Regional Roads 97 and 47 Industrial Lands, North Dumfries Transportation Impact Study

Paradigm Transportation Solutions Limited

September 2020
200319

ptsl.com

Project Summary

Project Number
200319

September 2020

Client
D5D Enterprises Ltd
c/o Sam Head
Dryden, Smith and Head Planning Consultants Ltd.
54 Cedar Street North
Kitchener ON N2H 2X1

Client Contact
Sam Head

Consultant Project Team
Jim Mallett
Matt Brower
Adam Morrison

Regional Roads 97 and 47 Industrial Lands, North Dumfries Transportation Impact Study

Matthew Brouwer, P.Eng.

Disclaimer

Paradigm Transportation Solutions Limited
5A-150 Pinebush Road
Cambridge ON N1R 8J8
p: 519.896.3163
905.381.2229
416.479.9684
www.ptsl.com

Version 1.0.0

Executive Summary

Content

D5D Enterprises Ltd retained Paradigm Transportation Solutions Limited (Paradigm) to conduct this Transportation Impact Study (TIS) for a proposed industrial development located in North Dumfries.

This report analyzes existing traffic conditions, describes the proposed development, forecasts traffic to five years from the date of this TIS (2025) and recommends improvements to mitigate future traffic conditions.

Development Concept

The proposed development is assumed to be 50.48 ha of industrial park lands and is set to be separated into 6 lots. There is a proposed municipal road, referred to as “Proposed Road”, with the following connections:

- **Proposed Road and Dumfries Road;** and
- **Cedar Creek Road and Proposed Road.**

Conclusions

Based on the investigations carried out, it is concluded that:

- **Existing Traffic Operations:** All study area intersections are currently operating within acceptable levels of service except for the intersection of **Cedar Creek Road and Highway 401 Eastbound Ramps** during both peak hours. As this intersection was found to warrant signalization under the existing conditions, the future horizons were assessed with the assumption of a signalized intersection;
- **Development Trip Generation:** The full build-out of the industrial park is forecast to generate 515 and 500 trips during weekday AM and PM peak hours, respectively;
- **2025 Background Traffic Conditions:** All study area intersections are forecast to operate within acceptable levels of service.
- **2025 Total Traffic Conditions:** All study area intersections are forecast to operate within acceptable levels of service.
- **Remedial Measures:** The following remedial measures were evaluated to mitigate the forecast capacity issues:

- **Cedar Creek Road and Highway 401 Eastbound Ramps:** The signalization of this intersection, as warranted by the existing conditions, with an eastbound left protected phase;
- **Proposed Road and Dumfries Road:** A northbound auxiliary left-turn lane; and
- **Cedar Creek Road and Proposed Road:** An eastbound auxiliary left-turn lane.

Recommendations

Based on the findings of this study, it is recommended that the development be approved with the construction of the following:

- A signal at **Cedar Creek Road and Highway 401 Eastbound Ramps** with an eastbound left protected phase signal head, regardless of whether the proposed development proceeds, as warranted by the existing conditions;
- A northbound auxiliary left-turn lane, with a storage length of 15 metres, on **Dumfries Road at Proposed Road;** and
- A northbound auxiliary left-turn lane, with a storage length of 15 metres, on **Cedar Creek Road at Proposed Road.**

Contents

Appendices

Figures

Tables

1 Introduction

1.1 Overview

D5D Enterprises Ltd retained Paradigm Transportation Solutions Limited (Paradigm) to conduct this Transportation Impact Study (TIS) for a proposed industrial development located in North Dumfries, Ontario.

The scope of the study includes:

- Assessment of the current traffic and site conditions within the study area;
- Estimates of background traffic growth for five years from the date of this TIS (2025);
- Estimates of additional traffic generated by the subject site;
- Analyses of the impact of the future traffic on the surrounding road network;
- Analyses of the proposed road connections; and
- Recommendations necessary to mitigate the site generated traffic in a satisfactory manner.

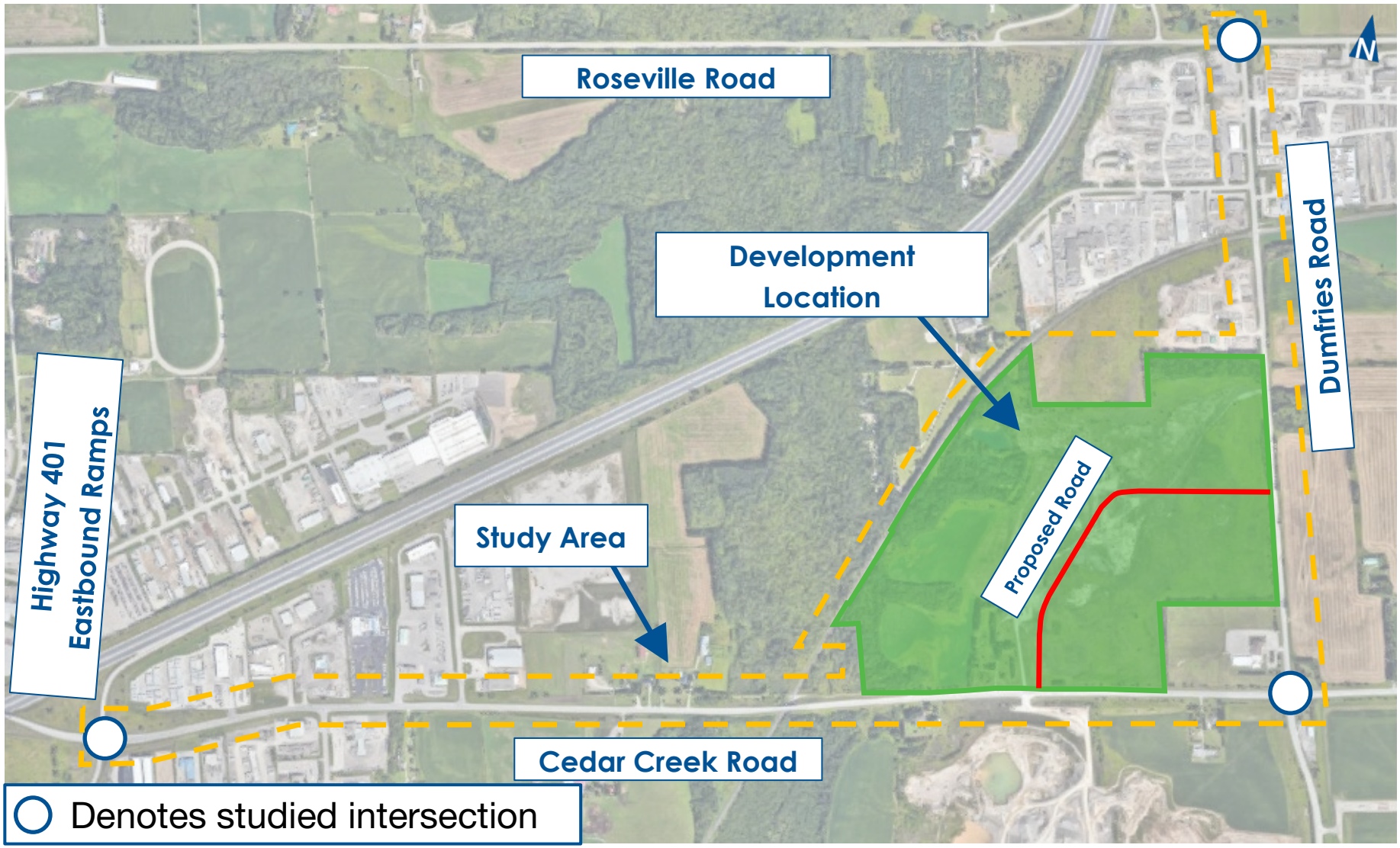
This study has been prepared in accordance with the requirements detailed by the Region of Waterloo (ROW) Transportation Impact Study Guidelines and the study scope has been confirmed with ROW staff in pre-study consultation.

Appendix A contains the pre-study conference form confirmed with ROW staff.

Based on the pre-study consultation, the following intersections were identified for investigation in this study:

- Roseville Road and Dumfries Road;
- Cedar Creek Road and Dumfries Road;
- Cedar Creek Road and Highway 401 Eastbound Ramps;
- Proposed Road and Dumfries Road; and
- Cedar Creek Road and Proposed Road.

Figure 1.1 illustrates the study area.



paradigm TRANSPORTATION SOLUTIONS LIMITED

Study Area and Development Location

Regional Roads 97 at 47 Industrial Lands
200319

Figure 1.1

2 Existing Conditions

2.1 Road Network

The subject site is located on the west side of Dumfries Road (RR 47), and the north side of Cedar Creek Road (RR 97), in North Dumfries. The surrounding area includes a mix of industrial and rural land uses. The main roadways near the subject site considered in assessing the traffic impacts of the development include:

- **Roseville Road:** an east-west road with a two-lane cross section. This roadway has a posted speed limit of 80 km/h;
- **Dumfries Road:** a north-south road with a two-lane cross section. This roadway has a posted speed limit of 80 km/hr;
- **Cedar Creek Road:** an east-west road with a two-lane cross section. This roadway has a posted speed limit of 80 km/h; and
- **Highway 401 Eastbound Ramps:** the on and off-ramps of the Highway 401 for the eastbound direction, which intersect with Cedar Creek Road at a two-way stop control.

Figure 2.1 details the existing traffic control and lane configuration at the study area intersections.

2.2 Transit Service

There are currently no transit routes which operate in the area.

2.3 Active Transportation

There are no sidewalks, multi-use trails or dedicated cycling facilities on either side of the roadway within the study area. However, there are the following existing and proposed facilities in the study area:

- Existing paved shoulders on Cedar Creek Road and Roseville Road;
- Proposed bike lane / paved shoulder on Dumfries Road, and;
- Proposed bike lane on Cedar Creek Road and Roseville Road.

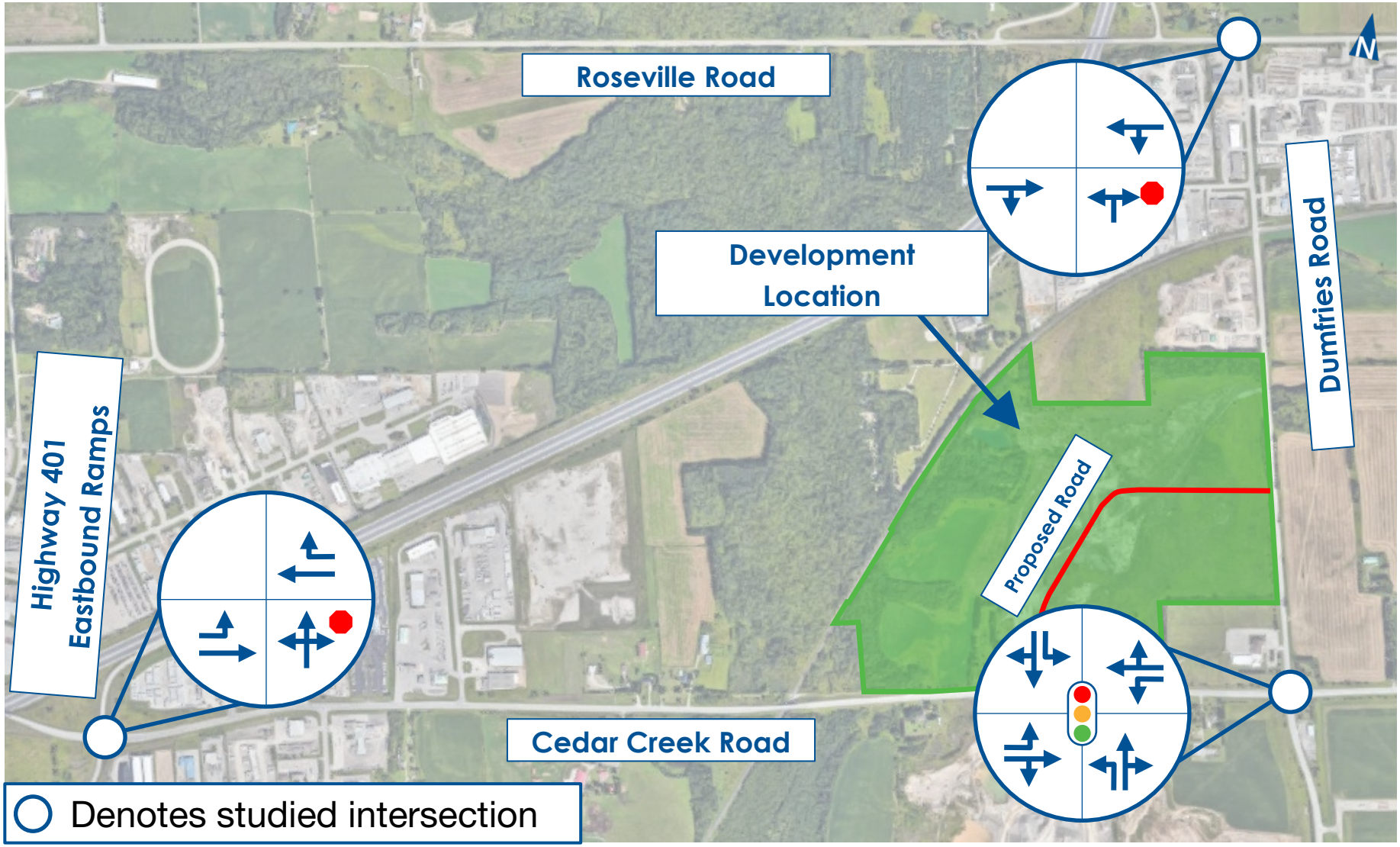
Figure 2.2 illustrates the existing and proposed trail network for North Dumfries as per the Cycling Master Plan[1].

[1] Township Of North Dumfries: Trails/Cycling Master Plan, *MMM Group*, June 2014

2.4 Traffic Volumes

Paradigm collected turning movement data for the AM and PM peak hours for the intersections within the study area in October 2018 and August 2020.

Figure 2.3 illustrates the existing AM and PM peak hour traffic volumes. **Appendix B** contains the existing count data.



paradigm TRANSPORTATION SOLUTIONS LIMITED

Existing Lane Configuration and Traffic Control

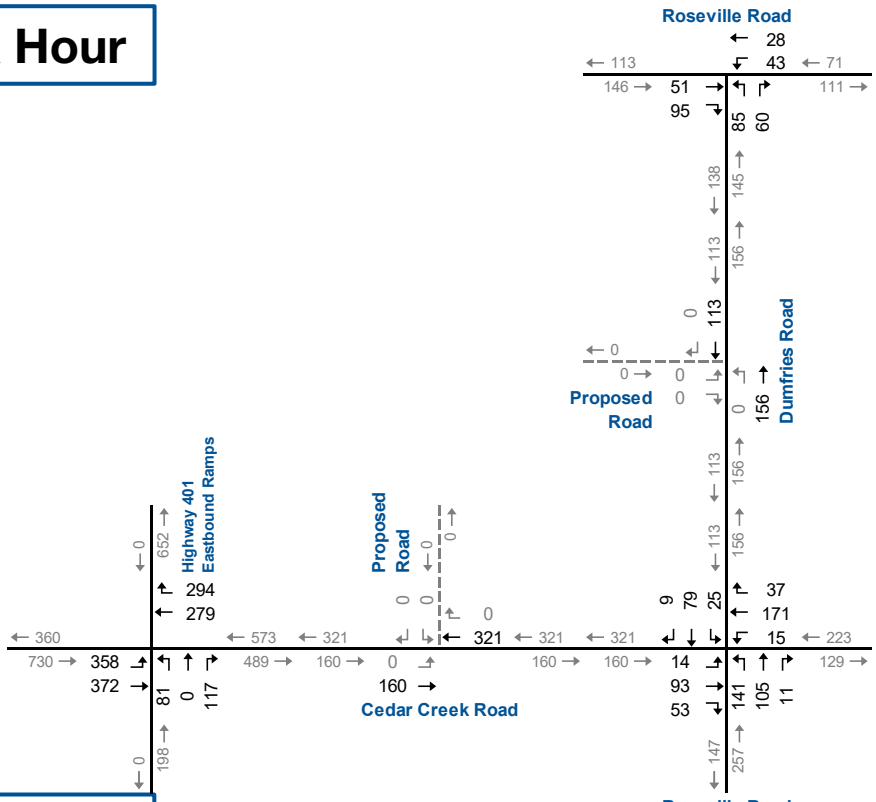
paradigm TRANSPORTATION SOLUTIONS LIMITED

Existing and Proposed North Dumfries Trail Network

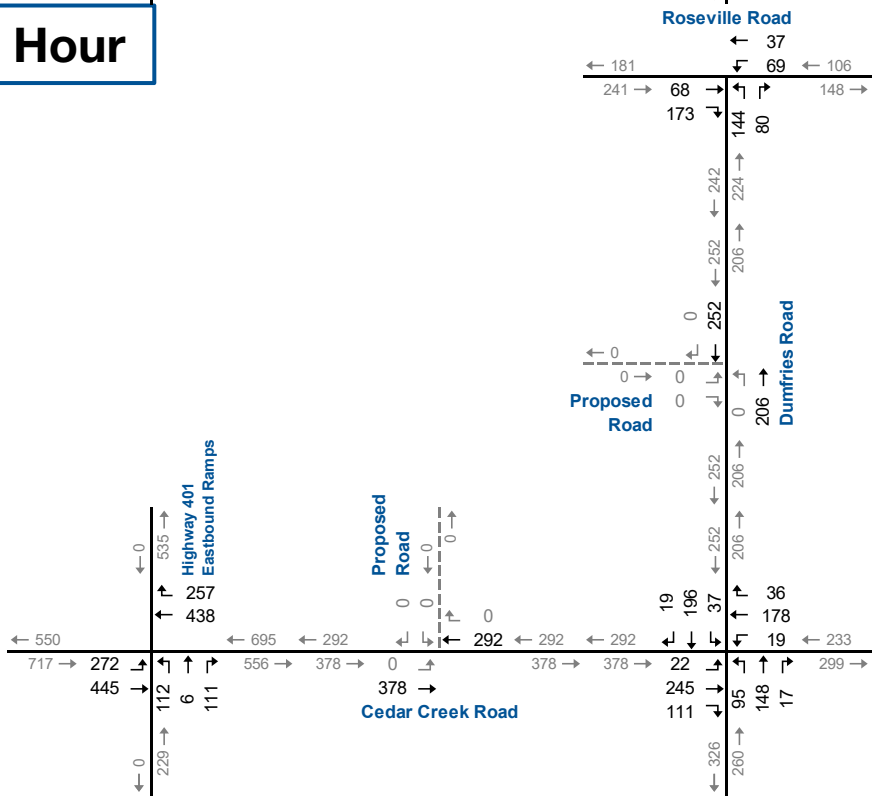
Regional Roads 97 at 47 Industrial Lands
200319

Figure 2.2

AM Peak Hour



PM Peak Hour



Existing Traffic Volumes

Regional Roads 97 at 47 Industrial Lands
200319

Figure 2.3

2.5 Traffic Operations

The existing traffic operations of the study area intersections were analysed using the existing lane configurations, traffic controls and existing AM and PM peak hour traffic volumes.

Intersection level of service (LOS) is a recognized method of quantifying the average delay experienced by drivers at intersections. It is based on the delay experienced by individual vehicles executing the various movements. The delay is related to the number of vehicles intending to make a particular movement, compared to the estimated capacity for that movement. The capacity is based on several criteria related to the opposing traffic flows and intersection geometry.

The highest possible rating is LOS A, under which the average total delay is equal or less than 10.0 seconds per vehicle. When the average delay exceeds 80 seconds for signalized intersections, 50 seconds for unsignalized intersections or when the volume to capacity ratio is greater than 1.0, the movement is classed as LOS F and remedial measures are usually implemented if they are feasible. LOS E is usually used as a guideline for the determination of road improvement needs on through lanes, while LOS F may be acceptable for left-turn movements at peak times, depending on delays.

The level of service conditions on the existing road network have been assessed using Synchro 9. The criteria, as defined by the ROW[2], for identifying “critical” intersections are:

- overall LOS E or F (i.e. average control delay per vehicle greater than 55 seconds) for signalized intersections; and
- overall LOS E or F (i.e. average control delay per vehicle greater than 35 seconds) for unsignalized intersections.

As well, the criteria for identifying individual “critical” movements are:

- the average control delay for individual movements is greater that 55 seconds;
- estimated 95th percentile queue length for an exclusive movement exceeds the available storage space;
- estimated 95th percentile queue length for an individual movement will block an existing access;
- exclusive turning lanes are inaccessible because of queue lengths in adjacent through lanes; and

[2] Transportation Impact Study Guidelines, *Region of Waterloo*, July 2014

- poor quality of service for non-auto modes.

Table 2.1 summarize the LOS and other performance results. The analyses indicate that there are critical movements at **Cedar Creek Road and Highway 401 Eastbound Ramps,** with the northbound movements of this intersection operate at LOS F with a v/c value exceeding 1.0 during both peak hours.

Appendix C contains the detailed Synchro reports.

TABLE 2.1: EXISTING TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																	
				Eastbound				Westbound				Northbound				Southbound				OVERALL
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	1: Dumfries Road & Roseville Road	TWSC	LOS		A	>	**A**	<	A		**A**	B		>	**B**					
			Delay		0	>	**0**	<	5		**5**	11		>	**11**					
			V/C		0.00	>		<	0.04			0.18		>						
			95th		0	>		<	1			5		>						
	2: Dumfries Road & Cedar Creek Road	TCS	LOS	A	A	>	**A**	A	A	>	**A**	C	C	>	**C**	C	C	>	**C**	**B**
			Delay	6	7	>	**7**	6	8	>	**8**	32	24	>	**24**	22	23	>	**23**	**17**
			V/C	0.03	0.20	>		0.03	0.23	>		0.53	0.35	>		0.10	0.29	>		
			95th	3	22	>		3	34	>		38	29	>		9	23	>		
	3: Cedar Creek Road & Highway 401 Eastbound Ramps	TWSC	LOS	B	A		**A**		A	A	**A**	<	F	>	**F**					
			Delay	14	0		**0**		0	0	**0**	<	202	>	**202**					
			V/C	0.39	0.00				0.00	0.00		<	1.23	>						
			95th	14	0				0	0		<	84	>						
PM Peak Hour	1: Dumfries Road & Roseville Road	TWSC	LOS		A	>	**A**	<	A		**A**	B		>	**B**					
			Delay		0	>	**0**	<	5		**5**	13		>	**13**					
			V/C		0.00	>		<	0.05			0.32		>						
			95th		0	>		<	2			11		>						
	2: Dumfries Road & Cedar Creek Road	TCS	LOS	A	B	>	**B**	A	A	>	**A**	C	C	>	**C**	C	C	>	**C**	**C**
			Delay	6	15	>	**15**	6	10	>	**10**	35	27	>	**27**	24	30	>	**30**	**20**
			V/C	0.03	0.46	>		0.03	0.24	>		0.50	0.44	>		0.15	0.56	>		
			95th	4	70	>		4	35	>		28	40	>		12	51	>		
	3: Cedar Creek Road & Highway 401 Eastbound Ramps	TWSC	LOS	B	A		**A**		A	A	**A**	<	F	>	**F**					
			Delay	11	0		**0**		0	0	**0**	<	389	>	**389**					
			V/C	0.32	0.00				0.00	0.00		<	1.67	>						
			95th	11	0				0	0		<	125	>						

MOE - Measure of Effectiveness
TWSC - Two-Way Stop Control
TCS - Traffic Control Signal
LOS - Level of Service
V/C - Volume to Capacity Ratio
95th - 95th Percentile Queue Length
> - Shared Right-Turn Lane
< - Shared Left-Turn Lane

2.5.1 Traffic Signal Control Justification

Under observed existing traffic volumes, there are LOS issues with the **Cedar Creek Road and Highway 401 Eastbound Ramps** intersections (LOS F with v/c greater than 1.0 critical movements).

As this is a rural area in Ontario, a speed limit of 80 km/hr is posted, traffic signal control warrant calculations were assessed under free flow conditions. This is important as the Ontario Traffic Manual (OTM) Traffic Signal Control Justifications[3] notes:

"Free Flow Conditions represent roads with operating or posted speeds equal to or greater than 70 km/h and are normally encountered in rural areas or on controlled access roads in urban areas. As driving characteristics in small urban communities can be different from those in larger urban areas, free flow conditions are also used for isolated communities with a population of less than 10,000 and located outside the community influence of a large urban center, even if the operating speed is less than 70 km/h." (Pg. 77)

OTM Traffic Signal Control Justifications 1, 2, and 3 were analyzed to assess the need for a signalized intersection. The analyses reveal that all Justifications were met.

Appendix D contains the Justifications 1, 2, and 3 signal warrant worksheet.

Given that existing volumes justify a signalized intersection be implemented at the intersection of **Cedar Creek Road and Highway 401 Eastbound Ramps,** all future analyses assume signalization.

