%		ICU Level of Service				E			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis<2031 Background> Weekday AM Peak Hour

2: Beaverdams Road & Thorold Townline Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	36	120	18	34	286	27	36	169	57	23	116	35
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	38	128	19	36	304	29	38	180	61	24	123	37
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	185	369	279	185								
Volume Left (vph)	38	36	38	24								
Volume Right (vph)	19	29	61	37								
Hadj (s)	0.01	0.01	0.02	-0.02								
Departure Headway (s)	6.0	5.7	5.9	6.1								
Degree Utilization, x	0.31	0.58	0.46	0.31								
Capacity (veh/h)	528	595	552	510								
Control Delay (s)	11.8	16.4	13.9	11.9								
Approach Delay (s)	11.8	16.4	13.9	11.9								
Approach LOS	B	C	B	B								
Intersection Summary												
Delay			14.0									
HCM Level of Service			B									
Intersection Capacity Utilization			47.1%		ICU Level of Service				A			
Analysis Period (min)			15									

Timings
3: Barker Parkway & Davis Road

<2031 Background> Weekday AM Peak Hour

2018-11-23

					
Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Configurations					
Volume (vph)	4	500	116	241	75
Turn Type	Perm		Perm		
Protected Phases	8		2		6
Permitted Phases		8		6	
Detector Phase	8	8	2	6	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	22.0	22.0	23.0	23.0	23.0
Total Split (%)	48.9%	48.9%	51.1%	51.1%	51.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	Max	Max	Max
Act Effect Green (s)	8.1	8.1	19.2	19.2	19.2
Actuated g/C Ratio	0.23	0.23	0.54	0.54	0.54
v/c Ratio	0.01	0.70	0.08	0.38	0.04
Control Delay	9.2	6.9	4.6	8.3	5.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	9.2	6.9	4.6	8.3	5.3
LOS	A	A	A	A	A
Approach Delay	6.9		4.6		7.6
Approach LOS	A		A		A

Intersection Summary

Cycle Length: 45

Actuated Cycle Length: 35.5

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.70

Intersection Signal Delay: 6.8

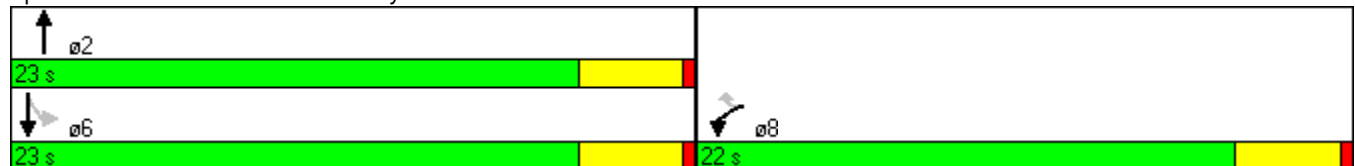
Intersection LOS: A

Intersection Capacity Utilization 41.7%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 3: Barker Parkway & Davis Road



HCM Signalized Intersection Capacity Analysis <2031 Background> Weekday AM Peak Hour

3: Barker Parkway & Davis Road

2018-11-23



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	4	500	116	27	241	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.97		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1538	3398		1805	3406
Flt Permitted	0.95	1.00	1.00		0.65	1.00
Satd. Flow (perm)	1805	1538	3398		1243	3406
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	4	538	125	29	259	81
RTOR Reduction (vph)	0	414	13	0	0	0
Lane Group Flow (vph)	4	124	141	0	259	81
Heavy Vehicles (%)	0%	5%	4%	0%	0%	6%
Turn Type	Perm		Perm		Perm	
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	8.2	8.2	19.3		19.3	19.3
Effective Green, g (s)	8.2	8.2	19.3		19.3	19.3
Actuated g/C Ratio	0.23	0.23	0.54		0.54	0.54
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	417	355	1847		676	1852
v/s Ratio Prot	0.00		0.04			0.02
v/s Ratio Perm		c0.08			c0.21	
v/c Ratio	0.01	0.35	0.08		0.38	0.04
Uniform Delay, d1	10.5	11.4	3.9		4.7	3.8
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.0	0.6	0.1		1.6	0.0
Delay (s)	10.5	12.0	3.9		6.3	3.8
Level of Service	B	B	A		A	A
Approach Delay (s)	12.0		3.9			5.7
Approach LOS	B		A			A
Intersection Summary						
HCM Average Control Delay			8.7		HCM Level of Service	A
HCM Volume to Capacity ratio			0.37			
Actuated Cycle Length (s)			35.5		Sum of lost time (s)	8.0
Intersection Capacity Utilization			41.7%		ICU Level of Service	A
Analysis Period (min)			15			

c Critical Lane Group

Timings
4: Allanburg Road & Davis Road

<2031 Background> Weekday AM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	69	0	56	56	0	54	290	57	145	27
Turn Type	Perm		Perm	Perm		Perm		Perm		Perm
Protected Phases		4			8		2		6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	4	4	4	8	8	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)		7.6	7.6		7.6	20.5	20.5	20.5	20.5	20.5
Actuated g/C Ratio		0.23	0.23		0.23	0.61	0.61	0.61	0.61	0.61
v/c Ratio		0.27	0.15		0.44	0.08	0.33	0.10	0.15	0.03
Control Delay		12.1	4.3		7.7	5.0	5.9	5.3	5.2	2.5
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		12.1	4.3		7.7	5.0	5.9	5.3	5.2	2.5
LOS		B	A		A	A	A	A	A	A
Approach Delay		8.6			7.7		5.8		4.9	
Approach LOS		A			A		A		A	

Intersection Summary

Cycle Length: 40

Actuated Cycle Length: 33.5

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.44

Intersection Signal Delay: 6.3

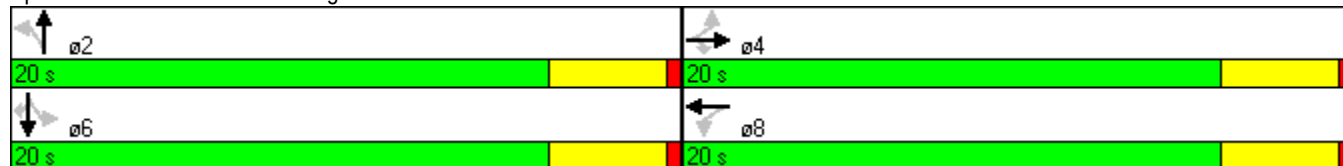
Intersection LOS: A

Intersection Capacity Utilization 47.0%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 4: Allanburg Road & Davis Road



HCM Signalized Intersection Capacity Analysis <2031 Background> Weekday AM Peak Hour

4: Allanburg Road & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	69	0	56	56	0	112	54	290	29	57	145	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.91		1.00	0.99		1.00	1.00	0.85
Flt Protected		0.95	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1671	1615		1701		1805	1793		1805	1792	1524
Flt Permitted		0.73	1.00		0.86		0.65	1.00		0.54	1.00	1.00
Satd. Flow (perm)		1291	1615		1484		1240	1793		1035	1792	1524
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	78	0	64	64	0	127	61	330	33	65	165	31
RTOR Reduction (vph)	0	0	52	0	103	0	0	6	0	0	0	13
Lane Group Flow (vph)	0	78	12	0	88	0	61	357	0	65	165	18
Heavy Vehicles (%)	8%	0%	0%	0%	0%	0%	0%	5%	0%	0%	6%	6%
Turn Type	Perm		Perm	Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		6.5	6.5		6.5		19.7	19.7		19.7	19.7	19.7
Effective Green, g (s)		6.5	6.5		6.5		19.7	19.7		19.7	19.7	19.7
Actuated g/C Ratio		0.19	0.19		0.19		0.58	0.58		0.58	0.58	0.58
Clearance Time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		245	307		282		714	1033		596	1032	878
v/s Ratio Prot							c0.20				0.09	
v/s Ratio Perm		c0.06	0.01		0.06		0.05			0.06		0.01
v/c Ratio		0.32	0.04		0.31		0.09	0.35		0.11	0.16	0.02
Uniform Delay, d1		11.9	11.3		11.9		3.2	3.8		3.3	3.4	3.1
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.8	0.1		0.6		0.2	0.9		0.4	0.3	0.0
Delay (s)		12.7	11.4		12.6		3.5	4.8		3.6	3.7	3.2
Level of Service		B	B		B		A	A		A	A	A
Approach Delay (s)		12.1			12.6			4.6			3.6	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay		6.9					HCM Level of Service			A		
HCM Volume to Capacity ratio		0.34										
Actuated Cycle Length (s)		34.2					Sum of lost time (s)			8.0		
Intersection Capacity Utilization		47.0%					ICU Level of Service			A		
Analysis Period (min)		15										
c Critical Lane Group												

Timings
5: Lundy's Lane & Davis Road

<2031 Background> Weekday AM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	175	479	90	469	76	35	172	50	102	154
Turn Type	pm+pt		pm+pt		Perm	Perm		pm+pt		Perm
Protected Phases	7	4	3	8			2	1	6	
Permitted Phases	4		8		8	2		6		6
Detector Phase	7	4	3	8	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	16.0	4.0	16.0	16.0	16.0	16.0	4.0	16.0	16.0
Minimum Split (s)	8.0	21.5	8.0	21.5	21.5	21.5	21.5	8.0	21.5	21.5
Total Split (s)	9.0	22.5	8.0	21.5	21.5	21.5	21.5	8.0	29.5	29.5
Total Split (%)	15.0%	37.5%	13.3%	35.8%	35.8%	35.8%	35.8%	13.3%	49.2%	49.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	2.0	0.5	2.0	2.0	2.0	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.5	4.0	5.5	5.5	5.5	5.5	4.0	5.5	5.5
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effect Green (s)	24.1	18.6	21.5	16.0	16.0	19.2	19.2	25.5	24.0	24.0
Actuated g/C Ratio	0.40	0.31	0.36	0.27	0.27	0.32	0.32	0.42	0.40	0.40
v/c Ratio	0.65	0.59	0.42	0.61	0.19	0.12	0.50	0.16	0.18	0.25
Control Delay	23.3	20.5	16.5	22.5	5.8	17.6	20.1	11.4	12.6	3.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.3	20.5	16.5	22.5	5.8	17.6	20.1	11.4	12.6	3.2
LOS	C	C	B	C	A	B	C	B	B	A
Approach Delay		21.2		19.6			19.7		7.7	
Approach LOS		C		B			B		A	

Intersection Summary

Cycle Length: 60

Actuated Cycle Length: 60

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.65

Intersection Signal Delay: 18.3

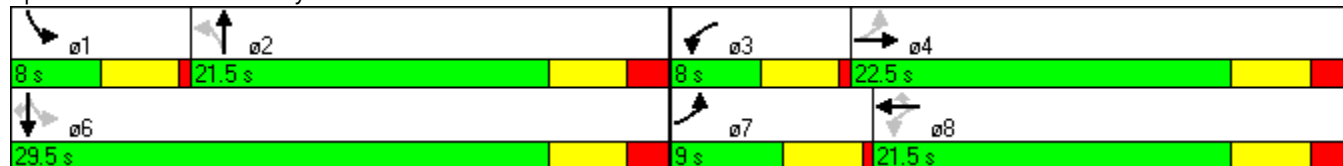
Intersection LOS: B

Intersection Capacity Utilization 66.8%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 5: Lundy's Lane & Davis Road



HCM Signalized Intersection Capacity Analysis <2031 Background> Weekday AM Peak Hour

5: Lundy's Lane & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	175	479	34	90	469	76	35	172	54	50	102	154
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	3413		1480	3539	1553	1626	1665		1719	1681	1599
Flt Permitted	0.31	1.00		0.35	1.00	1.00	0.68	1.00		0.43	1.00	1.00
Satd. Flow (perm)	569	3413		550	3539	1553	1160	1665		776	1681	1599
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	213	584	41	110	572	93	43	210	66	61	124	188
RTOR Reduction (vph)	0	8	0	0	0	68	0	18	0	0	0	111
Lane Group Flow (vph)	213	617	0	110	572	25	43	258	0	61	124	77
Heavy Vehicles (%)	3%	4%	15%	22%	2%	4%	11%	10%	10%	5%	13%	1%
Turn Type	pm+pt			pm+pt		Perm	Perm			pm+pt		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4			8		8	2			6		6
Actuated Green, G (s)	23.6	18.6		20.0	16.8	16.8	19.2	19.2		25.6	25.6	25.6
Effective Green, g (s)	23.6	18.6		20.0	16.8	16.8	19.2	19.2		25.6	25.6	25.6
Actuated g/C Ratio	0.38	0.30		0.32	0.27	0.27	0.31	0.31		0.41	0.41	0.41
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	310	1017		224	953	418	357	512		355	690	656
v/s Ratio Prot	c0.06	0.18		0.03	0.16			c0.15		0.01	c0.07	
v/s Ratio Perm	c0.20			0.13		0.02	0.04			0.06		0.05
v/c Ratio	0.69	0.61		0.49	0.60	0.06	0.12	0.50		0.17	0.18	0.12
Uniform Delay, d1	14.4	18.8		15.8	19.9	16.9	15.5	17.7		11.6	11.7	11.4
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.2	1.0		1.7	1.1	0.1	0.7	3.5		0.2	0.6	0.4
Delay (s)	20.6	19.8		17.4	20.9	17.0	16.2	21.2		11.8	12.3	11.8
Level of Service	C	B		B	C	B	B	C		B	B	B
Approach Delay (s)		20.0			20.0			20.5			11.9	
Approach LOS		B			B			C			B	
Intersection Summary												
HCM Average Control Delay			18.8			HCM Level of Service				B		
HCM Volume to Capacity ratio			0.61									
Actuated Cycle Length (s)			62.4			Sum of lost time (s)			19.0			
Intersection Capacity Utilization			66.8%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

Timings
6: Lundy's Lane & Thorold Townline Road

<2031 Background> Weekday AM Peak Hour

2018-11-23

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	61	636	176	45	516	83	94	146	122	79	31
Turn Type	Perm		Perm	Perm		Perm	pm+pt		pm+pt		Perm
Protected Phases		4			8		5	2	1	6	
Permitted Phases	4		4	8		8	2		6		6
Detector Phase	4	4	4	8	8	8	5	2	1	6	6
Switch Phase											
Minimum Initial (s)	16.0	16.0	16.0	16.0	16.0	16.0	4.0	16.0	4.0	16.0	16.0
Minimum Split (s)	21.5	21.5	21.5	21.5	21.5	21.5	8.0	21.5	8.0	21.5	21.5
Total Split (s)	35.0	35.0	35.0	35.0	35.0	35.0	8.0	22.0	8.0	22.0	22.0
Total Split (%)	53.8%	53.8%	53.8%	53.8%	53.8%	53.8%	12.3%	33.8%	12.3%	33.8%	33.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.5	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5	4.0	5.5	5.5
Lead/Lag							Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	None	Max	Max
Act Effect Green (s)	26.2	26.2	26.2	26.2	26.2	26.2	21.4	16.9	21.4	16.9	16.9
Actuated g/C Ratio	0.43	0.43	0.43	0.43	0.43	0.43	0.35	0.28	0.35	0.28	0.28
v/c Ratio	0.37	0.88	0.25	0.40	0.72	0.12	0.21	0.40	0.33	0.17	0.07
Control Delay	18.9	30.9	2.8	23.5	20.1	3.2	14.0	20.9	16.0	20.1	7.8
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	18.9	30.9	2.8	23.5	20.1	3.2	14.0	20.9	16.0	20.1	7.8
LOS	B	C	A	C	C	A	B	C	B	C	A
Approach Delay		24.4			18.1			18.6		16.3	
Approach LOS		C			B			B		B	

Intersection Summary

Cycle Length: 65

Actuated Cycle Length: 60.3

Natural Cycle: 65

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.88

Intersection Signal Delay: 20.7

Intersection LOS: C

Intersection Capacity Utilization 83.3%

ICU Level of Service E

Analysis Period (min) 15

Splits and Phases: 6: Lundy's Lane & Thorold Townline Road

		
ø1	ø2	ø4
8 s	22 s	35 s
		
ø5	ø6	ø8
8 s	22 s	35 s

HCM Signalized Intersection Capacity Analysis <2031 Background> Weekday AM Peak Hour 6: Lundy's Lane & Thorold Townline Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	61	636	176	45	516	83	94	146	40	122	79	31
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1612	1881	1615	1805	1881	1615	1787	1811		1671	1863	1615
Flt Permitted	0.25	1.00	1.00	0.15	1.00	1.00	0.70	1.00		0.61	1.00	1.00
Satd. Flow (perm)	427	1881	1615	290	1881	1615	1314	1811		1077	1863	1615
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	69	723	200	51	586	94	107	166	45	139	90	35
RTOR Reduction (vph)	0	0	114	0	0	54	0	14	0	0	0	25
Lane Group Flow (vph)	69	723	86	51	586	40	107	197	0	139	90	10
Heavy Vehicles (%)	12%	1%	0%	0%	1%	0%	1%	2%	0%	8%	2%	0%
Turn Type	Perm		Perm	Perm		Perm	pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	26.2	26.2	26.2	26.2	26.2	26.2	19.9	16.9		19.9	16.9	16.9
Effective Green, g (s)	26.2	26.2	26.2	26.2	26.2	26.2	19.9	16.9		19.9	16.9	16.9
Actuated g/C Ratio	0.43	0.43	0.43	0.43	0.43	0.43	0.33	0.28		0.33	0.28	0.28
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
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)	183	807	693	124	807	693	451	501		380	515	447
v/s Ratio Prot		c0.38			0.31		0.01	c0.11		c0.02	0.05	
v/s Ratio Perm	0.16		0.05	0.18		0.02	0.07			0.10		0.01
v/c Ratio	0.38	0.90	0.12	0.41	0.73	0.06	0.24	0.39		0.37	0.17	0.02
Uniform Delay, d1	11.9	16.2	10.5	12.1	14.5	10.2	14.8	17.9		15.2	16.8	16.1
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	1.3	12.5	0.1	2.2	3.3	0.0	0.3	2.3		0.6	0.7	0.1
Delay (s)	13.2	28.7	10.6	14.3	17.7	10.3	15.0	20.2		15.8	17.5	16.2
Level of Service	B	C	B	B	B	B	B	C		B	B	B
Approach Delay (s)		24.0			16.5			18.5			16.5	
Approach LOS		C			B			B			B	
Intersection Summary												
HCM Average Control Delay			20.0			HCM Level of Service				B		
HCM Volume to Capacity ratio			0.68									
Actuated Cycle Length (s)			61.1			Sum of lost time (s)				15.0		
Intersection Capacity Utilization			83.3%			ICU Level of Service				E		
Analysis Period (min)			15									
c Critical Lane Group												

Timings
7: Lundy's Lane & Site Access 1

<2031 Background> Weekday AM Peak Hour

2018-11-23



Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Volume (vph)	29	554	668	115	281
Turn Type	Perm			Perm	
Protected Phases		4	8		6
Permitted Phases	4			8	
Detector Phase	4	4	8	8	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	Max
Act Effect Green (s)	12.8	12.8	12.8	12.8	16.1
Actuated g/C Ratio	0.35	0.35	0.35	0.35	0.44
v/c Ratio	0.16	0.49	0.59	0.20	0.47
Control Delay	10.1	10.8	12.0	3.1	10.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	10.1	10.8	12.0	3.1	10.1
LOS	B	B	B	A	B
Approach Delay		10.8	10.6		10.1
Approach LOS		B	B		B

Intersection Summary

Cycle Length: 40

Actuated Cycle Length: 37

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.59

Intersection Signal Delay: 10.6

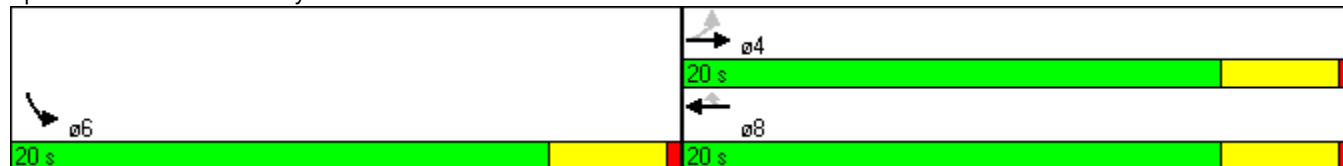
Intersection LOS: B

Intersection Capacity Utilization 49.7%

ICU Level of Service A

Analysis Period (min) 15

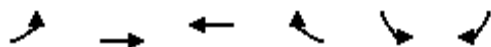
Splits and Phases: 7: Lundy's Lane & Site Access 1



HCM Signalized Intersection Capacity Analysis <2031 Background> Weekday AM Peak Hour

7: Lundy's Lane & Site Access 1

2018-11-23

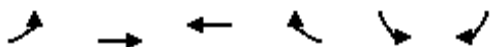


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	29	554	668	115	281	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.98	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1770	3539	3539	1583	1748	
Flt Permitted	0.31	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	582	3539	3539	1583	1748	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	32	602	726	125	305	61
RTOR Reduction (vph)	0	0	0	82	17	0
Lane Group Flow (vph)	32	602	726	43	349	0
Turn Type	Perm		Perm			
Protected Phases	4		8		6	
Permitted Phases	4		8			
Actuated Green, G (s)	12.8	12.8	12.8	12.8	16.1	
Effective Green, g (s)	12.8	12.8	12.8	12.8	16.1	
Actuated g/C Ratio	0.35	0.35	0.35	0.35	0.44	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	202	1228	1228	549	763	
v/s Ratio Prot		0.17	c0.21		c0.20	
v/s Ratio Perm	0.05			0.03		
v/c Ratio	0.16	0.49	0.59	0.08	0.46	
Uniform Delay, d1	8.3	9.5	9.9	8.1	7.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.4	0.3	0.8	0.1	2.0	
Delay (s)	8.7	9.8	10.7	8.2	9.3	
Level of Service	A	A	B	A	A	
Approach Delay (s)		9.7	10.3		9.3	
Approach LOS		A	B		A	
Intersection Summary						
HCM Average Control Delay			9.9	HCM Level of Service		A
HCM Volume to Capacity ratio			0.52			
Actuated Cycle Length (s)			36.9	Sum of lost time (s)		8.0
Intersection Capacity Utilization			49.7%	ICU Level of Service		A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis<2031 Background> Weekday AM Peak Hour

8: Lundy's Lane & Site Access 2

2018-11-23



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	29	834	612	29	0	56
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	32	907	665	32	0	61
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (m)		204				
pX, platoon unblocked						
vC, conflicting volume	697				1651	681
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	697				1651	681
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				100	86
cM capacity (veh/h)	899				105	450
Direction, Lane #	EB 1	EB 2	WB 1	SB 1		
Volume Total	32	907	697	61		
Volume Left	32	0	0	0		
Volume Right	0	0	32	61		
cSH	899	1700	1700	450		
Volume to Capacity	0.04	0.53	0.41	0.14		
Queue Length 95th (m)	0.9	0.0	0.0	3.7		
Control Delay (s)	9.1	0.0	0.0	14.2		
Lane LOS	A			B		
Approach Delay (s)	0.3		0.0	14.2		
Approach LOS				B		
Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization			54.0%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis<2031 Background> Weekday AM Peak Hour

9: Site Access 3 & Thorold Townline Road

2018-11-23



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	56	112	57	233	139	29
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	61	122	62	253	151	32
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	544	167	183			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	544	167	183			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	87	86	96			
cM capacity (veh/h)	478	877	1392			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	183	62	253	183		
Volume Left	61	62	0	0		
Volume Right	122	0	0	32		
cSH	686	1392	1700	1700		
Volume to Capacity	0.27	0.04	0.15	0.11		
Queue Length 95th (m)	8.6	1.1	0.0	0.0		
Control Delay (s)	12.1	7.7	0.0	0.0		
Lane LOS	B	A				
Approach Delay (s)	12.1	1.5		0.0		
Approach LOS	B					
Intersection Summary						
Average Delay			4.0			
Intersection Capacity Utilization			32.4%		ICU Level of Service	A
Analysis Period (min)			15			

Timings
1: Niagara Falls Road & Davis Road

<2031 Background> Weekday PM Peak Hour

2018-11-23

									
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	114	38	57	70	13	781	213	1138	154
Turn Type	Perm		Perm		Perm		Perm		Perm
Protected Phases		4		8		2		6	
Permitted Phases	4		8		2		6		6
Detector Phase	4	4	8	8	2	2	6	6	6
Switch Phase									
Minimum Initial (s)	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	33.3%	33.3%	33.3%	33.3%	66.7%	66.7%	66.7%	66.7%	66.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)	14.5	14.5		14.5	34.9	34.9	34.9	34.9	34.9
Actuated g/C Ratio	0.24	0.24		0.24	0.58	0.58	0.58	0.58	0.58
v/c Ratio	0.72	0.11		0.75	0.08	0.42	0.70	0.60	0.17
Control Delay	48.4	16.1		25.2	7.1	7.8	24.5	9.8	1.7
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.4	16.1		25.2	7.1	7.8	24.5	9.8	1.7
LOS	D	B		C	A	A	C	A	A
Approach Delay		39.1		25.2		7.8		11.1	
Approach LOS		D		C		A		B	

Intersection Summary

Cycle Length: 60

Actuated Cycle Length: 60.4

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.75

Intersection Signal Delay: 13.4

Intersection LOS: B

Intersection Capacity Utilization 84.6%

ICU Level of Service E

Analysis Period (min) 15

Splits and Phases: 1: Niagara Falls Road & Davis Road

			
40 s	20 s	20 s	20 s
			
40 s	20 s	20 s	20 s

HCM Signalized Intersection Capacity Analysis <2031 Background> Weekday PM Peak Hour

1: Niagara Falls Road & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	114	38	8	57	70	219	13	781	32	213	1138	154
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5			5.5		5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.97			0.91		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	1803			1697		1641	3544		1787	3505	1553
Flt Permitted	0.38	1.00			0.93		0.18	1.00		0.30	1.00	1.00
Satd. Flow (perm)	704	1803			1597		304	3544		561	3505	1553
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	121	40	9	61	74	233	14	831	34	227	1211	164
RTOR Reduction (vph)	0	7	0	0	104	0	0	5	0	0	0	69
Lane Group Flow (vph)	121	42	0	0	264	0	14	860	0	227	1211	95
Heavy Vehicles (%)	3%	3%	0%	7%	2%	0%	10%	1%	8%	1%	3%	4%
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	14.5	14.5			14.5		34.9	34.9		34.9	34.9	34.9
Effective Green, g (s)	14.5	14.5			14.5		34.9	34.9		34.9	34.9	34.9
Actuated g/C Ratio	0.24	0.24			0.24		0.58	0.58		0.58	0.58	0.58
Clearance Time (s)	5.5	5.5			5.5		5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	169	433			383		176	2048		324	2025	897
v/s Ratio Prot		0.02						0.24			0.35	
v/s Ratio Perm	c0.17				0.17		0.05			c0.40		0.06
v/c Ratio	0.72	0.10			0.69		0.08	0.42		0.70	0.60	0.11
Uniform Delay, d1	21.1	17.9			20.9		5.6	7.1		9.0	8.2	5.7
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	13.5	0.1			5.1		0.9	0.6		11.9	1.3	0.2
Delay (s)	34.5	18.0			26.0		6.5	7.7		21.0	9.5	6.0
Level of Service	C	B			C		A	A		C	A	A
Approach Delay (s)		29.7			26.0			7.7			10.8	
Approach LOS		C			C			A			B	
Intersection Summary												
HCM Average Control Delay	12.8			HCM Level of Service			B					
HCM Volume to Capacity ratio	0.70											
Actuated Cycle Length (s)	60.4			Sum of lost time (s)			11.0					
Intersection Capacity Utilization	84.6%			ICU Level of Service			E					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis<2031 Background> Weekday PM Peak Hour