[3] Book 12 – Traffic Signals, *Ontario Traffic Manual, Ministry of Transportation*, March 2012

3 Development Concept

3.1 Development Description

The proposed development is assumed to be 50.48 ha of industrial park lands and is set to be separated into 6 lots. There is a proposed municipal road, referred to as "Proposed Road", with the following connections:

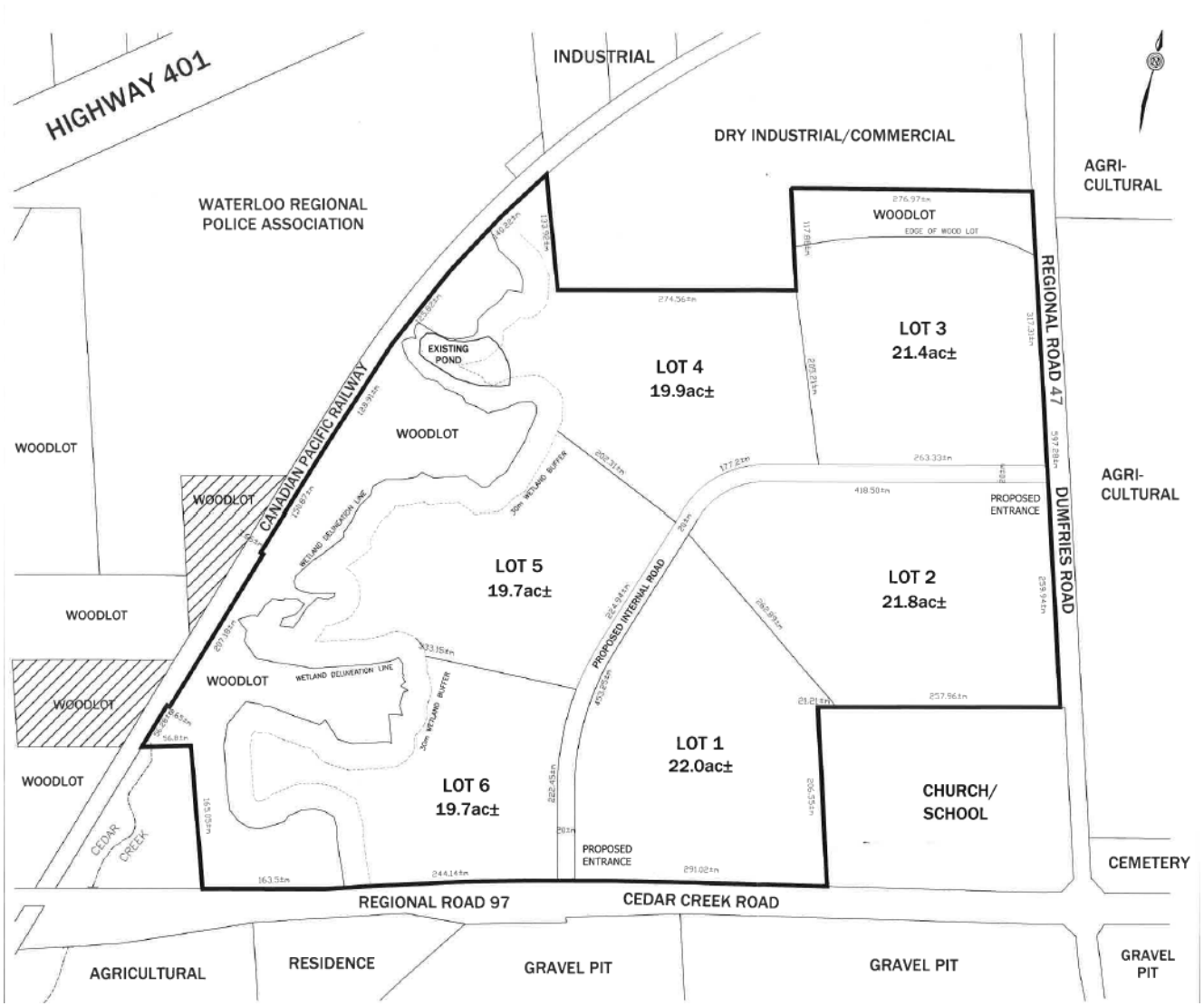
- **Proposed Road and Dumfries Road;** and
- **Cedar Creek Road and Proposed Road.**

As there are currently no site plans detailing the building design and site driveways for the proposed development, the following has been assumed:

- The number of employees assumed to occupy this land were determined using the ROW employment target of 25 employees/ha[4], for a total of 1262 employees.
- The internal site driveways are not assessed for traffic operations as the location and number of driveways have not been determined. For this study, trips have been allocated to proposed road connections.

Figure 3.1 shows the development concept plan.

[4] Regional Official Plan, *Region of Waterloo*, June 2015



paradigm TRANSPORTATION SOLUTIONS LIMITED

Development Site Plan

Regional Roads 97 at 47 Industrial Lands
200319

Figure 3.1

3.2 Site Trip Generation

The Institute of Transportation Engineers (ITE) Trip Generation Manual Land Use Code (LUC) 130 (Industrial Park) was used to estimate the proposed development's trip generation. This results in 515 and 500 trips during weekday AM and PM peak hours, respectively.

- **LUC 130 (Industrial Park):** An industrial park contains a number of industrial or related facilities. It is characterized by a mix of manufacturing, service, and warehouse facilities with a wide variation in the proportion of each type of use from one location to another. Many industrial parks contain highly diversified facilities-some with a large number of small businesses and others with one or two dominant industries.

Table 3.1 shows the trip generation for the subject development.

TABLE 3.1: TRIP GENERATION

Land Use Code	Units	AM Peak Hour				PM Peak Hour			
		Rate	In	Out	Total	Rate	In	Out	Total
130: Industrial Park	1262 Employees	(1)	443	72	515	(2)	100	400	500
Total Net Trips			***443***	***72***	***515***		***100***	***400***	***500***

(1) Ln(Trips) = 0.82Ln(X) + 0.39
(2) Ln(Trips) = 0.74Ln(X) + 0.93

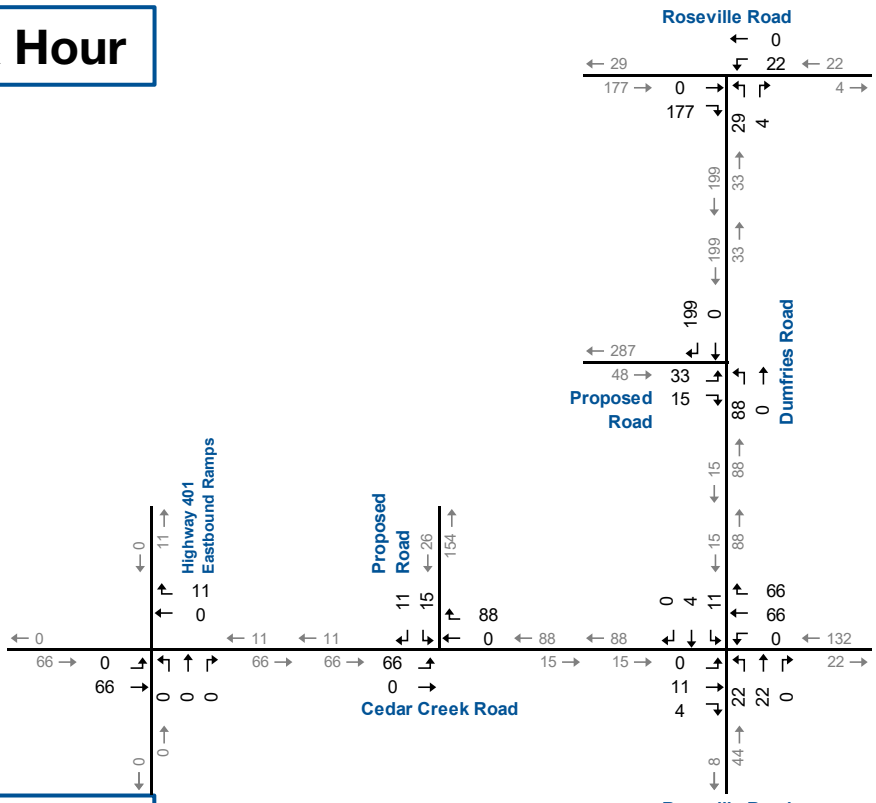
Table 3.2 displays the directional trip distribution and trip assignment used in this study. The trip distribution was determined using the Transportation Tomorrow Survey (TTS), based on travel to and from the TTS Zones (Zone 7440 and 7443) which includes the subject site.

TABLE 3.2: TRIP DISTRIBUTION

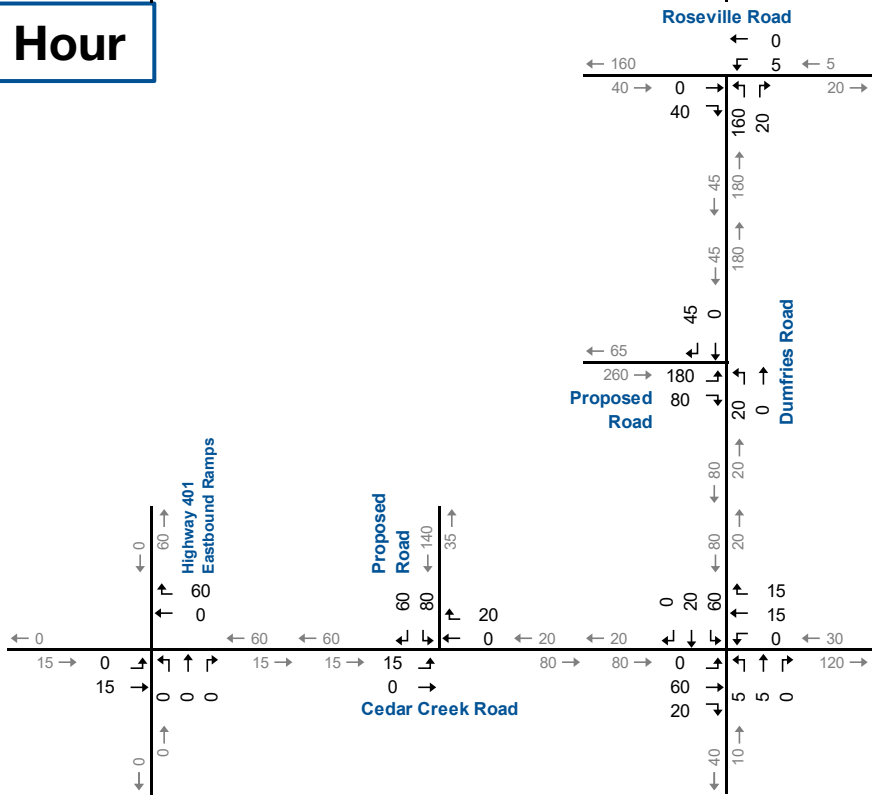
Direction	Distribution
East via Highway 401	15%
East via Cedar Creek Road	30%
West via Roseville Road	40%
East via Roseville Road	5%
South via Dumfries Road	10%

Figure 3.2 illustrates the site-generated traffic volumes for the AM and PM peak hours.

AM Peak Hour



PM Peak Hour



paradigm TRANSPORTATION SOLUTIONS LIMITED

Site-Generated Traffic Forecasts

Regional Roads 97 at 47 Industrial Lands
200319

Figure 3.2

4 Evaluation of Future Traffic Conditions

Future traffic conditions assessed include estimates of background and total traffic analysis for five years from the date of this TIS (2025). The future traffic volumes near the development will likely consist of increased non-site traffic volumes (background traffic), and the traffic forecast to be generated by the proposed development.

4.1 2025 Background Horizon

4.1.1 General Background Growth

The future general background traffic volumes within the study area result from applying a growth rate of 2% per annum, as confirmed by ROW staff.

4.1.2 Background Traffic Volumes

Figure 4.1 displays the 2025 background traffic volumes for the weekday AM and PM peak hours.

4.1.3 Background Traffic Operations

Based on the estimated 2025 background traffic volumes, LOS analyses have been conducted using Synchro 9, for the weekday AM and PM peak hour conditions for the intersections in the study area.

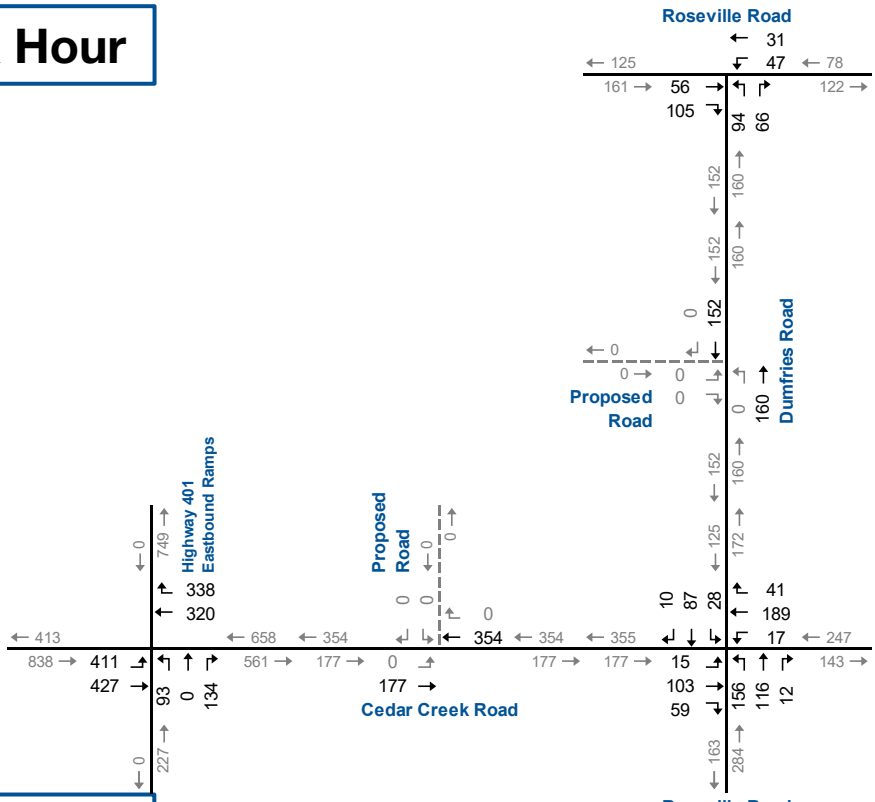
Table 4.1 summarizes the results of the analysis indicating the levels of service (LOS), volume to capacity ratios (V/C) and 95th percentile queues experienced at the study area intersections.

All intersections in the study area are forecast to have acceptable operational values.

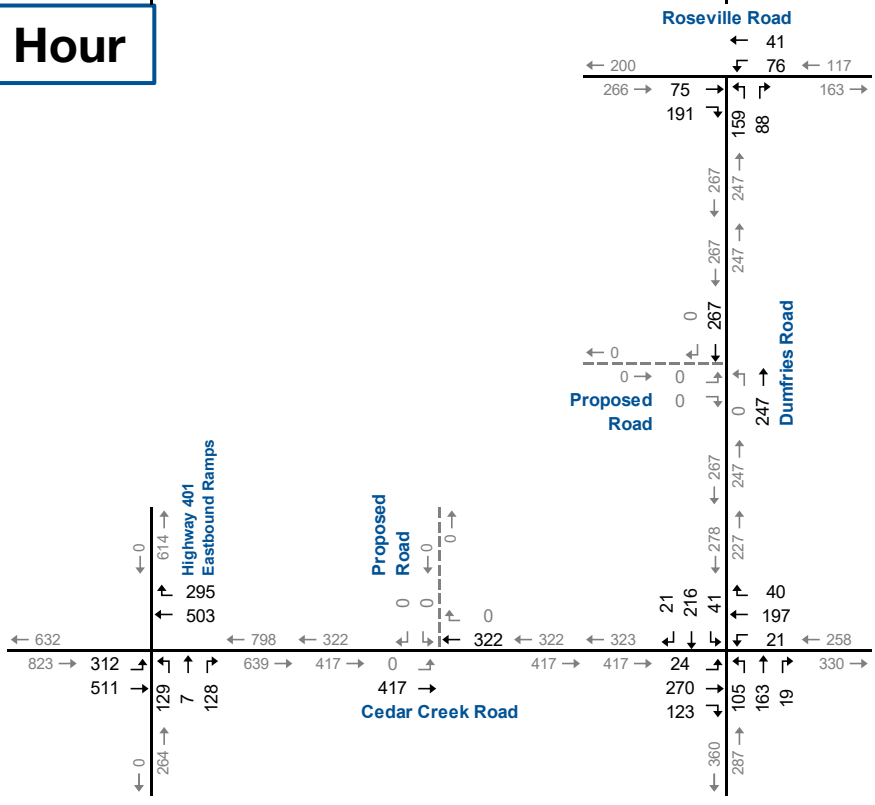
It is noted that the intersection of **Cedar Creek Road and Highway 401 Eastbound Ramp** is assumed to operate as a signalized intersection with a protected left-turn phase.

Appendix E includes the detailed Synchro 9 reports.

AM Peak Hour



PM Peak Hour



paradigm TRANSPORTATION SOLUTIONS LIMITED

2025 Background Traffic Forecasts

Regional Roads 97 at 47 Industrial Lands
200319

Figure 4.1

TABLE 4.1: 2025 BACKGROUND TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																
				Eastbound				Westbound				Northbound				Southbound				OVERALL
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	1: Dumfries Road & Roseville Road	TWSC	LOS		A	>	A	<	A		A	B		>	B					
			Delay		0	>	0	<	5		5	11		>	11					
			V/C		0.00	>		<	0.04			0.21		>						
			95th		0	>		<	1			6		>						
	2: Dumfries Road & Cedar Creek Road	TCS	LOS	A	A	>	A	A	A	>	A	C	C	>	C	C	C	>	C	B
			Delay	7	8	>	8	7	9	>	9	32	24	>	24	22	23	>	23	17
			V/C	0.03	0.22	>		0.04	0.26	>		0.56	0.36	>		0.11	0.30	>		
			95th	4	26	>		4	40	>		42	32	>		10	25	>		
	3: Cedar Creek Road & Highway 401 Eastbound Ramps	TCS	LOS	B	A		A		C	A	C	<	C	>	C					B
			Delay	13	7		7		22	5	22	<	30	>	30					14
			V/C	0.68	0.36				0.44	0.45		<	0.70	>						
			95th	55	53				80	21		<	46	>						
PM Peak Hour	1: Dumfries Road & Roseville Road	TWSC	LOS		A	>	A	<	A		A	B		>	B					
			Delay		0	>	0	<	5		5	14		>	14					
			V/C		0.00	>		<	0.06			0.37		>						
			95th		0	>		<	2			13		>						
	2: Dumfries Road & Cedar Creek Road	TCS	LOS	A	B	>	B	A	B	>	B	D	C	>	C	C	C	>	C	C
			Delay	7	12	>	12	7	11	>	11	38	27	>	27	24	31	>	31	20
			V/C	0.04	0.44	>		0.04	0.27	>		0.56	0.46	>		0.16	0.59	>		
			95th	5	71	>		4	40	>		32	44	>		13	57	>		
	3: Cedar Creek Road & Highway 401 Eastbound Ramps	TCS	LOS	B	B		B		C	A	C	<	D	>	D					B
			Delay	18	11		11		28	5	28	<	39	>	39					17
			V/C	0.71	0.48				0.69	0.41		<	0.78	>						
			95th	48	76				134	17		<	62	>						

MOE - Measure of Effectiveness
TWSC - Two-Way Stop Control
TCS - Traffic Control Signal
LOS - Level of Service
V/C - Volume to Capacity Ratio
95th - 95th Percentile Queue Length
> - Shared Right-Turn Lane
< - Shared Left-Turn Lane

4.2 2025 Total Horizon

4.2.1 Total Traffic Volumes

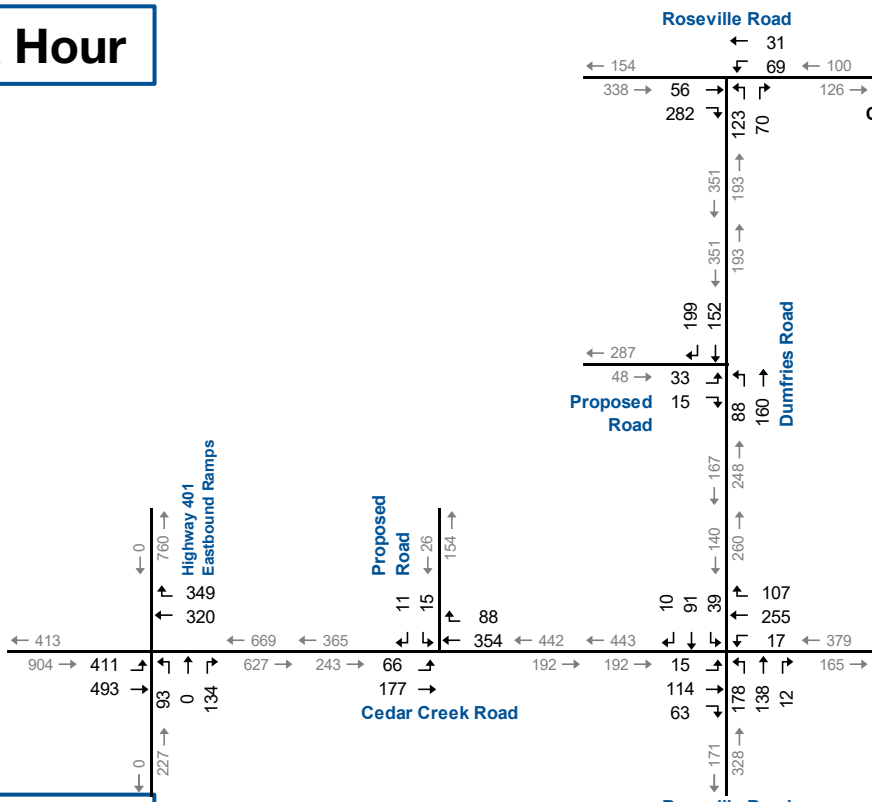
Figure 4.2 illustrates the estimated 2025 total traffic volumes, including both background traffic and development traffic, are shown for the AM and PM peak hours.

4.2.2 Total Traffic Operations

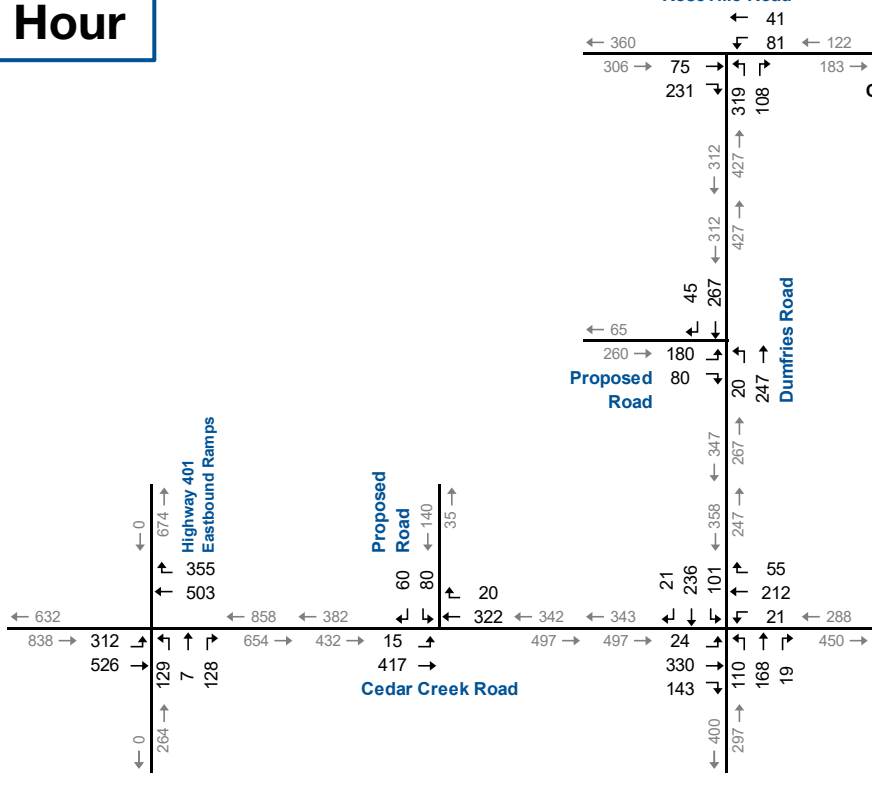
Table 4.2 summarizes the results of the LOS analysis. As under background traffic operations, all intersections in the study area are forecast to have acceptable operational values.

Appendix F contains the supporting detailed Synchro 9 reports.

AM Peak Hour



PM Peak Hour



paradigm TRANSPORTATION SOLUTIONS LIMITED

2025 Total Traffic Forecasts

Regional Roads 97 at 47 Industrial Lands
200319

Figure 4.2

TABLE 4.2: 2025 TOTAL TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	OVERALL
AM Peak Hour	1: Dumfries Road & Roseville Road	TWSC	LOS		A	>	A	<	A		A	B		>	B					
			Delay		0	>	0	<	6		6	13		>	13					
			V/C		0.00	>		<	0.07			0.30		>						
			95th		0	>		<	2			10		>						
	2: Dumfries Road & Cedar Creek Road	TCS	LOS	A	A	>	A	A	B	>	B	C	C	>	C	C	C	>	C	B
			Delay	7	9	>	9	7	11	>	11	33	25	>	25	22	22	>	22	18
			V/C	0.04	0.25	>		0.04	0.41	>		0.60	0.40	>		0.15	0.29	>		
			95th	4	29	>		4	66	>		48	37	>		13	26	>		
	3: Cedar Creek Road & Highway 401 Eastbound Ramps	TCS	LOS	B	A		A		C	A	C	<	C	>	C					B
			Delay	12	7		7		22	5	22	<	31	>	31					14
			V/C	0.67	0.41				0.43	0.46		<	0.71	>						
			95th	53	61				82	22		<	47	>						
	4: Dumfries Road & Proposed Road	TWSC	LOS	B		>	B					<	A		A		A	>		
			Delay	13		>	13					<	3		3		0	>	0	
			V/C	0.10		>						<	0.07				0.00	>		
			95th	2		>						<	2				0	>		
	5: Cedar Creek Road & Proposed Road	TWSC	LOS	<	A		A		A	>	A					B		>		
			Delay	<	2		2		0	>	0					13		>	13	
			V/C	<	0.06				0.00	>						0.06		>		
			95th	<	2				0	>						2		>		
PM Peak Hour	1: Dumfries Road & Roseville Road	TWSC	LOS		A	>	A	<	A		A	C		>	C					
			Delay		0	>	0	<	5		5	23		>	23					
			V/C		0.00	>		<	0.07			0.69		>						
			95th		0	>		<	2			41		>						
	2: Dumfries Road & Cedar Creek Road	TCS	LOS	A	B	>	B	A	B	>	B	D	C	>	C	C	C	>	C	C
			Delay	7	15	>	15	7	11	>	11	41	27	>	27	28	31	>	31	21
			V/C	0.04	0.54	>		0.05	0.31	>		0.61	0.46	>		0.39	0.61	>		
			95th	5	94	>		4	46	>		34	45	>		28	62	>		
	3: Cedar Creek Road & Highway 401 Eastbound Ramps	TCS	LOS	B	B		B		C	A	C	<	D	>	D					B
			Delay	18	11		11		27	5	27	<	39	>	39					19
			V/C	0.63	0.46				0.62	0.45		<	0.75	>						
			95th	47	79				134	19		<	62	>						
	4: Dumfries Road & Proposed Road	TWSC	LOS	C		>	C					<	A		A		A	>		
			Delay	18		>	18					<	1		1		0	>	0	
			V/C	0.49		>						<	0.02				0.00	>		
			95th	20		>						<	0				0	>		
	5: Cedar Creek Road & Proposed Road	TWSC	LOS	<	A		A		A	>	A					C		>		
			Delay	<	0		0		0	>	0					16		>	16	
			V/C	<	0.01				0.00	>						0.31		>		
			95th	<	0				0	>						10		>		

MOE - Measure of Effectiveness
TWSC - Two-Way Stop Control
TCS - Traffic Control Signal
LOS - Level of Service
V/C - Volume to Capacity Ratio
95th - 95th Percentile Queue Length
> - Shared Right-Turn Lane
< - Shared Left-Turn Lane

5 Remedial Measures

As there are operational issues forecast under future conditions, the subsequent remedial measures are offered to mitigate these problem movements.

5.1 Signal Justification Analysis

A signal warrant, using the OTM Book 12 Justification 7, was analyzed for the following intersections during the 2025 horizon year:

- **Proposed Road and Dumfries Road:** It was found that a signal is not forecast to be warranted at the intersection, Warrant 1 and 2 achieving 42.8% and 61.4% out of the 150% requirement, respectively; and
- **Cedar Creek Road and Proposed Road:** It was found that a signal is not forecast to be warranted at the intersection, Warrant 1 and 2 achieving 23.1% and 47.5% out of the 150% requirement, respectively.

Appendix G includes signal warrant worksheets.

5.2 Auxiliary Left-Turn Lanes

The need for auxiliary left-turn lanes at intersections within the study area was assessed using procedures detailed in the MTO Supplement to the TAC Geometric Design Manual. The design speed is taken to be 100 km/hr (20 km/h greater than the posted speed limit of 80 km/hr) for the two locations.

The procedures for determining if a left-turn lane is warranted include using nomographs contained in the MTO Supplement. The nomographs are provided for proportions of left-turning volumes within the approaching volume, rounded to the nearest 5%.

A left-turn lane warrant analysis under the 2025 total traffic horizon was completed for the following:

- **Proposed Road and Dumfries Road:** a northbound auxiliary left-turn lane is forecast to be warranted under the AM peak hour, with a 15-metre storage length; and
- **Cedar Creek Road and Proposed Road:** an eastbound auxiliary left-turn lane is forecast to be warranted under the AM peak hour, with a 15-metre storage length.

Figure 5.1 and **Figure 5.2** illustrates the nomographs for the above left-turn lanes.

5.3 Roundabout Screening Tools

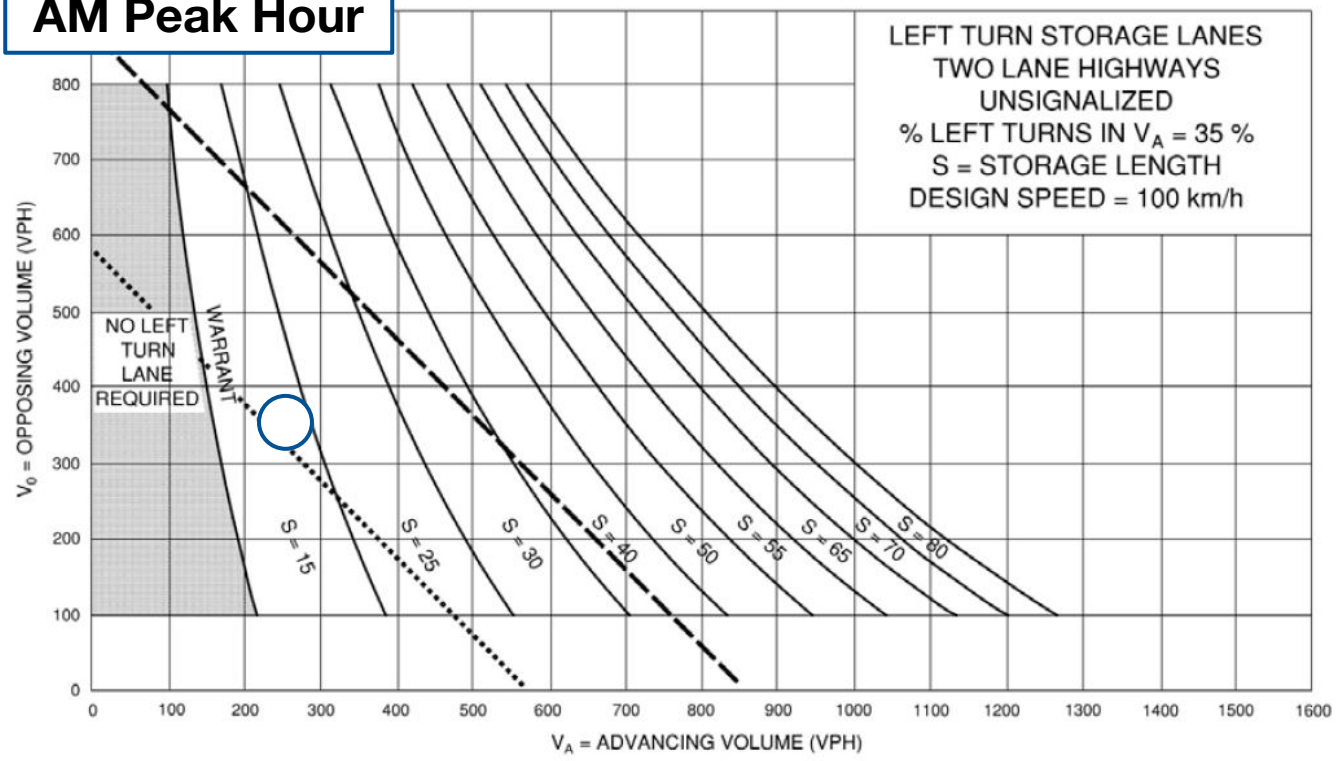
As “Proposed Road” is forecast to be a public road, a screening tool was completed for the intersections of:

- **Proposed Road and Dumfries Road;** and
- **Cedar Creek Road and Proposed Road.**

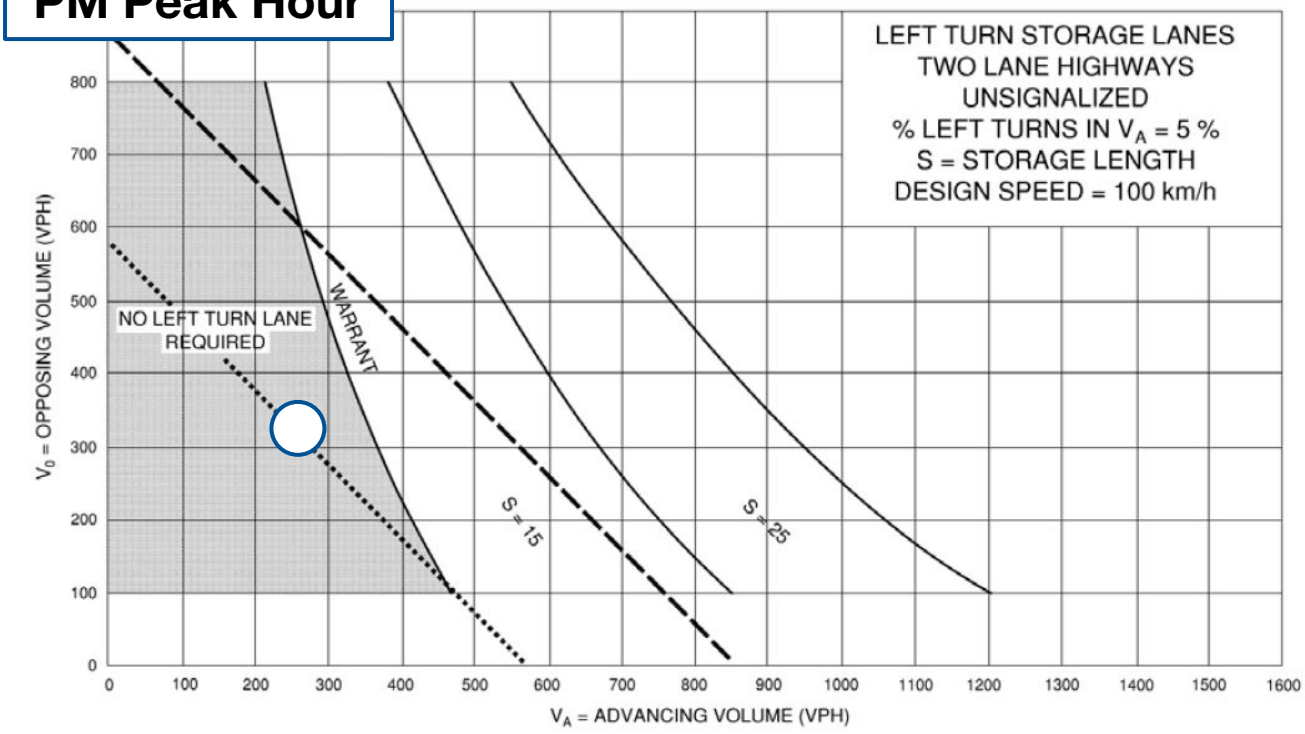
The results show that a roundabout is forecast to have a higher 20-year life cycle cost compared to the non-roundabout options, therefore an intersection control study is not recommended.

Appendix H contains the roundabout screening tools.

AM Peak Hour

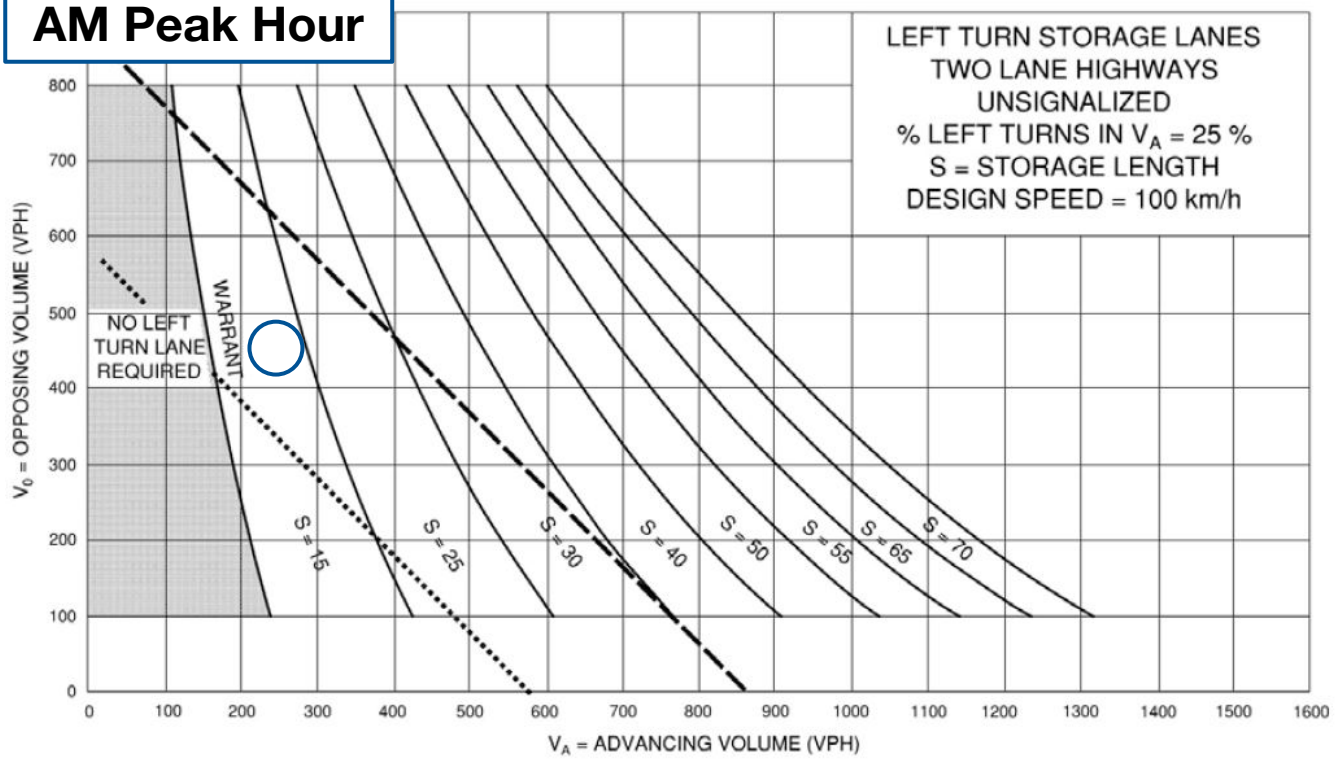


PM Peak Hour

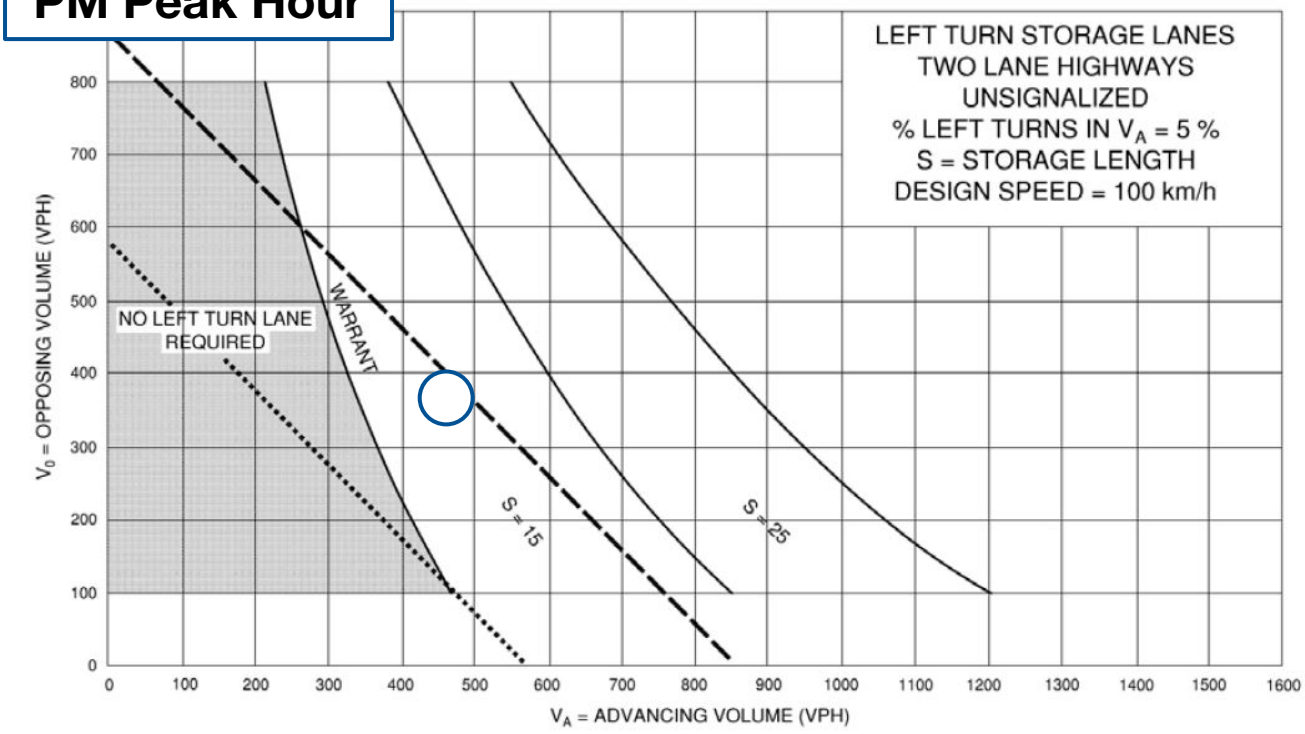


Northbound Left-Turn Lane Warrant, Dumfries Road at Proposed Road, 2025 Total Traffic Volumes

AM Peak Hour



PM Peak Hour



paradigm TRANSPORTATION SOLUTIONS LIMITED

Eastbound Left-Turn Lane Warrant, Cedar Creek Road at Proposed Road, 2025 Total Traffic Volumes

6 Conclusions and Recommendations

6.1 Conclusions

Based on the investigations carried out, it is concluded that:

- **Existing Traffic Operations:** All study area intersections are currently operating within acceptable levels of service except for the intersection of **Cedar Creek Road and Highway 401 Eastbound Ramps** during both peak hours. As this intersection was found to warrant signalization under the existing conditions, the future horizons were assessed with the assumption of a traffic control signal at this intersection;
- **Development Trip Generation:** The full build-out of the industrial park is forecast to generate 515 and 500 trips during weekday AM and PM peak hours, respectively;
- **2025 Background Traffic Conditions:** All study area intersections are forecast to operate within acceptable levels of service.
- **2025 Total Traffic Conditions:** All study area intersections are forecast to operate within acceptable levels of service.
- **Remedial Measures:** The following remedial measures were evaluated to mitigate the forecast capacity issues:
  - **Cedar Creek Road and Highway 401 Eastbound Ramps:** The signalization of this intersection, as warranted by the existing conditions, with an eastbound left protected phase;
  - **Proposed Road and Dumfries Road:** A northbound auxiliary left-turn lane; and
  - **Cedar Creek Road and Proposed Road:** An eastbound auxiliary left-turn lane.

6.2 Recommendations

Based on the findings of this study, it is recommended that the development be approved with the construction of the following:

- A signal at **Cedar Creek Road and Highway 401 Eastbound Ramps** with an eastbound left protected phase signal head, regardless of whether the proposed development proceeds, as warranted by the existing conditions;
- A northbound auxiliary left-turn lane, with a storage length of 15 metres, on **Dumfries Road at the Proposed Road;** and

- A northbound auxiliary left-turn lane, with a storage length of 15 metres, on **Cedar Creek Road at the Proposed Road.**

Appendix A

Pre-Study Conference Form

APPENDIX A: PRE-STUDY CONFERENCE FORM
(200319) Regional Road 47 & Regional Road 97 Industrial Lands

Item	Description	Details
ISSUES		
1	List any issues expected that may impact the content or recommendations of the subject Transportation Impact Study.	o o o o
INTRODUCTION		
2	Nature of application (Attach a drawing)	o Official Plan Amendment o Zoning Amendment o Site Plan Control Application o Plan of Subdivision o Community Plan o Other
3	TIS process, and relevant policies, procedures and approvals	o Guidelines for the preparation of Transportation Impact Studies in Support of Development Applications o Transportation Impact Studies Requirements for Capacity Analysis, Roundabouts, Turn Lanes o Safety Analysis Checklist o Policy and Procedures for Access onto Regional Roads
4	Public Meeting	o Not Required
CONTEXT		
5	Study intersections (Intersections to be analyzed) Note: the consultant is responsible to identify any further intersections impacted as the study progresses.	o Cedar Creek Road and Dumfries Road (signalized); o Dumfries Road and Roseville Road (unsignalized); o Proposed Access on Cedar Creek Road; and o Proposed Access on Dumfries Road. o Cedar Creek Road and 401 Eastbound Ramps (unsignalized)
6	Size and number of phases of development	o 50.66 hectares of industrial / employment lands (ITE Rate 110 – Light Industrial or 130 – Business Park, client is still finalizing land use)
7	Approved and pending approval development applications	N/A
8	Planned transportation system improvements	o Roseville Road (resurface and sidewalk / cycle add)
TRAVEL DEMAND		
9	Horizon years	o 5 years from date of TIS

Item	Description	Details
10	Peak hour determination	o AM weekday peak hour of adjacent roadway o PM weekday peak hour of adjacent roadway
11	Background	o Region to provide with the model output and data for historical counts
12	Trip generation	o ITE average rates o ITE fitted equation
13	Trip reductions (TDM, internal, pass-by)	o N/A
14	Trip distribution	o ITE trip distribution IN/OUT split o Travel Tomorrow Survey
15	Trip assignment	o Local traffic pattern
EVALUATION OF IMPACTS		
16	Traffic impact analysis (Use approved software)	o Unsignalized intersections o left turn warrant analysis o signal warrant analysis o Signalized intersections o LOS, v/c, delay, queuing o ROW saturation flow rates o Existing signal timings for existing conditions o Optimize signal timings for future conditions o Use existing cycle length to respect coordinated corridor o Queuing analysis o Roundabouts o Other…

Item	Description	Details
17	Roundabout feasibility (Use approved software)	o Initial screening (at both the proposed municipal connections)
18	Transit assessment	o Frequency and hours of service o Presence of bus stops o Reliability of service o Passenger loads o Travel time o Other
19	Pedestrian assessment	o Presence, connectivity, and width of sidewalks o Barriers and buffers from traffic o Crossing opportunities at intersections o Delay at intersections o Number of driveways and traffic volumes at the driveways o Presence of illumination o Future needs (desire lines / policy / accessibility / demand) o Other
20	Cycling assessment	o Presence of a dedicated facility o Network connectivity o Number and width of travel lanes adjacent to the route o Volume and speed of traffic o Percentage of trucks and buses encountered o Pavement condition o Presence of parking /showers/change rooms o Future needs (desire lines / policy / demand) o Other
21	Safety analysis	o Road safety review o Collision risk analysis o Access conflict evaluation
22	Site access and circulation	o Review sight distances at all new access points o Internal traffic controls o Loading facilities and access o Service/maintenance vehicle access o Emergency vehicle access
23	Submission format	o Three hard copies of main report including appendices (other than analysis results/output e.g. Synchro reports) o Minimum one original hard copy must be sealed by a professional engineer o Electronic copy of complete report and all appendices o Electronic copy of operational analysis files (e.g. Synchro, Arcady o Electronic copy of all signal warrant calculation files o Other

Appendix B

Existing Traffic Counts and Signal Timings

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Cedar Creek & Dumfries Road
Site Code: 200319
Start Date: 07/15/2020