2: Beaverdams Road & Thorold Townline Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	25	226	28	90	211	23	40	154	63	48	238	41
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	27	240	30	96	224	24	43	164	67	51	253	44
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	297	345	273	348								
Volume Left (vph)	27	96	43	51								
Volume Right (vph)	30	24	67	44								
Hadj (s)	-0.03	0.09	0.00	0.03								
Departure Headway (s)	7.2	7.2	7.3	7.1								
Degree Utilization, x	0.59	0.68	0.55	0.69								
Capacity (veh/h)	452	465	438	468								
Control Delay (s)	20.1	24.3	19.0	24.3								
Approach Delay (s)	20.1	24.3	19.0	24.3								
Approach LOS	C	C	C	C								
Intersection Summary												
Delay			22.2									
HCM Level of Service			C									
Intersection Capacity Utilization			65.7%		ICU Level of Service				C			
Analysis Period (min)			15									

Timings
3: Barker Parkway & Davis Road

<2031 Background> Weekday PM Peak Hour

2018-11-23

					
Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Configurations					
Volume (vph)	10	425	134	632	168
Turn Type	Perm		Perm		
Protected Phases	8		2		6
Permitted Phases		8		6	
Detector Phase	8	8	2	6	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	55.0	55.0	55.0
Total Split (%)	26.7%	26.7%	73.3%	73.3%	73.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	Max	Max	Max
Act Effect Green (s)	8.4	8.4	51.2	51.2	51.2
Actuated g/C Ratio	0.12	0.12	0.76	0.76	0.76
v/c Ratio	0.05	0.77	0.06	0.72	0.07
Control Delay	25.2	12.8	2.5	11.9	2.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	25.2	12.8	2.5	11.9	2.7
LOS	C	B	A	B	A
Approach Delay	13.1		2.5		10.0
Approach LOS	B		A		B

Intersection Summary

Cycle Length: 75

Actuated Cycle Length: 67.6

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.77

Intersection Signal Delay: 10.2

Intersection LOS: B

Intersection Capacity Utilization 52.5%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 3: Barker Parkway & Davis Road



HCM Signalized Intersection Capacity Analysis <2031 Background> Weekday PM Peak Hour

3: Barker Parkway & Davis Road

2018-11-23



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	10	425	134	13	632	168
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1538	3437		1805	3406
Flt Permitted	0.95	1.00	1.00		0.65	1.00
Satd. Flow (perm)	1805	1538	3437		1239	3406
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	11	457	144	14	680	181
RTOR Reduction (vph)	0	400	3	0	0	0
Lane Group Flow (vph)	11	57	155	0	680	181
Heavy Vehicles (%)	0%	5%	4%	0%	0%	6%
Turn Type	Perm		Perm			
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	8.4	8.4	51.2		51.2	51.2
Effective Green, g (s)	8.4	8.4	51.2		51.2	51.2
Actuated g/C Ratio	0.12	0.12	0.76		0.76	0.76
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	224	191	2603		938	2580
v/s Ratio Prot	0.01		0.04			0.05
v/s Ratio Perm		c0.04			c0.55	
v/c Ratio	0.05	0.30	0.06		0.72	0.07
Uniform Delay, d1	26.1	26.9	2.1		4.4	2.1
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.1	0.9	0.0		4.9	0.1
Delay (s)	26.2	27.8	2.1		9.3	2.2
Level of Service	C	C	A		A	A
Approach Delay (s)	27.8		2.1			7.8
Approach LOS	C		A			A
Intersection Summary						
HCM Average Control Delay			13.5	HCM Level of Service		B
HCM Volume to Capacity ratio			0.66			
Actuated Cycle Length (s)			67.6	Sum of lost time (s)		8.0
Intersection Capacity Utilization			52.5%	ICU Level of Service		A
Analysis Period (min)			15			

c Critical Lane Group

Timings
4: Allanburg Road & Davis Road

<2031 Background> Weekday PM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	47	0	54	54	0	93	235	163	247	61
Turn Type	Perm		Perm	Perm		Perm		Perm		Perm
Protected Phases		4			8		2		6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	4	4	4	8	8	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)		7.3	7.3		7.3	20.9	20.9	20.9	20.9	20.9
Actuated g/C Ratio		0.22	0.22		0.22	0.62	0.62	0.62	0.62	0.62
v/c Ratio		0.19	0.15		0.43	0.15	0.32	0.29	0.25	0.07
Control Delay		11.1	4.4		7.7	5.4	5.2	6.6	5.4	2.0
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		11.1	4.4		7.7	5.4	5.2	6.6	5.4	2.0
LOS		B	A		A	A	A	A	A	A
Approach Delay		7.5			7.7		5.2		5.4	
Approach LOS		A			A		A		A	

Intersection Summary

Cycle Length: 40

Actuated Cycle Length: 33.7

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.43

Intersection Signal Delay: 5.8

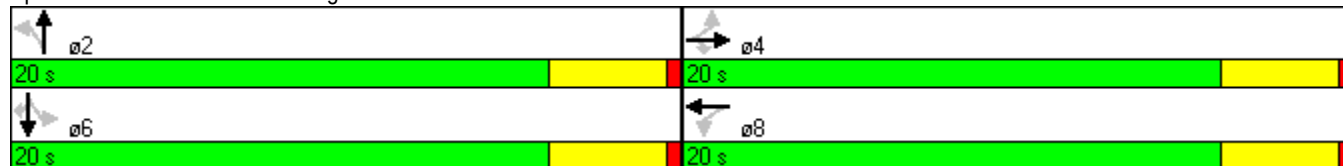
Intersection LOS: A

Intersection Capacity Utilization 52.6%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 4: Allanburg Road & Davis Road



HCM Signalized Intersection Capacity Analysis <2031 Background> Weekday PM Peak Hour

4: Allanburg Road & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	47	0	54	54	0	107	93	235	81	163	247	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.91		1.00	0.96		1.00	1.00	0.85
Flt Protected		0.95	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1671	1615		1701		1805	1761		1805	1792	1524
Flt Permitted		0.75	1.00		0.87		0.59	1.00		0.55	1.00	1.00
Satd. Flow (perm)		1316	1615		1501		1116	1761		1039	1792	1524
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	53	0	61	61	0	122	106	267	92	185	281	69
RTOR Reduction (vph)	0	0	50	0	100	0	0	22	0	0	0	29
Lane Group Flow (vph)	0	53	11	0	83	0	106	337	0	185	281	40
Heavy Vehicles (%)	8%	0%	0%	0%	0%	0%	0%	5%	0%	0%	6%	6%
Turn Type	Perm		Perm	Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		6.3	6.3		6.3		20.1	20.1		20.1	20.1	20.1
Effective Green, g (s)		6.3	6.3		6.3		20.1	20.1		20.1	20.1	20.1
Actuated g/C Ratio		0.18	0.18		0.18		0.58	0.58		0.58	0.58	0.58
Clearance Time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		241	296		275		652	1029		607	1047	890
v/s Ratio Prot							c0.19				0.16	
v/s Ratio Perm		0.04	0.01		c0.06		0.10			0.18		0.03
v/c Ratio		0.22	0.04		0.30		0.16	0.33		0.30	0.27	0.05
Uniform Delay, d1		12.0	11.6		12.2		3.3	3.7		3.6	3.5	3.1
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.5	0.1		0.6		0.5	0.9		1.3	0.6	0.1
Delay (s)		12.4	11.6		12.8		3.8	4.5		4.9	4.2	3.1
Level of Service		B	B		B		A	A		A	A	A
Approach Delay (s)		12.0			12.8			4.4			4.3	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay		6.2					HCM Level of Service			A		
HCM Volume to Capacity ratio		0.32										
Actuated Cycle Length (s)		34.4					Sum of lost time (s)			8.0		
Intersection Capacity Utilization		52.6%					ICU Level of Service			A		
Analysis Period (min)		15										
c Critical Lane Group												

Timings
5: Lundy's Lane & Davis Road

<2031 Background> Weekday PM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	200	765	84	643	74	71	141	80	149	183
Turn Type	pm+pt		pm+pt		Perm	Perm		pm+pt		Perm
Protected Phases	7	4	3	8			2	1	6	
Permitted Phases	4		8		8	2		6		6
Detector Phase	7	4	3	8	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	16.0	4.0	16.0	16.0	16.0	16.0	4.0	16.0	16.0
Minimum Split (s)	8.0	21.5	8.0	21.5	21.5	21.5	21.5	8.0	21.5	21.5
Total Split (s)	15.0	34.0	9.0	28.0	28.0	29.0	29.0	8.0	37.0	37.0
Total Split (%)	18.8%	42.5%	11.3%	35.0%	35.0%	36.3%	36.3%	10.0%	46.3%	46.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	2.0	0.5	2.0	2.0	2.0	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.5	4.0	5.5	5.5	5.5	5.5	4.0	5.5	5.5
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effect Green (s)	37.0	28.5	27.4	20.9	20.9	25.3	25.3	33.1	31.6	31.6
Actuated g/C Ratio	0.47	0.36	0.35	0.27	0.27	0.32	0.32	0.42	0.40	0.40
v/c Ratio	0.72	0.79	0.58	0.83	0.19	0.24	0.55	0.28	0.27	0.29
Control Delay	27.9	28.0	27.3	35.7	6.5	24.0	23.9	16.9	17.5	3.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.9	28.0	27.3	35.7	6.5	24.0	23.9	16.9	17.5	3.5
LOS	C	C	C	D	A	C	C	B	B	A
Approach Delay		28.0		32.1			23.9		11.2	
Approach LOS		C		C			C		B	

Intersection Summary

Cycle Length: 80

Actuated Cycle Length: 78.1

Natural Cycle: 65

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.83

Intersection Signal Delay: 26.1

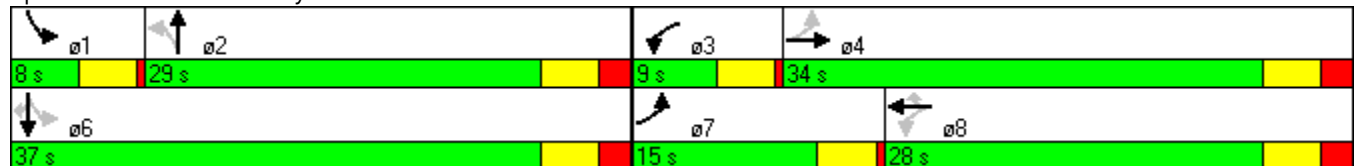
Intersection LOS: C

Intersection Capacity Utilization 72.6%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 5: Lundy's Lane & Davis Road



HCM Signalized Intersection Capacity Analysis <2031 Background> Weekday PM Peak Hour

5: Lundy's Lane & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	765	44	84	643	74	71	141	108	80	149	183
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	3423		1480	3539	1553	1626	1615		1719	1681	1599
Flt Permitted	0.16	1.00		0.18	1.00	1.00	0.64	1.00		0.39	1.00	1.00
Satd. Flow (perm)	287	3423		287	3539	1553	1100	1615		700	1681	1599
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	244	933	54	102	784	90	87	172	132	98	182	223
RTOR Reduction (vph)	0	5	0	0	0	66	0	33	0	0	0	132
Lane Group Flow (vph)	244	982	0	102	784	24	87	271	0	98	182	91
Heavy Vehicles (%)	3%	4%	15%	22%	2%	4%	11%	10%	10%	5%	13%	1%
Turn Type	pm+pt			pm+pt		Perm	Perm			pm+pt		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4			8		8	2			6		6
Actuated Green, G (s)	36.4	28.5		25.6	21.7	21.7	25.3	25.3		32.4	32.4	32.4
Effective Green, g (s)	36.4	28.5		25.6	21.7	21.7	25.3	25.3		32.4	32.4	32.4
Actuated g/C Ratio	0.46	0.36		0.32	0.27	0.27	0.32	0.32		0.41	0.41	0.41
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	327	1223		150	962	422	349	512		324	683	649
v/s Ratio Prot	c0.10	c0.29		0.03	0.22			c0.17		0.01	c0.11	
v/s Ratio Perm	0.24			0.18		0.02	0.08			0.11		0.06
v/c Ratio	0.75	0.80		0.68	0.81	0.06	0.25	0.53		0.30	0.27	0.14
Uniform Delay, d1	16.0	23.1		20.6	27.2	21.5	20.2	22.4		15.6	15.8	14.9
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	8.9	3.9		12.0	5.4	0.1	1.7	3.9		0.5	1.0	0.4
Delay (s)	25.0	27.0		32.5	32.6	21.5	21.9	26.2		16.1	16.7	15.4
Level of Service	C	C		C	C	C	C	C		B	B	B
Approach Delay (s)		26.6			31.5			25.3			16.0	
Approach LOS		C			C			C			B	
Intersection Summary												
HCM Average Control Delay			26.3			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.65									
Actuated Cycle Length (s)			79.8			Sum of lost time (s)			15.0			
Intersection Capacity Utilization			72.6%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

Timings
6: Lundy's Lane & Thorold Townline Road

<2031 Background> Weekday PM Peak Hour

2018-11-23

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	32	788	161	54	801	177	226	110	123	142	50
Turn Type	Perm		Perm	Perm		Perm	pm+pt		pm+pt		Perm
Protected Phases		4			8		5	2	1	6	
Permitted Phases	4		4	8		8	2		6		6
Detector Phase	4	4	4	8	8	8	5	2	1	6	6
Switch Phase											
Minimum Initial (s)	16.0	16.0	16.0	16.0	16.0	16.0	4.0	16.0	4.0	16.0	16.0
Minimum Split (s)	21.5	21.5	21.5	21.5	21.5	21.5	8.0	21.5	8.0	21.5	21.5
Total Split (s)	49.0	49.0	49.0	49.0	49.0	49.0	8.0	23.0	8.0	23.0	23.0
Total Split (%)	61.3%	61.3%	61.3%	61.3%	61.3%	61.3%	10.0%	28.8%	10.0%	28.8%	28.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.5	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5	4.0	5.5	5.5
Lead/Lag							Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	None	Max	Max
Act Effect Green (s)	39.9	39.9	39.9	39.9	39.9	39.9	24.0	19.4	23.1	17.6	17.6
Actuated g/C Ratio	0.52	0.52	0.52	0.52	0.52	0.52	0.31	0.25	0.30	0.23	0.23
v/c Ratio	0.41	0.91	0.20	0.62	0.93	0.21	0.65	0.39	0.38	0.38	0.14
Control Delay	27.4	31.9	2.5	44.4	34.0	2.1	32.0	25.2	23.7	29.2	8.6
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	27.4	31.9	2.5	44.4	34.0	2.1	32.0	25.2	23.7	29.2	8.6
LOS	C	C	A	D	C	A	C	C	C	C	A
Approach Delay		27.0			29.1			29.2		23.8	
Approach LOS		C			C			C		C	

Intersection Summary

Cycle Length: 80

Actuated Cycle Length: 76.6

Natural Cycle: 75

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.93

Intersection Signal Delay: 27.7

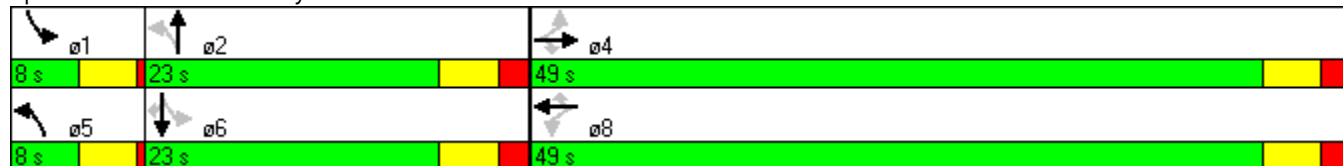
Intersection LOS: C

Intersection Capacity Utilization 83.2%

ICU Level of Service E

Analysis Period (min) 15

Splits and Phases: 6: Lundy's Lane & Thorold Townline Road



HCM Signalized Intersection Capacity Analysis <2031 Background> Weekday PM Peak Hour

6: Lundy's Lane & Thorold Townline Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	32	788	161	54	801	177	226	110	54	123	142	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1612	1881	1615	1805	1881	1615	1787	1783		1671	1863	1615
Flt Permitted	0.10	1.00	1.00	0.10	1.00	1.00	0.61	1.00		0.63	1.00	1.00
Satd. Flow (perm)	170	1881	1615	190	1881	1615	1157	1783		1109	1863	1615
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	36	895	183	61	910	201	257	125	61	140	161	57
RTOR Reduction (vph)	0	0	83	0	0	97	0	21	0	0	0	43
Lane Group Flow (vph)	36	895	100	61	910	104	257	165	0	140	161	14
Heavy Vehicles (%)	12%	1%	0%	0%	1%	0%	1%	2%	0%	8%	2%	0%
Turn Type	Perm		Perm	Perm		Perm	pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	39.9	39.9	39.9	39.9	39.9	39.9	23.4	19.4		21.6	18.5	18.5
Effective Green, g (s)	39.9	39.9	39.9	39.9	39.9	39.9	23.4	19.4		21.6	18.5	18.5
Actuated g/C Ratio	0.52	0.52	0.52	0.52	0.52	0.52	0.30	0.25		0.28	0.24	0.24
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
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)	88	970	833	98	970	833	382	447		332	445	386
v/s Ratio Prot		0.48			c0.48		c0.03	0.09		0.02	0.09	
v/s Ratio Perm	0.21		0.06	0.32		0.06	c0.17			0.10		0.01
v/c Ratio	0.41	0.92	0.12	0.62	0.94	0.12	0.67	0.37		0.42	0.36	0.04
Uniform Delay, d1	11.5	17.3	9.7	13.4	17.6	9.7	23.2	23.9		22.2	24.5	22.6
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	3.1	13.8	0.1	11.7	15.9	0.1	4.6	2.3		0.9	2.3	0.2
Delay (s)	14.6	31.1	9.7	25.1	33.5	9.8	27.8	26.3		23.1	26.8	22.8
Level of Service	B	C	A	C	C	A	C	C		C	C	C
Approach Delay (s)		27.1			29.0			27.2			24.7	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM Average Control Delay			27.5			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.78									
Actuated Cycle Length (s)			77.4			Sum of lost time (s)				9.5		
Intersection Capacity Utilization			83.2%			ICU Level of Service				E		
Analysis Period (min)			15									
c Critical Lane Group												

Timings
7: Lundy's Lane & Site Access 1

<2031 Background> Weekday PM Peak Hour

2018-11-23



Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Volume (vph)	81	872	1050	325	268
Turn Type	Perm			Perm	
Protected Phases		4	8		6
Permitted Phases	4			8	
Detector Phase	4	4	8	8	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	34.0	34.0	34.0	34.0	21.0
Total Split (%)	61.8%	61.8%	61.8%	61.8%	38.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	Max
Act Effect Green (s)	22.3	22.3	22.3	22.3	17.3
Actuated g/C Ratio	0.47	0.47	0.47	0.47	0.36
v/c Ratio	0.56	0.57	0.69	0.38	0.54
Control Delay	24.9	10.4	12.1	2.2	16.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	24.9	10.4	12.1	2.2	16.9
LOS	C	B	B	A	B
Approach Delay		11.6	9.8		16.9
Approach LOS		B	A		B

Intersection Summary

Cycle Length: 55

Actuated Cycle Length: 47.7

Natural Cycle: 55

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.69

Intersection Signal Delay: 11.3

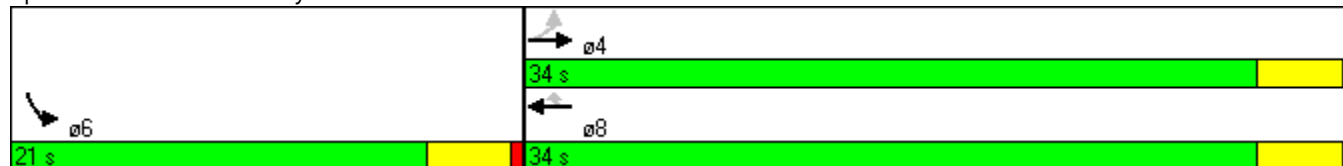
Intersection LOS: B

Intersection Capacity Utilization 61.7%

ICU Level of Service B

Analysis Period (min) 15

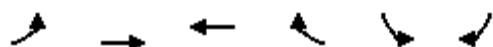
Splits and Phases: 7: Lundy's Lane & Site Access 1



HCM Signalized Intersection Capacity Analysis <2031 Background> Weekday PM Peak Hour

7: Lundy's Lane & Site Access 1

2018-11-23

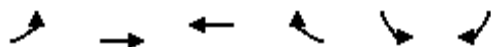


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	81	872	1050	325	268	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.98	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1770	3539	3539	1583	1748	
Flt Permitted	0.18	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	334	3539	3539	1583	1748	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	88	948	1141	353	291	59
RTOR Reduction (vph)	0	0	0	187	12	0
Lane Group Flow (vph)	88	948	1141	166	338	0
Turn Type	Perm		Perm			
Protected Phases	4		8		6	
Permitted Phases	4		8			
Actuated Green, G (s)	22.3	22.3	22.3	22.3	17.2	
Effective Green, g (s)	22.3	22.3	22.3	22.3	17.2	
Actuated g/C Ratio	0.47	0.47	0.47	0.47	0.36	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	157	1661	1661	743	633	
v/s Ratio Prot	0.27		c0.32		c0.19	
v/s Ratio Perm	0.26		0.10			
v/c Ratio	0.56	0.57	0.69	0.22	0.53	
Uniform Delay, d1	9.1	9.1	9.9	7.5	12.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	4.5	0.5	1.2	0.2	3.2	
Delay (s)	13.6	9.6	11.1	7.6	15.2	
Level of Service	B	A	B	A	B	
Approach Delay (s)	9.9		10.3		15.2	
Approach LOS	A		B		B	
Intersection Summary						
HCM Average Control Delay			10.7	HCM Level of Service		B
HCM Volume to Capacity ratio			0.62			
Actuated Cycle Length (s)			47.5	Sum of lost time (s)		8.0
Intersection Capacity Utilization			61.7%	ICU Level of Service		B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis<2031 Background> Weekday PM Peak Hour

8: Lundy's Lane & Site Access 2

2018-11-23



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	81	1140	996	81	0	54
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	88	1239	1083	88	0	59
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (m)		204				
pX, platoon unblocked						
vC, conflicting volume	1171				2542	1127
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1171				2542	1127
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	85				100	76
cM capacity (veh/h)	597				25	249
Direction, Lane #	EB 1	EB 2	WB 1	SB 1		
Volume Total	88	1239	1171	59		
Volume Left	88	0	0	0		
Volume Right	0	0	88	59		
cSH	597	1700	1700	249		
Volume to Capacity	0.15	0.73	0.69	0.24		
Queue Length 95th (m)	4.1	0.0	0.0	7.1		
Control Delay (s)	12.1	0.0	0.0	23.9		
Lane LOS	B			C		
Approach Delay (s)	0.8		0.0	23.9		
Approach LOS				C		
Intersection Summary						
Average Delay			1.0			
Intersection Capacity Utilization			75.2%		ICU Level of Service	D
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis<2031 Background> Weekday PM Peak Hour

9: Site Access 3 & Thorold Townline Road

2018-11-23



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	54	107	163	156	275	81
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	59	116	177	170	299	88
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	867	343	387			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	867	343	387			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	79	83	85			
cM capacity (veh/h)	274	700	1172			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	175	177	170	387		
Volume Left	59	177	0	0		
Volume Right	116	0	0	88		
cSH	460	1172	1700	1700		
Volume to Capacity	0.38	0.15	0.10	0.23		
Queue Length 95th (m)	14.0	4.3	0.0	0.0		
Control Delay (s)	17.5	8.6	0.0	0.0		
Lane LOS	C	A				
Approach Delay (s)	17.5	4.4		0.0		
Approach LOS	C					
Intersection Summary						
Average Delay			5.1			
Intersection Capacity Utilization			48.0%		ICU Level of Service	A
Analysis Period (min)			15			

Timings

<2021Total> Weekday AM Peak Hour

1: Niagara Falls Road & Davis Road

2018-11-23



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	120	34	22	29	5	931	84	465	42
Turn Type	Perm		Perm		Perm		Perm		Perm
Protected Phases		4		8		2		6	
Permitted Phases	4		8		2		6		6
Detector Phase	4	4	8	8	2	2	6	6	6
Switch Phase									
Minimum Initial (s)	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	35.0	35.0	35.0	35.0	35.0
Total Split (%)	36.4%	36.4%	36.4%	36.4%	63.6%	63.6%	63.6%	63.6%	63.6%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)	14.5	14.5		14.5	31.2	31.2	31.2	31.2	31.2
Actuated g/C Ratio	0.26	0.26		0.26	0.55	0.55	0.55	0.55	0.55
v/c Ratio	0.55	0.09		0.59	0.01	0.53	0.37	0.26	0.05
Control Delay	27.8	14.6		17.5	6.2	9.3	13.3	7.2	2.5
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.8	14.6		17.5	6.2	9.3	13.3	7.2	2.5
LOS	C	B		B	A	A	B	A	A
Approach Delay		24.6		17.5		9.3		7.7	
Approach LOS		C		B		A		A	

Intersection Summary

Cycle Length: 55

Actuated Cycle Length: 56.8

Natural Cycle: 45

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.59

Intersection Signal Delay: 11.2

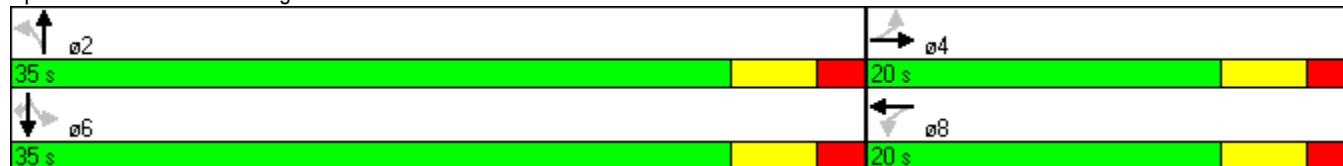
Intersection LOS: B

Intersection Capacity Utilization 85.7%

ICU Level of Service E

Analysis Period (min) 15

Splits and Phases: 1: Niagara Falls Road & Davis Road



HCM Signalized Intersection Capacity Analysis

<2021Total> Weekday AM Peak Hour

1: Niagara Falls Road & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	120	34	5	22	29	220	5	931	36	84	465	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5			5.5		5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.98			0.89		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	1817			1672		1641	3545		1787	3505	1553
Flt Permitted	0.49	1.00			0.97		0.47	1.00		0.23	1.00	1.00
Satd. Flow (perm)	913	1817			1637		813	3545		432	3505	1553
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	128	36	5	23	31	234	5	990	38	89	495	45
RTOR Reduction (vph)	0	4	0	0	70	0	0	5	0	0	0	20
Lane Group Flow (vph)	128	37	0	0	218	0	5	1023	0	89	495	25
Heavy Vehicles (%)	3%	3%	0%	7%	2%	0%	10%	1%	8%	1%	3%	4%
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	14.6	14.6			14.6		31.2	31.2		31.2	31.2	31.2
Effective Green, g (s)	14.6	14.6			14.6		31.2	31.2		31.2	31.2	31.2
Actuated g/C Ratio	0.26	0.26			0.26		0.55	0.55		0.55	0.55	0.55
Clearance Time (s)	5.5	5.5			5.5		5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	235	467			421		447	1947		237	1925	853
v/s Ratio Prot		0.02						c0.29			0.14	
v/s Ratio Perm	c0.14				0.13		0.01			0.21		0.02
v/c Ratio	0.54	0.08			0.52		0.01	0.53		0.38	0.26	0.03
Uniform Delay, d1	18.2	16.0			18.1		5.8	8.1		7.3	6.7	5.9
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.6	0.1			1.1		0.0	1.0		4.5	0.3	0.1
Delay (s)	20.8	16.1			19.2		5.9	9.1		11.8	7.0	5.9
Level of Service	C	B			B		A	A		B	A	A
Approach Delay (s)		19.7			19.2			9.1			7.6	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay	10.9			HCM Level of Service			B					
HCM Volume to Capacity ratio	0.53											
Actuated Cycle Length (s)	56.8			Sum of lost time (s)			11.0					
Intersection Capacity Utilization	85.7%			ICU Level of Service			E					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis 2: Beaverdams Road & Thorold Townline Road