Turning Movement Data

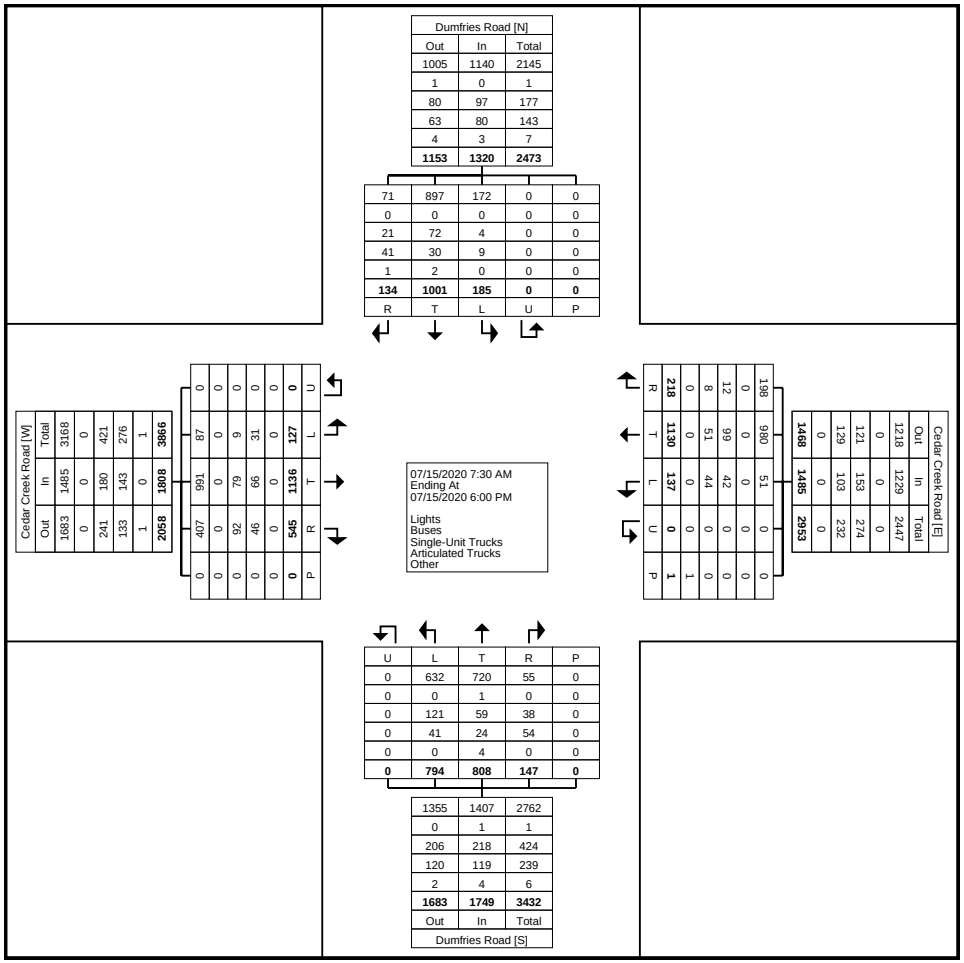
Start Time	Cedar Creek Road Eastbound						Cedar Creek Road Westbound						Dumfries Road Northbound						Dumfries Road Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
7:30 AM	6	21	12	0	0	39	2	54	17	0	0	73	36	30	2	0	0	68	6	22	0	0	0	28	208
7:45 AM	5	22	14	0	0	41	7	48	9	0	0	64	35	37	1	0	0	73	6	18	4	0	0	28	206
Hourly Total	11	43	26	0	0	80	9	102	26	0	0	137	71	67	3	0	0	141	12	40	4	0	0	56	414
8:00 AM	1	31	16	0	0	48	3	34	4	0	0	41	39	19	4	0	0	62	6	26	4	0	0	36	187
8:15 AM	2	19	11	0	0	32	3	35	7	0	0	45	31	19	4	0	0	54	7	13	1	0	0	21	152
8:30 AM	5	29	14	0	0	48	7	24	3	0	0	34	33	23	1	0	0	57	6	20	3	0	0	29	168
8:45 AM	5	25	12	0	0	42	3	36	7	0	0	46	24	29	2	0	0	55	4	22	4	0	0	30	173
Hourly Total	13	104	53	0	0	170	16	129	21	0	0	166	127	90	11	0	0	228	23	81	12	0	0	116	680
9:00 AM	4	28	15	0	0	47	3	24	5	0	0	32	18	12	6	0	0	36	3	25	2	0	0	30	145
9:15 AM	1	20	14	0	0	35	3	32	6	0	0	41	20	22	6	0	0	48	5	27	4	0	0	36	160
9:30 AM	5	27	17	0	0	49	5	32	5	0	0	42	20	21	2	0	0	43	5	18	6	0	0	29	163
9:45 AM	2	31	13	0	0	46	3	23	10	0	0	36	24	24	7	0	0	55	3	20	2	0	0	25	162
Hourly Total	12	106	59	0	0	177	14	111	26	0	0	151	82	79	21	0	0	182	16	90	14	0	0	120	630
10:00 AM	6	23	8	0	0	37	6	29	5	0	0	40	13	20	3	0	0	36	5	25	3	0	0	33	146
10:15 AM	2	25	15	0	0	42	4	35	7	0	0	46	24	32	6	0	0	62	3	27	4	0	0	34	184
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	8	48	23	0	0	79	10	64	12	0	0	86	37	52	9	0	0	98	8	52	7	0	0	67	330
12:00 PM	3	39	14	0	0	56	4	30	7	0	0	41	23	11	5	0	0	39	5	18	9	0	0	32	168
12:15 PM	5	45	16	0	0	66	8	33	5	0	0	46	17	20	4	0	0	41	5	28	3	0	0	36	189
12:30 PM	5	25	16	0	0	46	7	37	9	0	0	53	28	28	8	0	0	64	3	29	5	0	0	37	200
12:45 PM	3	31	11	0	0	45	6	31	4	0	0	41	15	17	9	0	0	41	9	23	4	0	0	36	163
Hourly Total	16	140	57	0	0	213	25	131	25	0	0	181	83	76	26	0	0	185	22	98	21	0	0	141	720
1:00 PM	4	27	14	0	0	45	4	29	9	0	0	42	26	15	2	0	0	43	2	27	5	0	0	34	164
1:15 PM	4	22	13	0	0	39	6	36	3	0	0	45	23	16	7	0	0	46	6	32	4	0	0	42	172
1:30 PM	4	33	17	0	0	54	5	25	5	0	0	35	30	20	4	0	0	54	1	22	5	0	0	28	171
1:45 PM	2	26	13	0	0	41	4	29	5	0	0	38	27	27	10	0	0	64	1	23	5	0	0	29	172
Hourly Total	14	108	57	0	0	179	19	119	22	0	0	160	106	78	23	0	0	207	10	104	19	0	0	133	679
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3:00 PM	4	37	23	0	0	64	4	37	8	0	1	49	21	22	11	0	0	54	7	38	5	0	0	50	217
3:15 PM	3	36	18	0	0	57	4	39	8	0	0	51	22	40	3	0	0	65	5	34	6	0	0	45	218
3:30 PM	0	43	22	0	0	65	2	32	3	0	0	37	31	34	6	0	0	71	7	51	5	0	0	63	236
3:45 PM	5	41	16	0	0	62	5	34	4	0	0	43	20	30	4	0	0	54	7	42	11	0	0	60	219
Hourly Total	12	157	79	0	0	248	15	142	23	0	1	180	94	126	24	0	0	244	26	165	27	0	0	218	890
4:00 PM	4	41	21	0	0	66	4	39	4	0	0	47	28	28	5	0	0	61	7	55	6	0	0	68	242
4:15 PM	5	52	17	0	0	74	4	40	13	0	0	57	29	39	9	0	0	77	7	58	7	0	0	72	280

4:30 PM	7	62	36	0	0	105	5	51	8	0	0	64	23	41	3	0	0	67	7	39	5	0	0	51	287
4:45 PM	2	51	24	0	0	77	7	47	7	0	0	61	25	35	2	0	0	62	10	54	2	0	0	66	266
Hourly Total	18	206	98	0	0	322	20	177	32	0	0	229	105	143	19	0	0	267	31	206	20	0	0	257	1075
5:00 PM	8	80	34	0	0	122	3	40	8	0	0	51	18	33	3	0	0	54	13	45	5	0	0	63	290
5:15 PM	5	56	24	0	0	85	1	46	8	0	0	55	25	18	2	0	0	45	9	47	3	0	0	59	244
5:30 PM	5	50	22	0	0	77	1	37	8	0	0	46	19	20	4	0	0	43	10	46	1	0	0	57	223
5:45 PM	5	38	13	0	0	56	4	32	7	0	0	43	27	26	2	0	0	55	5	27	1	0	0	33	187
Hourly Total	23	224	93	0	0	340	9	155	31	0	0	195	89	97	11	0	0	197	37	165	10	0	0	212	944
Grand Total	127	1136	545	0	0	1808	137	1130	218	0	1	1485	794	808	147	0	0	1749	185	1001	134	0	0	1320	6362
Approach %	7.0	62.8	30.1	0.0	-	-	9.2	76.1	14.7	0.0	-	-	45.4	46.2	8.4	0.0	-	-	14.0	75.8	10.2	0.0	-	-	-
Total %	2.0	17.9	8.6	0.0	-	28.4	2.2	17.8	3.4	0.0	-	23.3	12.5	12.7	2.3	0.0	-	27.5	2.9	15.7	2.1	0.0	-	20.7	-
Lights	87	991	407	0	-	1485	51	980	198	0	-	1229	632	720	55	0	-	1407	172	897	71	0	-	1140	5261
% Lights	68.5	87.2	74.7	-	-	82.1	37.2	86.7	90.8	-	-	82.8	79.6	89.1	37.4	-	-	80.4	93.0	89.6	53.0	-	-	86.4	82.7
Buses	0	0	0	0	-	0	0	0	0	0	-	0	0	1	0	0	-	1	0	0	0	0	-	0	1
% Buses	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.1	0.0	-	-	0.1	0.0	0.0	0.0	-	-	0.0	0.0
Single-Unit Trucks	9	79	92	0	-	180	42	99	12	0	-	153	121	59	38	0	-	218	4	72	21	0	-	97	648
% Single-Unit Trucks	7.1	7.0	16.9	-	-	10.0	30.7	8.8	5.5	-	-	10.3	15.2	7.3	25.9	-	-	12.5	2.2	7.2	15.7	-	-	7.3	10.2
Articulated Trucks	31	66	46	0	-	143	44	51	8	0	-	103	41	24	54	0	-	119	9	30	41	0	-	80	445
% Articulated Trucks	24.4	5.8	8.4	-	-	7.9	32.1	4.5	3.7	-	-	6.9	5.2	3.0	36.7	-	-	6.8	4.9	3.0	30.6	-	-	6.1	7.0
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	4	0	0	-	4	0	2	1	0	-	3	7
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.5	0.0	-	-	0.2	0.0	0.2	0.7	-	-	0.2	0.1
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Cedar Creek & Dumfries Road
Site Code: 200319
Start Date: 07/15/2020



Turning Movement Data Plot

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Cedar Creek & Dumfries Road
Site Code: 200319
Start Date: 07/15/2020

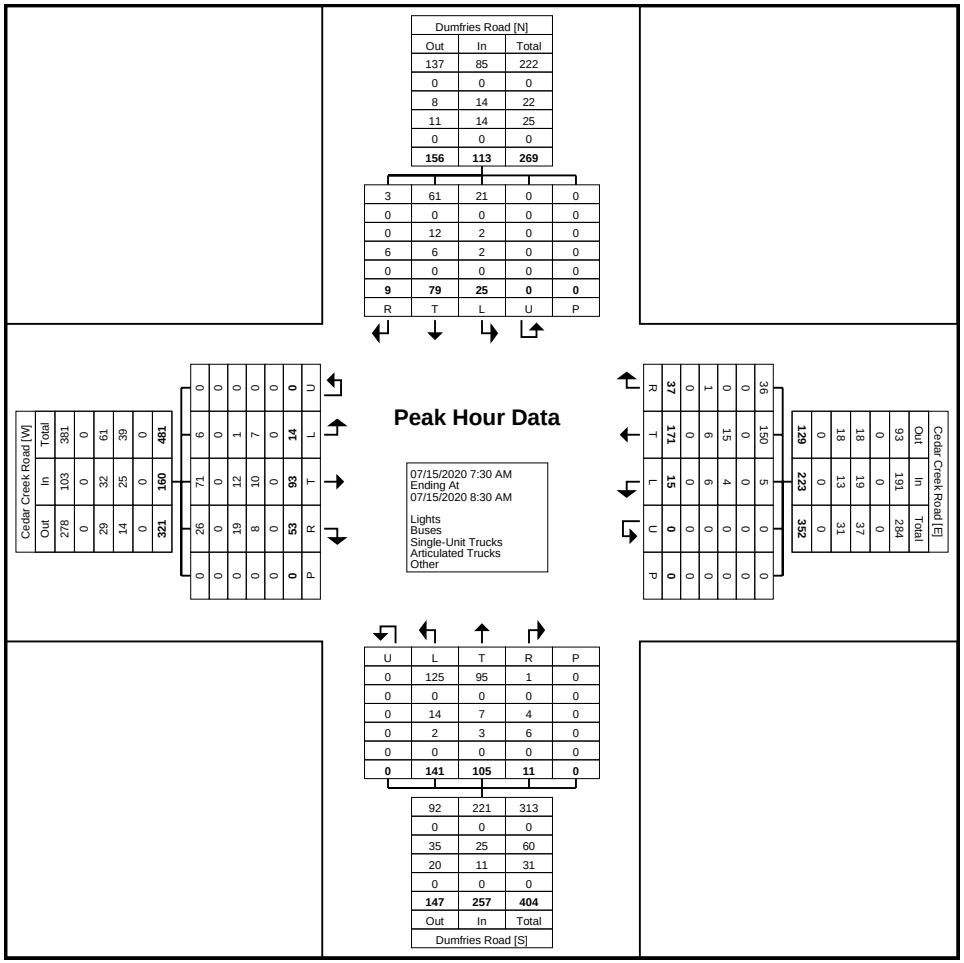
Turning Movement Peak Hour Data (7:30 AM)

Start Time	Cedar Creek Road Eastbound						Cedar Creek Road Westbound						Dumfries Road Northbound						Dumfries Road Southbound						
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Int. Total
7:30 AM	6	21	12	0	0	39	2	54	17	0	0	73	36	30	2	0	0	68	6	22	0	0	0	28	208
7:45 AM	5	22	14	0	0	41	7	48	9	0	0	64	35	37	1	0	0	73	6	18	4	0	0	28	206
8:00 AM	1	31	16	0	0	48	3	34	4	0	0	41	39	19	4	0	0	62	6	26	4	0	0	36	187
8:15 AM	2	19	11	0	0	32	3	35	7	0	0	45	31	19	4	0	0	54	7	13	1	0	0	21	152
Total	14	93	53	0	0	160	15	171	37	0	0	223	141	105	11	0	0	257	25	79	9	0	0	113	753
Approach %	8.8	58.1	33.1	0.0	-	-	6.7	76.7	16.6	0.0	-	-	54.9	40.9	4.3	0.0	-	-	22.1	69.9	8.0	0.0	-	-	-
Total %	1.9	12.4	7.0	0.0	-	21.2	2.0	22.7	4.9	0.0	-	29.6	18.7	13.9	1.5	0.0	-	34.1	3.3	10.5	1.2	0.0	-	15.0	-
PHF	0.583	0.750	0.828	0.000	-	0.833	0.536	0.792	0.544	0.000	-	0.764	0.904	0.709	0.688	0.000	-	0.880	0.893	0.760	0.563	0.000	-	0.785	0.905
Lights	6	71	26	0	-	103	5	150	36	0	-	191	125	95	1	0	-	221	21	61	3	0	-	85	600
% Lights	42.9	76.3	49.1	-	-	64.4	33.3	87.7	97.3	-	-	85.7	88.7	90.5	9.1	-	-	86.0	84.0	77.2	33.3	-	-	75.2	79.7
Buses	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Buses	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Single-Unit Trucks	1	12	19	0	-	32	4	15	0	0	-	19	14	7	4	0	-	25	2	12	0	0	-	14	90
% Single-Unit Trucks	7.1	12.9	35.8	-	-	20.0	26.7	8.8	0.0	-	-	8.5	9.9	6.7	36.4	-	-	9.7	8.0	15.2	0.0	-	-	12.4	12.0
Articulated Trucks	7	10	8	0	-	25	6	6	1	0	-	13	2	3	6	0	-	11	2	6	6	0	-	14	63
% Articulated Trucks	50.0	10.8	15.1	-	-	15.6	40.0	3.5	2.7	-	-	5.8	1.4	2.9	54.5	-	-	4.3	8.0	7.6	66.7	-	-	12.4	8.4
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Cedar Creek & Dumfries Road
Site Code: 200319
Start Date: 07/15/2020



Turning Movement Peak Hour Data Plot (7:30 AM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Cedar Creek & Dumfries Road
Site Code: 200319
Start Date: 07/15/2020

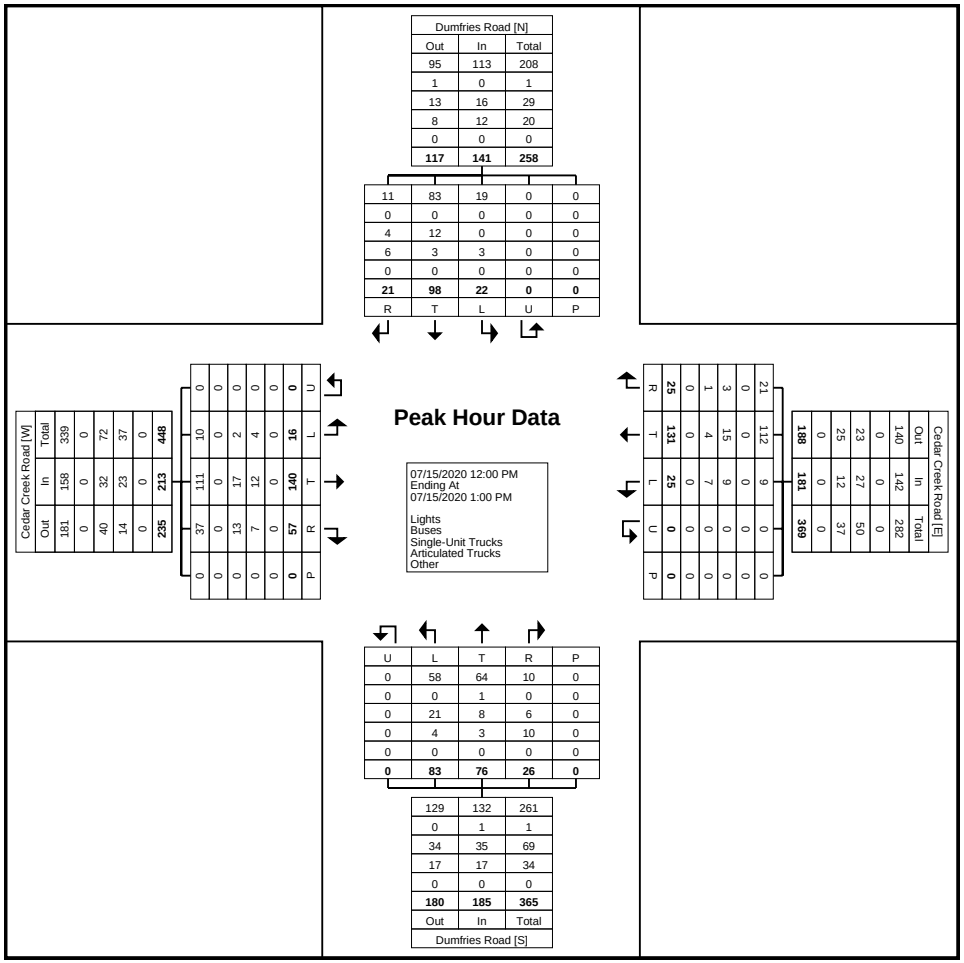
Turning Movement Peak Hour Data (12:00 PM)

Start Time	Cedar Creek Road Eastbound						Cedar Creek Road Westbound						Dumfries Road Northbound						Dumfries Road Southbound						
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Int. Total
12:00 PM	3	39	14	0	0	56	4	30	7	0	0	41	23	11	5	0	0	39	5	18	9	0	0	32	168
12:15 PM	5	45	16	0	0	66	8	33	5	0	0	46	17	20	4	0	0	41	5	28	3	0	0	36	189
12:30 PM	5	25	16	0	0	46	7	37	9	0	0	53	28	28	8	0	0	64	3	29	5	0	0	37	200
12:45 PM	3	31	11	0	0	45	6	31	4	0	0	41	15	17	9	0	0	41	9	23	4	0	0	36	163
Total	16	140	57	0	0	213	25	131	25	0	0	181	83	76	26	0	0	185	22	98	21	0	0	141	720
Approach %	7.5	65.7	26.8	0.0	-	-	13.8	72.4	13.8	0.0	-	-	44.9	41.1	14.1	0.0	-	-	15.6	69.5	14.9	0.0	-	-	-
Total %	2.2	19.4	7.9	0.0	-	29.6	3.5	18.2	3.5	0.0	-	25.1	11.5	10.6	3.6	0.0	-	25.7	3.1	13.6	2.9	0.0	-	19.6	-
PHF	0.800	0.778	0.891	0.000	-	0.807	0.781	0.885	0.694	0.000	-	0.854	0.741	0.679	0.722	0.000	-	0.723	0.611	0.845	0.583	0.000	-	0.953	0.900
Lights	10	111	37	0	-	158	9	112	21	0	-	142	58	64	10	0	-	132	19	83	11	0	-	113	545
% Lights	62.5	79.3	64.9	-	-	74.2	36.0	85.5	84.0	-	-	78.5	69.9	84.2	38.5	-	-	71.4	86.4	84.7	52.4	-	-	80.1	75.7
Buses	0	0	0	0	-	0	0	0	0	0	-	0	0	1	0	0	-	1	0	0	0	0	-	0	1
% Buses	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	1.3	0.0	-	-	0.5	0.0	0.0	0.0	-	-	0.0	0.1
Single-Unit Trucks	2	17	13	0	-	32	9	15	3	0	-	27	21	8	6	0	-	35	0	12	4	0	-	16	110
% Single-Unit Trucks	12.5	12.1	22.8	-	-	15.0	36.0	11.5	12.0	-	-	14.9	25.3	10.5	23.1	-	-	18.9	0.0	12.2	19.0	-	-	11.3	15.3
Articulated Trucks	4	12	7	0	-	23	7	4	1	0	-	12	4	3	10	0	-	17	3	3	6	0	-	12	64
% Articulated Trucks	25.0	8.6	12.3	-	-	10.8	28.0	3.1	4.0	-	-	6.6	4.8	3.9	38.5	-	-	9.2	13.6	3.1	28.6	-	-	8.5	8.9
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Cedar Creek & Dumfries Road
Site Code: 200319
Start Date: 07/15/2020



Turning Movement Peak Hour Data Plot (12:00 PM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Cedar Creek & Dumfries Road
Site Code: 200319
Start Date: 07/15/2020

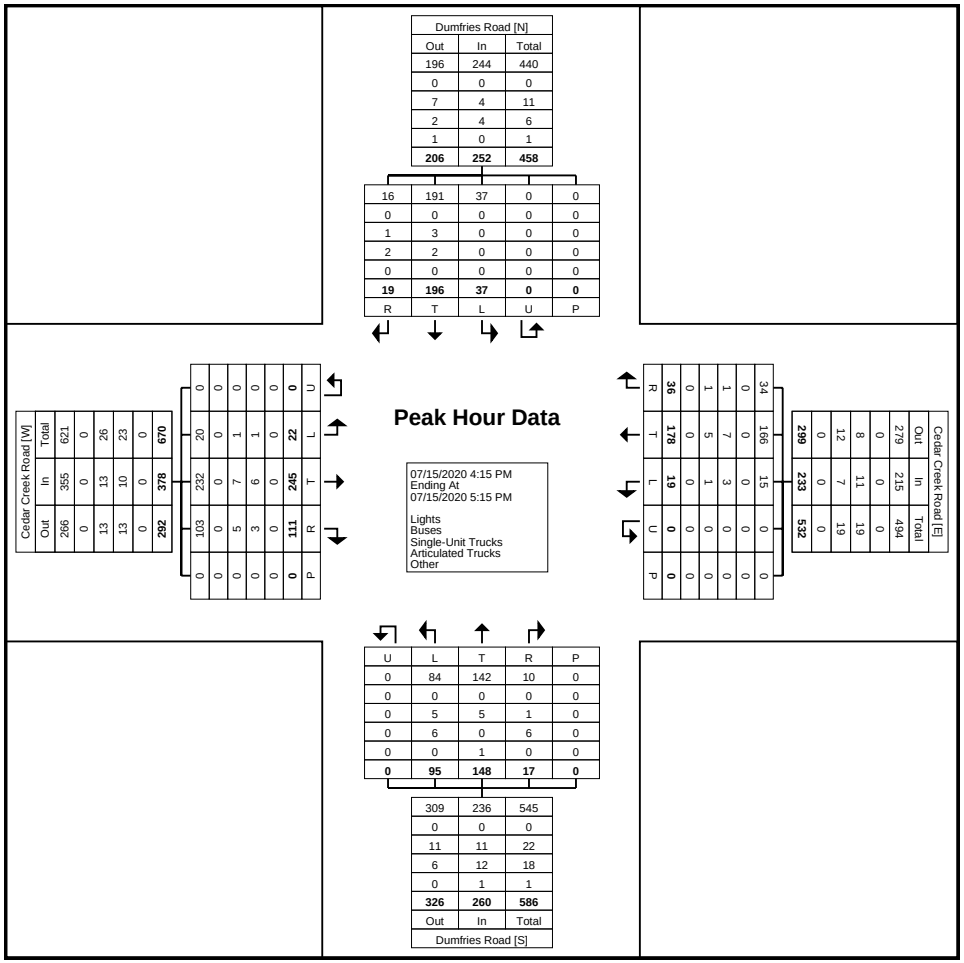
Turning Movement Peak Hour Data (4:15 PM)

Start Time	Cedar Creek Road Eastbound						Cedar Creek Road Westbound						Dumfries Road Northbound						Dumfries Road Southbound						
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Int. Total
4:15 PM	5	52	17	0	0	74	4	40	13	0	0	57	29	39	9	0	0	77	7	58	7	0	0	72	280
4:30 PM	7	62	36	0	0	105	5	51	8	0	0	64	23	41	3	0	0	67	7	39	5	0	0	51	287
4:45 PM	2	51	24	0	0	77	7	47	7	0	0	61	25	35	2	0	0	62	10	54	2	0	0	66	266
5:00 PM	8	80	34	0	0	122	3	40	8	0	0	51	18	33	3	0	0	54	13	45	5	0	0	63	290
Total	22	245	111	0	0	378	19	178	36	0	0	233	95	148	17	0	0	260	37	196	19	0	0	252	1123
Approach %	5.8	64.8	29.4	0.0	-	-	8.2	76.4	15.5	0.0	-	-	36.5	56.9	6.5	0.0	-	-	14.7	77.8	7.5	0.0	-	-	-
Total %	2.0	21.8	9.9	0.0	-	33.7	1.7	15.9	3.2	0.0	-	20.7	8.5	13.2	1.5	0.0	-	23.2	3.3	17.5	1.7	0.0	-	22.4	-
PHF	0.688	0.766	0.771	0.000	-	0.775	0.679	0.873	0.692	0.000	-	0.910	0.819	0.902	0.472	0.000	-	0.844	0.712	0.845	0.679	0.000	-	0.875	0.968
Lights	20	232	103	0	-	355	15	166	34	0	-	215	84	142	10	0	-	236	37	191	16	0	-	244	1050
% Lights	90.9	94.7	92.8	-	-	93.9	78.9	93.3	94.4	-	-	92.3	88.4	95.9	58.8	-	-	90.8	100.0	97.4	84.2	-	-	96.8	93.5
Buses	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Buses	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Single-Unit Trucks	1	7	5	0	-	13	3	7	1	0	-	11	5	5	1	0	-	11	0	3	1	0	-	4	39
% Single-Unit Trucks	4.5	2.9	4.5	-	-	3.4	15.8	3.9	2.8	-	-	4.7	5.3	3.4	5.9	-	-	4.2	0.0	1.5	5.3	-	-	1.6	3.5
Articulated Trucks	1	6	3	0	-	10	1	5	1	0	-	7	6	0	6	0	-	12	0	2	2	0	-	4	33
% Articulated Trucks	4.5	2.4	2.7	-	-	2.6	5.3	2.8	2.8	-	-	3.0	6.3	0.0	35.3	-	-	4.6	0.0	1.0	10.5	-	-	1.6	2.9
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	1	0	0	-	1	0	0	0	0	-	0	1
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.7	0.0	-	-	0.4	0.0	0.0	0.0	-	-	0.0	0.1
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Cedar Creek & Dumfries Road
Site Code: 200319
Start Date: 07/15/2020



Turning Movement Peak Hour Data Plot (4:15 PM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Cedar Creek & Dumfries Road
Site Code: 200319
Start Date: 07/15/2020

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Dumfries Road & Roseville Road
Site Code: 200319
Start Date: 07/15/2020

Turning Movement Data

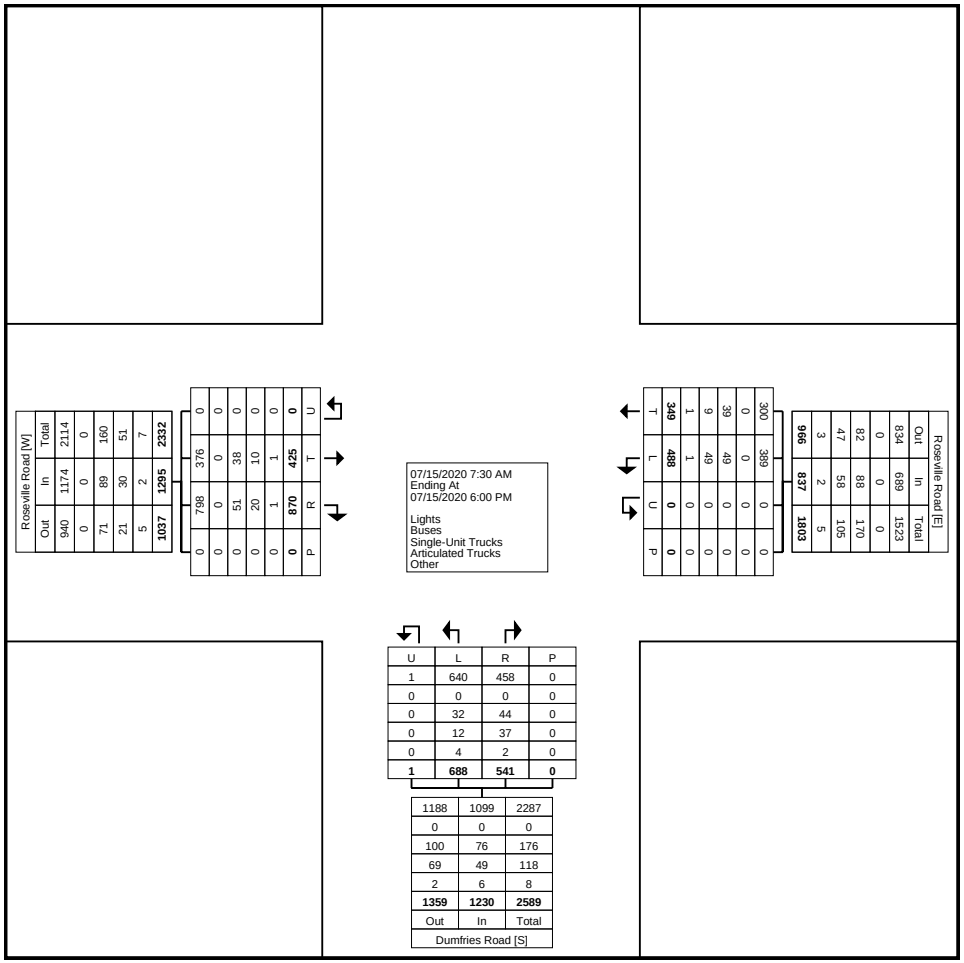
Start Time	Roseville Road Eastbound					Roseville Road Westbound					Dumfries Road Northbound					
	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	Int. Total
7:30 AM	10	25	0	0	35	8	12	0	0	20	34	17	0	0	51	106
7:45 AM	15	24	0	0	39	10	5	0	0	15	17	16	0	0	33	87
Hourly Total	25	49	0	0	74	18	17	0	0	35	51	33	0	0	84	193
8:00 AM	12	32	0	0	44	13	7	0	0	20	16	15	0	0	31	95
8:15 AM	14	14	0	0	28	12	4	0	0	16	18	12	0	0	30	74
8:30 AM	11	22	0	0	33	15	8	0	0	23	11	16	0	0	27	83
8:45 AM	19	20	0	0	39	7	5	0	0	12	16	24	0	0	40	91
Hourly Total	56	88	0	0	144	47	24	0	0	71	61	67	0	0	128	343
9:00 AM	16	19	0	0	35	13	8	0	0	21	11	17	0	0	28	84
9:15 AM	8	25	0	0	33	15	15	0	0	30	16	12	0	0	28	91
9:30 AM	9	14	0	0	23	11	8	0	0	19	17	18	0	0	35	77
9:45 AM	7	18	0	0	25	14	12	0	0	26	17	14	0	0	31	82
Hourly Total	40	76	0	0	116	53	43	0	0	96	61	61	0	0	122	334
10:00 AM	6	24	0	0	30	17	7	0	0	24	14	11	0	0	25	79
10:15 AM	9	23	0	0	32	7	8	0	0	15	14	27	0	0	41	88
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	15	47	0	0	62	24	15	0	0	39	28	38	0	0	66	167
12:00 PM	3	18	0	0	21	16	14	0	0	30	10	9	0	0	19	70
12:15 PM	16	27	0	0	43	13	13	0	0	26	12	17	0	0	29	98
12:30 PM	17	24	0	0	41	10	11	0	0	21	26	17	0	0	43	105
12:45 PM	11	28	0	0	39	11	16	0	0	27	14	18	0	0	32	98
Hourly Total	47	97	0	0	144	50	54	0	0	104	62	61	0	0	123	371
1:00 PM	24	24	0	0	48	14	10	0	0	24	17	14	0	0	31	103
1:15 PM	9	29	0	0	38	21	14	0	0	35	17	14	0	0	31	104
1:30 PM	22	18	0	0	40	10	14	0	0	24	22	15	0	0	37	101
1:45 PM	11	29	0	0	40	16	8	0	0	24	19	18	0	0	37	101
Hourly Total	66	100	0	0	166	61	46	0	0	107	75	61	0	0	136	409
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3:00 PM	14	26	0	0	40	19	9	0	0	28	24	22	0	0	46	114
3:15 PM	15	25	0	0	40	22	8	0	0	30	29	13	0	0	42	112
3:30 PM	10	39	0	0	49	17	14	0	0	31	27	24	0	0	51	131
3:45 PM	12	34	0	0	46	19	20	0	0	39	24	19	0	0	43	128
Hourly Total	51	124	0	0	175	77	51	0	0	128	104	78	0	0	182	485
4:00 PM	13	29	0	0	42	27	19	0	0	46	37	22	0	0	59	147
4:15 PM	14	47	0	0	61	24	7	0	0	31	47	17	0	0	64	156
4:30 PM	15	32	0	0	47	13	4	0	0	17	38	19	0	0	57	121

4:45 PM	19	52	0	0	71	14	9	0	0	23	24	22	0	0	46	140
Hourly Total	61	160	0	0	221	78	39	0	0	117	146	80	0	0	226	564
5:00 PM	20	42	0	0	62	18	17	0	0	35	35	22	1	0	58	155
5:15 PM	20	37	0	0	57	24	19	0	0	43	24	17	0	0	41	141
5:30 PM	17	32	0	0	49	20	14	0	0	34	22	7	0	0	29	112
5:45 PM	7	18	0	0	25	18	10	0	0	28	19	16	0	0	35	88
Hourly Total	64	129	0	0	193	80	60	0	0	140	100	62	1	0	163	496
Grand Total	425	870	0	0	1295	488	349	0	0	837	688	541	1	0	1230	3362
Approach %	32.8	67.2	0.0	-	-	58.3	41.7	0.0	-	-	55.9	44.0	0.1	-	-	-
Total %	12.6	25.9	0.0	-	38.5	14.5	10.4	0.0	-	24.9	20.5	16.1	0.0	-	36.6	-
Lights	376	798	0	-	1174	389	300	0	-	689	640	458	1	-	1099	2962
% Lights	88.5	91.7	-	-	90.7	79.7	86.0	-	-	82.3	93.0	84.7	100.0	-	89.3	88.1
Buses	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Buses	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	0.0	0.0
Single-Unit Trucks	38	51	0	-	89	49	39	0	-	88	32	44	0	-	76	253
% Single-Unit Trucks	8.9	5.9	-	-	6.9	10.0	11.2	-	-	10.5	4.7	8.1	0.0	-	6.2	7.5
Articulated Trucks	10	20	0	-	30	49	9	0	-	58	12	37	0	-	49	137
% Articulated Trucks	2.4	2.3	-	-	2.3	10.0	2.6	-	-	6.9	1.7	6.8	0.0	-	4.0	4.1
Bicycles on Road	1	1	0	-	2	1	1	0	-	2	4	2	0	-	6	10
% Bicycles on Road	0.2	0.1	-	-	0.2	0.2	0.3	-	-	0.2	0.6	0.4	0.0	-	0.5	0.3
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Dumfries Road & Roseville Road
Site Code: 200319
Start Date: 07/15/2020



Turning Movement Data Plot

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Dumfries Road & Roseville Road
Site Code: 200319
Start Date: 07/15/2020

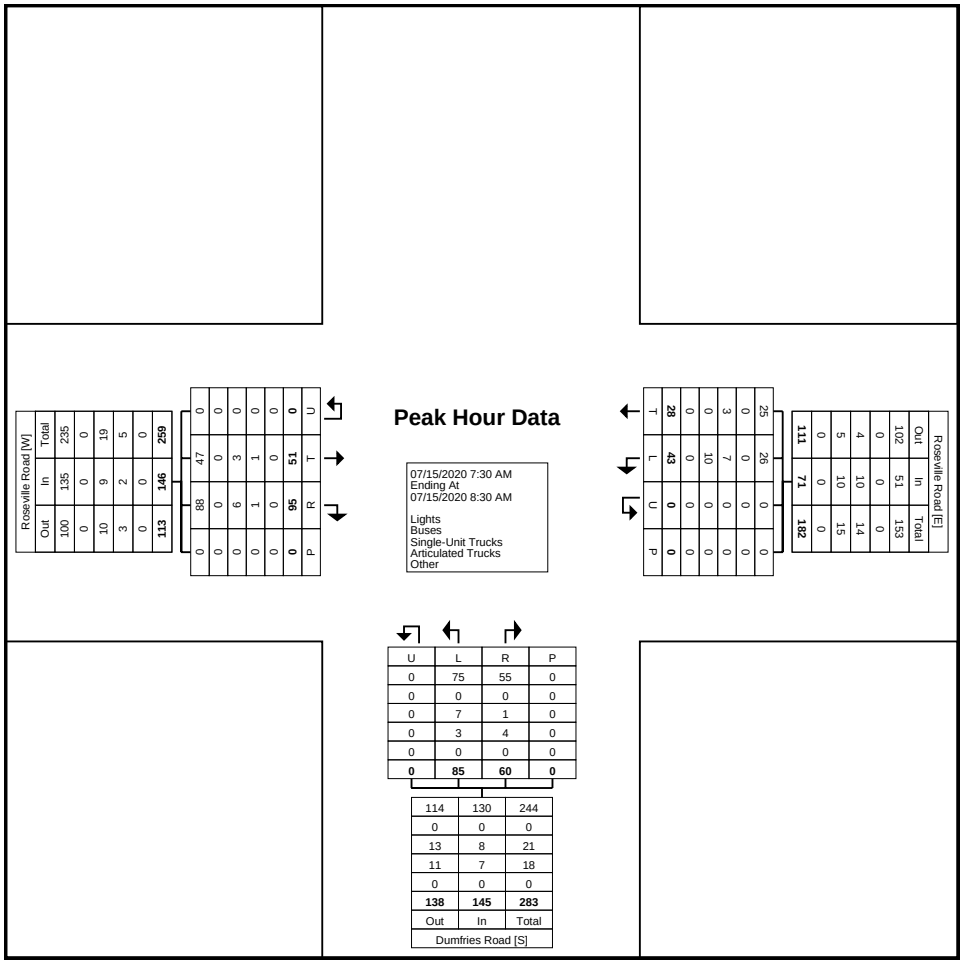
Turning Movement Peak Hour Data (7:30 AM)

Start Time	Roseville Road Eastbound					Roseville Road Westbound					Dumfries Road Northbound					
	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	Int. Total
7:30 AM	10	25	0	0	35	8	12	0	0	20	34	17	0	0	51	106
7:45 AM	15	24	0	0	39	10	5	0	0	15	17	16	0	0	33	87
8:00 AM	12	32	0	0	44	13	7	0	0	20	16	15	0	0	31	95
8:15 AM	14	14	0	0	28	12	4	0	0	16	18	12	0	0	30	74
Total	51	95	0	0	146	43	28	0	0	71	85	60	0	0	145	362
Approach %	34.9	65.1	0.0	-	-	60.6	39.4	0.0	-	-	58.6	41.4	0.0	-	-	-
Total %	14.1	26.2	0.0	-	40.3	11.9	7.7	0.0	-	19.6	23.5	16.6	0.0	-	40.1	-
PHF	0.850	0.742	0.000	-	0.830	0.827	0.583	0.000	-	0.888	0.625	0.882	0.000	-	0.711	0.854
Lights	47	88	0	-	135	26	25	0	-	51	75	55	0	-	130	316
% Lights	92.2	92.6	-	-	92.5	60.5	89.3	-	-	71.8	88.2	91.7	-	-	89.7	87.3
Buses	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Buses	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0
Single-Unit Trucks	3	6	0	-	9	7	3	0	-	10	7	1	0	-	8	27
% Single-Unit Trucks	5.9	6.3	-	-	6.2	16.3	10.7	-	-	14.1	8.2	1.7	-	-	5.5	7.5
Articulated Trucks	1	1	0	-	2	10	0	0	-	10	3	4	0	-	7	19
% Articulated Trucks	2.0	1.1	-	-	1.4	23.3	0.0	-	-	14.1	3.5	6.7	-	-	4.8	5.2
Bicycles on Road	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Dumfries Road & Roseville Road
Site Code: 200319
Start Date: 07/15/2020



Roseville Road [W]	U	L	T	R	P	Total
In	0	47	0	88	0	135
Out	0	0	0	0	0	100
Total	0	47	0	88	0	235
	0	0	0	0	0	0
	0	3	6	0	0	19
	0	1	1	0	0	5
	0	0	0	0	0	0
	0	**51**	**95**	**0**	**0**	**259**
	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
	0	**0**	**0**	**0**	**0**	**0**
	U	L	T	R	P	

Roseville Road [E]	T	L	U	P	Total
Out	25	26	0	0	102
In	0	0	0	0	51
Total	25	26	0	0	153
	0	0	0	0	0
	3	7	0	0	14
	0	10	0	0	10
	0	0	0	0	5
	0	**43**	**0**	**0**	**111**
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	**0**	**0**	**0**	**182**
	T	L	U	P	

U	L	R	P
0	75	55	0
0	0	0	0
0	7	1	0
0	3	4	0
0	0	0	0
0	**85**	**60**	**0**

Dumfries Road [S]		
114	130	244
0	0	0
13	8	21
11	7	18
0	0	0
138	**145**	**283**
Out	In	Total

Turning Movement Peak Hour Data Plot (7:30 AM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Dumfries Road & Roseville Road
Site Code: 200319
Start Date: 07/15/2020

Turning Movement Peak Hour Data (12:30 PM)

Start Time	Roseville Road Eastbound					Roseville Road Westbound					Dumfries Road Northbound					
	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	Int. Total
12:30 PM	17	24	0	0	41	10	11	0	0	21	26	17	0	0	43	105
12:45 PM	11	28	0	0	39	11	16	0	0	27	14	18	0	0	32	98
1:00 PM	24	24	0	0	48	14	10	0	0	24	17	14	0	0	31	103
1:15 PM	9	29	0	0	38	21	14	0	0	35	17	14	0	0	31	104
Total	61	105	0	0	166	56	51	0	0	107	74	63	0	0	137	410
Approach %	36.7	63.3	0.0	-	-	52.3	47.7	0.0	-	-	54.0	46.0	0.0	-	-	-
Total %	14.9	25.6	0.0	-	40.5	13.7	12.4	0.0	-	26.1	18.0	15.4	0.0	-	33.4	-
PHF	0.635	0.905	0.000	-	0.865	0.667	0.797	0.000	-	0.764	0.712	0.875	0.000	-	0.797	0.976
Lights	50	97	0	-	147	40	44	0	-	84	67	47	0	-	114	345
% Lights	82.0	92.4	-	-	88.6	71.4	86.3	-	-	78.5	90.5	74.6	-	-	83.2	84.1
Buses	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Buses	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0
Single-Unit Trucks	7	7	0	-	14	7	7	0	-	14	6	8	0	-	14	42
% Single-Unit Trucks	11.5	6.7	-	-	8.4	12.5	13.7	-	-	13.1	8.1	12.7	-	-	10.2	10.2
Articulated Trucks	3	1	0	-	4	8	0	0	-	8	1	8	0	-	9	21
% Articulated Trucks	4.9	1.0	-	-	2.4	14.3	0.0	-	-	7.5	1.4	12.7	-	-	6.6	5.1
Bicycles on Road	1	0	0	-	1	1	0	0	-	1	0	0	0	-	0	2
% Bicycles on Road	1.6	0.0	-	-	0.6	1.8	0.0	-	-	0.9	0.0	0.0	-	-	0.0	0.5
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Dumfries Road & Roseville Road
Site Code: 200319
Start Date: 07/15/2020

Peak Hour Data

07/15/2020 12:30 PM
Ending At
07/15/2020 1:30 PM

Lights
Buses
Single-Unit Trucks
Articulated Trucks
Other

Roseville Road [W]

	Out	In	Total
Lights	111	147	258
Buses	0	0	0
Single-Unit Trucks	13	14	27
Articulated Trucks	1	4	5
Other	0	1	1
Total	**125**	**166**	**291**

	U	T	R	P
Lights	0	50	97	0
Buses	0	0	0	0
Single-Unit Trucks	0	7	7	0
Articulated Trucks	0	3	1	0
Other	0	1	0	0
Total	**0**	**61**	**105**	**0**

Roseville Road [E]

	Out	In	Total
Lights	97	84	181
Buses	0	0	0
Single-Unit Trucks	15	14	29
Articulated Trucks	11	8	19
Other	1	1	2
Total	**124**	**107**	**231**

	T	L	U	P
Lights	44	40	0	0
Buses	0	0	0	0
Single-Unit Trucks	7	7	0	0
Articulated Trucks	0	8	0	0
Other	0	1	0	0
Total	**51**	**56**	**0**	**0**

Dumfries Road [S]

U	L	R	P
0	67	47	0
0	0	0	0
0	6	8	0
0	1	8	0
0	0	0	0
0	**74**	**63**	**0**

Out	In	Total
137	114	251
0	0	0
14	14	28
9	9	18
1	0	1
161	**137**	**298**

Dumfries Road [S]

Turning Movement Peak Hour Data Plot (12:30 PM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Dumfries Road & Roseville Road
Site Code: 200319
Start Date: 07/15/2020

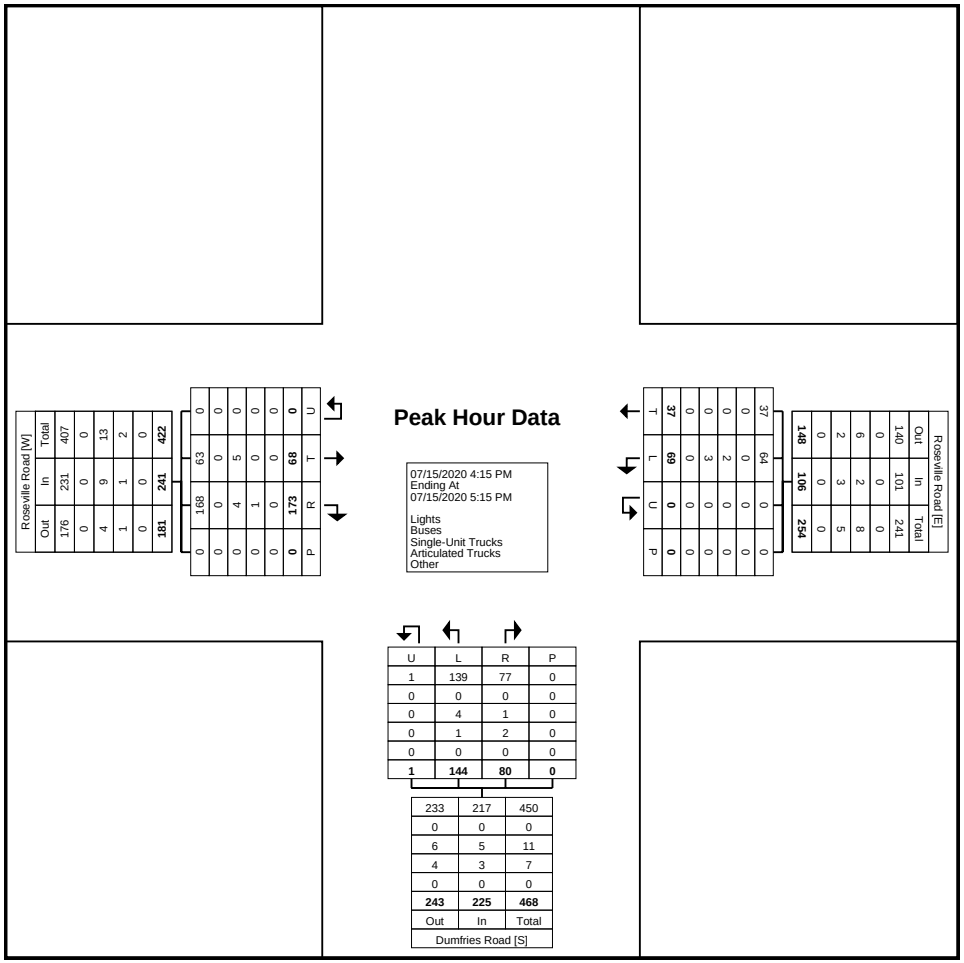
Turning Movement Peak Hour Data (4:15 PM)