<2021Total> Weekday AM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	30	99	15	35	235	22	30	139	68	19	96	29
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	32	105	16	37	250	23	32	148	72	20	102	31
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	153	311	252	153								
Volume Left (vph)	32	37	32	20								
Volume Right (vph)	16	23	72	31								
Hadj (s)	0.01	0.02	-0.04	-0.02								
Departure Headway (s)	5.6	5.3	5.4	5.6								
Degree Utilization, x	0.24	0.46	0.38	0.24								
Capacity (veh/h)	579	633	607	573								
Control Delay (s)	10.3	12.8	11.7	10.4								
Approach Delay (s)	10.3	12.8	11.7	10.4								
Approach LOS	B	B	B	B								
Intersection Summary												
Delay			11.6									
HCM Level of Service			B									
Intersection Capacity Utilization			42.2%		ICU Level of Service				A			
Analysis Period (min)			15									

Timings
3: Barker Parkway & Davis Road

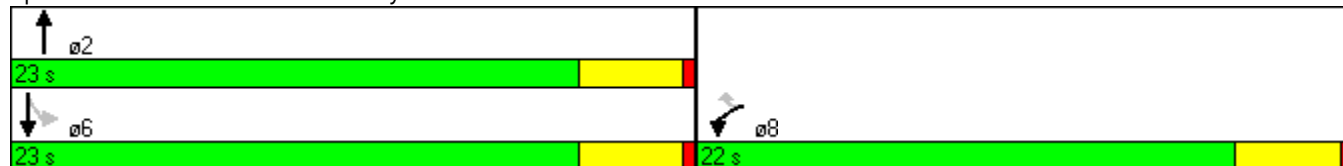
<2021Total> Weekday AM Peak Hour
2018-11-23

					
Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Configurations					
Volume (vph)	3	559	138	252	78
Turn Type	Perm		Perm		
Protected Phases	8		2		6
Permitted Phases		8		6	
Detector Phase	8	8	2	6	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	22.0	22.0	23.0	23.0	23.0
Total Split (%)	48.9%	48.9%	51.1%	51.1%	51.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	Max	Max	Max
Act Effect Green (s)	8.4	8.4	19.3	19.3	19.3
Actuated g/C Ratio	0.23	0.23	0.54	0.54	0.54
v/c Ratio	0.01	0.73	0.09	0.41	0.05
Control Delay	9.0	7.3	4.9	8.9	5.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	9.0	7.3	4.9	8.9	5.5
LOS	A	A	A	A	A
Approach Delay	7.3		4.9		8.1
Approach LOS	A		A		A

Intersection Summary

Cycle Length: 45
 Actuated Cycle Length: 35.8
 Natural Cycle: 40
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 0.73
 Intersection Signal Delay: 7.2
 Intersection LOS: A
 Intersection Capacity Utilization 45.8%
 ICU Level of Service A
 Analysis Period (min) 15

Splits and Phases: 3: Barker Parkway & Davis Road



HCM Signalized Intersection Capacity Analysis

3: Barker Parkway & Davis Road

<2021Total> Weekday AM Peak Hour

2018-11-23

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	3	559	138	22	252	78
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1538	3417		1805	3406
Flt Permitted	0.95	1.00	1.00		0.64	1.00
Satd. Flow (perm)	1805	1538	3417		1222	3406
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	3	601	148	24	271	84
RTOR Reduction (vph)	0	460	11	0	0	0
Lane Group Flow (vph)	3	141	161	0	271	84
Heavy Vehicles (%)	0%	5%	4%	0%	0%	6%
Turn Type	Perm			Perm		
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	8.4	8.4	19.3		19.3	19.3
Effective Green, g (s)	8.4	8.4	19.3		19.3	19.3
Actuated g/C Ratio	0.24	0.24	0.54		0.54	0.54
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	425	362	1847		661	1841
v/s Ratio Prot	0.00		0.05			0.02
v/s Ratio Perm		c0.09			c0.22	
v/c Ratio	0.01	0.39	0.09		0.41	0.05
Uniform Delay, d1	10.5	11.5	4.0		4.8	3.9
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.0	0.7	0.1		1.9	0.0
Delay (s)	10.5	12.2	4.0		6.7	3.9
Level of Service	B	B	A		A	A
Approach Delay (s)	12.2		4.0			6.1
Approach LOS	B		A			A
Intersection Summary						
HCM Average Control Delay			9.0		HCM Level of Service	A
HCM Volume to Capacity ratio			0.40			
Actuated Cycle Length (s)			35.7		Sum of lost time (s)	8.0
Intersection Capacity Utilization			45.8%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

Timings

4: Allanburg Road & Davis Road

<2021Total> Weekday AM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	56	0	46	67	0	45	238	63	119	22
Turn Type	Perm		Perm	Perm		Perm		Perm		Perm
Protected Phases		4			8		2		6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	4	4	4	8	8	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)		7.7	7.7		7.7	20.3	20.3	20.3	20.3	20.3
Actuated g/C Ratio		0.23	0.23		0.23	0.61	0.61	0.61	0.61	0.61
v/c Ratio		0.24	0.13		0.49	0.07	0.28	0.11	0.12	0.03
Control Delay		11.7	4.3		8.0	5.2	5.6	5.5	5.3	2.8
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		11.7	4.3		8.0	5.2	5.6	5.5	5.3	2.8
LOS		B	A		A	A	A	A	A	A
Approach Delay		8.4			8.0		5.6		5.1	
Approach LOS		A			A		A		A	

Intersection Summary

Cycle Length: 40

Actuated Cycle Length: 33.5

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.49

Intersection Signal Delay: 6.4

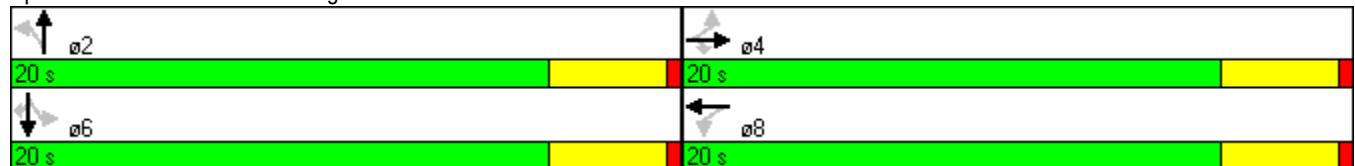
Intersection LOS: A

Intersection Capacity Utilization 46.6%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 4: Allanburg Road & Davis Road



HCM Signalized Intersection Capacity Analysis

<2021Total> Weekday AM Peak Hour

4: Allanburg Road & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	56	0	46	67	0	135	45	238	31	63	119	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.91		1.00	0.98		1.00	1.00	0.85
Flt Protected		0.95	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1671	1615		1700		1805	1788		1805	1792	1524
Flt Permitted		0.66	1.00		0.86		0.67	1.00		0.57	1.00	1.00
Satd. Flow (perm)		1164	1615		1494		1274	1788		1091	1792	1524
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	64	0	52	76	0	153	51	270	35	72	135	25
RTOR Reduction (vph)	0	0	42	0	123	0	0	8	0	0	0	11
Lane Group Flow (vph)	0	64	10	0	106	0	51	297	0	72	135	14
Heavy Vehicles (%)	8%	0%	0%	0%	0%	0%	0%	5%	0%	0%	6%	6%
Turn Type	Perm		Perm	Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		6.7	6.7		6.7		19.5	19.5		19.5	19.5	19.5
Effective Green, g (s)		6.7	6.7		6.7		19.5	19.5		19.5	19.5	19.5
Actuated g/C Ratio		0.20	0.20		0.20		0.57	0.57		0.57	0.57	0.57
Clearance Time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		228	316		293		726	1019		622	1022	869
v/s Ratio Prot							c0.17				0.08	
v/s Ratio Perm		0.05	0.01		c0.07		0.04			0.07		0.01
v/c Ratio		0.28	0.03		0.36		0.07	0.29		0.12	0.13	0.02
Uniform Delay, d1		11.7	11.1		11.9		3.3	3.8		3.4	3.4	3.2
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.7	0.0		0.8		0.2	0.7		0.4	0.3	0.0
Delay (s)		12.4	11.2		12.7		3.5	4.5		3.8	3.7	3.2
Level of Service		B	B		B		A	A		A	A	A
Approach Delay (s)		11.8			12.7			4.4			3.7	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay		7.2										
HCM Volume to Capacity ratio		0.31										
Actuated Cycle Length (s)		34.2										
Intersection Capacity Utilization		46.6%										
Analysis Period (min)		15										
c Critical Lane Group												

Timings
5: Lundy's Lane & Davis Road

<2021Total> Weekday AM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	151	400	95	406	63	29	141	41	84	148
Turn Type	pm+pt		pm+pt		Perm	Perm		pm+pt		Perm
Protected Phases	7	4	3	8			2	1	6	
Permitted Phases	4		8		8	2		6		6
Detector Phase	7	4	3	8	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	16.0	4.0	16.0	16.0	16.0	16.0	4.0	16.0	16.0
Minimum Split (s)	8.0	21.5	8.0	21.5	21.5	21.5	21.5	8.0	21.5	21.5
Total Split (s)	9.0	22.5	8.0	21.5	21.5	21.5	21.5	8.0	29.5	29.5
Total Split (%)	15.0%	37.5%	13.3%	35.8%	35.8%	35.8%	35.8%	13.3%	49.2%	49.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	2.0	0.5	2.0	2.0	2.0	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.5	4.0	5.5	5.5	5.5	5.5	4.0	5.5	5.5
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effect Green (s)	24.1	18.6	21.5	16.0	16.0	19.2	19.2	25.5	24.0	24.0
Actuated g/C Ratio	0.40	0.31	0.36	0.27	0.27	0.32	0.32	0.42	0.40	0.40
v/c Ratio	0.51	0.49	0.39	0.52	0.16	0.09	0.43	0.12	0.15	0.24
Control Delay	16.5	19.0	15.2	21.2	6.0	17.3	18.3	11.0	12.3	3.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.5	19.0	15.2	21.2	6.0	17.3	18.3	11.0	12.3	3.2
LOS	B	B	B	C	A	B	B	B	B	A
Approach Delay		18.4		18.4			18.2		7.2	
Approach LOS		B		B			B		A	

Intersection Summary

Cycle Length: 60

Actuated Cycle Length: 60

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.52

Intersection Signal Delay: 16.5

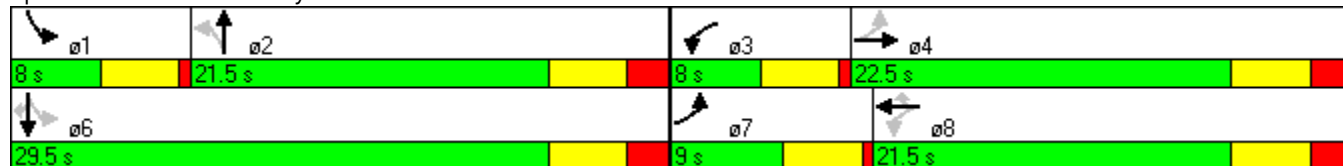
Intersection LOS: B

Intersection Capacity Utilization 65.4%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 5: Lundy's Lane & Davis Road



HCM Signalized Intersection Capacity Analysis

<2021Total> Weekday AM Peak Hour

5: Lundy's Lane & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	151	400	28	95	406	63	29	141	51	41	84	148
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	3414		1480	3539	1553	1626	1659		1719	1681	1599
Flt Permitted	0.37	1.00		0.44	1.00	1.00	0.69	1.00		0.48	1.00	1.00
Satd. Flow (perm)	681	3414		689	3539	1553	1183	1659		872	1681	1599
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	184	488	34	116	495	77	35	172	62	50	102	180
RTOR Reduction (vph)	0	8	0	0	0	56	0	20	0	0	0	106
Lane Group Flow (vph)	184	514	0	116	495	21	35	214	0	50	102	74
Heavy Vehicles (%)	3%	4%	15%	22%	2%	4%	11%	10%	10%	5%	13%	1%
Turn Type	pm+pt			pm+pt		Perm	Perm			pm+pt		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4			8		8	2			6		6
Actuated Green, G (s)	23.6	18.6		20.0	16.8	16.8	19.2	19.2		25.6	25.6	25.6
Effective Green, g (s)	23.6	18.6		20.0	16.8	16.8	19.2	19.2		25.6	25.6	25.6
Actuated g/C Ratio	0.38	0.30		0.32	0.27	0.27	0.31	0.31		0.41	0.41	0.41
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	343	1018		261	953	418	364	510		390	690	656
v/s Ratio Prot	c0.04	0.15		0.02	0.14			c0.13		0.00	c0.06	
v/s Ratio Perm	c0.16			0.12		0.01	0.03			0.05		0.05
v/c Ratio	0.54	0.50		0.44	0.52	0.05	0.10	0.42		0.13	0.15	0.11
Uniform Delay, d1	13.6	18.1		15.7	19.4	16.9	15.4	17.2		11.4	11.6	11.4
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.6	0.4		1.2	0.5	0.0	0.5	2.5		0.1	0.5	0.3
Delay (s)	15.3	18.5		16.9	19.9	16.9	15.9	19.7		11.5	12.0	11.7
Level of Service	B	B		B	B	B	B	B		B	B	B
Approach Delay (s)		17.6			19.0			19.2			11.8	
Approach LOS		B			B			B			B	
Intersection Summary												
HCM Average Control Delay			17.4			HCM Level of Service				B		
HCM Volume to Capacity ratio			0.49									
Actuated Cycle Length (s)			62.4			Sum of lost time (s)			19.0			
Intersection Capacity Utilization			65.4%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

Timings
6: Lundy's Lane & Thorold Townline Road

<2021Total> Weekday AM Peak Hour

2018-11-23

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	50	606	166	37	454	84	84	120	143	65	25
Turn Type	Perm		Perm	Perm		Perm	pm+pt		pm+pt		Perm
Protected Phases		4			8		5	2	1	6	
Permitted Phases	4		4	8		8	2		6		6
Detector Phase	4	4	4	8	8	8	5	2	1	6	6
Switch Phase											
Minimum Initial (s)	16.0	16.0	16.0	16.0	16.0	16.0	4.0	16.0	4.0	16.0	16.0
Minimum Split (s)	21.5	21.5	21.5	21.5	21.5	21.5	8.0	21.5	8.0	21.5	21.5
Total Split (s)	35.0	35.0	35.0	35.0	35.0	35.0	8.0	22.0	8.0	22.0	22.0
Total Split (%)	53.8%	53.8%	53.8%	53.8%	53.8%	53.8%	12.3%	33.8%	12.3%	33.8%	33.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.5	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5	4.0	5.5	5.5
Lead/Lag							Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	None	Max	Max
Act Effect Green (s)	26.1	26.1	26.1	26.1	26.1	26.1	21.4	16.8	21.4	16.8	16.8
Actuated g/C Ratio	0.43	0.43	0.43	0.43	0.43	0.43	0.36	0.28	0.36	0.28	0.28
v/c Ratio	0.24	0.84	0.23	0.33	0.63	0.13	0.19	0.33	0.37	0.14	0.06
Control Delay	14.3	27.2	2.8	20.1	17.7	3.2	13.5	19.3	16.5	19.6	8.4
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	14.3	27.2	2.8	20.1	17.7	3.2	13.5	19.3	16.5	19.6	8.4
LOS	B	C	A	C	B	A	B	B	B	B	A
Approach Delay		21.5			15.7			17.3		16.5	
Approach LOS		C			B			B		B	

Intersection Summary

Cycle Length: 65

Actuated Cycle Length: 60.1

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.84

Intersection Signal Delay: 18.6

Intersection LOS: B

Intersection Capacity Utilization 75.3%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 6: Lundy's Lane & Thorold Townline Road

		
ø1	ø2	ø4
8 s	22 s	35 s
		
ø5	ø6	ø8
8 s	22 s	35 s

HCM Signalized Intersection Capacity Analysis

6: Lundy's Lane & Thorold Townline Road

<2021Total> Weekday AM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	606	166	37	454	84	84	120	33	143	65	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1612	1881	1615	1805	1881	1615	1787	1809		1671	1863	1615
Flt Permitted	0.32	1.00	1.00	0.15	1.00	1.00	0.71	1.00		0.65	1.00	1.00
Satd. Flow (perm)	542	1881	1615	294	1881	1615	1333	1809		1139	1863	1615
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	57	689	189	42	516	95	95	136	38	162	74	28
RTOR Reduction (vph)	0	0	108	0	0	54	0	15	0	0	0	20
Lane Group Flow (vph)	57	689	81	42	516	41	95	159	0	162	74	8
Heavy Vehicles (%)	12%	1%	0%	0%	1%	0%	1%	2%	0%	8%	2%	0%
Turn Type	Perm		Perm	Perm		Perm	pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	26.1	26.1	26.1	26.1	26.1	26.1	19.8	16.8		19.8	16.8	16.8
Effective Green, g (s)	26.1	26.1	26.1	26.1	26.1	26.1	19.8	16.8		19.8	16.8	16.8
Actuated g/C Ratio	0.43	0.43	0.43	0.43	0.43	0.43	0.33	0.28		0.33	0.28	0.28
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
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)	232	806	692	126	806	692	456	499		397	514	446
v/s Ratio Prot		c0.37			0.27		0.01	0.09		c0.02	0.04	
v/s Ratio Perm	0.11		0.05	0.14		0.03	0.06			c0.11		0.00
v/c Ratio	0.25	0.85	0.12	0.33	0.64	0.06	0.21	0.32		0.41	0.14	0.02
Uniform Delay, d1	11.1	15.7	10.5	11.6	13.7	10.2	14.6	17.5		15.4	16.6	16.0
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	0.6	8.8	0.1	1.6	1.7	0.0	0.2	1.7		0.7	0.6	0.1
Delay (s)	11.7	24.5	10.5	13.2	15.4	10.2	14.9	19.2		16.1	17.2	16.1
Level of Service	B	C	B	B	B	B	B	B		B	B	B
Approach Delay (s)		20.9			14.5			17.7			16.4	
Approach LOS		C			B			B			B	
Intersection Summary												
HCM Average Control Delay			18.0			HCM Level of Service				B		
HCM Volume to Capacity ratio			0.64									
Actuated Cycle Length (s)			60.9			Sum of lost time (s)				13.5		
Intersection Capacity Utilization			75.3%			ICU Level of Service				D		
Analysis Period (min)			15									
c Critical Lane Group												

Timings
7: Lundy's Lane & Site Access 1

<2021Total> Weekday AM Peak Hour

2018-11-23



Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Volume (vph)	31	461	589	125	336
Turn Type	Perm			Perm	
Protected Phases		4	8		6
Permitted Phases	4			8	
Detector Phase	4	4	8	8	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	Max
Act Effect Green (s)	11.9	11.9	11.9	11.9	16.1
Actuated g/C Ratio	0.33	0.33	0.33	0.33	0.45
v/c Ratio	0.16	0.43	0.55	0.22	0.55
Control Delay	10.0	10.4	11.6	3.2	10.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	10.0	10.4	11.6	3.2	10.8
LOS	A	B	B	A	B
Approach Delay		10.4	10.1		10.8
Approach LOS		B	B		B

Intersection Summary

Cycle Length: 40

Actuated Cycle Length: 36.1

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.55

Intersection Signal Delay: 10.4

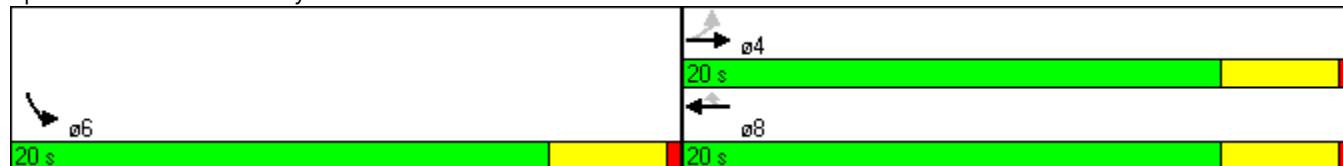
Intersection LOS: B

Intersection Capacity Utilization 52.3%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 7: Lundy's Lane & Site Access 1

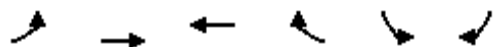


HCM Signalized Intersection Capacity Analysis

7: Lundy's Lane & Site Access 1

<2021Total> Weekday AM Peak Hour

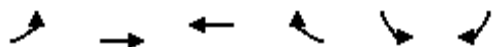
2018-11-23



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	31	461	589	125	336	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.98	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1770	3539	3539	1583	1748	
Flt Permitted	0.36	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	662	3539	3539	1583	1748	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	34	501	640	136	365	73
RTOR Reduction (vph)	0	0	0	91	17	0
Lane Group Flow (vph)	34	501	640	45	421	0
Turn Type	Perm		Perm			
Protected Phases	4		8		6	
Permitted Phases	4		8			
Actuated Green, G (s)	11.9	11.9	11.9	11.9	16.1	
Effective Green, g (s)	11.9	11.9	11.9	11.9	16.1	
Actuated g/C Ratio	0.33	0.33	0.33	0.33	0.45	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	219	1170	1170	523	782	
v/s Ratio Prot		0.14	c0.18		c0.24	
v/s Ratio Perm	0.05			0.03		
v/c Ratio	0.16	0.43	0.55	0.09	0.54	
Uniform Delay, d1	8.5	9.4	9.8	8.3	7.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.3	0.3	0.5	0.1	2.7	
Delay (s)	8.8	9.7	10.4	8.4	9.9	
Level of Service	A	A	B	A	A	
Approach Delay (s)		9.6	10.0		9.9	
Approach LOS		A	B		A	
Intersection Summary						
HCM Average Control Delay			9.9	HCM Level of Service		A
HCM Volume to Capacity ratio			0.54			
Actuated Cycle Length (s)			36.0	Sum of lost time (s)		8.0
Intersection Capacity Utilization			52.3%	ICU Level of Service		A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis 8: Lundy's Lane & Site Access 2

<2021Total> Weekday AM Peak Hour
2018-11-23



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	31	798	532	31	0	67
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	34	867	578	34	0	73
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (m)		204				
pX, platoon unblocked						
vC, conflicting volume	612				1530	595
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	612				1530	595
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				100	86
cM capacity (veh/h)	967				124	504
Direction, Lane #	EB 1	EB 2	WB 1	SB 1		
Volume Total	34	867	612	73		
Volume Left	34	0	0	0		
Volume Right	0	0	34	73		
cSH	967	1700	1700	504		
Volume to Capacity	0.03	0.51	0.36	0.14		
Queue Length 95th (m)	0.9	0.0	0.0	4.0		
Control Delay (s)	8.9	0.0	0.0	13.3		
Lane LOS	A			B		
Approach Delay (s)	0.3		0.0	13.3		
Approach LOS				B		
Intersection Summary						
Average Delay			0.8			
Intersection Capacity Utilization			52.8%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

9: Site Access 3 & Thorold Townline Road

<2021Total> Weekday AM Peak Hour

2018-11-23

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	67	135	63	191	115	31
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	73	147	68	208	125	34
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	486	142	159			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	486	142	159			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	86	84	95			
cM capacity (veh/h)	514	906	1421			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	220	68	208	159		
Volume Left	73	68	0	0		
Volume Right	147	0	0	34		
cSH	723	1421	1700	1700		
Volume to Capacity	0.30	0.05	0.12	0.09		
Queue Length 95th (m)	10.3	1.2	0.0	0.0		
Control Delay (s)	12.1	7.7	0.0	0.0		
Lane LOS	B	A				
Approach Delay (s)	12.1	1.9		0.0		
Approach LOS	B					
Intersection Summary						
Average Delay			4.9			
Intersection Capacity Utilization			33.4%		ICU Level of Service	A
Analysis Period (min)			15			

Timings

<2021 Total> Weekday PM Peak Hour

1: Niagara Falls Road & Davis Road

2018-11-23



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	93	31	47	57	11	763	175	1133	126
Turn Type	Perm		Perm		Perm		Perm		Perm
Protected Phases		4		8		2		6	
Permitted Phases	4		8		2		6		6
Detector Phase	4	4	8	8	2	2	6	6	6
Switch Phase									
Minimum Initial (s)	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	33.3%	33.3%	33.3%	33.3%	66.7%	66.7%	66.7%	66.7%	66.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)	14.5	14.5		14.5	36.0	36.0	36.0	36.0	36.0
Actuated g/C Ratio	0.24	0.24		0.24	0.58	0.58	0.58	0.58	0.58
v/c Ratio	0.50	0.09		0.62	0.07	0.40	0.55	0.59	0.14
Control Delay	29.8	16.4		17.6	6.8	7.6	15.6	9.6	1.7
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.8	16.4		17.6	6.8	7.6	15.6	9.6	1.7
LOS	C	B		B	A	A	B	A	A
Approach Delay		26.0		17.6		7.6		9.7	
Approach LOS		C		B		A		A	

Intersection Summary

Cycle Length: 60

Actuated Cycle Length: 61.6

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.62

Intersection Signal Delay: 10.7

Intersection LOS: B

Intersection Capacity Utilization 80.4%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 1: Niagara Falls Road & Davis Road



HCM Signalized Intersection Capacity Analysis

1: Niagara Falls Road & Davis Road

<2021 Total> Weekday PM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	93	31	6	47	57	179	11	763	27	175	1133	126
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5			5.5		5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.98			0.91		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	1810			1697		1641	3547		1787	3505	1553
Flt Permitted	0.45	1.00			0.94		0.18	1.00		0.31	1.00	1.00
Satd. Flow (perm)	836	1810			1605		310	3547		582	3505	1553
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	99	33	6	50	61	190	12	812	29	186	1205	134
RTOR Reduction (vph)	0	5	0	0	103	0	0	4	0	0	0	55
Lane Group Flow (vph)	99	34	0	0	198	0	12	837	0	186	1205	79
Heavy Vehicles (%)	3%	3%	0%	7%	2%	0%	10%	1%	8%	1%	3%	4%
Turn Type	Perm		Perm			Perm			Perm			Perm
Protected Phases	4		8			2			6			
Permitted Phases	4	8			2			6			6	
Actuated Green, G (s)	14.5	14.5	14.5			36.1			36.1	36.1	36.1	36.1
Effective Green, g (s)	14.5	14.5	14.5			36.1			36.1	36.1	36.1	36.1
Actuated g/C Ratio	0.24	0.24	0.24			0.59			0.59	0.59	0.59	0.59
Clearance Time (s)	5.5	5.5	5.5			5.5			5.5	5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0			3.0			3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	197	426	378			182			2079	341	2054	910
v/s Ratio Prot		0.02				0.24			c0.34			
v/s Ratio Perm	0.12	c0.12			0.04			0.32			0.05	
v/c Ratio	0.50	0.08	0.52			0.07			0.40	0.55	0.59	0.09
Uniform Delay, d1	20.4	18.4	20.5			5.5			6.9	7.8	8.0	5.6
Progression Factor	1.00	1.00	1.00			1.00			1.00	1.00	1.00	1.00
Incremental Delay, d2	2.0	0.1	1.3			0.7			0.6	6.1	1.2	0.2
Delay (s)	22.4	18.4	21.8			6.2			7.5	13.9	9.3	5.7
Level of Service	C	B	C			A			A	B	A	A
Approach Delay (s)		21.3	21.8			7.5			9.5			
Approach LOS		C	C			A			A			
Intersection Summary												
HCM Average Control Delay			10.8	HCM Level of Service			B					
HCM Volume to Capacity ratio			0.57									
Actuated Cycle Length (s)			61.6	Sum of lost time (s)			11.0					
Intersection Capacity Utilization			80.4%	ICU Level of Service			D					
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis 2: Beaverdams Road & Thorold Townline Road