Start Time	Roseville Road Eastbound					Roseville Road Westbound					Dumfries Road Northbound					
	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	Int. Total
4:15 PM	14	47	0	0	61	24	7	0	0	31	47	17	0	0	64	156
4:30 PM	15	32	0	0	47	13	4	0	0	17	38	19	0	0	57	121
4:45 PM	19	52	0	0	71	14	9	0	0	23	24	22	0	0	46	140
5:00 PM	20	42	0	0	62	18	17	0	0	35	35	22	1	0	58	155
Total	68	173	0	0	241	69	37	0	0	106	144	80	1	0	225	572
Approach %	28.2	71.8	0.0	-	-	65.1	34.9	0.0	-	-	64.0	35.6	0.4	-	-	-
Total %	11.9	30.2	0.0	-	42.1	12.1	6.5	0.0	-	18.5	25.2	14.0	0.2	-	39.3	-
PHF	0.850	0.832	0.000	-	0.849	0.719	0.544	0.000	-	0.757	0.766	0.909	0.250	-	0.879	0.917
Lights	63	168	0	-	231	64	37	0	-	101	139	77	1	-	217	549
% Lights	92.6	97.1	-	-	95.9	92.8	100.0	-	-	95.3	96.5	96.3	100.0	-	96.4	96.0
Buses	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Buses	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	0.0	0.0
Single-Unit Trucks	5	4	0	-	9	2	0	0	-	2	4	1	0	-	5	16
% Single-Unit Trucks	7.4	2.3	-	-	3.7	2.9	0.0	-	-	1.9	2.8	1.3	0.0	-	2.2	2.8
Articulated Trucks	0	1	0	-	1	3	0	0	-	3	1	2	0	-	3	7
% Articulated Trucks	0.0	0.6	-	-	0.4	4.3	0.0	-	-	2.8	0.7	2.5	0.0	-	1.3	1.2
Bicycles on Road	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Dumfries Road & Roseville Road
Site Code: 200319
Start Date: 07/15/2020



Roseville Road [W]							
Total	407	0	13	2	0	**422**	
In	231	0	9	1	0	**241**	
Out	176	0	4	1	0	**181**	

0	0	0	0	0	**0**	U	
63	0	5	0	0	**68**	T	
168	0	4	1	0	**173**	R	
0	0	0	0	0	**0**	P	

T	**37**	0	0	0	0	37	
L	**69**	0	3	2	0	64	
U	**0**	0	0	0	0	0	
P	**0**	0	0	0	0	0	

148	0	2	6	0	140	Out	Roseville Road [E]
106	0	3	2	0	101	In	
254	0	5	8	0	241	Total	

U	L	R	P
1	139	77	0
0	0	0	0
0	4	1	0
0	1	2	0
0	0	0	0
1	**144**	**80**	**0**

233	217	450
0	0	0
6	5	11
4	3	7
0	0	0
243	**225**	**468**
Out	In	Total
Dumfries Road [S]		

Turning Movement Peak Hour Data Plot (4:15 PM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Dumfries Road & Roseville Road
Site Code: 200319
Start Date: 07/15/2020

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Cedar Creek Road & Highway 40 EB
Site Code:
Start Date: 07/12/2018

Turning Movement Data

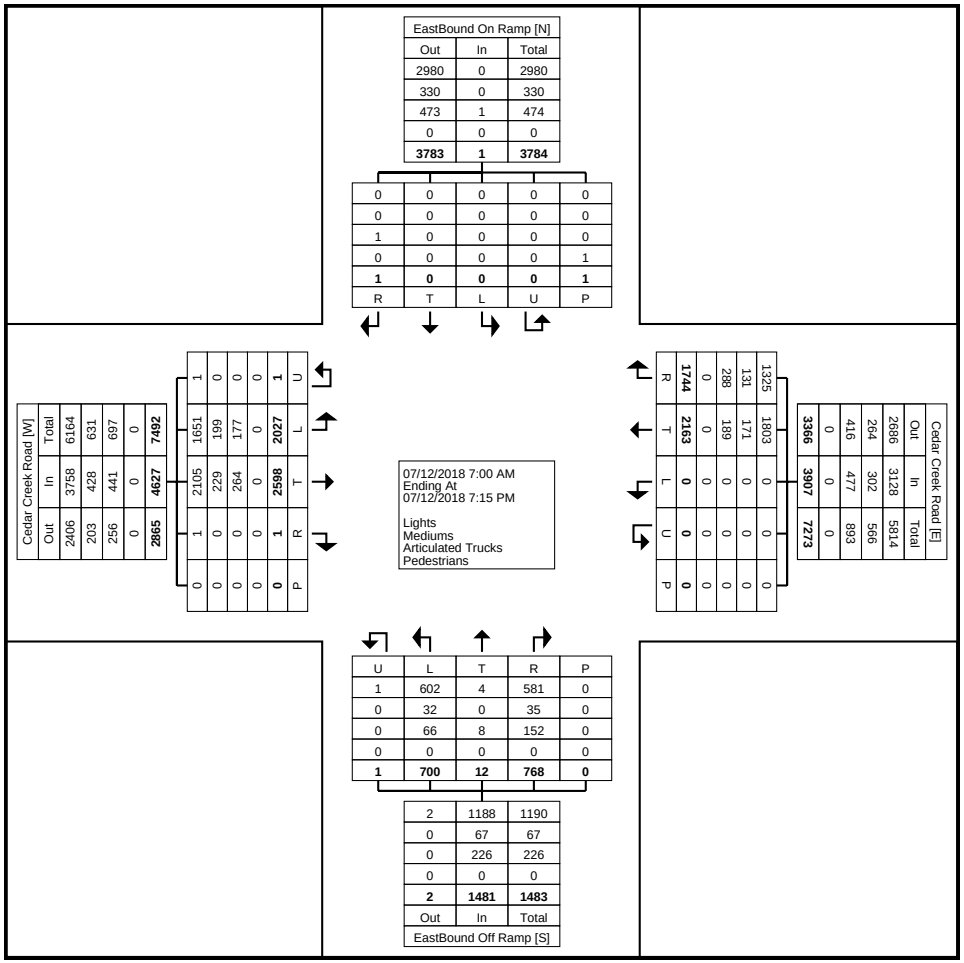
Start Time	Cedar Creek Road Eastbound						Cedar Creek Road Westbound						EastBound Off Ramp Northbound						EastBound On Ramp Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
7:00 AM	63	70	0	0	0	133	0	44	76	0	0	120	13	0	28	0	0	41	0	0	0	0	0	0	294
7:15 AM	93	75	0	0	0	168	0	71	68	0	0	139	16	0	21	0	0	37	0	0	0	0	1	0	344
7:30 AM	98	94	0	0	0	192	0	79	89	0	0	168	10	0	38	0	0	48	0	0	0	0	0	0	408
7:45 AM	91	108	0	0	0	199	0	70	76	0	0	146	30	0	40	0	0	70	0	0	0	0	0	0	415
Hourly Total	345	347	0	0	0	692	0	264	309	0	0	573	69	0	127	0	0	196	0	0	0	0	1	0	1461
8:00 AM	76	95	0	0	0	171	0	59	61	0	0	120	25	0	18	0	0	43	0	0	0	0	0	0	334
8:15 AM	88	77	0	0	0	165	0	62	63	0	0	125	20	0	24	0	0	44	0	0	0	0	0	0	334
8:30 AM	71	78	0	0	0	149	0	66	67	0	0	133	20	0	26	0	0	46	0	0	0	0	0	0	328
8:45 AM	58	91	0	0	0	149	0	65	56	0	0	121	15	0	19	0	0	34	0	0	0	0	0	0	304
Hourly Total	293	341	0	0	0	634	0	252	247	0	0	499	80	0	87	0	0	167	0	0	0	0	0	0	1300
9:00 AM	55	46	0	0	0	101	0	55	59	0	0	114	17	0	19	0	0	36	0	0	1	0	0	1	252
9:15 AM	52	58	0	0	0	110	0	44	59	0	0	103	18	0	28	0	0	46	0	0	0	0	0	0	259
9:30 AM	55	43	0	0	0	98	0	52	47	0	0	99	17	0	25	0	0	42	0	0	0	0	0	0	239
9:45 AM	57	53	0	0	0	110	0	36	47	0	0	83	12	0	21	0	0	33	0	0	0	0	0	0	226
Hourly Total	219	200	0	0	0	419	0	187	212	0	0	399	64	0	93	0	0	157	0	0	1	0	0	1	976
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30 AM	73	83	0	0	0	156	0	61	37	0	0	98	11	0	22	0	0	33	0	0	0	0	0	0	287
11:45 AM	57	87	0	0	0	144	0	58	52	0	0	110	16	0	19	0	0	35	0	0	0	0	0	0	289
Hourly Total	130	170	0	0	0	300	0	119	89	0	0	208	27	0	41	0	0	68	0	0	0	0	0	0	576
12:00 PM	71	79	0	0	0	150	0	62	41	0	0	103	22	0	16	0	0	38	0	0	0	0	0	0	291
12:15 PM	73	87	0	0	0	160	0	54	44	0	0	98	16	0	15	0	0	31	0	0	0	0	0	0	289
12:30 PM	71	87	0	0	0	158	0	55	51	0	0	106	17	0	14	0	0	31	0	0	0	0	0	0	295
12:45 PM	59	76	0	0	0	135	0	52	47	0	0	99	21	2	22	0	0	45	0	0	0	0	0	0	279
Hourly Total	274	329	0	0	0	603	0	223	183	0	0	406	76	2	67	0	0	145	0	0	0	0	0	0	1154
1:00 PM	48	69	0	0	0	117	0	52	59	0	0	111	21	1	12	0	0	34	0	0	0	0	0	0	262
1:15 PM	48	75	0	0	0	123	0	60	49	0	0	109	16	0	25	0	0	41	0	0	0	0	0	0	273
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	96	144	0	0	0	240	0	112	108	0	0	220	37	1	37	0	0	75	0	0	0	0	0	0	535
4:00 PM	72	110	0	0	0	182	0	119	71	0	0	190	27	0	30	0	0	57	0	0	0	0	0	0	429
4:15 PM	67	99	0	1	0	167	0	105	76	0	0	181	27	0	36	0	0	63	0	0	0	0	0	0	411
4:30 PM	60	122	0	0	0	182	0	108	66	0	0	174	27	0	19	0	0	46	0	0	0	0	0	0	402
4:45 PM	62	110	0	0	0	172	0	91	55	0	0	146	36	2	27	1	0	66	0	0	0	0	0	0	384
Hourly Total	261	441	0	1	0	703	0	423	268	0	0	691	117	2	112	1	0	232	0	0	0	0	0	0	1626
5:00 PM	83	114	0	0	0	197	0	134	60	0	0	194	22	4	29	0	0	55	0	0	0	0	0	0	446
5:15 PM	58	99	0	0	0	157	0	91	51	0	0	142	45	2	33	0	0	80	0	0	0	0	0	0	379

5:30 PM	60	115	0	0	0	175	0	105	46	0	0	151	37	0	35	0	0	72	0	0	0	0	0	0	398
5:45 PM	46	73	0	0	0	119	0	54	34	0	0	88	32	1	22	0	0	55	0	0	0	0	0	0	262
Hourly Total	247	401	0	0	0	648	0	384	191	0	0	575	136	7	119	0	0	262	0	0	0	0	0	0	1485
6:00 PM	55	66	1	0	0	122	0	60	36	0	0	96	23	0	29	0	0	52	0	0	0	0	0	0	270
6:15 PM	33	64	0	0	0	97	0	48	36	0	0	84	18	0	21	0	0	39	0	0	0	0	0	0	220
6:30 PM	41	56	0	0	0	97	0	46	30	0	0	76	30	0	20	0	0	50	0	0	0	0	0	0	223
6:45 PM	33	39	0	0	0	72	0	45	35	0	0	80	23	0	15	0	0	38	0	0	0	0	0	0	190
Hourly Total	162	225	1	0	0	388	0	199	137	0	0	336	94	0	85	0	0	179	0	0	0	0	0	0	903
7:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	2027	2598	1	1	0	4627	0	2163	1744	0	0	3907	700	12	768	1	0	1481	0	0	1	0	1	1	10016
Approach %	43.8	56.1	0.0	0.0	-	-	0.0	55.4	44.6	0.0	-	-	47.3	0.8	51.9	0.1	-	-	0.0	0.0	100.0	0.0	-	-	-
Total %	20.2	25.9	0.0	0.0	-	46.2	0.0	21.6	17.4	0.0	-	39.0	7.0	0.1	7.7	0.0	-	14.8	0.0	0.0	0.0	0.0	-	0.0	-
Lights	1651	2105	1	1	-	3758	0	1803	1325	0	-	3128	602	4	581	1	-	1188	0	0	0	0	-	0	8074
% Lights	81.5	81.0	100.0	100.0	-	81.2	-	83.4	76.0	-	-	80.1	86.0	33.3	75.7	100.0	-	80.2	-	-	0.0	-	-	0.0	80.6
Mediums	199	229	0	0	-	428	0	171	131	0	-	302	32	0	35	0	-	67	0	0	0	0	-	0	797
% Mediums	9.8	8.8	0.0	0.0	-	9.3	-	7.9	7.5	-	-	7.7	4.6	0.0	4.6	0.0	-	4.5	-	-	0.0	-	-	0.0	8.0
Articulated Trucks	177	264	0	0	-	441	0	189	288	0	-	477	66	8	152	0	-	226	0	0	1	0	-	1	1145
% Articulated Trucks	8.7	10.2	0.0	0.0	-	9.5	-	8.7	16.5	-	-	12.2	9.4	66.7	19.8	0.0	-	15.3	-	-	100.0	-	-	100.0	11.4
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	1	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Cedar Creek Road & Highway 40 EB
Site Code:
Start Date: 07/12/2018



Turning Movement Data Plot

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Cedar Creek Road & Highway 40 EB
Site Code:
Start Date: 07/12/2018

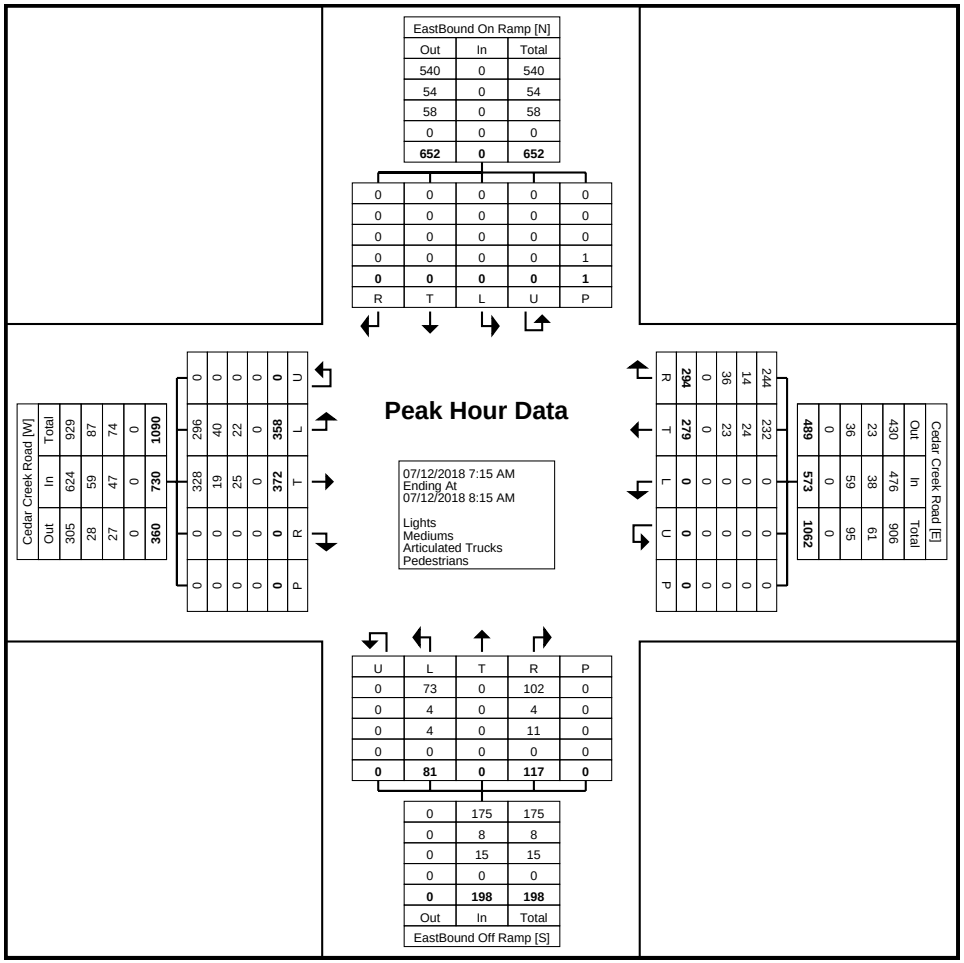
Turning Movement Peak Hour Data (7:15 AM)

Start Time	Cedar Creek Road Eastbound						Cedar Creek Road Westbound						EastBound Off Ramp Northbound						EastBound On Ramp Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
7:15 AM	93	75	0	0	0	168	0	71	68	0	0	139	16	0	21	0	0	37	0	0	0	0	1	0	344
7:30 AM	98	94	0	0	0	192	0	79	89	0	0	168	10	0	38	0	0	48	0	0	0	0	0	0	408
7:45 AM	91	108	0	0	0	199	0	70	76	0	0	146	30	0	40	0	0	70	0	0	0	0	0	0	415
8:00 AM	76	95	0	0	0	171	0	59	61	0	0	120	25	0	18	0	0	43	0	0	0	0	0	0	334
Total	358	372	0	0	0	730	0	279	294	0	0	573	81	0	117	0	0	198	0	0	0	0	1	0	1501
Approach %	49.0	51.0	0.0	0.0	-	-	0.0	48.7	51.3	0.0	-	-	40.9	0.0	59.1	0.0	-	-	0.0	0.0	0.0	0.0	-	-	-
Total %	23.9	24.8	0.0	0.0	-	48.6	0.0	18.6	19.6	0.0	-	38.2	5.4	0.0	7.8	0.0	-	13.2	0.0	0.0	0.0	0.0	-	0.0	-
PHF	0.913	0.861	0.000	0.000	-	0.917	0.000	0.883	0.826	0.000	-	0.853	0.675	0.000	0.731	0.000	-	0.707	0.000	0.000	0.000	0.000	-	0.000	0.904
Lights	296	328	0	0	-	624	0	232	244	0	-	476	73	0	102	0	-	175	0	0	0	0	-	0	1275
% Lights	82.7	88.2	-	-	-	85.5	-	83.2	83.0	-	-	83.1	90.1	-	87.2	-	-	88.4	-	-	-	-	-	-	84.9
Mediums	40	19	0	0	-	59	0	24	14	0	-	38	4	0	4	0	-	8	0	0	0	0	-	0	105
% Mediums	11.2	5.1	-	-	-	8.1	-	8.6	4.8	-	-	6.6	4.9	-	3.4	-	-	4.0	-	-	-	-	-	-	7.0
Articulated Trucks	22	25	0	0	-	47	0	23	36	0	-	59	4	0	11	0	-	15	0	0	0	0	-	0	121
% Articulated Trucks	6.1	6.7	-	-	-	6.4	-	8.2	12.2	-	-	10.3	4.9	-	9.4	-	-	7.6	-	-	-	-	-	-	8.1
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	1	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Cedar Creek Road & Highway 40 EB
Site Code:
Start Date: 07/12/2018



Turning Movement Peak Hour Data Plot (7:15 AM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Cedar Creek Road & Highway 40 EB
Site Code:
Start Date: 07/12/2018

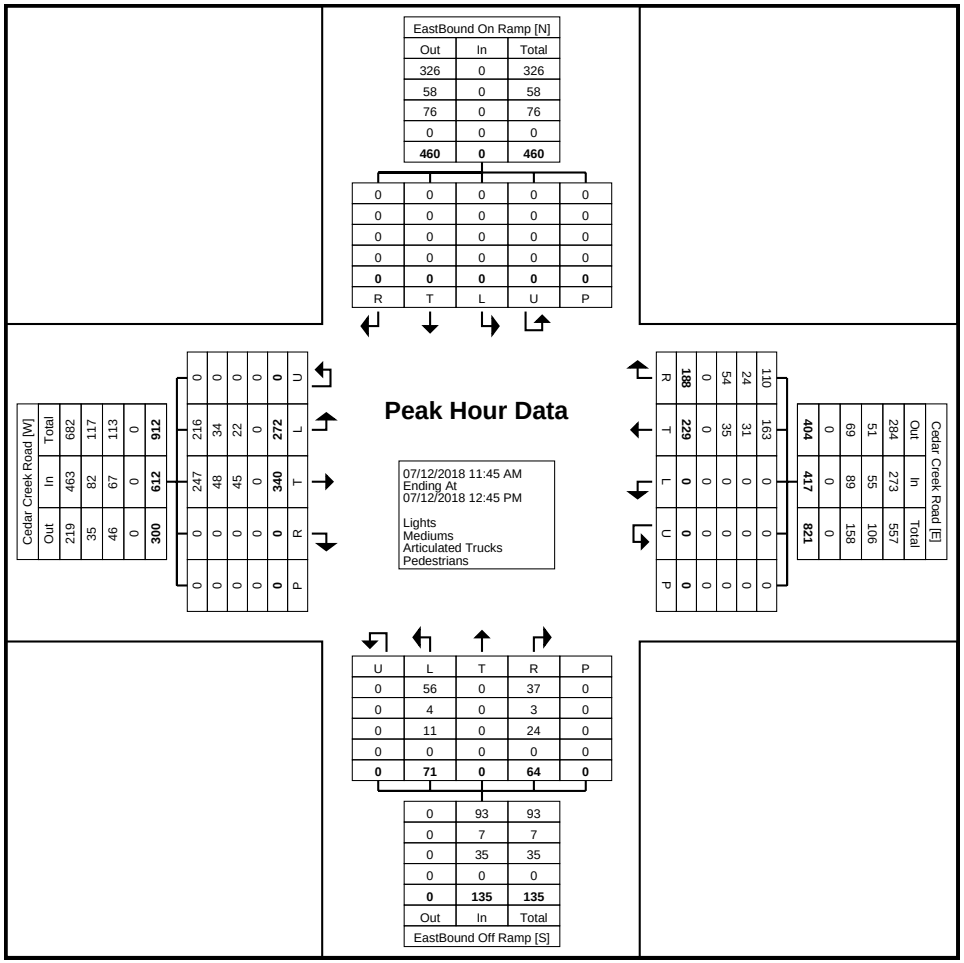
Turning Movement Peak Hour Data (11:45 AM)

Start Time	Cedar Creek Road Eastbound						Cedar Creek Road Westbound						EastBound Off Ramp Northbound						EastBound On Ramp Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
11:45 AM	57	87	0	0	0	144	0	58	52	0	0	110	16	0	19	0	0	35	0	0	0	0	0	0	289
12:00 PM	71	79	0	0	0	150	0	62	41	0	0	103	22	0	16	0	0	38	0	0	0	0	0	0	291
12:15 PM	73	87	0	0	0	160	0	54	44	0	0	98	16	0	15	0	0	31	0	0	0	0	0	0	289
12:30 PM	71	87	0	0	0	158	0	55	51	0	0	106	17	0	14	0	0	31	0	0	0	0	0	0	295
Total	272	340	0	0	0	612	0	229	188	0	0	417	71	0	64	0	0	135	0	0	0	0	0	0	1164
Approach %	44.4	55.6	0.0	0.0	-	-	0.0	54.9	45.1	0.0	-	-	52.6	0.0	47.4	0.0	-	-	0.0	0.0	0.0	0.0	-	-	-
Total %	23.4	29.2	0.0	0.0	-	52.6	0.0	19.7	16.2	0.0	-	35.8	6.1	0.0	5.5	0.0	-	11.6	0.0	0.0	0.0	0.0	-	0.0	-
PHF	0.932	0.977	0.000	0.000	-	0.956	0.000	0.923	0.904	0.000	-	0.948	0.807	0.000	0.842	0.000	-	0.888	0.000	0.000	0.000	0.000	-	0.000	0.986
Lights	216	247	0	0	-	463	0	163	110	0	-	273	56	0	37	0	-	93	0	0	0	0	-	0	829
% Lights	79.4	72.6	-	-	-	75.7	-	71.2	58.5	-	-	65.5	78.9	-	57.8	-	-	68.9	-	-	-	-	-	-	71.2
Mediums	34	48	0	0	-	82	0	31	24	0	-	55	4	0	3	0	-	7	0	0	0	0	-	0	144
% Mediums	12.5	14.1	-	-	-	13.4	-	13.5	12.8	-	-	13.2	5.6	-	4.7	-	-	5.2	-	-	-	-	-	-	12.4
Articulated Trucks	22	45	0	0	-	67	0	35	54	0	-	89	11	0	24	0	-	35	0	0	0	0	-	0	191
% Articulated Trucks	8.1	13.2	-	-	-	10.9	-	15.3	28.7	-	-	21.3	15.5	-	37.5	-	-	25.9	-	-	-	-	-	-	16.4
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Cedar Creek Road & Highway 40 EB
Site Code:
Start Date: 07/12/2018