<2021 Total> Weekday PM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	20	186	23	96	173	19	33	126	65	39	195	34
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	21	198	24	102	184	20	35	134	69	41	207	36
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	244	306	238	285								
Volume Left (vph)	21	102	35	41								
Volume Right (vph)	24	20	69	36								
Hadj (s)	-0.03	0.12	-0.04	0.03								
Departure Headway (s)	6.2	6.2	6.3	6.2								
Degree Utilization, x	0.42	0.53	0.41	0.49								
Capacity (veh/h)	511	526	515	522								
Control Delay (s)	13.7	16.0	13.6	15.1								
Approach Delay (s)	13.7	16.0	13.6	15.1								
Approach LOS	B	C	B	C								
Intersection Summary												
Delay				14.7								
HCM Level of Service				B								
Intersection Capacity Utilization				57.2%	ICU Level of Service	B						
Analysis Period (min)				15								

Timings
3: Barker Parkway & Davis Road

<2021 Total> Weekday PM Peak Hour

2018-11-23

					
Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Configurations					
Volume (vph)	8	444	137	674	182
Turn Type		Perm		Perm	
Protected Phases	8		2		6
Permitted Phases		8		6	
Detector Phase	8	8	2	6	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	55.0	55.0	55.0
Total Split (%)	26.7%	26.7%	73.3%	73.3%	73.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	Max	Max	Max
Act Effect Green (s)	8.4	8.4	51.2	51.2	51.2
Actuated g/C Ratio	0.12	0.12	0.76	0.76	0.76
v/c Ratio	0.04	0.78	0.06	0.77	0.08
Control Delay	25.0	13.0	2.6	14.3	2.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	25.0	13.0	2.6	14.3	2.8
LOS	C	B	A	B	A
Approach Delay	13.2		2.6		11.8
Approach LOS	B		A		B

Intersection Summary

Cycle Length: 75

Actuated Cycle Length: 67.6

Natural Cycle: 70

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.78

Intersection Signal Delay: 11.3

Intersection LOS: B

Intersection Capacity Utilization 54.8%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 3: Barker Parkway & Davis Road



HCM Signalized Intersection Capacity Analysis

3: Barker Parkway & Davis Road

<2021 Total> Weekday PM Peak Hour

2018-11-23

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	8	444	137	11	674	182
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1538	3442		1805	3406
Flt Permitted	0.95	1.00	1.00		0.65	1.00
Satd. Flow (perm)	1805	1538	3442		1237	3406
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	9	477	147	12	725	196
RTOR Reduction (vph)	0	418	3	0	0	0
Lane Group Flow (vph)	9	59	156	0	725	196
Heavy Vehicles (%)	0%	5%	4%	0%	0%	6%
Turn Type	Perm			Perm		
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	8.4	8.4	51.2		51.2	51.2
Effective Green, g (s)	8.4	8.4	51.2		51.2	51.2
Actuated g/C Ratio	0.12	0.12	0.76		0.76	0.76
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	224	191	2607		937	2580
v/s Ratio Prot	0.00		0.05			0.06
v/s Ratio Perm		c0.04			c0.59	
v/c Ratio	0.04	0.31	0.06		0.77	0.08
Uniform Delay, d1	26.1	27.0	2.1		4.8	2.1
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.1	0.9	0.0		6.2	0.1
Delay (s)	26.1	27.9	2.1		11.0	2.2
Level of Service	C	C	A		B	A
Approach Delay (s)	27.9		2.1			9.1
Approach LOS	C		A			A
Intersection Summary						
HCM Average Control Delay			14.2		HCM Level of Service	B
HCM Volume to Capacity ratio			0.71			
Actuated Cycle Length (s)			67.6		Sum of lost time (s)	8.0
Intersection Capacity Utilization			54.8%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

Timings

4: Allanburg Road & Davis Road

<2021 Total> Weekday PM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	38	0	45	58	0	76	193	178	203	50
Turn Type	Perm		Perm	Perm		Perm		Perm		Perm
Protected Phases		4			8		2		6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	4	4	4	8	8	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)		7.4	7.4		7.4	21.0	21.0	21.0	21.0	21.0
Actuated g/C Ratio		0.22	0.22		0.22	0.62	0.62	0.62	0.62	0.62
v/c Ratio		0.16	0.13		0.45	0.12	0.29	0.30	0.21	0.06
Control Delay		10.7	4.4		7.9	5.2	4.7	6.7	5.3	2.2
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		10.7	4.4		7.9	5.2	4.7	6.7	5.3	2.2
LOS		B	A		A	A	A	A	A	A
Approach Delay		7.3			7.9		4.8		5.5	
Approach LOS		A			A		A		A	

Intersection Summary

Cycle Length: 40

Actuated Cycle Length: 33.8

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.45

Intersection Signal Delay: 5.8

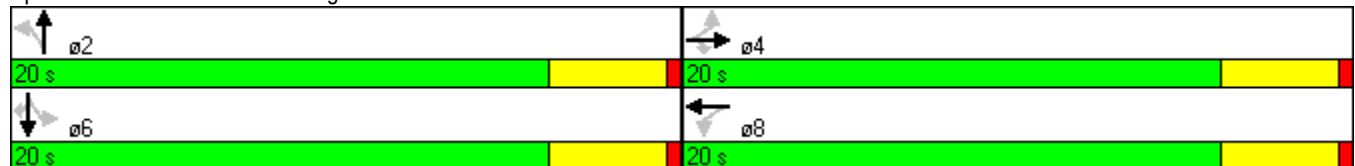
Intersection LOS: A

Intersection Capacity Utilization 52.4%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 4: Allanburg Road & Davis Road



HCM Signalized Intersection Capacity Analysis

4: Allanburg Road & Davis Road

<2021 Total> Weekday PM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	38	0	45	58	0	115	76	193	89	178	203	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.91		1.00	0.95		1.00	1.00	0.85
Flt Protected		0.95	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1671	1615		1701		1805	1750		1805	1792	1524
Flt Permitted		0.72	1.00		0.87		0.61	1.00		0.57	1.00	1.00
Satd. Flow (perm)		1261	1615		1507		1168	1750		1076	1792	1524
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	43	0	51	66	0	131	86	219	101	202	231	57
RTOR Reduction (vph)	0	0	42	0	107	0	0	29	0	0	0	24
Lane Group Flow (vph)	0	43	9	0	90	0	86	291	0	202	231	33
Heavy Vehicles (%)	8%	0%	0%	0%	0%	0%	0%	5%	0%	0%	6%	6%
Turn Type	Perm		Perm	Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		6.3	6.3		6.3		20.2	20.2		20.2	20.2	20.2
Effective Green, g (s)		6.3	6.3		6.3		20.2	20.2		20.2	20.2	20.2
Actuated g/C Ratio		0.18	0.18		0.18		0.59	0.59		0.59	0.59	0.59
Clearance Time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		230	295		275		684	1025		630	1049	892
v/s Ratio Prot								0.17			0.13	
v/s Ratio Perm		0.03	0.01		0.06		0.07			0.19		0.02
v/c Ratio		0.19	0.03		0.33		0.13	0.28		0.32	0.22	0.04
Uniform Delay, d1		11.9	11.6		12.3		3.2	3.6		3.6	3.4	3.0
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.4	0.0		0.7		0.4	0.7		1.3	0.5	0.1
Delay (s)		12.3	11.6		13.0		3.6	4.3		5.0	3.9	3.1
Level of Service		B	B		B		A	A		A	A	A
Approach Delay (s)		12.0			13.0			4.1			4.3	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay		6.3										
HCM Volume to Capacity ratio		0.32										
Actuated Cycle Length (s)		34.5										
Intersection Capacity Utilization		52.4%										
Analysis Period (min)		15										
c Critical Lane Group												

Timings
5: Lundy's Lane & Davis Road

<2021 Total> Weekday PM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	187	650	82	541	60	58	116	66	122	164
Turn Type	pm+pt		pm+pt		Perm	Perm		pm+pt		Perm
Protected Phases	7	4	3	8			2	1	6	
Permitted Phases	4		8		8	2		6		6
Detector Phase	7	4	3	8	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	16.0	4.0	16.0	16.0	16.0	16.0	4.0	16.0	16.0
Minimum Split (s)	8.0	21.5	8.0	21.5	21.5	21.5	21.5	8.0	21.5	21.5
Total Split (s)	15.0	34.0	9.0	28.0	28.0	29.0	29.0	8.0	37.0	37.0
Total Split (%)	18.8%	42.5%	11.3%	35.0%	35.0%	36.3%	36.3%	10.0%	46.3%	46.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	2.0	0.5	2.0	2.0	2.0	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.5	4.0	5.5	5.5	5.5	5.5	4.0	5.5	5.5
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effect Green (s)	35.3	26.7	26.0	19.5	19.5	25.3	25.3	33.1	31.6	31.6
Actuated g/C Ratio	0.46	0.35	0.34	0.26	0.26	0.33	0.33	0.43	0.41	0.41
v/c Ratio	0.64	0.70	0.48	0.73	0.16	0.19	0.48	0.21	0.21	0.26
Control Delay	21.2	25.2	21.2	31.4	6.9	22.6	20.7	15.5	16.4	3.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.2	25.2	21.2	31.4	6.9	22.6	20.7	15.5	16.4	3.5
LOS	C	C	C	C	A	C	C	B	B	A
Approach Delay		24.4		28.0			21.1		10.2	
Approach LOS		C		C			C		B	

Intersection Summary

Cycle Length: 80

Actuated Cycle Length: 76.4

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.73

Intersection Signal Delay: 22.8

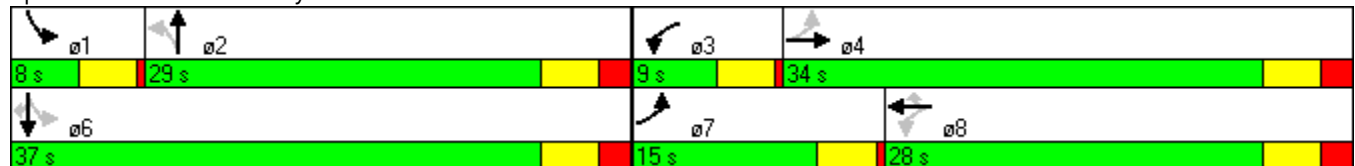
Intersection LOS: C

Intersection Capacity Utilization 69.1%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 5: Lundy's Lane & Davis Road



HCM Signalized Intersection Capacity Analysis

5: Lundy's Lane & Davis Road

<2021 Total> Weekday PM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	187	650	36	82	541	60	58	116	111	66	122	164
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	3425		1480	3539	1553	1626	1601		1719	1681	1599
Flt Permitted	0.20	1.00		0.26	1.00	1.00	0.66	1.00		0.43	1.00	1.00
Satd. Flow (perm)	367	3425		403	3539	1553	1134	1601		774	1681	1599
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	228	793	44	100	660	73	71	141	135	80	149	200
RTOR Reduction (vph)	0	5	0	0	0	54	0	41	0	0	0	117
Lane Group Flow (vph)	228	832	0	100	660	19	71	235	0	80	149	83
Heavy Vehicles (%)	3%	4%	15%	22%	2%	4%	11%	10%	10%	5%	13%	1%
Turn Type	pm+pt			pm+pt		Perm	Perm			pm+pt		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4			8		8	2			6		6
Actuated Green, G (s)	34.7	26.8		24.3	20.4	20.4	25.3	25.3		32.4	32.4	32.4
Effective Green, g (s)	34.7	26.8		24.3	20.4	20.4	25.3	25.3		32.4	32.4	32.4
Actuated g/C Ratio	0.44	0.34		0.31	0.26	0.26	0.32	0.32		0.41	0.41	0.41
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	346	1175		179	924	406	367	519		359	697	663
v/s Ratio Prot	c0.09	c0.24		0.03	0.19			c0.15		0.01	c0.09	
v/s Ratio Perm	0.21			0.15		0.01	0.06			0.08		0.05
v/c Ratio	0.66	0.71		0.56	0.71	0.05	0.19	0.45		0.22	0.21	0.13
Uniform Delay, d1	15.3	22.3		20.1	26.2	21.6	19.0	20.9		14.5	14.7	14.1
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.5	2.0		3.7	2.6	0.0	1.2	2.8		0.3	0.7	0.4
Delay (s)	19.8	24.2		23.8	28.8	21.6	20.2	23.7		14.8	15.4	14.5
Level of Service	B	C		C	C	C	C	C		B	B	B
Approach Delay (s)		23.3			27.6			23.0			14.9	
Approach LOS		C			C			C			B	
Intersection Summary												
HCM Average Control Delay			23.2			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.56									
Actuated Cycle Length (s)			78.1			Sum of lost time (s)			15.0			
Intersection Capacity Utilization			69.1%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

Timings
6: Lundy's Lane & Thorold Townline Road

<2021 Total> Weekday PM Peak Hour

2018-11-23

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	27	701	146	45	746	190	208	90	128	117	41
Turn Type	Perm		Perm	Perm		Perm	pm+pt		pm+pt		Perm
Protected Phases		4			8		5	2	1	6	
Permitted Phases	4		4	8		8	2		6		6
Detector Phase	4	4	4	8	8	8	5	2	1	6	6
Switch Phase											
Minimum Initial (s)	16.0	16.0	16.0	16.0	16.0	16.0	4.0	16.0	4.0	16.0	16.0
Minimum Split (s)	21.5	21.5	21.5	21.5	21.5	21.5	8.0	21.5	8.0	21.5	21.5
Total Split (s)	49.0	49.0	49.0	49.0	49.0	49.0	8.0	23.0	8.0	23.0	23.0
Total Split (%)	61.3%	61.3%	61.3%	61.3%	61.3%	61.3%	10.0%	28.8%	10.0%	28.8%	28.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.5	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5	4.0	5.5	5.5
Lead/Lag							Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	None	Max	Max
Act Effect Green (s)	36.8	36.8	36.8	36.8	36.8	36.8	24.2	19.6	23.2	17.7	17.7
Actuated g/C Ratio	0.50	0.50	0.50	0.50	0.50	0.50	0.33	0.27	0.31	0.24	0.24
v/c Ratio	0.33	0.85	0.19	0.44	0.90	0.24	0.55	0.31	0.37	0.30	0.11
Control Delay	22.1	25.6	2.2	25.2	30.9	2.1	26.8	22.6	22.6	27.3	9.0
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	22.1	25.6	2.2	25.2	30.9	2.1	26.8	22.6	22.6	27.3	9.0
LOS	C	C	A	C	C	A	C	C	C	C	A
Approach Delay		21.6			25.0			25.2		22.6	
Approach LOS		C			C			C		C	

Intersection Summary

Cycle Length: 80

Actuated Cycle Length: 73.7

Natural Cycle: 70

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.90

Intersection Signal Delay: 23.6

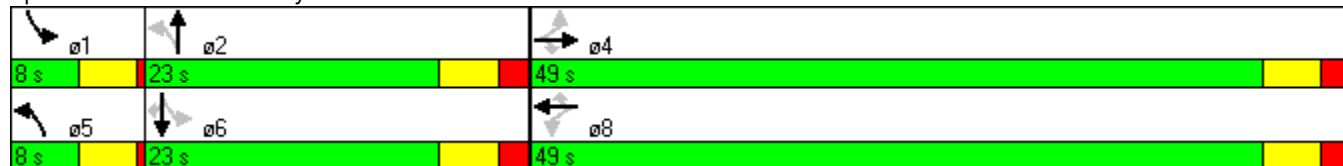
Intersection LOS: C

Intersection Capacity Utilization 76.6%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 6: Lundy's Lane & Thorold Townline Road



HCM Signalized Intersection Capacity Analysis

6: Lundy's Lane & Thorold Townline Road

<2021 Total> Weekday PM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	27	701	146	45	746	190	208	90	45	128	117	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1612	1881	1615	1805	1881	1615	1787	1781		1671	1863	1615
Flt Permitted	0.11	1.00	1.00	0.12	1.00	1.00	0.64	1.00		0.66	1.00	1.00
Satd. Flow (perm)	184	1881	1615	232	1881	1615	1206	1781		1161	1863	1615
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	31	797	166	51	848	216	236	102	51	145	133	47
RTOR Reduction (vph)	0	0	84	0	0	109	0	21	0	0	0	35
Lane Group Flow (vph)	31	797	82	51	848	107	236	132	0	145	133	12
Heavy Vehicles (%)	12%	1%	0%	0%	1%	0%	1%	2%	0%	8%	2%	0%
Turn Type	Perm		Perm	Perm		Perm	pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	36.8	36.8	36.8	36.8	36.8	36.8	23.6	19.6		21.8	18.7	18.7
Effective Green, g (s)	36.8	36.8	36.8	36.8	36.8	36.8	23.6	19.6		21.8	18.7	18.7
Actuated g/C Ratio	0.49	0.49	0.49	0.49	0.49	0.49	0.32	0.26		0.29	0.25	0.25
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
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)	91	929	798	115	929	798	413	469		361	468	405
v/s Ratio Prot		0.42			c0.45		c0.03	0.07		0.02	0.07	
v/s Ratio Perm	0.17		0.05	0.22		0.07	c0.15			0.10		0.01
v/c Ratio	0.34	0.86	0.10	0.44	0.91	0.13	0.57	0.28		0.40	0.28	0.03
Uniform Delay, d1	11.5	16.6	10.0	12.2	17.4	10.2	20.7	21.8		20.5	22.5	21.1
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	2.2	7.9	0.1	2.7	13.0	0.1	1.9	1.5		0.7	1.5	0.1
Delay (s)	13.7	24.5	10.1	14.9	30.4	10.3	22.6	23.3		21.3	24.0	21.2
Level of Service	B	C	B	B	C	B	C	C		C	C	C
Approach Delay (s)		21.7			25.8			22.9			22.4	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM Average Control Delay			23.6			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.72									
Actuated Cycle Length (s)			74.5			Sum of lost time (s)			9.5			
Intersection Capacity Utilization			76.6%			ICU Level of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

Timings
7: Lundy's Lane & Site Access 1

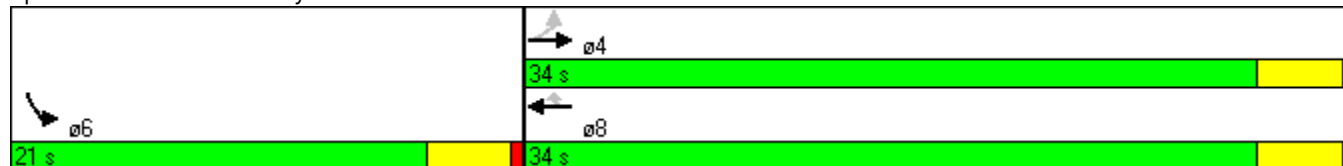
<2021 Total> Weekday PM Peak Hour
2018-11-23

					
Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Volume (vph)	89	738	934	355	288
Turn Type	Perm			Perm	
Protected Phases		4	8		6
Permitted Phases	4			8	
Detector Phase	4	4	8	8	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	34.0	34.0	34.0	34.0	21.0
Total Split (%)	61.8%	61.8%	61.8%	61.8%	38.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	Max
Act Effect Green (s)	20.2	20.2	20.2	20.2	17.3
Actuated g/C Ratio	0.44	0.44	0.44	0.44	0.38
v/c Ratio	0.60	0.51	0.65	0.42	0.56
Control Delay	25.7	10.0	11.7	2.5	16.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	25.7	10.0	11.7	2.5	16.7
LOS	C	B	B	A	B
Approach Delay		11.7	9.2		16.7
Approach LOS		B	A		B

Intersection Summary

Cycle Length: 55
 Actuated Cycle Length: 45.6
 Natural Cycle: 50
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 0.65
 Intersection Signal Delay: 11.1
 Intersection LOS: B
 Intersection Capacity Utilization 60.2%
 ICU Level of Service B
 Analysis Period (min) 15

Splits and Phases: 7: Lundy's Lane & Site Access 1

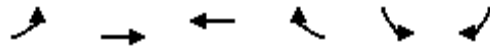


HCM Signalized Intersection Capacity Analysis

7: Lundy's Lane & Site Access 1

<2021 Total> Weekday PM Peak Hour

2018-11-23

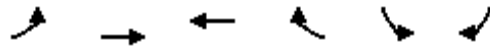


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	89	738	934	355	288	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.98	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1770	3539	3539	1583	1748	
Flt Permitted	0.20	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	369	3539	3539	1583	1748	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	97	802	1015	386	313	63
RTOR Reduction (vph)	0	0	0	215	12	0
Lane Group Flow (vph)	97	802	1015	171	364	0
Turn Type	Perm		Perm			
Protected Phases	4		8		6	
Permitted Phases	4		8			
Actuated Green, G (s)	20.2	20.2	20.2	20.2	17.3	
Effective Green, g (s)	20.2	20.2	20.2	20.2	17.3	
Actuated g/C Ratio	0.44	0.44	0.44	0.44	0.38	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	164	1571	1571	703	665	
v/s Ratio Prot		0.23	c0.29		c0.21	
v/s Ratio Perm	0.26			0.11		
v/c Ratio	0.59	0.51	0.65	0.24	0.55	
Uniform Delay, d1	9.5	9.1	9.9	7.9	11.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	5.6	0.3	0.9	0.2	3.2	
Delay (s)	15.2	9.4	10.8	8.1	14.3	
Level of Service	B	A	B	A	B	
Approach Delay (s)		10.0	10.0		14.3	
Approach LOS		B	B		B	
Intersection Summary						
HCM Average Control Delay			10.6	HCM Level of Service		B
HCM Volume to Capacity ratio			0.60			
Actuated Cycle Length (s)			45.5	Sum of lost time (s)		8.0
Intersection Capacity Utilization			60.2%	ICU Level of Service		B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis 8: Lundy's Lane & Site Access 2

<2021 Total> Weekday PM Peak Hour

2018-11-23



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	89	1025	906	89	0	58
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	97	1114	985	97	0	63
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (m)		204				
pX, platoon unblocked						
vC, conflicting volume	1082				2341	1033
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1082				2341	1033
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	85				100	78
cM capacity (veh/h)	645				34	282
Direction, Lane #	EB 1	EB 2	WB 1	SB 1		
Volume Total	97	1114	1082	63		
Volume Left	97	0	0	0		
Volume Right	0	0	97	63		
cSH	645	1700	1700	282		
Volume to Capacity	0.15	0.66	0.64	0.22		
Queue Length 95th (m)	4.2	0.0	0.0	6.7		
Control Delay (s)	11.6	0.0	0.0	21.4		
Lane LOS	B			C		
Approach Delay (s)	0.9		0.0	21.4		
Approach LOS				C		
Intersection Summary						
Average Delay			1.0			
Intersection Capacity Utilization			71.6%		ICU Level of Service	C
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

9: Site Access 3 & Thorold Townline Road

<2021 Total> Weekday PM Peak Hour

2018-11-23

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	58	115	178	129	225	89
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	63	125	193	140	245	97
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	820	293	341			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	820	293	341			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	78	83	84			
cM capacity (veh/h)	290	746	1218			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	188	193	140	341		
Volume Left	63	193	0	0		
Volume Right	125	0	0	97		
cSH	488	1218	1700	1700		
Volume to Capacity	0.38	0.16	0.08	0.20		
Queue Length 95th (m)	14.3	4.5	0.0	0.0		
Control Delay (s)	16.9	8.5	0.0	0.0		
Lane LOS	C	A				
Approach Delay (s)	16.9	4.9		0.0		
Approach LOS	C					
Intersection Summary						
Average Delay			5.6			
Intersection Capacity Utilization			47.4%		ICU Level of Service	A
Analysis Period (min)			15			

Timings

<2026 Total> Weekday AM Peak Hour

1: Niagara Falls Road & Davis Road

2018-11-23



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	132	37	25	32	6	965	93	484	47
Turn Type	Perm		Perm		Perm		Perm		Perm
Protected Phases		4		8		2		6	
Permitted Phases	4		8		2		6		6
Detector Phase	4	4	8	8	2	2	6	6	6
Switch Phase									
Minimum Initial (s)	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	35.0	35.0	35.0	35.0	35.0
Total Split (%)	36.4%	36.4%	36.4%	36.4%	63.6%	63.6%	63.6%	63.6%	63.6%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)	14.5	14.5		14.5	30.6	30.6	30.6	30.6	30.6
Actuated g/C Ratio	0.26	0.26		0.26	0.55	0.55	0.55	0.55	0.55
v/c Ratio	0.64	0.09		0.66	0.01	0.55	0.45	0.27	0.06
Control Delay	34.9	14.5		20.8	6.2	9.6	16.3	7.3	2.4
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.9	14.5		20.8	6.2	9.6	16.3	7.3	2.4
LOS	C	B		C	A	A	B	A	A
Approach Delay		30.0		20.8		9.6		8.3	
Approach LOS		C		C		A		A	

Intersection Summary

Cycle Length: 55

Actuated Cycle Length: 56.1

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.66

Intersection Signal Delay: 12.5

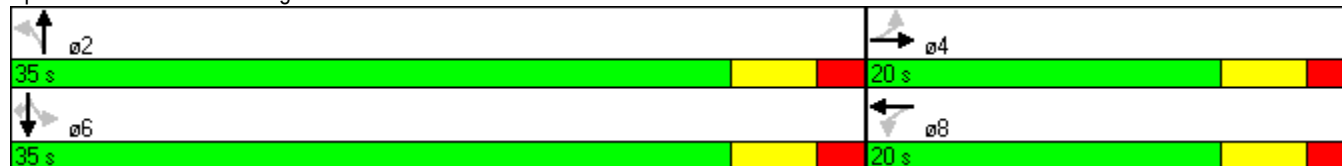
Intersection LOS: B

Intersection Capacity Utilization 88.5%

ICU Level of Service E

Analysis Period (min) 15

Splits and Phases: 1: Niagara Falls Road & Davis Road



HCM Signalized Intersection Capacity Analysis

1: Niagara Falls Road & Davis Road

<2026 Total> Weekday AM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	132	37	6	25	32	243	6	965	40	93	484	47
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5			5.5		5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.98			0.89		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	1815			1672		1641	3543		1787	3505	1553
Flt Permitted	0.46	1.00			0.97		0.46	1.00		0.21	1.00	1.00
Satd. Flow (perm)	842	1815			1632		798	3543		402	3505	1553
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	140	39	6	27	34	259	6	1027	43	99	515	50
RTOR Reduction (vph)	0	4	0	0	64	0	0	5	0	0	0	23
Lane Group Flow (vph)	140	41	0	0	256	0	6	1065	0	99	515	27
Heavy Vehicles (%)	3%	3%	0%	7%	2%	0%	10%	1%	8%	1%	3%	4%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	14.5	14.5			14.5		30.5	30.5		30.5	30.5	30.5
Effective Green, g (s)	14.5	14.5			14.5		30.5	30.5		30.5	30.5	30.5
Actuated g/C Ratio	0.26	0.26			0.26		0.54	0.54		0.54	0.54	0.54
Clearance Time (s)	5.5	5.5			5.5		5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	218	470			423		435	1930		219	1909	846
v/s Ratio Prot		0.02						c0.30			0.15	
v/s Ratio Perm	c0.17				0.16		0.01			0.25		0.02
v/c Ratio	0.64	0.09			0.61		0.01	0.55		0.45	0.27	0.03
Uniform Delay, d1	18.4	15.7			18.2		5.8	8.3		7.7	6.8	5.9
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.3	0.1			2.5		0.1	1.1		6.6	0.3	0.1
Delay (s)	24.8	15.8			20.7		5.9	9.4		14.3	7.2	6.0
Level of Service	C	B			C		A	A		B	A	A
Approach Delay (s)		22.6			20.7			9.4			8.1	
Approach LOS		C			C			A			A	
Intersection Summary												
HCM Average Control Delay			11.7	HCM Level of Service			B					
HCM Volume to Capacity ratio			0.58									
Actuated Cycle Length (s)			56.0	Sum of lost time (s)			11.0					
Intersection Capacity Utilization			88.5%	ICU Level of Service			E					
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis 2: Beaverdams Road & Thorold Townline Road

<2026 Total> Weekday AM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	33	109	16	36	259	25	33	153	68	21	105	32
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	35	116	17	38	276	27	35	163	72	22	112	34
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	168	340	270	168								
Volume Left (vph)	35	38	35	22								
Volume Right (vph)	17	27	72	34								
Hadj (s)	0.01	0.02	-0.02	-0.02								
Departure Headway (s)	5.8	5.5	5.7	5.9								
Degree Utilization, x	0.27	0.52	0.43	0.27								
Capacity (veh/h)	552	613	583	545								
Control Delay (s)	11.0	14.4	12.8	11.1								
Approach Delay (s)	11.0	14.4	12.8	11.1								
Approach LOS	B	B	B	B								
Intersection Summary												
Delay				12.7								
HCM Level of Service				B								
Intersection Capacity Utilization				45.1%	ICU Level of Service	A						
Analysis Period (min)				15								

Timings
3: Barker Parkway & Davis Road

<2026 Total> Weekday AM Peak Hour

2018-11-23

					
Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Configurations					
Volume (vph)	4	568	139	255	79
Turn Type	Perm		Perm		
Protected Phases	8		2		6
Permitted Phases		8		6	
Detector Phase	8	8	2	6	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	22.0	22.0	23.0	23.0	23.0
Total Split (%)	48.9%	48.9%	51.1%	51.1%	51.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	Max	Max	Max
Act Effect Green (s)	8.4	8.4	19.3	19.3	19.3
Actuated g/C Ratio	0.23	0.23	0.54	0.54	0.54
v/c Ratio	0.01	0.74	0.10	0.42	0.05
Control Delay	9.0	7.4	4.8	9.0	5.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	9.0	7.4	4.8	9.0	5.5
LOS	A	A	A	A	A
Approach Delay	7.4		4.8		8.2
Approach LOS	A		A		A

Intersection Summary

Cycle Length: 45

Actuated Cycle Length: 35.8

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.74

Intersection Signal Delay: 7.2

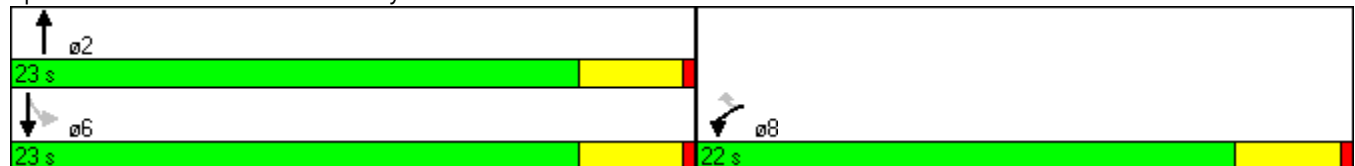
Intersection LOS: A

Intersection Capacity Utilization 46.5%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 3: Barker Parkway & Davis Road



HCM Signalized Intersection Capacity Analysis

3: Barker Parkway & Davis Road

<2026 Total> Weekday AM Peak Hour

2018-11-23

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	4	568	139	25	255	79
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1538	3411		1805	3406
Flt Permitted	0.95	1.00	1.00		0.64	1.00
Satd. Flow (perm)	1805	1538	3411		1217	3406
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	4	611	149	27	274	85
RTOR Reduction (vph)	0	467	12	0	0	0
Lane Group Flow (vph)	4	144	164	0	274	85
Heavy Vehicles (%)	0%	5%	4%	0%	0%	6%
Turn Type	Perm			Perm		
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	8.4	8.4	19.3		19.3	19.3
Effective Green, g (s)	8.4	8.4	19.3		19.3	19.3
Actuated g/C Ratio	0.24	0.24	0.54		0.54	0.54
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	425	362	1844		658	1841
v/s Ratio Prot	0.00		0.05			0.02
v/s Ratio Perm		c0.09			c0.23	
v/c Ratio	0.01	0.40	0.09		0.42	0.05
Uniform Delay, d1	10.5	11.5	4.0		4.9	3.9
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.0	0.7	0.1		1.9	0.0
Delay (s)	10.5	12.2	4.1		6.8	3.9
Level of Service	B	B	A		A	A
Approach Delay (s)	12.2		4.1			6.1
Approach LOS	B		A			A
Intersection Summary						
HCM Average Control Delay			9.1		HCM Level of Service	A
HCM Volume to Capacity ratio			0.41			
Actuated Cycle Length (s)			35.7		Sum of lost time (s)	8.0
Intersection Capacity Utilization			46.5%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

Timings

4: Allanburg Road & Davis Road

<2026 Total> Weekday AM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	62	0	50	67	0	49	262	63	131	25
Turn Type	Perm		Perm	Perm		Perm		Perm		Perm
Protected Phases		4			8		2		6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	4	4	4	8	8	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)		7.8	7.8		7.8	20.2	20.2	20.2	20.2	20.2
Actuated g/C Ratio		0.23	0.23		0.23	0.60	0.60	0.60	0.60	0.60
v/c Ratio		0.26	0.14		0.49	0.07	0.31	0.11	0.14	0.03
Control Delay		12.0	4.2		7.9	5.2	5.9	5.6	5.4	2.7
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		12.0	4.2		7.9	5.2	5.9	5.6	5.4	2.7
LOS		B	A		A	A	A	A	A	A
Approach Delay		8.5			7.9		5.8		5.1	
Approach LOS		A			A		A		A	

Intersection Summary

Cycle Length: 40

Actuated Cycle Length: 33.5

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.49

Intersection Signal Delay: 6.5

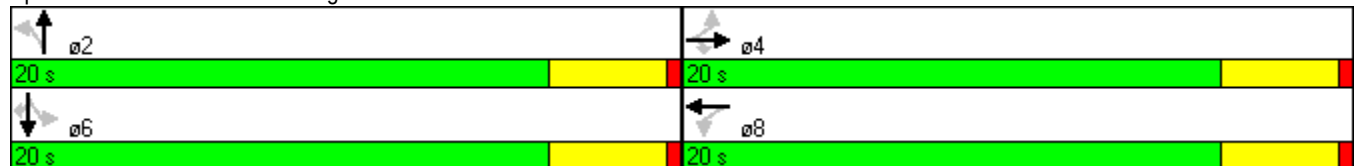
Intersection LOS: A

Intersection Capacity Utilization 47.8%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 4: Allanburg Road & Davis Road



HCM Signalized Intersection Capacity Analysis

4: Allanburg Road & Davis Road

<2026 Total> Weekday AM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	62	0	50	67	0	135	49	262	31	63	131	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.91		1.00	0.98		1.00	1.00	0.85
Flt Protected		0.95	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1671	1615		1700		1805	1790		1805	1792	1524
Flt Permitted		0.66	1.00		0.86		0.66	1.00		0.56	1.00	1.00
Satd. Flow (perm)		1164	1615		1490		1258	1790		1064	1792	1524
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	70	0	57	76	0	153	56	298	35	72	149	28
RTOR Reduction (vph)	0	0	46	0	123	0	0	8	0	0	0	12
Lane Group Flow (vph)	0	70	11	0	106	0	56	325	0	72	149	16
Heavy Vehicles (%)	8%	0%	0%	0%	0%	0%	0%	5%	0%	0%	6%	6%
Turn Type	Perm		Perm	Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		6.7	6.7		6.7		19.5	19.5		19.5	19.5	19.5
Effective Green, g (s)		6.7	6.7		6.7		19.5	19.5		19.5	19.5	19.5
Actuated g/C Ratio		0.20	0.20		0.20		0.57	0.57		0.57	0.57	0.57
Clearance Time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		228	316		292		717	1021		607	1022	869
v/s Ratio Prot							c0.18				0.08	
v/s Ratio Perm		0.06	0.01		c0.07		0.04			0.07		0.01
v/c Ratio		0.31	0.04		0.36		0.08	0.32		0.12	0.15	0.02
Uniform Delay, d1		11.8	11.1		11.9		3.3	3.9		3.4	3.4	3.2
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.8	0.0		0.8		0.2	0.8		0.4	0.3	0.0
Delay (s)		12.5	11.2		12.7		3.5	4.7		3.8	3.7	3.2
Level of Service		B	B		B		A	A		A	A	A
Approach Delay (s)		11.9			12.7			4.5			3.7	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay		7.1					HCM Level of Service			A		
HCM Volume to Capacity ratio		0.33										
Actuated Cycle Length (s)		34.2					Sum of lost time (s)			8.0		
Intersection Capacity Utilization		47.8%					ICU Level of Service			A		
Analysis Period (min)		15										
c Critical Lane Group												

Timings
5: Lundy's Lane & Davis Road

<2026 Total> Weekday AM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	163	439	97	441	69	32	156	46	93	156
Turn Type	pm+pt		pm+pt		Perm	Perm		pm+pt		Perm
Protected Phases	7	4	3	8			2	1	6	
Permitted Phases	4		8		8	2		6		6
Detector Phase	7	4	3	8	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	16.0	4.0	16.0	16.0	16.0	16.0	4.0	16.0	16.0
Minimum Split (s)	8.0	21.5	8.0	21.5	21.5	21.5	21.5	8.0	21.5	21.5
Total Split (s)	9.0	22.5	8.0	21.5	21.5	21.5	21.5	8.0	29.5	29.5
Total Split (%)	15.0%	37.5%	13.3%	35.8%	35.8%	35.8%	35.8%	13.3%	49.2%	49.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	2.0	0.5	2.0	2.0	2.0	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.5	4.0	5.5	5.5	5.5	5.5	4.0	5.5	5.5
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effect Green (s)	24.1	18.6	21.5	16.0	16.0	19.2	19.2	25.5	24.0	24.0
Actuated g/C Ratio	0.40	0.31	0.36	0.27	0.27	0.32	0.32	0.42	0.40	0.40
v/c Ratio	0.58	0.54	0.42	0.57	0.18	0.10	0.46	0.14	0.17	0.25
Control Delay	19.1	19.7	16.2	21.8	5.9	17.4	19.1	11.2	12.5	3.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.1	19.7	16.2	21.8	5.9	17.4	19.1	11.2	12.5	3.2
LOS	B	B	B	C	A	B	B	B	B	A
Approach Delay		19.5		19.1			18.9		7.4	
Approach LOS		B		B			B		A	

Intersection Summary

Cycle Length: 60

Actuated Cycle Length: 60

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.58

Intersection Signal Delay: 17.3

Intersection LOS: B

Intersection Capacity Utilization 66.1%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 5: Lundy's Lane & Davis Road

 ø1	 ø2	 ø3	 ø4
8 s	21.5 s	8 s	22.5 s
 ø6		 ø7	 ø8
29.5 s		9 s	21.5 s

HCM Signalized Intersection Capacity Analysis

5: Lundy's Lane & Davis Road

<2026 Total> Weekday AM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	163	439	30	97	441	69	32	156	53	46	93	156
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Flt Protected	1.00	0.99		1.00	1.00	0.85	1.00	0.96		1.00	1.00	0.85
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	3414		1480	3539	1553	1626	1661		1719	1681	1599
Satd. Flow (perm)	618	3414		620	3539	1553	1171	1661		824	1681	1599
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	199	535	37	118	538	84	39	190	65	56	113	190
RTOR Reduction (vph)	0	8	0	0	0	61	0	19	0	0	0	112
Lane Group Flow (vph)	199	564	0	118	538	23	39	236	0	56	113	78
Heavy Vehicles (%)	3%	4%	15%	22%	2%	4%	11%	10%	10%	5%	13%	1%
Turn Type	pm+pt			pm+pt		Perm	Perm			pm+pt		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4			8		8	2			6		6
Actuated Green, G (s)	23.6	18.6		20.0	16.8	16.8	19.2	19.2		25.6	25.6	25.6
Effective Green, g (s)	23.6	18.6		20.0	16.8	16.8	19.2	19.2		25.6	25.6	25.6
Actuated g/C Ratio	0.38	0.30		0.32	0.27	0.27	0.31	0.31		0.41	0.41	0.41
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	325	1018		243	953	418	360	511		372	690	656
v/s Ratio Prot	c0.05	0.17		0.02	0.15			c0.14		0.01	c0.07	
v/s Ratio Perm	c0.18			0.13		0.01	0.03			0.06		0.05
v/c Ratio	0.61	0.55		0.49	0.56	0.05	0.11	0.46		0.15	0.16	0.12
Uniform Delay, d1	13.9	18.4		15.9	19.6	16.9	15.5	17.4		11.5	11.6	11.4
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.4	0.7		1.5	0.8	0.1	0.6	3.0		0.2	0.5	0.4
Delay (s)	17.2	19.1		17.4	20.4	17.0	16.1	20.4		11.7	12.1	11.8
Level of Service	B	B		B	C	B	B	C		B	B	B
Approach Delay (s)		18.6			19.5			19.8			11.9	
Approach LOS		B			B			B			B	
Intersection Summary												
HCM Average Control Delay			18.0			HCM Level of Service				B		
HCM Volume to Capacity ratio			0.55									
Actuated Cycle Length (s)			62.4			Sum of lost time (s)				19.0		
Intersection Capacity Utilization			66.1%			ICU Level of Service				C		
Analysis Period (min)			15									
c Critical Lane Group												

Timings
6: Lundy's Lane & Thorold Townline Road

<2026 Total> Weekday AM Peak Hour

2018-11-23

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	55	642	176	41	488	86	90	132	144	71	28
Turn Type	Perm		Perm	Perm		Perm	pm+pt		pm+pt		Perm
Protected Phases		4			8		5	2	1	6	
Permitted Phases	4		4	8		8	2		6		6
Detector Phase	4	4	4	8	8	8	5	2	1	6	6
Switch Phase											
Minimum Initial (s)	16.0	16.0	16.0	16.0	16.0	16.0	4.0	16.0	4.0	16.0	16.0
Minimum Split (s)	21.5	21.5	21.5	21.5	21.5	21.5	8.0	21.5	8.0	21.5	21.5
Total Split (s)	35.0	35.0	35.0	35.0	35.0	35.0	8.0	22.0	8.0	22.0	22.0
Total Split (%)	53.8%	53.8%	53.8%	53.8%	53.8%	53.8%	12.3%	33.8%	12.3%	33.8%	33.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.5	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5	4.0	5.5	5.5
Lead/Lag							Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	None	Max	Max
Act Effect Green (s)	27.1	27.1	27.1	27.1	27.1	27.1	21.3	16.8	21.3	16.8	16.8
Actuated g/C Ratio	0.44	0.44	0.44	0.44	0.44	0.44	0.35	0.27	0.35	0.27	0.27
v/c Ratio	0.29	0.88	0.24	0.38	0.67	0.13	0.21	0.37	0.38	0.16	0.07
Control Delay	15.6	29.9	2.7	22.4	18.4	3.1	13.9	20.3	17.0	19.9	8.0
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	15.6	29.9	2.7	22.4	18.4	3.1	13.9	20.3	17.0	19.9	8.0
LOS	B	C	A	C	B	A	B	C	B	B	A
Approach Delay		23.5			16.5			18.1		16.8	
Approach LOS		C			B			B		B	

Intersection Summary

Cycle Length: 65

Actuated Cycle Length: 61.1

Natural Cycle: 65

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.88

Intersection Signal Delay: 19.8

Intersection LOS: B

Intersection Capacity Utilization 79.5%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 6: Lundy's Lane & Thorold Townline Road

		
ø1	ø2	ø4
8 s	22 s	35 s
		
ø5	ø6	ø8
8 s	22 s	35 s

HCM Signalized Intersection Capacity Analysis

6: Lundy's Lane & Thorold Townline Road

<2026 Total> Weekday AM Peak Hour

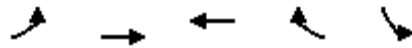
2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	642	176	41	488	86	90	132	36	144	71	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1612	1881	1615	1805	1881	1615	1787	1810		1671	1863	1615
Flt Permitted	0.29	1.00	1.00	0.15	1.00	1.00	0.70	1.00		0.64	1.00	1.00
Satd. Flow (perm)	488	1881	1615	280	1881	1615	1325	1810		1121	1863	1615
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	62	730	200	47	555	98	102	150	41	164	81	32
RTOR Reduction (vph)	0	0	112	0	0	55	0	15	0	0	0	23
Lane Group Flow (vph)	62	730	88	47	555	43	102	176	0	164	81	9
Heavy Vehicles (%)	12%	1%	0%	0%	1%	0%	1%	2%	0%	8%	2%	0%
Turn Type	Perm		Perm	Perm		Perm	pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	27.1	27.1	27.1	27.1	27.1	27.1	19.8	16.8		19.8	16.8	16.8
Effective Green, g (s)	27.1	27.1	27.1	27.1	27.1	27.1	19.8	16.8		19.8	16.8	16.8
Actuated g/C Ratio	0.44	0.44	0.44	0.44	0.44	0.44	0.32	0.27		0.32	0.27	0.27
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
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)	214	824	707	123	824	707	446	491		385	506	438
v/s Ratio Prot		c0.39			0.30		0.01	0.10		c0.02	0.04	
v/s Ratio Perm	0.13		0.05	0.17		0.03	0.06			c0.12		0.01
v/c Ratio	0.29	0.89	0.12	0.38	0.67	0.06	0.23	0.36		0.43	0.16	0.02
Uniform Delay, d1	11.2	16.0	10.3	11.7	13.9	10.0	15.2	18.2		16.0	17.2	16.5
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	0.8	11.2	0.1	2.0	2.2	0.0	0.3	2.0		0.8	0.7	0.1
Delay (s)	12.0	27.2	10.4	13.7	16.1	10.1	15.4	20.2		16.7	17.9	16.6
Level of Service	B	C	B	B	B	B	B	C		B	B	B
Approach Delay (s)		22.9			15.1			18.6			17.1	
Approach LOS		C			B			B			B	
Intersection Summary												
HCM Average Control Delay			19.2			HCM Level of Service				B		
HCM Volume to Capacity ratio			0.67									
Actuated Cycle Length (s)			61.9			Sum of lost time (s)				13.5		
Intersection Capacity Utilization			79.5%			ICU Level of Service				D		
Analysis Period (min)			15									
c Critical Lane Group												

Timings
7: Lundy's Lane & Site Access 1

<2026 Total> Weekday AM Peak Hour

2018-11-23



Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Volume (vph)	31	507	632	125	336
Turn Type	Perm			Perm	
Protected Phases		4	8		6
Permitted Phases	4			8	
Detector Phase	4	4	8	8	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	Max
Act Effect Green (s)	12.5	12.5	12.5	12.5	16.1
Actuated g/C Ratio	0.34	0.34	0.34	0.34	0.44
v/c Ratio	0.16	0.46	0.57	0.22	0.56
Control Delay	10.2	10.6	11.8	3.1	11.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	10.2	10.6	11.8	3.1	11.3
LOS	B	B	B	A	B
Approach Delay		10.5	10.3		11.3
Approach LOS		B	B		B

Intersection Summary

Cycle Length: 40

Actuated Cycle Length: 36.6

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.57

Intersection Signal Delay: 10.6

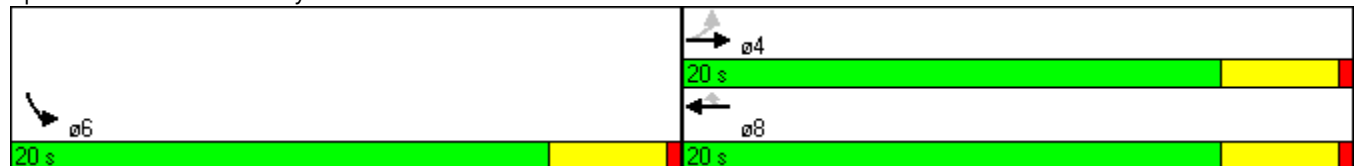
Intersection LOS: B

Intersection Capacity Utilization 53.5%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 7: Lundy's Lane & Site Access 1

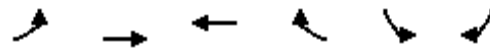


HCM Signalized Intersection Capacity Analysis

7: Lundy's Lane & Site Access 1

<2026 Total> Weekday AM Peak Hour

2018-11-23



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	31	507	632	125	336	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.98	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1770	3539	3539	1583	1748	
Flt Permitted	0.33	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	608	3539	3539	1583	1748	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	34	551	687	136	365	73
RTOR Reduction (vph)	0	0	0	90	17	0
Lane Group Flow (vph)	34	551	687	46	421	0
Turn Type	Perm		Perm			
Protected Phases	4		8		6	
Permitted Phases	4		8			
Actuated Green, G (s)	12.5	12.5	12.5	12.5	16.1	
Effective Green, g (s)	12.5	12.5	12.5	12.5	16.1	
Actuated g/C Ratio	0.34	0.34	0.34	0.34	0.44	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	208	1209	1209	541	769	
v/s Ratio Prot		0.16	c0.19		c0.24	
v/s Ratio Perm	0.06			0.03		
v/c Ratio	0.16	0.46	0.57	0.09	0.55	
Uniform Delay, d1	8.4	9.4	9.8	8.2	7.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.4	0.3	0.6	0.1	2.8	
Delay (s)	8.8	9.7	10.5	8.2	10.4	
Level of Service	A	A	B	A	B	
Approach Delay (s)		9.6	10.1		10.4	
Approach LOS		A	B		B	
Intersection Summary						
HCM Average Control Delay			10.0	HCM Level of Service		B
HCM Volume to Capacity ratio			0.56			
Actuated Cycle Length (s)			36.6	Sum of lost time (s)		8.0
Intersection Capacity Utilization			53.5%	ICU Level of Service		A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis 8: Lundy's Lane & Site Access 2

<2026 Total> Weekday AM Peak Hour

2018-11-23



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	31	844	575	31	0	67
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	34	917	625	34	0	73
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (m)		204				
pX, platoon unblocked						
vC, conflicting volume	659				1627	642
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	659				1627	642
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				100	85
cM capacity (veh/h)	929				108	474
Direction, Lane #	EB 1	EB 2	WB 1	SB 1		
Volume Total	34	917	659	73		
Volume Left	34	0	0	0		
Volume Right	0	0	34	73		
cSH	929	1700	1700	474		
Volume to Capacity	0.04	0.54	0.39	0.15		
Queue Length 95th (m)	0.9	0.0	0.0	4.3		
Control Delay (s)	9.0	0.0	0.0	14.0		
Lane LOS	A			B		
Approach Delay (s)	0.3		0.0	14.0		
Approach LOS				B		
Intersection Summary						
Average Delay			0.8			
Intersection Capacity Utilization			55.2%	ICU Level of Service		B
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

9: Site Access 3 & Thorold Townline Road

<2026 Total> Weekday AM Peak Hour

2018-11-23

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	67	135	63	210	126	31
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	73	147	68	228	137	34
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	519	154	171			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	519	154	171			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	85	84	95			
cM capacity (veh/h)	492	892	1407			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	220	68	228	171		
Volume Left	73	68	0	0		
Volume Right	147	0	0	34		
cSH	703	1407	1700	1700		
Volume to Capacity	0.31	0.05	0.13	0.10		
Queue Length 95th (m)	10.7	1.2	0.0	0.0		
Control Delay (s)	12.4	7.7	0.0	0.0		
Lane LOS	B	A				
Approach Delay (s)	12.4	1.8		0.0		
Approach LOS	B					
Intersection Summary						
Average Delay			4.7			
Intersection Capacity Utilization			34.0%		ICU Level of Service	A
Analysis Period (min)			15			

Timings
1: Niagara Falls Road & Davis Road

<2026 Total> Weekday PM Peak Hour

2018-11-23

									
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	103	34	52	63	12	789	193	1168	139
Turn Type	Perm		Perm		Perm		Perm		Perm
Protected Phases		4		8		2		6	
Permitted Phases	4		8		2		6		6
Detector Phase	4	4	8	8	2	2	6	6	6
Switch Phase									
Minimum Initial (s)	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	33.3%	33.3%	33.3%	33.3%	66.7%	66.7%	66.7%	66.7%	66.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)	14.5	14.5		14.5	35.4	35.4	35.4	35.4	35.4
Actuated g/C Ratio	0.24	0.24		0.24	0.58	0.58	0.58	0.58	0.58
v/c Ratio	0.60	0.10		0.69	0.08	0.42	0.63	0.61	0.15
Control Delay	36.9	16.3		20.7	7.2	7.8	20.2	10.0	1.7
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.9	16.3		20.7	7.2	7.8	20.2	10.0	1.7
LOS	D	B		C	A	A	C	A	A
Approach Delay		31.1		20.7		7.8		10.5	
Approach LOS		C		C		A		B	

Intersection Summary

Cycle Length: 60

Actuated Cycle Length: 60.9

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.69

Intersection Signal Delay: 11.9

Intersection LOS: B

Intersection Capacity Utilization 83.1%

ICU Level of Service E

Analysis Period (min) 15

Splits and Phases: 1: Niagara Falls Road & Davis Road

 ø2	 ø4
40 s	20 s
 ø6	 ø8
40 s	20 s

HCM Signalized Intersection Capacity Analysis

1: Niagara Falls Road & Davis Road

<2026 Total> Weekday PM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	103	34	7	52	63	198	12	789	29	193	1168	139
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5			5.5		5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.98			0.91		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	1808			1697		1641	3546		1787	3505	1553
Flt Permitted	0.42	1.00			0.94		0.17	1.00		0.30	1.00	1.00
Satd. Flow (perm)	771	1808			1602		289	3546		558	3505	1553
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	110	36	7	55	67	211	13	839	31	205	1243	148
RTOR Reduction (vph)	0	5	0	0	104	0	0	4	0	0	0	62
Lane Group Flow (vph)	110	38	0	0	229	0	13	866	0	205	1243	86
Heavy Vehicles (%)	3%	3%	0%	7%	2%	0%	10%	1%	8%	1%	3%	4%
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	14.5	14.5			14.5		35.4	35.4		35.4	35.4	35.4
Effective Green, g (s)	14.5	14.5			14.5		35.4	35.4		35.4	35.4	35.4
Actuated g/C Ratio	0.24	0.24			0.24		0.58	0.58		0.58	0.58	0.58
Clearance Time (s)	5.5	5.5			5.5		5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	184	430			381		168	2061		324	2037	903
v/s Ratio Prot		0.02						0.24			0.35	
v/s Ratio Perm	0.14				c0.14		0.04			c0.37		0.06
v/c Ratio	0.60	0.09			0.60		0.08	0.42		0.63	0.61	0.10
Uniform Delay, d1	20.6	18.1			20.6		5.6	7.1		8.4	8.3	5.7
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.1	0.1			2.7		0.9	0.6		9.1	1.4	0.2
Delay (s)	25.8	18.1			23.3		6.5	7.7		17.5	9.6	5.9
Level of Service	C	B			C		A	A		B	A	A
Approach Delay (s)		23.6			23.3			7.7			10.3	
Approach LOS		C			C			A			B	
Intersection Summary												
HCM Average Control Delay	11.7			HCM Level of Service			B					
HCM Volume to Capacity ratio	0.62											
Actuated Cycle Length (s)	60.9			Sum of lost time (s)			11.0					
Intersection Capacity Utilization	83.1%			ICU Level of Service			E					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis 2: Beaverdams Road & Thorold Townline Road