Turning Movement Peak Hour Data Plot (11:45 AM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Cedar Creek Road & Highway 40 EB
Site Code:
Start Date: 07/12/2018

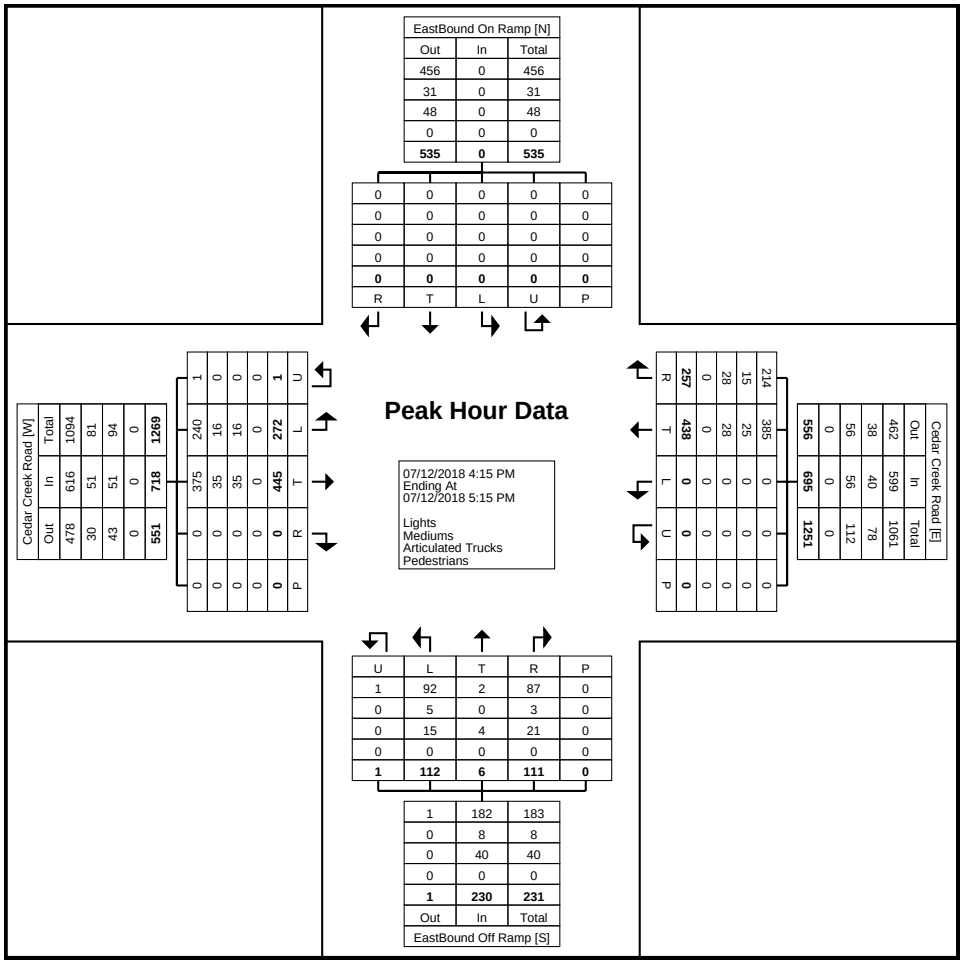
Turning Movement Peak Hour Data (4:15 PM)

Start Time	Cedar Creek Road Eastbound						Cedar Creek Road Westbound						EastBound Off Ramp Northbound						EastBound On Ramp Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
4:15 PM	67	99	0	1	0	167	0	105	76	0	0	181	27	0	36	0	0	63	0	0	0	0	0	0	411
4:30 PM	60	122	0	0	0	182	0	108	66	0	0	174	27	0	19	0	0	46	0	0	0	0	0	0	402
4:45 PM	62	110	0	0	0	172	0	91	55	0	0	146	36	2	27	1	0	66	0	0	0	0	0	0	384
5:00 PM	83	114	0	0	0	197	0	134	60	0	0	194	22	4	29	0	0	55	0	0	0	0	0	0	446
Total	272	445	0	1	0	718	0	438	257	0	0	695	112	6	111	1	0	230	0	0	0	0	0	0	1643
Approach %	37.9	62.0	0.0	0.1	-	-	0.0	63.0	37.0	0.0	-	-	48.7	2.6	48.3	0.4	-	-	0.0	0.0	0.0	0.0	-	-	-
Total %	16.6	27.1	0.0	0.1	-	43.7	0.0	26.7	15.6	0.0	-	42.3	6.8	0.4	6.8	0.1	-	14.0	0.0	0.0	0.0	0.0	-	0.0	-
PHF	0.819	0.912	0.000	0.250	-	0.911	0.000	0.817	0.845	0.000	-	0.896	0.778	0.375	0.771	0.250	-	0.871	0.000	0.000	0.000	0.000	-	0.000	0.921
Lights	240	375	0	1	-	616	0	385	214	0	-	599	92	2	87	1	-	182	0	0	0	0	-	0	1397
% Lights	88.2	84.3	-	100.0	-	85.8	-	87.9	83.3	-	-	86.2	82.1	33.3	78.4	100.0	-	79.1	-	-	-	-	-	-	85.0
Mediums	16	35	0	0	-	51	0	25	15	0	-	40	5	0	3	0	-	8	0	0	0	0	-	0	99
% Mediums	5.9	7.9	-	0.0	-	7.1	-	5.7	5.8	-	-	5.8	4.5	0.0	2.7	0.0	-	3.5	-	-	-	-	-	-	6.0
Articulated Trucks	16	35	0	0	-	51	0	28	28	0	-	56	15	4	21	0	-	40	0	0	0	0	-	0	147
% Articulated Trucks	5.9	7.9	-	0.0	-	7.1	-	6.4	10.9	-	-	8.1	13.4	66.7	18.9	0.0	-	17.4	-	-	-	-	-	-	8.9
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Cedar Creek Road & Highway 40 EB
Site Code:
Start Date: 07/12/2018



Turning Movement Peak Hour Data Plot (4:15 PM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Cedar Creek Road & Highway 40 EB
Site Code:
Start Date: 07/12/2018

INT # 768 **CEDAR CREEK ROAD (RR 97) @ Dumfries Road (RR 47)** T08-50/ 5ND

Fully-Actuated Operation
Actuated protected/permissive left-turn phase on East and West Approaches

Signal Timing in Effect: All Times

Cedar Creek Road

EB Green Arrow	Min	5.0	seconds	WB Green Arrow	Min	5.0	seconds
	Ext	3.0	seconds		Ext	3.0	seconds
	Max	10.0	seconds		Max	10.0	seconds
EB Amber Arrow		3.0	seconds	WB Amber Arrow		3.0	seconds
All Red		1.0	seconds	All Red		1.0	seconds
Green	Min	20.0	seconds				
	Ext	3.0	seconds				
	Max	40.0	seconds	Pedestrian Call			
Amber		4.6	seconds	Walk	7.0	seconds	
All Red		2.3	seconds	FDW	10.0	seconds	

Dumfries Road

Green	Min	10.0	seconds			
	Ext	4.0	seconds			
	Max	25.0	seconds	Pedestrian Call		
Amber		4.6	seconds	Walk	7.0	seconds
All Red		2.3	seconds	FDW	14.0	seconds
TOTAL		92.8	seconds			

Appendix C

Existing Traffic Operations Reports

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	51	95	43	28	85	60
Future Volume (vph)	51	95	43	28	85	60
Ideal Flow (vphpl)	1650	1650	1650	1650	1765	1765
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.912				0.944	
Flt Protected				0.971	0.972	
Satd. Flow (prot)	1402	0	0	1246	1468	0
Flt Permitted				0.971	0.972	
Satd. Flow (perm)	1402	0	0	1246	1468	0
Link Speed (k/h)	80			80	80	
Link Distance (m)	226.9			258.9	348.5	
Travel Time (s)	10.2			11.7	15.7	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	8%	7%	40%	11%	12%	8%
Adj. Flow (vph)	51	95	43	28	85	60
Shared Lane Traffic (%)						
Lane Group Flow (vph)	146	0	0	71	145	0
Sign Control	Free			Free	Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 33.3%		ICU Level of Service A	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	5.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	51	95	43	28	85	60
Future Vol, veh/h	51	95	43	28	85	60
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	8	7	40	11	12	8
Mvmt Flow	51	95	43	28	85	60

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	146	0	213	99
Stage 1	-	-	-	-	99	-
Stage 2	-	-	-	-	114	-
Critical Hdwy	-	-	4.5	-	6.52	6.28
Critical Hdwy Stg 1	-	-	-	-	5.52	-
Critical Hdwy Stg 2	-	-	-	-	5.52	-
Follow-up Hdwy	-	-	2.56	-	3.608	3.372
Pot Cap-1 Maneuver	-	-	1234	-	753	941
Stage 1	-	-	-	-	900	-
Stage 2	-	-	-	-	887	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1234	-	727	941
Mov Cap-2 Maneuver	-	-	-	-	727	-
Stage 1	-	-	-	-	900	-
Stage 2	-	-	-	-	856	-

Approach	EB	WB	NB
HCM Control Delay, s	0	4.9	10.5
HCM LOS			B

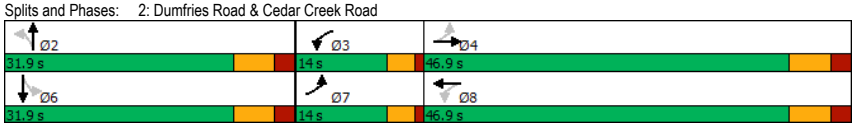
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	803	-	-	1234	-
HCM Lane V/C Ratio	0.181	-	-	0.035	-
HCM Control Delay (s)	10.5	-	-	8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.7	-	-	0.1	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	14	93	53	15	171	37	141	105	11	25	79	9
Future Volume (vph)	14	93	53	15	171	37	141	105	11	25	79	9
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	20.0		0.0	20.0		0.0	45.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	100.0			100.0			100.0			100.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.946			0.973			0.986			0.985	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1074	1167	0	1010	1454	0	1519	1382	0	1454	1275	0
Flt Permitted	0.628			0.662			0.700			0.679		
Satd. Flow (perm)	710	1167	0	704	1454	0	1119	1382	0	1039	1275	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		41			16			6			6	
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		323.0			231.1			119.4			348.5	
Travel Time (s)		14.5			10.4			5.4			15.7	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	57%	24%	51%	67%	12%	3%	11%	10%	91%	16%	23%	67%
Adj. Flow (vph)	14	93	53	15	171	37	141	105	11	25	79	9
Shared Lane Traffic (%)												
Lane Group Flow (vph)	14	146	0	15	208	0	141	116	0	25	88	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	7	4		3	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	9.5	24.9		9.5	24.9		24.9	24.9		24.9	24.9	
Total Split (s)	14.0	46.9		14.0	46.9		31.9	31.9		31.9	31.9	
Total Split (%)	15.1%	50.5%		15.1%	50.5%		34.4%	34.4%		34.4%	34.4%	
Maximum Green (s)	10.0	40.0		10.0	40.0		25.0	25.0		25.0	25.0	
Yellow Time (s)	3.0	4.6		3.0	4.6		4.6	4.6		4.6	4.6	
All-Red Time (s)	1.0	2.3		1.0	2.3		2.3	2.3		2.3	2.3	
Lost Time Adjust (s)	0.0	-2.9		0.0	-2.9		-2.9	-2.9		-2.9	-2.9	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	Max		None	Max		None	None		None	None	
Walk Time (s)		7.0			7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		11.0			11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effct Green (s)	47.2	46.0		47.2	46.1		17.3	17.3		17.3	17.3	
Actuated g/C Ratio	0.64	0.63		0.64	0.63		0.24	0.24		0.24	0.24	
v/c Ratio	0.03	0.20		0.03	0.23		0.53	0.35		0.10	0.29	
Control Delay	6.2	6.9		6.3	8.2		31.8	24.4		22.1	23.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay	6.2	6.9		6.3	8.2		31.8	24.4		22.1	23.1	
LOS	A	A		A	A		C	C		C	C	
Approach Delay		6.9			8.1			28.5			22.8	
Approach LOS		A			A			C			C	
Queue Length 50th (m)	0.6	4.7		0.6	9.1		16.1	12.0		2.6	8.8	
Queue Length 95th (m)	3.2	22.1		3.3	34.2		37.9	29.2		9.2	23.0	
Internal Link Dist (m)		299.0			207.1			95.4			324.5	
Turn Bay Length (m)	20.0			20.0			45.0			25.0		
Base Capacity (vph)	512	748		500	919		431	535		400	494	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.03	0.20		0.03	0.23		0.33	0.22		0.06	0.18	

Intersection Summary			
Area Type:	Other		
Cycle Length: 92.8			
Actuated Cycle Length: 73.3			
Natural Cycle: 60			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.53			
Intersection Signal Delay: 17.0		Intersection LOS: B	
Intersection Capacity Utilization 35.0%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 2: Dumfries Road & Cedar Creek Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	358	372	0	0	279	294	81	0	117	0	0	0
Future Volume (vph)	358	372	0	0	279	294	81	0	117	0	0	0
Ideal Flow (vphpl)	1775	1900	0	0	1900	1750	1550	1550	1550	0	0	0
Storage Length (m)	80.0		0.0	0.0		75.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	0		1	0		0	0		0
Taper Length (m)	80.0			7.5			7.5			7.5		
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	1.00
Ped Bike Factor												
Frt						0.850		0.920				
Flt Protected	0.950							0.980				
Satd. Flow (prot)	1441	1696	0	0	1624	1271	0	1257	0	0	0	0
Flt Permitted	0.950							0.980				
Satd. Flow (perm)	1441	1696	0	0	1624	1271	0	1257	0	0	0	0
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		192.4			323.0			72.3			56.5	
Travel Time (s)		8.7			14.5			3.3			2.5	
Confl. Peds. (#/hr)	1					1						
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	17%	12%	0%	0%	17%	17%	10%	0%	12%	0%	0%	0%
Adj. Flow (vph)	358	372	0	0	279	294	81	0	117	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	358	372	0	0	279	294	0	198	0	0	0	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 65.4%		ICU Level of Service C	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	29.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	358	372	0	0	279	294	81	0	117	0	0	0
Future Vol, veh/h	358	372	0	0	279	294	81	0	117	0	0	0
Conflicting Peds, #/hr	1	0	0	0	0	1	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	800	-	-	-	-	750	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	17	12	0	0	17	17	10	0	12	0	0	0
Mvmt Flow	358	372	0	0	279	294	81	0	117	0	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	574	0	-	-	-	0	1514	1662	372
Stage 1	-	-	-	-	-	-	1088	1088	-
Stage 2	-	-	-	-	-	-	426	574	-
Critical Hdwy	4.27	-	-	-	-	-	6.5	6.5	6.32
Critical Hdwy Stg 1	-	-	-	-	-	-	5.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.5	5.5	-
Follow-up Hdwy	2.353	-	-	-	-	-	3.59	4	3.408
Pot Cap-1 Maneuver	929	-	0	0	-	-	126	98	652
Stage 1	-	-	0	0	-	-	312	294	-
Stage 2	-	-	0	0	-	-	642	506	-
Platoon blocked, %		-			-	-			
Mov Cap-1 Maneuver	929	-	-	-	-	-	~ 77	0	652
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 77	0	-
Stage 1	-	-	-	-	-	-	192	0	-
Stage 2	-	-	-	-	-	-	642	0	-

Approach	EB	WB	NB
HCM Control Delay, s	5.5	0	201.7
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBT	WBR
Capacity (veh/h)	161	929	-	-	-	-
HCM Lane V/C Ratio	1.23	0.385	-	-	-	-
HCM Control Delay (s)	201.7	11.3	-	-	-	-
HCM Lane LOS	F	B	-	-	-	-
HCM 95th %tile Q(veh)	11.2	1.8	-	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	68	173	69	37	144	80
Future Volume (vph)	68	173	69	37	144	80
Ideal Flow (vphpl)	1650	1650	1650	1650	1765	1765
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.903				0.952	
Flt Protected				0.968	0.969	
Satd. Flow (prot)	1431	0	0	1528	1566	0
Flt Permitted				0.968	0.969	
Satd. Flow (perm)	1431	0	0	1528	1566	0
Link Speed (k/h)	80			80	80	
Link Distance (m)	226.9			258.9	348.5	
Travel Time (s)	10.2			11.7	15.7	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	7%	3%	7%	0%	4%	4%
Adj. Flow (vph)	68	173	69	37	144	80
Shared Lane Traffic (%)						
Lane Group Flow (vph)	241	0	0	106	224	0
Sign Control	Free			Free	Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 46.9%		ICU Level of Service A	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	5.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	68	173	69	37	144	80
Future Vol, veh/h	68	173	69	37	144	80
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	7	3	7	0	4	4
Mvmt Flow	68	173	69	37	144	80

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	241	0	330	155
Stage 1	-	-	-	-	155	-
Stage 2	-	-	-	-	175	-
Critical Hdwy	-	-	4.17	-	6.44	6.24
Critical Hdwy Stg 1	-	-	-	-	5.44	-
Critical Hdwy Stg 2	-	-	-	-	5.44	-
Follow-up Hdwy	-	-	2.263	-	3.536	3.336
Pot Cap-1 Maneuver	-	-	1297	-	661	886
Stage 1	-	-	-	-	868	-
Stage 2	-	-	-	-	851	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1297	-	625	886
Mov Cap-2 Maneuver	-	-	-	-	625	-
Stage 1	-	-	-	-	868	-
Stage 2	-	-	-	-	805	-

Approach	EB	WB	NB
HCM Control Delay, s	0	5.2	12.6
HCM LOS			B

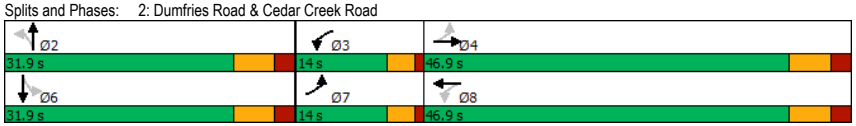
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	698	-	-	1297	-
HCM Lane V/C Ratio	0.321	-	-	0.053	-
HCM Control Delay (s)	12.6	-	-	7.9	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	1.4	-	-	0.2	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	22	245	111	19	178	36	95	148	17	37	196	19
Future Volume (vph)	22	245	111	19	178	36	95	148	17	37	196	19
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	20.0		0.0	20.0		0.0	45.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	100.0			100.0			100.0			100.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.953			0.975			0.985			0.987	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1547	1489	0	1394	1506	0	1506	1520	0	1686	1564	0
Flt Permitted	0.619			0.548			0.491			0.586		
Satd. Flow (perm)	1008	1489	0	804	1506	0	778	1520	0	1040	1564	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		29			15			6			5	
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		323.0			231.1			119.4			348.5	
Travel Time (s)		14.5			10.4			5.4			15.7	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	9%	5%	7%	21%	7%	6%	12%	3%	41%	0%	3%	16%
Adj. Flow (vph)	22	245	111	19	178	36	95	148	17	37	196	19
Shared Lane Traffic (%)												
Lane Group Flow (vph)	22	356	0	19	214	0	95	165	0	37	215	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	7	4		3	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	9.0	26.9		9.0	26.9		16.9	16.9		16.9	16.9	
Total Split (s)	14.0	46.9		14.0	46.9		31.9	31.9		31.9	31.9	
Total Split (%)	15.1%	50.5%		15.1%	50.5%		34.4%	34.4%		34.4%	34.4%	
Maximum Green (s)	10.0	40.0		10.0	40.0		25.0	25.0		25.0	25.0	
Yellow Time (s)	3.0	4.6		3.0	4.6		4.6	4.6		4.6	4.6	
All-Red Time (s)	1.0	2.3		1.0	2.3		2.3	2.3		2.3	2.3	
Lost Time Adjust (s)	0.0	2.9		0.0	-2.9		-2.9	-2.9		-2.9	-2.9	
Total Lost Time (s)	4.0	9.8		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	Max		None	Max		None	None		None	None	
Walk Time (s)		7.0			7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		11.0			11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effct Green (s)	45.9	37.8		45.9	43.7		18.0	18.0		18.0	18.0	
Actuated g/C Ratio	0.62	0.51		0.62	0.59		0.24	0.24		0.24	0.24	
v/c Ratio	0.03	0.46		0.03	0.24		0.50	0.44		0.15	0.56	
Control Delay	6.1	15.1		6.3	9.7		34.5	27.0		23.9	30.0	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay	6.1	15.1		6.3	9.7		34.5	27.0		23.9	30.0	
LOS	A	B		A	A		C	C		C	C	
Approach Delay		14.6			9.4			29.7			29.1	
Approach LOS		B			A			C			C	
Queue Length 50th (m)	1.0	23.3		0.8	9.8		10.8	17.7		3.8	24.3	
Queue Length 95th (m)	4.2	70.2		3.9	35.0		28.4	39.7		12.4	51.3	
Internal Link Dist (m)		299.0			207.1			95.4			324.5	
Turn Bay Length (m)	20.0			20.0			45.0			25.0		
Base Capacity (vph)	721	779		597	901		300	591		402	607	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.03	0.46		0.03	0.24		0.32	0.28		0.09	0.35	

Intersection Summary			
Area Type:	Other		
Cycle Length: 92.8			
Actuated Cycle Length: 73.5			
Natural Cycle: 60			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.56			
Intersection Signal Delay: 20.3		Intersection LOS: C	
Intersection Capacity Utilization 56.3%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 2: Dumfries Road & Cedar Creek Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	272	445	0	0	438	257	112	6	111	0	0	0
Future Volume (vph)	272	445	0	0	438	257	112	6	111	0	0	0
Ideal Flow (vphpl)	1775	1900	0	0	1900	1750	1550	1550	1550	0	0	0
Storage Length (m)	80.0		0.0	0.0		75.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	0		1	0		0	0		0
Taper Length (m)	80.0			7.5			7.5			7.5		
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	1.00
Frt						0.850		0.935				
Flt Protected	0.950							0.976				
Satd. Flow (prot)	1506	1638	0	0	1696	1271	0	1167	0	0	0	0
Flt Permitted	0.950							0.976				
Satd. Flow (perm)	1506	1638	0	0	1696	1271	0	1167	0	0	0	0
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		87.2			323.0			72.3			56.5	
Travel Time (s)		3.9			14.5			3.3			2.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	12%	16%	0%	0%	12%	17%	18%	67%	22%	0%	0%	0%
Adj. Flow (vph)	272	445	0	0	438	257	112	6	111	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	272	445	0	0	438	257	0	229	0	0	0	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 65.5%		ICU Level of Service C	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	56.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	272	445	0	0	438	257	112	6	111	0	0	0
Future Vol, veh/h	272	445	0	0	438	257	112	6	111	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	800	-	-	-	-	750	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	-	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	12	16	0	0	12	17	18	67	22	0	0	0
Mvmt Flow	272	445	0	0	438	257	112	6	111	0	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	695	0	-	-	-	0	1556	1684	445
Stage 1	-	-	-	-	-	-	989	989	-
Stage 2	-	-	-	-	-	-	567	695	-
Critical Hdwy	4.22	-	-	-	-	-	6.58	7.17	6.42
Critical Hdwy Stg 1	-	-	-	-	-	-	5.58	6.17	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.58	6.17	-
Follow-up Hdwy	2.308	-	-	-	-	-	3.662	4.603	3.498
Pot Cap-1 Maneuver	856	-	0	0	-	-	114	67	573
Stage 1	-	-	0	0	-	-	337	253	-
Stage 2	-	-	0	0	-	-	537	359	-
Platoon blocked, %		-			-	-			
Mov Cap-1 Maneuver	856	-	-	-	-	-	~ 78	0	573
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 78	0	-
Stage 1	-	-	-	-	-	-	230	0	-
Stage 2	-	-	-	-	-	-	537	0	-

Approach	EB	WB	NB
HCM Control Delay, s	4.2	0	$ 388.8
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	WBT	WBR
Capacity (veh/h)	137	856	-	-	-
HCM Lane V/C Ratio	1.672	0.318	-	-	-
HCM Control Delay (s)	$ 388.8	11.2	-	-	-
HCM Lane LOS	F	B	-	-	-
HCM 95th %tile Q(veh)	16.7	1.4	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Appendix D

OTM Traffic Signal Control Justification 1, 2 and 3 Signal Warrants

Signal Justification Calculation
(OTM Book 12 - Justifications 1, 2, 3)