<2026 Total> Weekday PM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	22	205	26	97	191	21	36	139	66	43	216	37
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	23	218	28	103	203	22	38	148	70	46	230	39
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	269	329	256	315								
Volume Left (vph)	23	103	38	46								
Volume Right (vph)	28	22	70	39								
Hadj (s)	-0.03	0.11	-0.03	0.03								
Departure Headway (s)	6.6	6.6	6.7	6.6								
Degree Utilization, x	0.50	0.60	0.48	0.58								
Capacity (veh/h)	483	497	477	494								
Control Delay (s)	16.0	19.2	15.7	18.3								
Approach Delay (s)	16.0	19.2	15.7	18.3								
Approach LOS	C	C	C	C								
Intersection Summary												
Delay				17.4								
HCM Level of Service				C								
Intersection Capacity Utilization				61.5%	ICU Level of Service	B						
Analysis Period (min)				15								

Timings
3: Barker Parkway & Davis Road

<2026 Total> Weekday PM Peak Hour

2018-11-23

					
Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Configurations					
Volume (vph)	9	449	140	679	183
Turn Type		Perm		Perm	
Protected Phases	8		2		6
Permitted Phases		8		6	
Detector Phase	8	8	2	6	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	55.0	55.0	55.0
Total Split (%)	26.7%	26.7%	73.3%	73.3%	73.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	Max	Max	Max
Act Effect Green (s)	8.5	8.5	51.2	51.2	51.2
Actuated g/C Ratio	0.13	0.13	0.76	0.76	0.76
v/c Ratio	0.04	0.79	0.06	0.78	0.08
Control Delay	25.0	13.0	2.6	14.8	2.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	25.0	13.0	2.6	14.8	2.8
LOS	C	B	A	B	A
Approach Delay	13.3		2.6		12.2
Approach LOS	B		A		B

Intersection Summary

Cycle Length: 75

Actuated Cycle Length: 67.7

Natural Cycle: 70

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.79

Intersection Signal Delay: 11.6

Intersection LOS: B

Intersection Capacity Utilization 55.2%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 3: Barker Parkway & Davis Road



HCM Signalized Intersection Capacity Analysis

3: Barker Parkway & Davis Road

<2026 Total> Weekday PM Peak Hour

2018-11-23

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	9	449	140	12	679	183
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1538	3440		1805	3406
Flt Permitted	0.95	1.00	1.00		0.65	1.00
Satd. Flow (perm)	1805	1538	3440		1231	3406
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	10	483	151	13	730	197
RTOR Reduction (vph)	0	422	3	0	0	0
Lane Group Flow (vph)	10	61	161	0	730	197
Heavy Vehicles (%)	0%	5%	4%	0%	0%	6%
Turn Type	Perm		Perm		Perm	
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	8.5	8.5	51.2		51.2	51.2
Effective Green, g (s)	8.5	8.5	51.2		51.2	51.2
Actuated g/C Ratio	0.13	0.13	0.76		0.76	0.76
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	227	193	2602		931	2576
v/s Ratio Prot	0.01		0.05			0.06
v/s Ratio Perm		c0.04			c0.59	
v/c Ratio	0.04	0.31	0.06		0.78	0.08
Uniform Delay, d1	26.0	26.9	2.1		4.9	2.1
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.1	0.9	0.0		6.6	0.1
Delay (s)	26.1	27.9	2.2		11.5	2.2
Level of Service	C	C	A		B	A
Approach Delay (s)	27.8		2.2			9.5
Approach LOS	C		A			A
Intersection Summary						
HCM Average Control Delay			14.5		HCM Level of Service	B
HCM Volume to Capacity ratio			0.72			
Actuated Cycle Length (s)			67.7		Sum of lost time (s)	8.0
Intersection Capacity Utilization			55.2%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

Timings

4: Allanburg Road & Davis Road

<2026 Total> Weekday PM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	42	0	49	58	0	84	213	178	224	55
Turn Type	Perm		Perm	Perm		Perm		Perm		Perm
Protected Phases		4			8		2		6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	4	4	4	8	8	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)		7.4	7.4		7.4	20.8	20.8	20.8	20.8	20.8
Actuated g/C Ratio		0.22	0.22		0.22	0.62	0.62	0.62	0.62	0.62
v/c Ratio		0.17	0.14		0.45	0.13	0.31	0.31	0.23	0.06
Control Delay		10.9	4.3		7.9	5.4	5.0	6.9	5.4	2.1
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		10.9	4.3		7.9	5.4	5.0	6.9	5.4	2.1
LOS		B	A		A	A	A	A	A	A
Approach Delay		7.4			7.9		5.1		5.6	
Approach LOS		A			A		A		A	

Intersection Summary

Cycle Length: 40

Actuated Cycle Length: 33.7

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.45

Intersection Signal Delay: 5.9

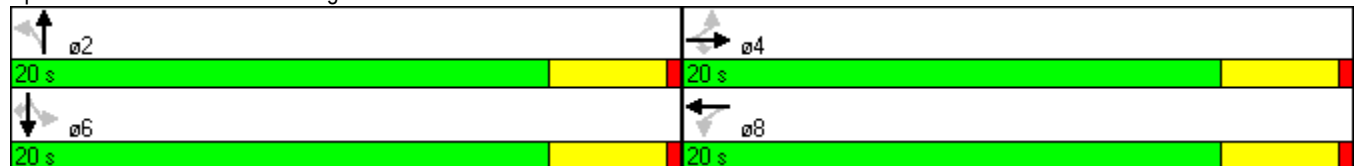
Intersection LOS: A

Intersection Capacity Utilization 53.4%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 4: Allanburg Road & Davis Road



HCM Signalized Intersection Capacity Analysis

4: Allanburg Road & Davis Road

<2026 Total> Weekday PM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	42	0	49	58	0	115	84	213	89	178	224	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.91		1.00	0.96		1.00	1.00	0.85
Flt Protected		0.95	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1671	1615		1701		1805	1754		1805	1792	1524
Flt Permitted		0.72	1.00		0.87		0.60	1.00		0.55	1.00	1.00
Satd. Flow (perm)		1262	1615		1504		1142	1754		1054	1792	1524
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	48	0	56	66	0	131	95	242	101	202	255	62
RTOR Reduction (vph)	0	0	46	0	107	0	0	26	0	0	0	26
Lane Group Flow (vph)	0	48	10	0	90	0	95	317	0	202	255	36
Heavy Vehicles (%)	8%	0%	0%	0%	0%	0%	0%	5%	0%	0%	6%	6%
Turn Type	Perm		Perm	Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		6.4	6.4		6.4		20.1	20.1		20.1	20.1	20.1
Effective Green, g (s)		6.4	6.4		6.4		20.1	20.1		20.1	20.1	20.1
Actuated g/C Ratio		0.19	0.19		0.19		0.58	0.58		0.58	0.58	0.58
Clearance Time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		234	300		279		665	1022		614	1044	888
v/s Ratio Prot								0.18			0.14	
v/s Ratio Perm		0.04	0.01		0.06		0.08			0.19		0.02
v/c Ratio		0.21	0.03		0.32		0.14	0.31		0.33	0.24	0.04
Uniform Delay, d1		11.9	11.5		12.2		3.3	3.7		3.7	3.5	3.1
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.4	0.0		0.7		0.5	0.8		1.4	0.6	0.1
Delay (s)		12.3	11.6		12.9		3.7	4.5		5.1	4.1	3.2
Level of Service		B	B		B		A	A		A	A	A
Approach Delay (s)		11.9			12.9			4.3			4.4	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay		6.3			HCM Level of Service			A				
HCM Volume to Capacity ratio		0.33										
Actuated Cycle Length (s)		34.5			Sum of lost time (s)			8.0				
Intersection Capacity Utilization		53.4%			ICU Level of Service			A				
Analysis Period (min)		15										
c Critical Lane Group												

Timings
5: Lundy's Lane & Davis Road

<2026 Total> Weekday PM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	197	709	85	591	67	64	128	73	135	175
Turn Type	pm+pt		pm+pt		Perm	Perm		pm+pt		Perm
Protected Phases	7	4	3	8			2	1	6	
Permitted Phases	4		8		8	2		6		6
Detector Phase	7	4	3	8	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	16.0	4.0	16.0	16.0	16.0	16.0	4.0	16.0	16.0
Minimum Split (s)	8.0	21.5	8.0	21.5	21.5	21.5	21.5	8.0	21.5	21.5
Total Split (s)	15.0	34.0	9.0	28.0	28.0	29.0	29.0	8.0	37.0	37.0
Total Split (%)	18.8%	42.5%	11.3%	35.0%	35.0%	36.3%	36.3%	10.0%	46.3%	46.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	2.0	0.5	2.0	2.0	2.0	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.5	4.0	5.5	5.5	5.5	5.5	4.0	5.5	5.5
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effect Green (s)	36.1	27.6	26.6	20.1	20.1	25.3	25.3	33.0	31.5	31.5
Actuated g/C Ratio	0.47	0.36	0.34	0.26	0.26	0.33	0.33	0.43	0.41	0.41
v/c Ratio	0.70	0.74	0.55	0.78	0.18	0.21	0.52	0.25	0.24	0.27
Control Delay	25.9	26.5	24.9	33.3	6.7	23.2	22.3	16.2	17.0	3.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.9	26.5	24.9	33.3	6.7	23.2	22.3	16.2	17.0	3.5
LOS	C	C	C	C	A	C	C	B	B	A
Approach Delay		26.4		29.9			22.5		10.7	
Approach LOS		C		C			C		B	

Intersection Summary

Cycle Length: 80

Actuated Cycle Length: 77.2

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.78

Intersection Signal Delay: 24.5

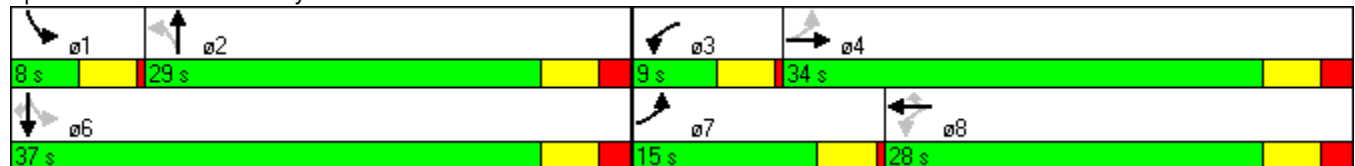
Intersection LOS: C

Intersection Capacity Utilization 71.0%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 5: Lundy's Lane & Davis Road



HCM Signalized Intersection Capacity Analysis

5: Lundy's Lane & Davis Road

<2026 Total> Weekday PM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	197	709	40	85	591	67	64	128	114	73	135	175
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Flt Protected	1.00	0.99		1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	3424		1480	3539	1553	1626	1605		1719	1681	1599
Satd. Flow (perm)	307	3424		333	3539	1553	1117	1605		727	1681	1599
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	240	865	49	104	721	82	78	156	139	89	165	213
RTOR Reduction (vph)	0	5	0	0	0	60	0	39	0	0	0	126
Lane Group Flow (vph)	240	909	0	104	721	22	78	256	0	89	165	87
Heavy Vehicles (%)	3%	4%	15%	22%	2%	4%	11%	10%	10%	5%	13%	1%
Turn Type	pm+pt			pm+pt		Perm	Perm			pm+pt		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4			8		8	2			6		6
Actuated Green, G (s)	35.5	27.6		24.9	21.0	21.0	25.3	25.3		32.4	32.4	32.4
Effective Green, g (s)	35.5	27.6		24.9	21.0	21.0	25.3	25.3		32.4	32.4	32.4
Actuated g/C Ratio	0.45	0.35		0.32	0.27	0.27	0.32	0.32		0.41	0.41	0.41
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	330	1198		162	942	413	358	515		338	690	657
v/s Ratio Prot	c0.10	c0.27		0.03	0.20			c0.16		0.01	c0.10	
v/s Ratio Perm	0.23			0.17		0.01	0.07			0.10		0.05
v/c Ratio	0.73	0.76		0.64	0.77	0.05	0.22	0.50		0.26	0.24	0.13
Uniform Delay, d1	15.7	22.7		20.5	26.7	21.5	19.6	21.7		15.0	15.2	14.5
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	7.8	2.8		8.4	3.8	0.1	1.4	3.4		0.4	0.8	0.4
Delay (s)	23.5	25.5		28.9	30.4	21.6	21.0	25.1		15.4	16.0	14.9
Level of Service	C	C		C	C	C	C	C		B	B	B
Approach Delay (s)		25.1			29.5			24.2			15.4	
Approach LOS		C			C			C			B	
Intersection Summary												
HCM Average Control Delay			24.8			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.62									
Actuated Cycle Length (s)			78.9			Sum of lost time (s)				15.0		
Intersection Capacity Utilization			71.0%			ICU Level of Service				C		
Analysis Period (min)			15									
c Critical Lane Group												

Timings
6: Lundy's Lane & Thorold Townline Road

<2026 Total> Weekday PM Peak Hour

2018-11-23

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	29	750	155	49	786	191	220	100	129	129	46
Turn Type	Perm		Perm	Perm		Perm	pm+pt		pm+pt		Perm
Protected Phases		4			8		5	2	1	6	
Permitted Phases	4		4	8		8	2		6		6
Detector Phase	4	4	4	8	8	8	5	2	1	6	6
Switch Phase											
Minimum Initial (s)	16.0	16.0	16.0	16.0	16.0	16.0	4.0	16.0	4.0	16.0	16.0
Minimum Split (s)	21.5	21.5	21.5	21.5	21.5	21.5	8.0	21.5	8.0	21.5	21.5
Total Split (s)	49.0	49.0	49.0	49.0	49.0	49.0	8.0	23.0	8.0	23.0	23.0
Total Split (%)	61.3%	61.3%	61.3%	61.3%	61.3%	61.3%	10.0%	28.8%	10.0%	28.8%	28.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.5	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5	4.0	5.5	5.5
Lead/Lag							Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	None	Max	Max
Act Effect Green (s)	39.0	39.0	39.0	39.0	39.0	39.0	23.1	17.6	23.1	17.6	17.6
Actuated g/C Ratio	0.52	0.52	0.52	0.52	0.52	0.52	0.31	0.23	0.31	0.23	0.23
v/c Ratio	0.37	0.88	0.19	0.55	0.92	0.23	0.61	0.39	0.40	0.34	0.12
Control Delay	24.3	28.3	2.2	37.0	33.2	2.1	29.4	24.8	23.8	28.4	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	24.3	28.3	2.2	37.0	33.2	2.1	29.4	24.8	23.8	28.4	8.8
LOS	C	C	A	D	C	A	C	C	C	C	A
Approach Delay		23.9			27.6			27.5		23.5	
Approach LOS		C			C			C		C	

Intersection Summary

Cycle Length: 80

Actuated Cycle Length: 75.7

Natural Cycle: 75

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.92

Intersection Signal Delay: 25.8

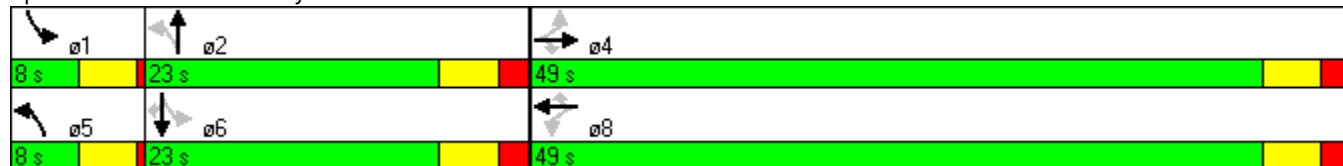
Intersection LOS: C

Intersection Capacity Utilization 79.4%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 6: Lundy's Lane & Thorold Townline Road



HCM Signalized Intersection Capacity Analysis

6: Lundy's Lane & Thorold Townline Road

<2026 Total> Weekday PM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	29	750	155	49	786	191	220	100	49	129	129	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1612	1881	1615	1805	1881	1615	1787	1782		1671	1863	1615
Flt Permitted	0.10	1.00	1.00	0.10	1.00	1.00	0.66	1.00		0.63	1.00	1.00
Satd. Flow (perm)	174	1881	1615	196	1881	1615	1248	1782		1107	1863	1615
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	33	852	176	56	893	217	250	114	56	147	147	52
RTOR Reduction (vph)	0	0	84	0	0	105	0	21	0	0	0	40
Lane Group Flow (vph)	33	852	92	56	893	112	250	149	0	147	147	12
Heavy Vehicles (%)	12%	1%	0%	0%	1%	0%	1%	2%	0%	8%	2%	0%
Turn Type	Perm		Perm	Perm		Perm	pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	39.0	39.0	39.0	39.0	39.0	39.0	21.6	17.6		21.6	17.6	17.6
Effective Green, g (s)	39.0	39.0	39.0	39.0	39.0	39.0	21.6	17.6		21.6	17.6	17.6
Actuated g/C Ratio	0.52	0.52	0.52	0.52	0.52	0.52	0.29	0.23		0.29	0.23	0.23
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
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)	90	970	833	101	970	833	385	415		346	434	376
v/s Ratio Prot		0.45			c0.47		c0.03	0.08		0.02	0.08	
v/s Ratio Perm	0.19		0.06	0.29		0.07	c0.15			0.10		0.01
v/c Ratio	0.37	0.88	0.11	0.55	0.92	0.13	0.65	0.36		0.42	0.34	0.03
Uniform Delay, d1	10.9	16.2	9.4	12.4	16.9	9.5	22.9	24.3		21.3	24.2	22.4
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	2.5	9.1	0.1	6.4	13.6	0.1	3.8	2.4		0.8	2.1	0.2
Delay (s)	13.5	25.3	9.5	18.9	30.5	9.6	26.7	26.7		22.1	26.3	22.6
Level of Service	B	C	A	B	C	A	C	C		C	C	C
Approach Delay (s)		22.3			26.0			26.7			24.0	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM Average Control Delay			24.6			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.80									
Actuated Cycle Length (s)			75.6			Sum of lost time (s)				13.5		
Intersection Capacity Utilization			79.4%			ICU Level of Service				D		
Analysis Period (min)			15									
c Critical Lane Group												

Timings
7: Lundy's Lane & Site Access 1

<2026 Total> Weekday PM Peak Hour

2018-11-23

					
Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Volume (vph)	89	807	991	355	288
Turn Type	Perm			Perm	
Protected Phases		4	8		6
Permitted Phases	4			8	
Detector Phase	4	4	8	8	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	34.0	34.0	34.0	34.0	21.0
Total Split (%)	61.8%	61.8%	61.8%	61.8%	38.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	Max
Act Effect Green (s)	21.3	21.3	21.3	21.3	17.3
Actuated g/C Ratio	0.46	0.46	0.46	0.46	0.37
v/c Ratio	0.61	0.54	0.67	0.41	0.57
Control Delay	27.6	10.2	11.8	2.4	17.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	27.6	10.2	11.8	2.4	17.5
LOS	C	B	B	A	B
Approach Delay		11.9	9.3		17.5
Approach LOS		B	A		B

Intersection Summary

Cycle Length: 55

Actuated Cycle Length: 46.7

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.67

Intersection Signal Delay: 11.3

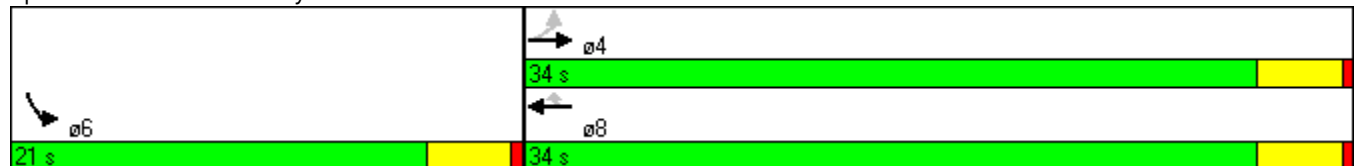
Intersection LOS: B

Intersection Capacity Utilization 61.8%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 7: Lundy's Lane & Site Access 1

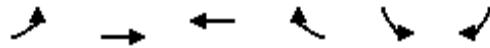


HCM Signalized Intersection Capacity Analysis

7: Lundy's Lane & Site Access 1

<2026 Total> Weekday PM Peak Hour

2018-11-23

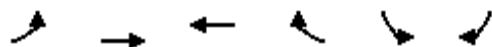


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	89	807	991	355	288	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.98	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1770	3539	3539	1583	1748	
Flt Permitted	0.19	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	350	3539	3539	1583	1748	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	97	877	1077	386	313	63
RTOR Reduction (vph)	0	0	0	209	12	0
Lane Group Flow (vph)	97	877	1077	177	364	0
Turn Type	Perm		Perm			
Protected Phases	4		8		6	
Permitted Phases	4		8			
Actuated Green, G (s)	21.3	21.3	21.3	21.3	17.2	
Effective Green, g (s)	21.3	21.3	21.3	21.3	17.2	
Actuated g/C Ratio	0.46	0.46	0.46	0.46	0.37	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	160	1621	1621	725	647	
v/s Ratio Prot		0.25	c0.30		c0.21	
v/s Ratio Perm	0.28			0.11		
v/c Ratio	0.61	0.54	0.66	0.24	0.56	
Uniform Delay, d1	9.5	9.1	9.8	7.7	11.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	6.4	0.4	1.0	0.2	3.5	
Delay (s)	15.8	9.4	10.9	7.9	15.2	
Level of Service	B	A	B	A	B	
Approach Delay (s)		10.1	10.1		15.2	
Approach LOS		B	B		B	
Intersection Summary						
HCM Average Control Delay			10.8	HCM Level of Service		B
HCM Volume to Capacity ratio			0.62			
Actuated Cycle Length (s)			46.5	Sum of lost time (s)		8.0
Intersection Capacity Utilization			61.8%	ICU Level of Service		B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis 8: Lundy's Lane & Site Access 2

<2026 Total> Weekday PM Peak Hour

2018-11-23



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	89	1094	963	89	0	58
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	97	1189	1047	97	0	63
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (m)		204				
pX, platoon unblocked						
vC, conflicting volume	1143				2478	1095
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1143				2478	1095
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	84				100	76
cM capacity (veh/h)	611				28	260
Direction, Lane #	EB 1	EB 2	WB 1	SB 1		
Volume Total	97	1189	1143	63		
Volume Left	97	0	0	0		
Volume Right	0	0	97	63		
cSH	611	1700	1700	260		
Volume to Capacity	0.16	0.70	0.67	0.24		
Queue Length 95th (m)	4.5	0.0	0.0	7.4		
Control Delay (s)	12.0	0.0	0.0	23.2		
Lane LOS	B			C		
Approach Delay (s)	0.9		0.0	23.2		
Approach LOS				C		
Intersection Summary						
Average Delay			1.1			
Intersection Capacity Utilization			74.6%		ICU Level of Service	D
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

9: Site Access 3 & Thorold Townline Road

<2026 Total> Weekday PM Peak Hour

2018-11-23

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	58	115	178	142	250	89
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	63	125	193	154	272	97
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	861	320	368			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	861	320	368			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	77	83	84			
cM capacity (veh/h)	273	721	1190			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	188	193	154	368		
Volume Left	63	193	0	0		
Volume Right	125	0	0	97		
cSH	465	1190	1700	1700		
Volume to Capacity	0.40	0.16	0.09	0.22		
Queue Length 95th (m)	15.4	4.6	0.0	0.0		
Control Delay (s)	17.9	8.6	0.0	0.0		
Lane LOS	C	A				
Approach Delay (s)	17.9	4.8		0.0		
Approach LOS	C					
Intersection Summary						
Average Delay			5.6			
Intersection Capacity Utilization			48.7%		ICU Level of Service	A
Analysis Period (min)			15			

Timings
1: Niagara Falls Road & Davis Road

<2031 Total> Weekday AM Peak Hour

2018-11-23

									
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	146	41	27	35	6	1002	102	505	52
Turn Type	Perm		Perm		Perm		Perm		Perm
Protected Phases		4		8		2		6	
Permitted Phases	4		8		2		6		6
Detector Phase	4	4	8	8	2	2	6	6	6
Switch Phase									
Minimum Initial (s)	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	35.0	35.0	35.0	35.0	35.0
Total Split (%)	36.4%	36.4%	36.4%	36.4%	63.6%	63.6%	63.6%	63.6%	63.6%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)	14.5	14.5		14.5	30.0	30.0	30.0	30.0	30.0
Actuated g/C Ratio	0.26	0.26		0.26	0.54	0.54	0.54	0.54	0.54
v/c Ratio	0.76	0.10		0.73	0.01	0.58	0.54	0.28	0.06
Control Delay	46.9	14.7		25.3	6.2	10.0	21.9	7.5	2.4
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.9	14.7		25.3	6.2	10.0	21.9	7.5	2.4
LOS	D	B		C	A	A	C	A	A
Approach Delay		39.1		25.3		10.0		9.3	
Approach LOS		D		C		A		A	

Intersection Summary

Cycle Length: 55

Actuated Cycle Length: 55.5

Natural Cycle: 55

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.76

Intersection Signal Delay: 14.6

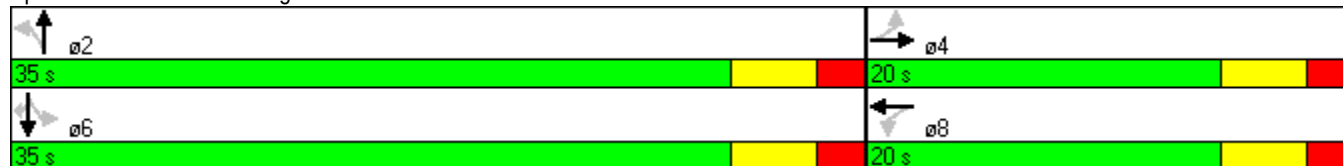
Intersection LOS: B

Intersection Capacity Utilization 91.5%

ICU Level of Service F

Analysis Period (min) 15

Splits and Phases: 1: Niagara Falls Road & Davis Road



HCM Signalized Intersection Capacity Analysis

1: Niagara Falls Road & Davis Road

<2031 Total> Weekday AM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	146	41	6	27	35	268	6	1002	44	102	505	52
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5			5.5		5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.98			0.89		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	1818			1672		1641	3541		1787	3505	1553
Flt Permitted	0.42	1.00			0.97		0.45	1.00		0.20	1.00	1.00
Satd. Flow (perm)	777	1818			1631		781	3541		372	3505	1553
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	155	44	6	29	37	285	6	1066	47	109	537	55
RTOR Reduction (vph)	0	4	0	0	57	0	0	6	0	0	0	25
Lane Group Flow (vph)	155	46	0	0	294	0	6	1107	0	109	537	30
Heavy Vehicles (%)	3%	3%	0%	7%	2%	0%	10%	1%	8%	1%	3%	4%
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	14.5	14.5			14.5		30.0	30.0		30.0	30.0	30.0
Effective Green, g (s)	14.5	14.5			14.5		30.0	30.0		30.0	30.0	30.0
Actuated g/C Ratio	0.26	0.26			0.26		0.54	0.54		0.54	0.54	0.54
Clearance Time (s)	5.5	5.5			5.5		5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	203	475			426		422	1914		201	1895	839
v/s Ratio Prot		0.03						c0.31			0.15	
v/s Ratio Perm	c0.20				0.18		0.01			0.29		0.02
v/c Ratio	0.76	0.10			0.69		0.01	0.58		0.54	0.28	0.04
Uniform Delay, d1	18.9	15.5			18.5		5.9	8.5		8.3	6.9	6.0
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	15.6	0.1			4.8		0.1	1.3		10.1	0.4	0.1
Delay (s)	34.5	15.6			23.3		6.0	9.8		18.4	7.3	6.1
Level of Service	C	B			C		A	A		B	A	A
Approach Delay (s)		29.9			23.3			9.8			8.9	
Approach LOS		C			C			A			A	
Intersection Summary												
HCM Average Control Delay	13.3			HCM Level of Service			B					
HCM Volume to Capacity ratio	0.64											
Actuated Cycle Length (s)	55.5			Sum of lost time (s)			11.0					
Intersection Capacity Utilization	91.5%			ICU Level of Service			F					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis 2: Beaverdams Road & Thorold Townline Road

<2031 Total> Weekday AM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	36	120	18	36	286	27	36	169	68	23	116	35
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	38	128	19	38	304	29	38	180	72	24	123	37
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	185	371	290	185								
Volume Left (vph)	38	38	38	24								
Volume Right (vph)	19	29	72	37								
Hadj (s)	0.01	0.01	-0.01	-0.02								
Departure Headway (s)	6.1	5.7	5.9	6.2								
Degree Utilization, x	0.31	0.59	0.48	0.32								
Capacity (veh/h)	520	590	554	506								
Control Delay (s)	11.9	16.7	14.3	12.0								
Approach Delay (s)	11.9	16.7	14.3	12.0								
Approach LOS	B	C	B	B								
Intersection Summary												
Delay			14.3									
HCM Level of Service			B									
Intersection Capacity Utilization			48.0%	ICU Level of Service					A			
Analysis Period (min)			15									

Timings
3: Barker Parkway & Davis Road

<2031 Total> Weekday AM Peak Hour

2018-11-23

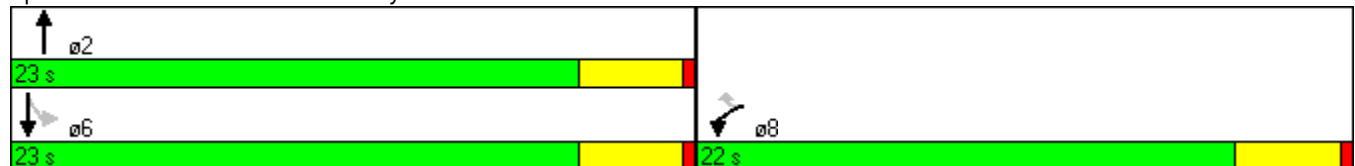
					
Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Configurations					
Volume (vph)	4	578	139	259	81
Turn Type		Perm		Perm	
Protected Phases	8		2		6
Permitted Phases		8		6	
Detector Phase	8	8	2	6	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	22.0	22.0	23.0	23.0	23.0
Total Split (%)	48.9%	48.9%	51.1%	51.1%	51.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	Max	Max	Max
Act Effect Green (s)	8.4	8.4	19.3	19.3	19.3
Actuated g/C Ratio	0.23	0.23	0.54	0.54	0.54
v/c Ratio	0.01	0.74	0.10	0.42	0.05
Control Delay	9.0	7.5	4.8	9.1	5.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	9.0	7.5	4.8	9.1	5.5
LOS	A	A	A	A	A
Approach Delay	7.5		4.8		8.3
Approach LOS	A		A		A

Intersection Summary

Cycle Length: 45
 Actuated Cycle Length: 35.9
 Natural Cycle: 40
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 0.74
 Intersection Signal Delay: 7.3
 Intersection Capacity Utilization 47.2%
 Analysis Period (min) 15

Intersection LOS: A
 ICU Level of Service A

Splits and Phases: 3: Barker Parkway & Davis Road



HCM Signalized Intersection Capacity Analysis

3: Barker Parkway & Davis Road

<2031 Total> Weekday AM Peak Hour

2018-11-23

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	4	578	139	27	259	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1538	3408		1805	3406
Flt Permitted	0.95	1.00	1.00		0.64	1.00
Satd. Flow (perm)	1805	1538	3408		1215	3406
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	4	622	149	29	278	87
RTOR Reduction (vph)	0	476	13	0	0	0
Lane Group Flow (vph)	4	146	165	0	278	87
Heavy Vehicles (%)	0%	5%	4%	0%	0%	6%
Turn Type	Perm			Perm		
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	8.4	8.4	19.3		19.3	19.3
Effective Green, g (s)	8.4	8.4	19.3		19.3	19.3
Actuated g/C Ratio	0.24	0.24	0.54		0.54	0.54
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	425	362	1842		657	1841
v/s Ratio Prot	0.00		0.05			0.03
v/s Ratio Perm		c0.10			c0.23	
v/c Ratio	0.01	0.40	0.09		0.42	0.05
Uniform Delay, d1	10.5	11.5	4.0		4.9	3.9
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.0	0.7	0.1		2.0	0.0
Delay (s)	10.5	12.3	4.1		6.9	3.9
Level of Service	B	B	A		A	A
Approach Delay (s)	12.3		4.1			6.2
Approach LOS	B		A			A
Intersection Summary						
HCM Average Control Delay			9.1		HCM Level of Service	A
HCM Volume to Capacity ratio			0.42			
Actuated Cycle Length (s)			35.7		Sum of lost time (s)	8.0
Intersection Capacity Utilization			47.2%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

Timings

4: Allanburg Road & Davis Road

<2031 Total> Weekday AM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	69	0	56	67	0	54	290	63	145	27
Turn Type	Perm		Perm	Perm		Perm		Perm		Perm
Protected Phases		4			8		2		6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	4	4	4	8	8	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)		7.9	7.9		7.9	20.1	20.1	20.1	20.1	20.1
Actuated g/C Ratio		0.24	0.24		0.24	0.60	0.60	0.60	0.60	0.60
v/c Ratio		0.28	0.15		0.49	0.08	0.34	0.12	0.15	0.03
Control Delay		12.4	4.1		7.9	5.3	6.2	5.7	5.4	2.7
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		12.4	4.1		7.9	5.3	6.2	5.7	5.4	2.7
LOS		B	A		A	A	A	A	A	A
Approach Delay		8.6			7.9		6.0		5.2	
Approach LOS		A			A		A		A	

Intersection Summary

Cycle Length: 40

Actuated Cycle Length: 33.4

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.49

Intersection Signal Delay: 6.6

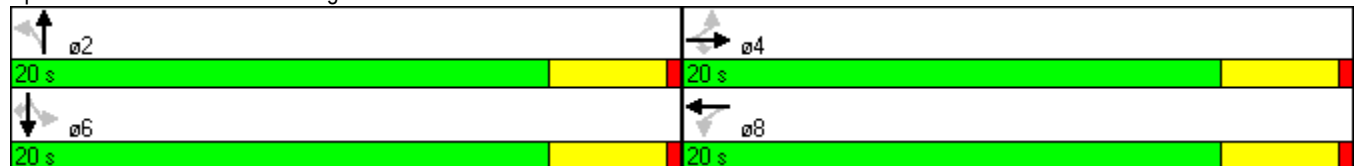
Intersection LOS: A

Intersection Capacity Utilization 49.3%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 4: Allanburg Road & Davis Road



HCM Signalized Intersection Capacity Analysis

4: Allanburg Road & Davis Road

<2031 Total> Weekday AM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	69	0	56	67	0	135	54	290	31	63	145	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.91		1.00	0.99		1.00	1.00	0.85
Flt Protected		0.95	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1671	1615		1700		1805	1792		1805	1792	1524
Flt Permitted		0.66	1.00		0.86		0.65	1.00		0.54	1.00	1.00
Satd. Flow (perm)		1168	1615		1485		1240	1792		1033	1792	1524
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	78	0	64	76	0	153	61	330	35	72	165	31
RTOR Reduction (vph)	0	0	51	0	122	0	0	7	0	0	0	13
Lane Group Flow (vph)	0	78	13	0	107	0	61	358	0	72	165	18
Heavy Vehicles (%)	8%	0%	0%	0%	0%	0%	0%	5%	0%	0%	6%	6%
Turn Type	Perm		Perm	Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		6.8	6.8		6.8		19.3	19.3		19.3	19.3	19.3
Effective Green, g (s)		6.8	6.8		6.8		19.3	19.3		19.3	19.3	19.3
Actuated g/C Ratio		0.20	0.20		0.20		0.57	0.57		0.57	0.57	0.57
Clearance Time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		233	322		296		702	1014		585	1014	863
v/s Ratio Prot							c0.20				0.09	
v/s Ratio Perm		0.07	0.01		c0.07		0.05			0.07		0.01
v/c Ratio		0.33	0.04		0.36		0.09	0.35		0.12	0.16	0.02
Uniform Delay, d1		11.7	11.0		11.8		3.4	4.0		3.5	3.5	3.2
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.9	0.1		0.8		0.2	1.0		0.4	0.3	0.0
Delay (s)		12.6	11.1		12.5		3.6	5.0		3.9	3.9	3.3
Level of Service		B	B		B		A	A		A	A	A
Approach Delay (s)		11.9			12.5			4.8			3.8	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay		7.2					HCM Level of Service			A		
HCM Volume to Capacity ratio		0.35										
Actuated Cycle Length (s)		34.1					Sum of lost time (s)			8.0		
Intersection Capacity Utilization		49.3%					ICU Level of Service			A		
Analysis Period (min)		15										
c Critical Lane Group												

Timings
5: Lundy's Lane & Davis Road

<2031 Total> Weekday AM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	177	481	101	480	76	35	172	50	102	165
Turn Type	pm+pt		pm+pt		Perm	Perm		pm+pt		Perm
Protected Phases	7	4	3	8			2	1	6	
Permitted Phases	4		8		8	2		6		6
Detector Phase	7	4	3	8	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	16.0	4.0	16.0	16.0	16.0	16.0	4.0	16.0	16.0
Minimum Split (s)	8.0	21.5	8.0	21.5	21.5	21.5	21.5	8.0	21.5	21.5
Total Split (s)	9.0	22.5	8.0	21.5	21.5	21.5	21.5	8.0	29.5	29.5
Total Split (%)	15.0%	37.5%	13.3%	35.8%	35.8%	35.8%	35.8%	13.3%	49.2%	49.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	2.0	0.5	2.0	2.0	2.0	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.5	4.0	5.5	5.5	5.5	5.5	4.0	5.5	5.5
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effect Green (s)	24.1	18.6	21.5	16.0	16.0	19.2	19.2	25.5	24.0	24.0
Actuated g/C Ratio	0.40	0.31	0.36	0.27	0.27	0.32	0.32	0.42	0.40	0.40
v/c Ratio	0.67	0.59	0.48	0.62	0.19	0.12	0.51	0.16	0.18	0.26
Control Delay	24.7	20.5	18.1	22.7	5.8	17.6	20.2	11.4	12.6	3.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.7	20.5	18.1	22.7	5.8	17.6	20.2	11.4	12.6	3.2
LOS	C	C	B	C	A	B	C	B	B	A
Approach Delay		21.6		20.0			19.8		7.5	
Approach LOS		C		C			B		A	

Intersection Summary

Cycle Length: 60

Actuated Cycle Length: 60

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.67

Intersection Signal Delay: 18.5

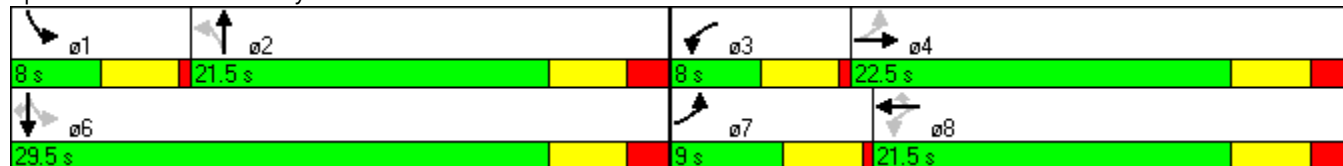
Intersection LOS: B

Intersection Capacity Utilization 66.9%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 5: Lundy's Lane & Davis Road



HCM Signalized Intersection Capacity Analysis

5: Lundy's Lane & Davis Road

<2031 Total> Weekday AM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	177	481	34	101	480	76	35	172	56	50	102	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	3414		1480	3539	1553	1626	1664		1719	1681	1599
Flt Permitted	0.30	1.00		0.35	1.00	1.00	0.68	1.00		0.43	1.00	1.00
Satd. Flow (perm)	551	3414		546	3539	1553	1160	1664		772	1681	1599
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	216	587	41	123	585	93	43	210	68	61	124	201
RTOR Reduction (vph)	0	8	0	0	0	68	0	18	0	0	0	119
Lane Group Flow (vph)	216	620	0	123	585	25	43	260	0	61	124	82
Heavy Vehicles (%)	3%	4%	15%	22%	2%	4%	11%	10%	10%	5%	13%	1%
Turn Type	pm+pt			pm+pt		Perm	Perm			pm+pt		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4			8		8	2			6		6
Actuated Green, G (s)	23.6	18.6		20.0	16.8	16.8	19.2	19.2		25.6	25.6	25.6
Effective Green, g (s)	23.6	18.6		20.0	16.8	16.8	19.2	19.2		25.6	25.6	25.6
Actuated g/C Ratio	0.38	0.30		0.32	0.27	0.27	0.31	0.31		0.41	0.41	0.41
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	305	1018		223	953	418	357	512		353	690	656
v/s Ratio Prot	c0.06	0.18		0.03	0.17			c0.16		0.01	c0.07	
v/s Ratio Perm	c0.21			0.15		0.02	0.04			0.06		0.05
v/c Ratio	0.71	0.61		0.55	0.61	0.06	0.12	0.51		0.17	0.18	0.13
Uniform Delay, d1	14.5	18.8		16.2	20.0	16.9	15.5	17.7		11.6	11.7	11.4
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	7.3	1.0		2.9	1.2	0.1	0.7	3.6		0.2	0.6	0.4
Delay (s)	21.9	19.8		19.1	21.1	17.0	16.2	21.3		11.8	12.3	11.8
Level of Service	C	B		B	C	B	B	C		B	B	B
Approach Delay (s)		20.3			20.4			20.6			12.0	
Approach LOS		C			C			C			B	
Intersection Summary												
HCM Average Control Delay			19.0			HCM Level of Service				B		
HCM Volume to Capacity ratio			0.63									
Actuated Cycle Length (s)			62.4			Sum of lost time (s)			19.0			
Intersection Capacity Utilization			66.9%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

Timings
6: Lundy's Lane & Thorold Townline Road

<2031 Total> Weekday AM Peak Hour

2018-11-23

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	61	680	187	45	526	89	96	146	145	79	31
Turn Type	Perm		Perm	Perm		Perm	pm+pt		pm+pt		Perm
Protected Phases		4			8		5	2	1	6	
Permitted Phases	4		4	8		8	2		6		6
Detector Phase	4	4	4	8	8	8	5	2	1	6	6
Switch Phase											
Minimum Initial (s)	16.0	16.0	16.0	16.0	16.0	16.0	4.0	16.0	4.0	16.0	16.0
Minimum Split (s)	21.5	21.5	21.5	21.5	21.5	21.5	8.0	21.5	8.0	21.5	21.5
Total Split (s)	35.0	35.0	35.0	35.0	35.0	35.0	8.0	22.0	8.0	22.0	22.0
Total Split (%)	53.8%	53.8%	53.8%	53.8%	53.8%	53.8%	12.3%	33.8%	12.3%	33.8%	33.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.5	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5	4.0	5.5	5.5
Lead/Lag							Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	None	Max	Max
Act Effect Green (s)	28.2	28.2	28.2	28.2	28.2	28.2	21.3	16.7	21.3	16.7	16.7
Actuated g/C Ratio	0.45	0.45	0.45	0.45	0.45	0.45	0.34	0.27	0.34	0.27	0.27
v/c Ratio	0.35	0.91	0.25	0.41	0.70	0.13	0.23	0.42	0.41	0.18	0.08
Control Delay	17.9	33.3	2.7	24.7	19.4	3.1	14.3	21.3	17.7	20.3	7.8
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	17.9	33.3	2.7	24.7	19.4	3.1	14.3	21.3	17.7	20.3	7.8
LOS	B	C	A	C	B	A	B	C	B	C	A
Approach Delay		26.1			17.5			18.9		17.3	
Approach LOS		C			B			B		B	

Intersection Summary

Cycle Length: 65

Actuated Cycle Length: 62.1

Natural Cycle: 65

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.91

Intersection Signal Delay: 21.4

Intersection LOS: C

Intersection Capacity Utilization 84.6%

ICU Level of Service E

Analysis Period (min) 15

Splits and Phases: 6: Lundy's Lane & Thorold Townline Road

 ø1	 ø2	 ø4
8 s	22 s	35 s
 ø5	 ø6	 ø8
8 s	22 s	35 s

HCM Signalized Intersection Capacity Analysis

6: Lundy's Lane & Thorold Townline Road

<2031 Total> Weekday AM Peak Hour

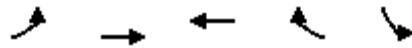
2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	61	680	187	45	526	89	96	146	40	145	79	31
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1612	1881	1615	1805	1881	1615	1787	1811		1671	1863	1615
Flt Permitted	0.25	1.00	1.00	0.14	1.00	1.00	0.70	1.00		0.60	1.00	1.00
Satd. Flow (perm)	432	1881	1615	270	1881	1615	1314	1811		1058	1863	1615
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	69	773	212	51	598	101	109	166	45	165	90	35
RTOR Reduction (vph)	0	0	117	0	0	56	0	15	0	0	0	26
Lane Group Flow (vph)	69	773	95	51	598	45	109	196	0	165	90	9
Heavy Vehicles (%)	12%	1%	0%	0%	1%	0%	1%	2%	0%	8%	2%	0%
Turn Type	Perm		Perm	Perm		Perm	pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	28.2	28.2	28.2	28.2	28.2	28.2	19.8	16.7		19.8	16.7	16.7
Effective Green, g (s)	28.2	28.2	28.2	28.2	28.2	28.2	19.8	16.7		19.8	16.7	16.7
Actuated g/C Ratio	0.45	0.45	0.45	0.45	0.45	0.45	0.31	0.27		0.31	0.27	0.27
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
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)	193	842	723	121	842	723	436	480		363	494	428
v/s Ratio Prot		c0.41			0.32		0.01	0.11		c0.02	0.05	
v/s Ratio Perm	0.16		0.06	0.19		0.03	0.07			c0.12		0.01
v/c Ratio	0.36	0.92	0.13	0.42	0.71	0.06	0.25	0.41		0.45	0.18	0.02
Uniform Delay, d1	11.4	16.3	10.2	11.8	14.1	9.9	15.8	19.1		16.7	17.9	17.1
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	1.1	14.7	0.1	2.4	2.8	0.0	0.3	2.6		0.9	0.8	0.1
Delay (s)	12.6	31.0	10.3	14.2	16.9	9.9	16.1	21.7		17.6	18.7	17.2
Level of Service	B	C	B	B	B	A	B	C		B	B	B
Approach Delay (s)		25.6			15.8			19.8			17.9	
Approach LOS		C			B			B			B	
Intersection Summary												
HCM Average Control Delay			20.9			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.71									
Actuated Cycle Length (s)			63.0			Sum of lost time (s)				13.5		
Intersection Capacity Utilization			84.6%			ICU Level of Service				E		
Analysis Period (min)			15									
c Critical Lane Group												

Timings
7: Lundy's Lane & Site Access 1

<2031 Total> Weekday AM Peak Hour

2018-11-23



Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Volume (vph)	31	556	679	125	336
Turn Type	Perm			Perm	
Protected Phases		4	8		6
Permitted Phases	4			8	
Detector Phase	4	4	8	8	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	Max
Act Effect Green (s)	12.9	12.9	12.9	12.9	16.1
Actuated g/C Ratio	0.35	0.35	0.35	0.35	0.44
v/c Ratio	0.17	0.49	0.60	0.21	0.56
Control Delay	10.3	10.8	12.1	3.0	11.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	10.3	10.8	12.1	3.0	11.6
LOS	B	B	B	A	B
Approach Delay		10.8	10.6		11.6
Approach LOS		B	B		B

Intersection Summary

Cycle Length: 40

Actuated Cycle Length: 37

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.60

Intersection Signal Delay: 10.9

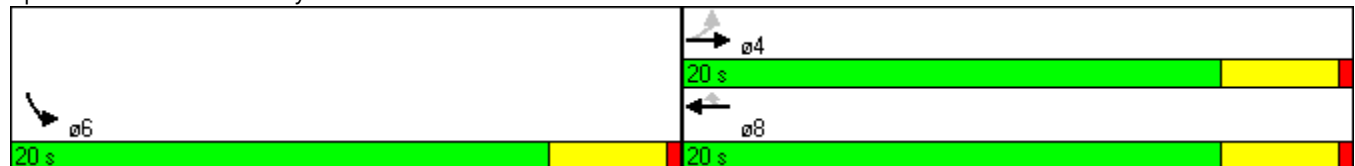
Intersection LOS: B

Intersection Capacity Utilization 54.8%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 7: Lundy's Lane & Site Access 1

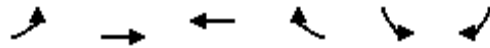


HCM Signalized Intersection Capacity Analysis

7: Lundy's Lane & Site Access 1

<2031 Total> Weekday AM Peak Hour

2018-11-23



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	31	556	679	125	336	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.98	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1770	3539	3539	1583	1748	
Flt Permitted	0.31	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	578	3539	3539	1583	1748	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	34	604	738	136	365	73
RTOR Reduction (vph)	0	0	0	89	17	0
Lane Group Flow (vph)	34	604	738	47	421	0
Turn Type	Perm		Perm			
Protected Phases	4		8		6	
Permitted Phases	4		8			
Actuated Green, G (s)	12.9	12.9	12.9	12.9	16.1	
Effective Green, g (s)	12.9	12.9	12.9	12.9	16.1	
Actuated g/C Ratio	0.35	0.35	0.35	0.35	0.44	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	202	1234	1234	552	761	
v/s Ratio Prot		0.17	c0.21		c0.24	
v/s Ratio Perm	0.06			0.03		
v/c Ratio	0.17	0.49	0.60	0.09	0.55	
Uniform Delay, d1	8.3	9.5	9.9	8.1	7.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.4	0.3	0.8	0.1	2.9	
Delay (s)	8.7	9.8	10.7	8.2	10.7	
Level of Service	A	A	B	A	B	
Approach Delay (s)		9.7	10.3		10.7	
Approach LOS		A	B		B	
Intersection Summary						
HCM Average Control Delay			10.2	HCM Level of Service		B
HCM Volume to Capacity ratio			0.57			
Actuated Cycle Length (s)			37.0	Sum of lost time (s)		8.0
Intersection Capacity Utilization			54.8%	ICU Level of Service		A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis 8: Lundy's Lane & Site Access 2

<2031 Total> Weekday AM Peak Hour

2018-11-23



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	31	893	622	31	0	67
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	34	971	676	34	0	73
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (m)		204				
pX, platoon unblocked						
vC, conflicting volume	710				1731	693
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	710				1731	693
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				100	84
cM capacity (veh/h)	889				93	443
Direction, Lane #	EB 1	EB 2	WB 1	SB 1		
Volume Total	34	971	710	73		
Volume Left	34	0	0	0		
Volume Right	0	0	34	73		
cSH	889	1700	1700	443		
Volume to Capacity	0.04	0.57	0.42	0.16		
Queue Length 95th (m)	0.9	0.0	0.0	4.7		
Control Delay (s)	9.2	0.0	0.0	14.7		
Lane LOS	A			B		
Approach Delay (s)	0.3		0.0	14.7		
Approach LOS				B		
Intersection Summary						
Average Delay			0.8			
Intersection Capacity Utilization			57.8%		ICU Level of Service	B
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis 9: Site Access 3 & Thorold Townline Road

<2031 Total> Weekday AM Peak Hour

2018-11-23

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	67	135	63	233	139	31
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	73	147	68	253	151	34
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	558	168	185			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	558	168	185			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	84	83	95			
cM capacity (veh/h)	466	876	1390			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	220	68	253	185		
Volume Left	73	68	0	0		
Volume Right	147	0	0	34		
cSH	679	1390	1700	1700		
Volume to Capacity	0.32	0.05	0.15	0.11		
Queue Length 95th (m)	11.2	1.2	0.0	0.0		
Control Delay (s)	12.8	7.7	0.0	0.0		
Lane LOS	B	A				
Approach Delay (s)	12.8	1.6		0.0		
Approach LOS	B					
Intersection Summary						
Average Delay			4.6			
Intersection Capacity Utilization			34.7%		ICU Level of Service	A
Analysis Period (min)			15			

Timings

<2031 Total> Weekday PM Peak Hour

1: Niagara Falls Road & Davis Road

2018-11-23



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	114	38	57	70	13	817	213	1206	154
Turn Type	Perm		Perm		Perm		Perm		Perm
Protected Phases		4		8		2		6	
Permitted Phases	4		8		2		6		6
Detector Phase	4	4	8	8	2	2	6	6	6
Switch Phase									
Minimum Initial (s)	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	33.3%	33.3%	33.3%	33.3%	66.7%	66.7%	66.7%	66.7%	66.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)	14.5	14.5		14.5	34.9	34.9	34.9	34.9	34.9
Actuated g/C Ratio	0.24	0.24		0.24	0.58	0.58	0.58	0.58	0.58
v/c Ratio	0.72	0.11		0.75	0.09	0.44	0.74	0.63	0.17
Control Delay	48.4	16.1		25.2	7.5	8.0	28.3	10.3	1.7
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.4	16.1		25.2	7.5	8.0	28.3	10.3	1.7
LOS	D	B		C	A	A	C	B	A
Approach Delay		39.1		25.2		8.0		11.9	
Approach LOS		D		C		A		B	

Intersection Summary

Cycle Length: 60

Actuated Cycle Length: 60.4

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.75

Intersection Signal Delay: 13.8

Intersection LOS: B

Intersection Capacity Utilization 86.5%

ICU Level of Service E

Analysis Period (min) 15

Splits and Phases: 1: Niagara Falls Road & Davis Road



HCM Signalized Intersection Capacity Analysis

<2031 Total> Weekday PM Peak Hour

1: Niagara Falls Road & Davis Road

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	114	38	8	57	70	219	13	817	32	213	1206	154
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5			5.5		5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.97			0.91		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	1803			1697		1641	3545		1787	3505	1553
Flt Permitted	0.38	1.00			0.93		0.16	1.00		0.28	1.00	1.00
Satd. Flow (perm)	704	1803			1597		268	3545		532	3505	1553
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	121	40	9	61	74	233	14	869	34	227	1283	164
RTOR Reduction (vph)	0	7	0	0	104	0	0	5	0	0	0	69
Lane Group Flow (vph)	121	42	0	0	264	0	14	898	0	227	1283	95
Heavy Vehicles (%)	3%	3%	0%	7%	2%	0%	10%	1%	8%	1%	3%	4%
Turn Type	Perm		Perm			Perm			Perm			Perm
Protected Phases	4		8			2			6			6
Permitted Phases	4		8			2			6			6
Actuated Green, G (s)	14.5	14.5	14.5			34.9	34.9	34.9		34.9	34.9	34.9
Effective Green, g (s)	14.5	14.5	14.5			34.9	34.9	34.9		34.9	34.9	34.9
Actuated g/C Ratio	0.24	0.24	0.24			0.58	0.58	0.58		0.58	0.58	0.58
Clearance Time (s)	5.5	5.5	5.5			5.5	5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0			3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	169	433	383			155	2048	307		2025	897	
v/s Ratio Prot	0.02					0.25			0.37			
v/s Ratio Perm	c0.17				0.17	0.05		c0.43		0.06		
v/c Ratio	0.72	0.10	0.69			0.09	0.44	0.74		0.63	0.11	
Uniform Delay, d1	21.1	17.9	20.9			5.7	7.2	9.4		8.5	5.7	
Progression Factor	1.00	1.00	1.00			1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	13.5	0.1	5.1			1.1	0.7	14.8		1.5	0.2	
Delay (s)	34.5	18.0	26.0			6.8	7.9	24.2		10.0	6.0	
Level of Service	C	B	C			A	A	C		B	A	
Approach Delay (s)	29.7		26.0			7.9		11.5				
Approach LOS	C		C			A		B				
Intersection Summary												
HCM Average Control Delay			13.2	HCM Level of Service			B					
HCM Volume to Capacity ratio			0.73									
Actuated Cycle Length (s)			60.4	Sum of lost time (s)			11.0					
Intersection Capacity Utilization			86.5%	ICU Level of Service			E					
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis 2: Beaverdams Road & Thorold Townline Road

<2031 Total> Weekday PM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	25	226	28	98	211	23	40	154	67	48	238	41
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	27	240	30	104	224	24	43	164	71	51	253	44
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	297	353	278	348								
Volume Left (vph)	27	104	43	51								
Volume Right (vph)	30	24	71	44								
Hadj (s)	-0.03	0.10	-0.01	0.03								
Departure Headway (s)	7.3	7.2	7.4	7.2								
Degree Utilization, x	0.60	0.71	0.57	0.69								
Capacity (veh/h)	447	463	436	463								
Control Delay (s)	20.6	25.9	19.6	25.0								
Approach Delay (s)	20.6	25.9	19.6	25.0								
Approach LOS	C	D	C	C								
Intersection Summary												
Delay			23.0									
HCM Level of Service			C									
Intersection Capacity Utilization			66.2%		ICU Level of Service				C			
Analysis Period (min)			15									

Timings
3: Barker Parkway & Davis Road

<2031 Total> Weekday PM Peak Hour

2018-11-23

					
Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Configurations					
Volume (vph)	10	453	142	685	183
Turn Type	Perm		Perm		
Protected Phases	8		2		6
Permitted Phases		8		6	
Detector Phase	8	8	2	6	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	55.0	55.0	55.0
Total Split (%)	26.7%	26.7%	73.3%	73.3%	73.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	Max	Max	Max
Act Effct Green (s)	8.5	8.5	51.2	51.2	51.2
Actuated g/C Ratio	0.13	0.13	0.76	0.76	0.76
v/c Ratio	0.05	0.79	0.06	0.79	0.08
Control Delay	25.1	13.0	2.6	15.4	2.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	25.1	13.0	2.6	15.4	2.8
LOS	C	B	A	B	A
Approach Delay	13.3		2.6		12.7
Approach LOS	B		A		B

Intersection Summary

Cycle Length: 75

Actuated Cycle Length: 67.7

Natural Cycle: 75

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.79

Intersection Signal Delay: 11.8

Intersection LOS: B

Intersection Capacity Utilization 55.6%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 3: Barker Parkway & Davis Road



HCM Signalized Intersection Capacity Analysis

3: Barker Parkway & Davis Road

<2031 Total> Weekday PM Peak Hour

2018-11-23

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	10	453	142	13	685	183
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1538	3439		1805	3406
Flt Permitted	0.95	1.00	1.00		0.65	1.00
Satd. Flow (perm)	1805	1538	3439		1228	3406
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	11	487	153	14	737	197
RTOR Reduction (vph)	0	426	3	0	0	0
Lane Group Flow (vph)	11	61	164	0	737	197
Heavy Vehicles (%)	0%	5%	4%	0%	0%	6%
Turn Type	Perm				Perm	
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	8.5	8.5	51.2		51.2	51.2
Effective Green, g (s)	8.5	8.5	51.2		51.2	51.2
Actuated g/C Ratio	0.13	0.13	0.76		0.76	0.76
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	227	193	2601		929	2576
v/s Ratio Prot	0.01		0.05			0.06
v/s Ratio Perm		c0.04			c0.60	
v/c Ratio	0.05	0.32	0.06		0.79	0.08
Uniform Delay, d1	26.0	27.0	2.1		5.0	2.1
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.1	0.9	0.0		6.9	0.1
Delay (s)	26.1	27.9	2.2		11.9	2.2
Level of Service	C	C	A		B	A
Approach Delay (s)	27.9		2.2			9.9
Approach LOS	C		A			A
Intersection Summary						
HCM Average Control Delay			14.7		HCM Level of Service	B
HCM Volume to Capacity ratio			0.73			
Actuated Cycle Length (s)			67.7		Sum of lost time (s)	8.0
Intersection Capacity Utilization			55.6%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

Timings

4: Allanburg Road & Davis Road

<2031 Total> Weekday PM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	47	0	54	58	0	93	235	178	247	61
Turn Type	Perm		Perm	Perm		Perm		Perm		Perm
Protected Phases		4			8		2		6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	4	4	4	8	8	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	Max	Max	Max	Max	Max
Act Effect Green (s)		7.4	7.4		7.4	20.7	20.7	20.7	20.7	20.7
Actuated g/C Ratio		0.22	0.22		0.22	0.62	0.62	0.62	0.62	0.62
v/c Ratio		0.19	0.15		0.45	0.15	0.33	0.32	0.25	0.07
Control Delay		11.1	4.3		7.8	5.5	5.3	7.0	5.5	2.0
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		11.1	4.3		7.8	5.5	5.3	7.0	5.5	2.0
LOS		B	A		A	A	A	A	A	A
Approach Delay		7.5			7.8		5.3		5.6	
Approach LOS		A			A		A		A	

Intersection Summary

Cycle Length: 40

Actuated Cycle Length: 33.6

Natural Cycle: 40

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.45

Intersection Signal Delay: 6.0

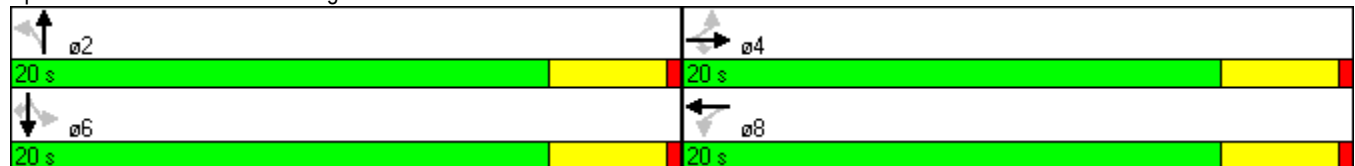
Intersection LOS: A

Intersection Capacity Utilization 54.6%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 4: Allanburg Road & Davis Road



HCM Signalized Intersection Capacity Analysis

4: Allanburg Road & Davis Road

<2031 Total> Weekday PM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	47	0	54	58	0	115	93	235	89	178	247	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.91		1.00	0.96		1.00	1.00	0.85
Flt Protected		0.95	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1671	1615		1701		1805	1758		1805	1792	1524
Flt Permitted		0.72	1.00		0.87		0.59	1.00		0.54	1.00	1.00
Satd. Flow (perm)		1266	1615		1500		1116	1758		1030	1792	1524
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	53	0	61	66	0	131	106	267	101	202	281	69
RTOR Reduction (vph)	0	0	50	0	107	0	0	24	0	0	0	29
Lane Group Flow (vph)	0	53	11	0	90	0	106	344	0	202	281	40
Heavy Vehicles (%)	8%	0%	0%	0%	0%	0%	0%	5%	0%	0%	6%	6%
Turn Type	Perm		Perm	Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		6.4	6.4		6.4		19.9	19.9		19.9	19.9	19.9
Effective Green, g (s)		6.4	6.4		6.4		19.9	19.9		19.9	19.9	19.9
Actuated g/C Ratio		0.19	0.19		0.19		0.58	0.58		0.58	0.58	0.58
Clearance Time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		236	301		280		647	1020		598	1040	884
v/s Ratio Prot								0.20			0.16	
v/s Ratio Perm		0.04	0.01		0.06		0.10			0.20		0.03
v/c Ratio		0.22	0.04		0.32		0.16	0.34		0.34	0.27	0.05
Uniform Delay, d1		11.8	11.4		12.1		3.3	3.8		3.8	3.6	3.1
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.5	0.1		0.7		0.5	0.9		1.5	0.6	0.1
Delay (s)		12.3	11.5		12.7		3.9	4.7		5.3	4.2	3.2
Level of Service		B	B		B		A	A		A	A	A
Approach Delay (s)		11.9			12.7			4.5			4.5	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay			6.3			HCM Level of Service				A		
HCM Volume to Capacity ratio			0.33									
Actuated Cycle Length (s)			34.3			Sum of lost time (s)				8.0		
Intersection Capacity Utilization			54.6%			ICU Level of Service				A		
Analysis Period (min)			15									
c Critical Lane Group												

Timings
5: Lundy's Lane & Davis Road

<2031 Total> Weekday PM Peak Hour

2018-11-23

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	208	773	88	647	74	71	141	80	149	187
Turn Type	pm+pt		pm+pt		Perm	Perm		pm+pt		Perm
Protected Phases	7	4	3	8			2	1	6	
Permitted Phases	4		8		8	2		6		6
Detector Phase	7	4	3	8	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	16.0	4.0	16.0	16.0	16.0	16.0	4.0	16.0	16.0
Minimum Split (s)	8.0	21.5	8.0	21.5	21.5	21.5	21.5	8.0	21.5	21.5
Total Split (s)	15.0	34.0	9.0	28.0	28.0	29.0	29.0	8.0	37.0	37.0
Total Split (%)	18.8%	42.5%	11.3%	35.0%	35.0%	36.3%	36.3%	10.0%	46.3%	46.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	2.0	0.5	2.0	2.0	2.0	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.5	4.0	5.5	5.5	5.5	5.5	4.0	5.5	5.5
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Recall Mode	None	None	None	None	None	Max	Max	None	Max	Max
Act Effect Green (s)	37.2	28.6	27.5	20.9	20.9	25.3	25.3	33.1	31.6	31.6
Actuated g/C Ratio	0.48	0.37	0.35	0.27	0.27	0.32	0.32	0.42	0.40	0.40
v/c Ratio	0.75	0.79	0.60	0.83	0.19	0.25	0.56	0.29	0.27	0.29
Control Delay	30.0	28.3	29.3	36.0	6.5	24.0	24.2	17.1	17.6	3.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.0	28.3	29.3	36.0	6.5	24.0	24.2	17.1	17.6	3.5
LOS	C	C	C	D	A	C	C	B	B	A
Approach Delay		28.6		32.6			24.1		11.2	
Approach LOS		C		C			C		B	

Intersection Summary

Cycle Length: 80

Actuated Cycle Length: 78.3

Natural Cycle: 65

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.83

Intersection Signal Delay: 26.5

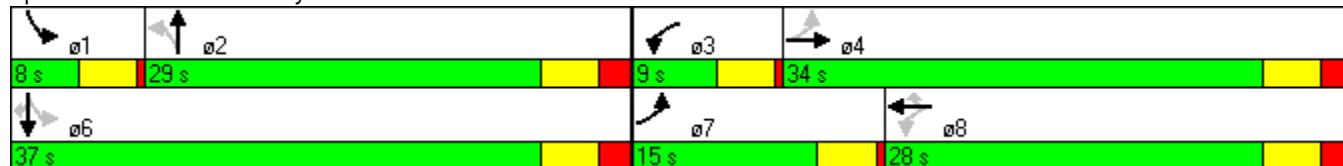
Intersection LOS: C

Intersection Capacity Utilization 73.2%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 5: Lundy's Lane & Davis Road



HCM Signalized Intersection Capacity Analysis

5: Lundy's Lane & Davis Road

<2031 Total> Weekday PM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	208	773	44	88	647	74	71	141	116	80	149	187
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	3423		1480	3539	1553	1626	1611		1719	1681	1599
Flt Permitted	0.16	1.00		0.18	1.00	1.00	0.64	1.00		0.38	1.00	1.00
Satd. Flow (perm)	287	3423		287	3539	1553	1100	1611		680	1681	1599
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	254	943	54	107	789	90	87	172	141	98	182	228
RTOR Reduction (vph)	0	5	0	0	0	66	0	36	0	0	0	136
Lane Group Flow (vph)	254	992	0	107	789	24	87	277	0	98	182	92
Heavy Vehicles (%)	3%	4%	15%	22%	2%	4%	11%	10%	10%	5%	13%	1%
Turn Type	pm+pt			pm+pt		Perm	Perm			pm+pt		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4			8		8	2			6		6
Actuated Green, G (s)	36.5	28.6		25.6	21.7	21.7	25.3	25.3		32.4	32.4	32.4
Effective Green, g (s)	36.5	28.6		25.6	21.7	21.7	25.3	25.3		32.4	32.4	32.4
Actuated g/C Ratio	0.46	0.36		0.32	0.27	0.27	0.32	0.32		0.41	0.41	0.41
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		4.0	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	329	1225		150	961	422	348	510		316	682	648
v/s Ratio Prot	c0.10	c0.29		0.03	0.22			c0.17		0.01	c0.11	
v/s Ratio Perm	0.25			0.19		0.02	0.08			0.11		0.06
v/c Ratio	0.77	0.81		0.71	0.82	0.06	0.25	0.54		0.31	0.27	0.14
Uniform Delay, d1	16.2	23.2		21.1	27.3	21.5	20.3	22.5		15.7	15.8	15.0
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	10.7	4.1		14.8	5.7	0.1	1.7	4.1		0.6	1.0	0.5
Delay (s)	26.9	27.2		36.0	33.0	21.6	22.0	26.7		16.2	16.8	15.4
Level of Service	C	C		D	C	C	C	C		B	B	B
Approach Delay (s)		27.2			32.3			25.6			16.1	
Approach LOS		C			C			C			B	
Intersection Summary												
HCM Average Control Delay			26.8			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.66									
Actuated Cycle Length (s)			79.9			Sum of lost time (s)			15.0			
Intersection Capacity Utilization			73.2%			ICU Level of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

Timings

<2031 Total> Weekday PM Peak Hour

6: Lundy's Lane & Thorold Townline Road

2018-11-23

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	32	804	165	54	831	192	234	110	131	142	50
Turn Type	Perm		Perm	Perm		Perm	pm+pt		pm+pt		Perm
Protected Phases		4			8		5	2	1	6	
Permitted Phases	4		4	8		8	2		6		6
Detector Phase	4	4	4	8	8	8	5	2	1	6	6
Switch Phase											
Minimum Initial (s)	16.0	16.0	16.0	16.0	16.0	16.0	4.0	16.0	4.0	16.0	16.0
Minimum Split (s)	21.5	21.5	21.5	21.5	21.5	21.5	8.0	21.5	8.0	21.5	21.5
Total Split (s)	49.0	49.0	49.0	49.0	49.0	49.0	8.0	23.0	8.0	23.0	23.0
Total Split (%)	61.3%	61.3%	61.3%	61.3%	61.3%	61.3%	10.0%	28.8%	10.0%	28.8%	28.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.5	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5	4.0	5.5	5.5
Lead/Lag							Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max	None	Max	Max
Act Effect Green (s)	41.4	41.4	41.4	41.4	41.4	41.4	23.1	17.6	23.1	17.6	17.6
Actuated g/C Ratio	0.53	0.53	0.53	0.53	0.53	0.53	0.30	0.23	0.30	0.23	0.23
v/c Ratio	0.41	0.92	0.20	0.62	0.95	0.23	0.69	0.44	0.44	0.38	0.14
Control Delay	27.9	32.3	2.5	45.9	36.9	2.0	34.2	26.5	25.4	29.7	8.7
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	27.9	32.3	2.5	45.9	36.9	2.0	34.2	26.5	25.4	29.7	8.7
LOS	C	C	A	D	D	A	C	C	C	C	A
Approach Delay		27.2			31.1			31.0		24.7	
Approach LOS		C			C			C		C	

Intersection Summary

Cycle Length: 80

Actuated Cycle Length: 78

Natural Cycle: 80

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.95

Intersection Signal Delay: 29.0

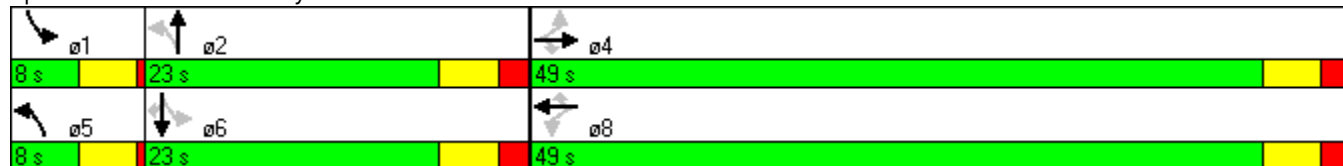
Intersection LOS: C

Intersection Capacity Utilization 83.7%

ICU Level of Service E

Analysis Period (min) 15

Splits and Phases: 6: Lundy's Lane & Thorold Townline Road



HCM Signalized Intersection Capacity Analysis

6: Lundy's Lane & Thorold Townline Road

<2031 Total> Weekday PM Peak Hour

2018-11-23

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	32	804	165	54	831	192	234	110	54	131	142	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1612	1881	1615	1805	1881	1615	1787	1783		1671	1863	1615
Flt Permitted	0.10	1.00	1.00	0.10	1.00	1.00	0.64	1.00		0.59	1.00	1.00
Satd. Flow (perm)	164	1881	1615	184	1881	1615	1202	1783		1033	1863	1615
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	36	914	188	61	944	218	266	125	61	149	161	57
RTOR Reduction (vph)	0	0	81	0	0	102	0	22	0	0	0	44
Lane Group Flow (vph)	36	914	107	61	944	116	266	164	0	149	161	13
Heavy Vehicles (%)	12%	1%	0%	0%	1%	0%	1%	2%	0%	8%	2%	0%
Turn Type	Perm		Perm	Perm		Perm	pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	41.4	41.4	41.4	41.4	41.4	41.4	21.6	17.6		21.6	17.6	17.6
Effective Green, g (s)	41.4	41.4	41.4	41.4	41.4	41.4	21.6	17.6		21.6	17.6	17.6
Actuated g/C Ratio	0.53	0.53	0.53	0.53	0.53	0.53	0.28	0.23		0.28	0.23	0.23
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	4.0	5.5		4.0	5.5	5.5
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)	87	998	857	98	998	857	363	402		319	420	364
v/s Ratio Prot		0.49			c0.50		c0.04	0.09		0.02	0.09	
v/s Ratio Perm	0.22		0.07	0.33		0.07	c0.17			0.11		0.01
v/c Ratio	0.41	0.92	0.13	0.62	0.95	0.14	0.73	0.41		0.47	0.38	0.04
Uniform Delay, d1	11.0	16.7	9.2	12.8	17.2	9.2	24.9	25.8		22.8	25.6	23.6
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	3.2	12.6	0.1	11.7	16.8	0.1	7.5	3.1		1.1	2.6	0.2
Delay (s)	14.2	29.3	9.3	24.5	34.1	9.3	32.4	28.8		23.9	28.2	23.8
Level of Service	B	C	A	C	C	A	C	C		C	C	C
Approach Delay (s)		25.5			29.2			30.9			25.8	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM Average Control Delay			27.7			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.85									
Actuated Cycle Length (s)			78.0			Sum of lost time (s)				13.5		
Intersection Capacity Utilization			83.7%			ICU Level of Service				E		
Analysis Period (min)			15									
c Critical Lane Group												

Timings
7: Lundy's Lane & Site Access 1

<2031 Total> Weekday PM Peak Hour
2018-11-23

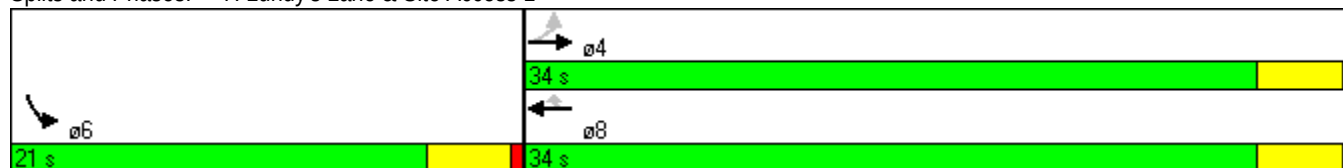
					
Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Volume (vph)	89	880	1054	355	288
Turn Type	Perm			Perm	
Protected Phases		4	8		6
Permitted Phases	4			8	
Detector Phase	4	4	8	8	6
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	34.0	34.0	34.0	34.0	21.0
Total Split (%)	61.8%	61.8%	61.8%	61.8%	38.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	Max
Act Effect Green (s)	22.8	22.8	22.8	22.8	17.3
Actuated g/C Ratio	0.47	0.47	0.47	0.47	0.36
v/c Ratio	0.63	0.57	0.68	0.41	0.59
Control Delay	30.6	10.3	11.9	2.3	18.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	30.6	10.3	11.9	2.3	18.7
LOS	C	B	B	A	B
Approach Delay		12.2	9.5		18.7
Approach LOS		B	A		B

Intersection Summary

Cycle Length: 55
 Actuated Cycle Length: 48.2
 Natural Cycle: 60
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 0.68
 Intersection Signal Delay: 11.6
 Intersection Capacity Utilization 63.6%
 Analysis Period (min) 15

Intersection LOS: B
 ICU Level of Service B

Splits and Phases: 7: Lundy's Lane & Site Access 1

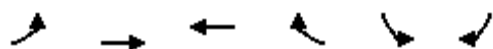


HCM Signalized Intersection Capacity Analysis

7: Lundy's Lane & Site Access 1

<2031 Total> Weekday PM Peak Hour

2018-11-23

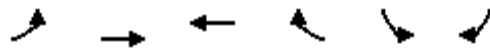


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	89	880	1054	355	288	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.98	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1770	3539	3539	1583	1748	
Flt Permitted	0.18	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	327	3539	3539	1583	1748	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	97	957	1146	386	313	63
RTOR Reduction (vph)	0	0	0	203	12	0
Lane Group Flow (vph)	97	957	1146	183	364	0
Turn Type	Perm		Perm			
Protected Phases	4		8	6		
Permitted Phases	4		8			
Actuated Green, G (s)	22.8	22.8	22.8	22.8	17.3	
Effective Green, g (s)	22.8	22.8	22.8	22.8	17.3	
Actuated g/C Ratio	0.47	0.47	0.47	0.47	0.36	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	155	1678	1678	750	629	
v/s Ratio Prot		0.27	c0.32		c0.21	
v/s Ratio Perm	0.30			0.12		
v/c Ratio	0.63	0.57	0.68	0.24	0.58	
Uniform Delay, d1	9.5	9.1	9.8	7.5	12.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	7.7	0.5	1.2	0.2	3.8	
Delay (s)	17.1	9.6	11.0	7.7	16.3	
Level of Service	B	A	B	A	B	
Approach Delay (s)		10.3	10.2		16.3	
Approach LOS		B	B		B	
Intersection Summary						
HCM Average Control Delay			11.0	HCM Level of Service		B
HCM Volume to Capacity ratio			0.64			
Actuated Cycle Length (s)			48.1	Sum of lost time (s)		8.0
Intersection Capacity Utilization			63.6%	ICU Level of Service		B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis 8: Lundy's Lane & Site Access 2

<2031 Total> Weekday PM Peak Hour

2018-11-23



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	89	1167	1026	89	0	58
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	97	1268	1115	97	0	63
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (m)		204				
pX, platoon unblocked						
vC, conflicting volume	1212				2626	1164
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1212				2626	1164
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	83				100	73
cM capacity (veh/h)	576				22	237
Direction, Lane #	EB 1	EB 2	WB 1	SB 1		
Volume Total	97	1268	1212	63		
Volume Left	97	0	0	0		
Volume Right	0	0	97	63		
cSH	576	1700	1700	237		
Volume to Capacity	0.17	0.75	0.71	0.27		
Queue Length 95th (m)	4.8	0.0	0.0	8.3		
Control Delay (s)	12.5	0.0	0.0	25.6		
Lane LOS	B			D		
Approach Delay (s)	0.9		0.0	25.6		
Approach LOS				D		
Intersection Summary						
Average Delay			1.1			
Intersection Capacity Utilization			77.9%		ICU Level of Service	D
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

9: Site Access 3 & Thorold Townline Road

<2031 Total> Weekday PM Peak Hour

2018-11-23

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	58	115	178	156	275	89
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	63	125	193	170	299	97
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	904	347	396			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	904	347	396			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	75	82	83			
cM capacity (veh/h)	256	696	1163			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	188	193	170	396		
Volume Left	63	193	0	0		
Volume Right	125	0	0	97		
cSH	442	1163	1700	1700		
Volume to Capacity	0.43	0.17	0.10	0.23		
Queue Length 95th (m)	16.7	4.8	0.0	0.0		
Control Delay (s)	19.1	8.7	0.0	0.0		
Lane LOS	C	A				
Approach Delay (s)	19.1	4.6		0.0		
Approach LOS	C					
Intersection Summary						
Average Delay			5.6			
Intersection Capacity Utilization			50.0%	ICU Level of Service		A
Analysis Period (min)			15			



APPENDIX E

LOS Definitions

LEVEL OF SERVICE ANALYSIS AT SIGNALIZED INTERSECTIONS

To assist in clarifying the arithmetic analysis associated with traffic engineering, it is often useful to refer to “Level of Service”. The term Level of Service implies a qualitative measure of traffic flow at an intersection. It is dependent upon vehicle delay and vehicle queue lengths at the approaches. Specifically, Level of Service criteria are stated in terms of the average stopped delay per vehicle for a 15-minute analysis period. The following table describes the characteristics of each level:

<u>Level of Service</u>	<u>Features</u>	<u>Stopped Delay per Vehicle (sec)</u>
A	At this level of service, almost no signal phase is fully utilized by traffic. Very seldom does a vehicle wait longer than one red indication. The approach appears open, turning movements are easily made and drivers have freedom of operation.	≤ 5.0
B	At this level, an occasional signal phase is fully utilized and many phases approach full use. Many drivers begin to feel somewhat restricted within platoons of vehicles approaching the intersection.	$> 5.0 \text{ and } \leq 15.0$
C	At this level, the operation is stable though with more frequent fully utilized signal phases. Drivers feel more restricted and occasionally may have to wait more than one red signal indication, and queues may develop behind turning vehicles. This level is normally employed in urban intersection design.	$> 15.0 \text{ and } \leq 25.0$
D	At this level, the motorist experiences increasing restriction and instability of flow. There are substantial delays to approaching vehicles during short peaks within the peak period, but there are enough cycles with lower demand to permit occasional clearance of developing queues and prevent excessive backups.	$> 25.0 \text{ and } \leq 40.0$
E	At this level, capacity is reached. There are long queues of vehicles waiting upstream of the intersection and delays to vehicles may extend to several signal cycles.	$> 40.0 \text{ and } \leq 60.0$
F	At this level, saturation occurs, with vehicle demand exceeding the available capacity.	> 60.0

LEVEL OF SERVICE ANALYSIS AT UNSIGNALIZED INTERSECTIONS⁽¹⁾

The term "level of service" implies a qualitative measure of traffic flow at an intersection. It is dependent upon the vehicle delay and vehicle queue lengths at approaches. The level of service at unsignalized intersections is often related to the delay accumulated by flows on the minor streets, caused by all other conflicting movements. The following table describes the characteristics of each level.

Level of Service	Features
A	Little or no traffic delay occurs. Approaches appear open, turning movements are easily made, and drivers have freedom of operation.
B	Short traffic delays occur. Many drivers begin to feel somewhat restricted in terms of freedom of operation.
C	Average traffic delays occur. Operations are generally stable, but drivers emerging from the minor street may experience difficulty in completing their movement. This may occasionally impact on the stability of flow on the major street.
D	Long traffic delays occur. Motorists emerging from the minor street experience significant restriction and frustration. Drivers on the major street will experience congestion and delay as drivers emerging from the minor street interfere with the major through movements.
E	Very long traffic delays occur. Operations approach the capacity of the intersection.
F	Saturation occurs, with vehicle demand exceeding the available capacity. Very long traffic delays occur.

⁽¹⁾ Highway Capacity Manual - Special Report No. 209, Transportation Research Board, 1985.