Horizon Year: 2018
Region/City/Township: Ayr

Major Street: Cedar Creek Road
Minor Street: Hwy 401 EB Ramp
North/South?: N

Number of Approach Lanes: 1
Tee Intersection? N
Flow Conditions: Free

PM Forecast Only? N

	Major Street						Minor Street						
	Cedar Creek Road						Hwy 401 EB Ramp						
	Eastbound			Westbound			Northbound			Southbound			Peds Crossing
Hour	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	Main Road
7:00 - 8:00	345	347	0	0	264	309	69	0	127	0	0	0	1
8:00 - 9:00	293	341	0	0	252	247	80	0	87	0	0	0	0
9:00 - 10:00	219	200	0	0	187	212	64	0	93	0	0	1	0
11:30 - 12:30	274	336	0	0	235	174	65	0	72	0	0	0	1
13:00 - 14:00	226	307	0	0	219	206	75	3	73	0	0	0	0
15:00 - 16:00	261	441	0	0	423	268	117	2	112	0	0	0	0
16:00 - 17:00	247	401	0	0	384	191	136	7	119	0	0	0	0
17:00 - 18:00	162	225	1	0	199	137	94	0	85	0	0	0	0

	1A		1B		2A		2B	
Hour	All Approach Lanes		Minor Street Both Approaches		Major Street Both Approaches		Traffic Crossing Major Street	
Threshold	480		120		480		50	
1	1461	100%	196	100%	1265	100%	70	100%
2	1300	100%	167	100%	1133	100%	80	100%
3	976	100%	158	100%	818	100%	64	100%
4	1156	100%	137	100%	1019	100%	66	100%
5	1109	100%	151	100%	958	100%	78	100%
6	1624	100%	231	100%	1393	100%	119	100%
7	1485	100%	262	100%	1223	100%	143	100%
8	903	100%	179	100%	724	100%	94	100%
8 Hours 100% Fulfilled?		Yes		Yes		Yes		Yes
8 Hours 80% Fulfilled?		Yes		Yes		Yes		Yes

Justification Results	
Justification 1 (Minimum Vehicle Volume)	Yes
Justification 2 (Delay To Cross Traffic	Yes
Justification 3 (Volume/Delay Combination)	Yes

Is A Signal Justfied? Yes

Appendix E

2025 Background Traffic Operations Reports

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	56	105	47	31	94	66
Future Volume (vph)	56	105	47	31	94	66
Ideal Flow (vphpl)	1650	1650	1650	1650	1765	1765
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.912				0.944	
Flt Protected				0.971	0.971	
Satd. Flow (prot)	1402	0	0	1247	1466	0
Flt Permitted				0.971	0.971	
Satd. Flow (perm)	1402	0	0	1247	1466	0
Link Speed (k/h)	80			80	80	
Link Distance (m)	226.9			258.9	348.5	
Travel Time (s)	10.2			11.7	15.7	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	8%	7%	40%	11%	12%	8%
Adj. Flow (vph)	56	105	47	31	94	66
Shared Lane Traffic (%)						
Lane Group Flow (vph)	161	0	0	78	160	0
Sign Control	Free			Free	Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 35.6%		ICU Level of Service A	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	5.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	56	105	47	31	94	66
Future Vol, veh/h	56	105	47	31	94	66
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	8	7	40	11	12	8
Mvmt Flow	56	105	47	31	94	66

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	161	0	234	109
Stage 1	-	-	-	-	109	-
Stage 2	-	-	-	-	125	-
Critical Hdwy	-	-	4.5	-	6.52	6.28
Critical Hdwy Stg 1	-	-	-	-	5.52	-
Critical Hdwy Stg 2	-	-	-	-	5.52	-
Follow-up Hdwy	-	-	2.56	-	3.608	3.372
Pot Cap-1 Maneuver	-	-	1217	-	733	929
Stage 1	-	-	-	-	891	-
Stage 2	-	-	-	-	876	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1217	-	704	929
Mov Cap-2 Maneuver	-	-	-	-	704	-
Stage 1	-	-	-	-	891	-
Stage 2	-	-	-	-	842	-

Approach	EB	WB	NB
HCM Control Delay, s	0	4.9	10.8
HCM LOS			B

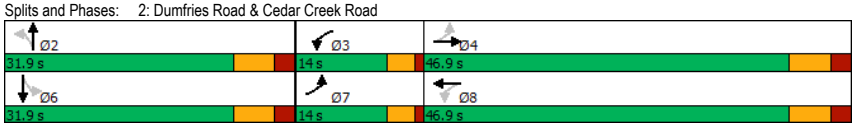
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	782	-	-	1217	-
HCM Lane V/C Ratio	0.205	-	-	0.039	-
HCM Control Delay (s)	10.8	-	-	8.1	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.8	-	-	0.1	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	103	59	17	189	41	156	116	12	28	87	10
Future Volume (vph)	15	103	59	17	189	41	156	116	12	28	87	10
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	20.0		0.0	20.0		0.0	45.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	100.0			100.0			100.0			100.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.945			0.973			0.986			0.985	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1074	1165	0	1010	1454	0	1519	1383	0	1454	1274	0
Flt Permitted	0.605			0.654			0.694			0.658		
Satd. Flow (perm)	684	1165	0	695	1454	0	1110	1383	0	1007	1274	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		41			16			6			6	
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		323.0			231.1			119.4			348.5	
Travel Time (s)		14.5			10.4			5.4			15.7	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	57%	24%	51%	67%	12%	3%	11%	10%	91%	16%	23%	67%
Adj. Flow (vph)	15	103	59	17	189	41	156	116	12	28	87	10
Shared Lane Traffic (%)												
Lane Group Flow (vph)	15	162	0	17	230	0	156	128	0	28	97	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	7	4		3	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	9.5	24.9		9.5	24.9		24.9	24.9		24.9	24.9	
Total Split (s)	14.0	46.9		14.0	46.9		31.9	31.9		31.9	31.9	
Total Split (%)	15.1%	50.5%		15.1%	50.5%		34.4%	34.4%		34.4%	34.4%	
Maximum Green (s)	10.0	40.0		10.0	40.0		25.0	25.0		25.0	25.0	
Yellow Time (s)	3.0	4.6		3.0	4.6		4.6	4.6		4.6	4.6	
All-Red Time (s)	1.0	2.3		1.0	2.3		2.3	2.3		2.3	2.3	
Lost Time Adjust (s)	0.0	-2.9		0.0	-2.9		-2.9	-2.9		-2.9	-2.9	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	Max		None	Max		None	None		None	None	
Walk Time (s)		7.0			7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		11.0			11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effct Green (s)	46.2	45.1		46.3	45.1		18.7	18.7		18.7	18.7	
Actuated g/C Ratio	0.63	0.61		0.63	0.61		0.25	0.25		0.25	0.25	
v/c Ratio	0.03	0.22		0.04	0.26		0.56	0.36		0.11	0.30	
Control Delay	6.9	7.9		6.9	9.2		31.7	24.1		21.7	22.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay	6.9	7.9		6.9	9.2		31.7	24.1		21.7	22.8	
LOS	A	A		A	A		C	C		C	C	
Approach Delay		7.8			9.0			28.3			22.5	
Approach LOS		A			A			C			C	
Queue Length 50th (m)	0.7	5.9		0.8	10.9		18.1	13.4		2.9	9.8	
Queue Length 95th (m)	3.5	25.8		3.8	39.6		41.8	31.9		10.1	25.1	
Internal Link Dist (m)		299.0			207.1			95.4			324.5	
Turn Bay Length (m)	20.0			20.0			45.0			25.0		
Base Capacity (vph)	486	728		483	895		425	533		385	491	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.03	0.22		0.04	0.26		0.37	0.24		0.07	0.20	

Intersection Summary			
Area Type:	Other		
Cycle Length: 92.8			
Actuated Cycle Length: 73.7			
Natural Cycle: 60			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.56			
Intersection Signal Delay: 17.4		Intersection LOS: B	
Intersection Capacity Utilization 40.3%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 2: Dumfries Road & Cedar Creek Road

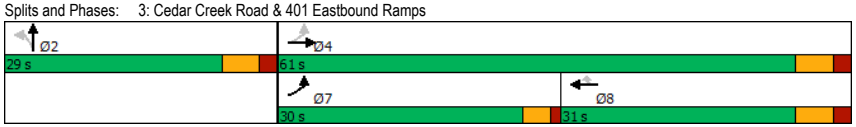


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	411	427	0	0	320	338	93	0	134	0	0	0
Future Volume (vph)	411	427	0	0	320	338	93	0	134	0	0	0
Ideal Flow (vphpl)	1775	1900	0	0	1900	1750	1550	1550	1550	0	0	0
Storage Length (m)	80.0		0.0	0.0		75.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	0		1	0		0	0		0
Taper Length (m)	80.0			7.5			7.5			7.5		
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	1.00
Ped Bike Factor	1.00					0.98						
Frt						0.850		0.920				
Flt Protected	0.950							0.980				
Satd. Flow (prot)	1441	1696	0	0	1624	1271	0	1257	0	0	0	0
Flt Permitted	0.425							0.980				
Satd. Flow (perm)	644	1696	0	0	1624	1243	0	1257	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						338		85				
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		192.4			323.0			72.3			56.5	
Travel Time (s)		8.7			14.5			3.3			2.5	
Confl. Peds. (#/hr)	1					1						
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	17%	12%	0%	0%	17%	17%	10%	0%	12%	0%	0%	0%
Adj. Flow (vph)	411	427	0	0	320	338	93	0	134	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	411	427	0	0	320	338	0	227	0	0	0	0
Turn Type	pm+pt	NA			NA	Perm	Perm	NA				
Protected Phases	7	4			8			2				
Permitted Phases	4					8	2					
Detector Phase	7	4			8	8	2	2				
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0	5.0	5.0	5.0				
Minimum Split (s)	9.5	24.0			24.0	24.0	24.0	24.0				
Total Split (s)	30.0	61.0			31.0	31.0	29.0	29.0				
Total Split (%)	33.3%	67.8%			34.4%	34.4%	32.2%	32.2%				
Maximum Green (s)	26.0	55.0			25.0	25.0	23.0	23.0				
Yellow Time (s)	3.0	4.0			4.0	4.0	4.0	4.0				
All-Red Time (s)	1.0	2.0			2.0	2.0	2.0	2.0				
Lost Time Adjust (s)	0.0	-2.0			-2.0	-2.0		-2.0				
Total Lost Time (s)	4.0	4.0			4.0	4.0		4.0				
Lead/Lag	Lead				Lag	Lag						
Lead-Lag Optimize?	Yes				Yes	Yes						
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0				
Recall Mode	None	Max			Max	Max	None	None				
Walk Time (s)		7.0			7.0	7.0	7.0	7.0				
Flash Dont Walk (s)		11.0			11.0	11.0	11.0	11.0				
Pedestrian Calls (#/hr)		0			0	0	0	0				
Act Effct Green (s)	57.3	57.3			36.9	36.9		16.7				
Actuated g/C Ratio	0.70	0.70			0.45	0.45		0.20				
v/c Ratio	0.68	0.36			0.44	0.45		0.70				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	12.5	7.0			21.7	5.0		30.4				
Queue Delay	0.0	0.0			0.0	0.0		0.0				
Total Delay	12.5	7.0			21.7	5.0		30.4				
LOS	B	A			C	A		C				
Approach Delay		9.7			13.2			30.4				
Approach LOS		A			B			C				
Queue Length 50th (m)	24.3	24.2			34.1	0.0		21.4				
Queue Length 95th (m)	54.9	52.6			80.1	21.1		45.7				
Internal Link Dist (m)		168.4			299.0			48.3			32.5	
Turn Bay Length (m)	80.0					75.0						
Base Capacity (vph)	703	1184			730	744		443				
Starvation Cap Reductn	0	0			0	0		0				
Spillback Cap Reductn	0	0			0	0		0				
Storage Cap Reductn	0	0			0	0		0				
Reduced v/c Ratio	0.58	0.36			0.44	0.45		0.51				

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 82			
Natural Cycle: 70			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.70			
Intersection Signal Delay: 13.7		Intersection LOS: B	
Intersection Capacity Utilization 73.6%		ICU Level of Service D	
Analysis Period (min) 15			

Splits and Phases: 3: Cedar Creek Road & 401 Eastbound Ramps



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	75	191	76	41	159	88
Future Volume (vph)	75	191	76	41	159	88
Ideal Flow (vphpl)	1650	1650	1650	1650	1765	1765
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.903				0.952	
Flt Protected				0.969	0.969	
Satd. Flow (prot)	1431	0	0	1529	1566	0
Flt Permitted				0.969	0.969	
Satd. Flow (perm)	1431	0	0	1529	1566	0
Link Speed (k/h)	80			80	80	
Link Distance (m)	226.9			258.9	348.5	
Travel Time (s)	10.2			11.7	15.7	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	7%	3%	7%	0%	4%	4%
Adj. Flow (vph)	75	191	76	41	159	88
Shared Lane Traffic (%)						
Lane Group Flow (vph)	266	0	0	117	247	0
Sign Control	Free			Free	Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 50.7%		ICU Level of Service A	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	6.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	75	191	76	41	159	88
Future Vol, veh/h	75	191	76	41	159	88
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	7	3	7	0	4	4
Mvmt Flow	75	191	76	41	159	88

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	266	0	364	171
Stage 1	-	-	-	-	171	-
Stage 2	-	-	-	-	193	-
Critical Hdwy	-	-	4.17	-	6.44	6.24
Critical Hdwy Stg 1	-	-	-	-	5.44	-
Critical Hdwy Stg 2	-	-	-	-	5.44	-
Follow-up Hdwy	-	-	2.263	-	3.536	3.336
Pot Cap-1 Maneuver	-	-	1269	-	631	868
Stage 1	-	-	-	-	854	-
Stage 2	-	-	-	-	835	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1269	-	593	868
Mov Cap-2 Maneuver	-	-	-	-	593	-
Stage 1	-	-	-	-	854	-
Stage 2	-	-	-	-	784	-

Approach	EB	WB	NB
HCM Control Delay, s	0	5.2	13.5
HCM LOS			B

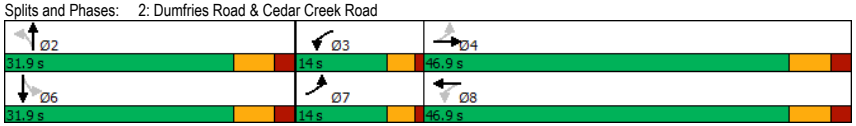
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	668	-	-	1269	-
HCM Lane V/C Ratio	0.37	-	-	0.06	-
HCM Control Delay (s)	13.5	-	-	8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	1.7	-	-	0.2	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	24	270	123	21	197	40	105	163	19	41	216	21
Future Volume (vph)	24	270	123	21	197	40	105	163	19	41	216	21
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	20.0		0.0	20.0		0.0	45.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	100.0			100.0			100.0			100.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.953			0.975			0.984			0.987	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1547	1489	0	1394	1506	0	1506	1518	0	1686	1564	0
Flt Permitted	0.595			0.461			0.458			0.558		
Satd. Flow (perm)	969	1489	0	676	1506	0	726	1518	0	990	1564	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		33			15			6			5	
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		323.0			231.1			119.4			348.5	
Travel Time (s)		14.5			10.4			5.4			15.7	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	9%	5%	7%	21%	7%	6%	12%	3%	41%	0%	3%	16%
Adj. Flow (vph)	24	270	123	21	197	40	105	163	19	41	216	21
Shared Lane Traffic (%)												
Lane Group Flow (vph)	24	393	0	21	237	0	105	182	0	41	237	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	7	4		3	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	9.5	24.9		9.5	24.9		24.9	24.9		24.9	24.9	
Total Split (s)	14.0	46.9		14.0	46.9		31.9	31.9		31.9	31.9	
Total Split (%)	15.1%	50.5%		15.1%	50.5%		34.4%	34.4%		34.4%	34.4%	
Maximum Green (s)	10.0	40.0		10.0	40.0		25.0	25.0		25.0	25.0	
Yellow Time (s)	3.0	4.6		3.0	4.6		4.6	4.6		4.6	4.6	
All-Red Time (s)	1.0	2.3		1.0	2.3		2.3	2.3		2.3	2.3	
Lost Time Adjust (s)	0.0	-2.9		0.0	-2.9		-2.9	-2.9		-2.9	-2.9	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	Max		None	Max		None	None		None	None	
Walk Time (s)		7.0			7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		11.0			11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effct Green (s)	46.0	43.7		46.0	43.7		19.2	19.2		19.2	19.2	
Actuated g/C Ratio	0.62	0.59		0.62	0.59		0.26	0.26		0.26	0.26	
v/c Ratio	0.04	0.44		0.04	0.27		0.56	0.46		0.16	0.59	
Control Delay	6.6	12.3		6.7	10.5		37.8	27.2		23.9	30.6	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay	6.6	12.3		6.7	10.5		37.8	27.2		23.9	30.6	
LOS	A	B		A	B		D	C		C	C	
Approach Delay		12.0			10.2			31.1			29.6	
Approach LOS		B			B			C			C	
Queue Length 50th (m)	1.1	21.4		1.0	11.7		12.3	19.9		4.3	27.2	
Queue Length 95th (m)	4.7	71.4		4.3	40.4		32.2	43.7		13.4	56.6	
Internal Link Dist (m)		299.0			207.1			95.4			324.5	
Turn Bay Length (m)	20.0			20.0			45.0			25.0		
Base Capacity (vph)	690	884		524	887		276	581		376	598	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.03	0.44		0.04	0.27		0.38	0.31		0.11	0.40	

Intersection Summary			
Area Type:	Other		
Cycle Length: 92.8			
Actuated Cycle Length: 74.7			
Natural Cycle: 60			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.59			
Intersection Signal Delay: 20.0		Intersection LOS: B	
Intersection Capacity Utilization 55.8%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 2: Dumfries Road & Cedar Creek Road

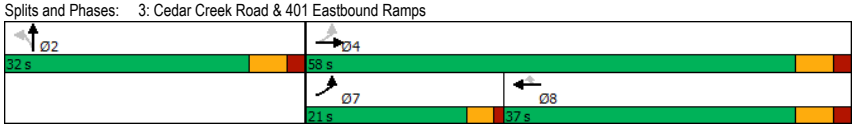


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	312	511	0	0	503	295	129	7	128	0	0	0
Future Volume (vph)	312	511	0	0	503	295	129	7	128	0	0	0
Ideal Flow (vphpl)	1775	1900	0	0	1900	1750	1550	1550	1550	0	0	0
Storage Length (m)	80.0		0.0	0.0		75.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	0		1	0		0	0		0
Taper Length (m)	80.0			7.5			7.5			7.5		
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	1.00
Frt						0.850		0.935				
Flt Protected	0.950							0.976				
Satd. Flow (prot)	1506	1638	0	0	1696	1271	0	1167	0	0	0	0
Flt Permitted	0.250							0.976				
Satd. Flow (perm)	396	1638	0	0	1696	1271	0	1167	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						295		55				
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		155.6			323.0			72.3			56.5	
Travel Time (s)		7.0			14.5			3.3			2.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	12%	16%	0%	0%	12%	17%	18%	67%	22%	0%	0%	0%
Adj. Flow (vph)	312	511	0	0	503	295	129	7	128	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	312	511	0	0	503	295	0	264	0	0	0	0
Turn Type	pm+pt	NA			NA	Perm	Perm	NA				
Protected Phases	7	4			8			2				
Permitted Phases	4					8	2					
Detector Phase	7	4			8	8	2	2				
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0	5.0	5.0	5.0				
Minimum Split (s)	9.5	24.0			24.0	24.0	24.0	24.0				
Total Split (s)	21.0	58.0			37.0	37.0	32.0	32.0				
Total Split (%)	23.3%	64.4%			41.1%	41.1%	35.6%	35.6%				
Maximum Green (s)	17.0	52.0			31.0	31.0	26.0	26.0				
Yellow Time (s)	3.0	4.0			4.0	4.0	4.0	4.0				
All-Red Time (s)	1.0	2.0			2.0	2.0	2.0	2.0				
Lost Time Adjust (s)	0.0	-2.0			-2.0	-2.0		-2.0				
Total Lost Time (s)	4.0	4.0			4.0	4.0		4.0				
Lead/Lag	Lead				Lag	Lag						
Lead-Lag Optimize?	Yes				Yes	Yes						
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0				
Recall Mode	None	Max			Max	Max	None	None				
Walk Time (s)		7.0			7.0	7.0	7.0	7.0				
Flash Dont Walk (s)		11.0			11.0	11.0	11.0	11.0				
Pedestrian Calls (#/hr)		0			0	0	0	0				
Act Effct Green (s)	54.3	54.3			36.4	36.4		21.6				
Actuated g/C Ratio	0.65	0.65			0.43	0.43		0.26				
v/c Ratio	0.71	0.48			0.69	0.41		0.78				
Control Delay	18.4	10.6			28.0	4.5		38.6				
Queue Delay	0.0	0.0			0.0	0.0		0.0				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay	18.4	10.6			28.0	4.5		38.6				
LOS	B	B			C	A		D				
Approach Delay		13.6			19.3			38.6				
Approach LOS		B			B			D				
Queue Length 50th (m)	21.7	41.0			70.7	0.0		32.7				
Queue Length 95th (m)	48.1	75.8			#134.3	16.7		61.5				
Internal Link Dist (m)		131.6			299.0			48.3			32.5	
Turn Bay Length (m)	80.0					75.0						
Base Capacity (vph)	482	1059			734	717		428				
Starvation Cap Reductn	0	0			0	0		0				
Spillback Cap Reductn	0	0			0	0		0				
Storage Cap Reductn	0	0			0	0		0				
Reduced v/c Ratio	0.65	0.48			0.69	0.41		0.62				

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 83.9			
Natural Cycle: 70			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.78			
Intersection Signal Delay: 19.5		Intersection LOS: B	
Intersection Capacity Utilization 73.8%		ICU Level of Service D	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 3: Cedar Creek Road & 401 Eastbound Ramps



Appendix F

2025 Total Traffic Operations Reports

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	56	282	69	31	123	70
Future Volume (vph)	56	282	69	31	123	70
Ideal Flow (vphpl)	1650	1650	1650	1650	1765	1765
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.887				0.951	
Flt Protected				0.967	0.969	
Satd. Flow (prot)	1366	0	0	1218	1471	0
Flt Permitted				0.967	0.969	
Satd. Flow (perm)	1366	0	0	1218	1471	0
Link Speed (k/h)	80			80	80	
Link Distance (m)	226.9			258.9	151.4	
Travel Time (s)	10.2			11.7	6.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	8%	7%	40%	11%	12%	8%
Adj. Flow (vph)	56	282	69	31	123	70
Shared Lane Traffic (%)						
Lane Group Flow (vph)	338	0	0	100	193	0
Sign Control	Free			Free	Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 51.6%		ICU Level of Service A	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	4.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	56	282	69	31	123	70
Future Vol, veh/h	56	282	69	31	123	70
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	8	7	40	11	12	8
Mvmt Flow	56	282	69	31	123	70

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	338	0	366	197
Stage 1	-	-	-	-	197	-
Stage 2	-	-	-	-	169	-
Critical Hdwy	-	-	4.5	-	6.52	6.28
Critical Hdwy Stg 1	-	-	-	-	5.52	-
Critical Hdwy Stg 2	-	-	-	-	5.52	-
Follow-up Hdwy	-	-	2.56	-	3.608	3.372
Pot Cap-1 Maneuver	-	-	1037	-	614	829
Stage 1	-	-	-	-	813	-
Stage 2	-	-	-	-	837	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1037	-	572	829
Mov Cap-2 Maneuver	-	-	-	-	572	-
Stage 1	-	-	-	-	813	-
Stage 2	-	-	-	-	780	-

Approach	EB	WB	NB
HCM Control Delay, s	0	6	13
HCM LOS			B

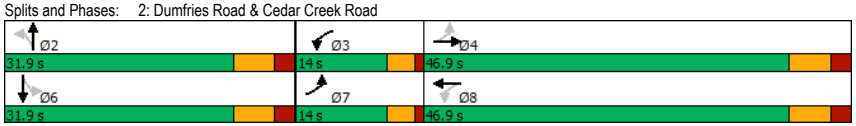
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	644	-	-	1037	-
HCM Lane V/C Ratio	0.3	-	-	0.067	-
HCM Control Delay (s)	13	-	-	8.7	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	1.3	-	-	0.2	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	114	63	17	255	107	178	138	12	39	91	10
Future Volume (vph)	15	114	63	17	255	107	178	138	12	39	91	10
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	20.0		0.0	20.0		0.0	45.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	100.0			100.0			100.0			100.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.947			0.956			0.988			0.985	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1074	1169	0	1010	1443	0	1519	1400	0	1454	1276	0
Flt Permitted	0.488			0.646			0.692			0.621		
Satd. Flow (perm)	552	1169	0	687	1443	0	1107	1400	0	950	1276	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		40			30			5			6	
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		140.1			231.1			119.4			197.1	
Travel Time (s)		6.3			10.4			5.4			8.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	57%	24%	51%	67%	12%	3%	11%	10%	91%	16%	23%	67%
Adj. Flow (vph)	15	114	63	17	255	107	178	138	12	39	91	10
Shared Lane Traffic (%)												
Lane Group Flow (vph)	15	177	0	17	362	0	178	150	0	39	101	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	7	4		3	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	9.5	24.9		9.5	24.9		24.9	24.9		24.9	24.9	
Total Split (s)	14.0	46.9		14.0	46.9		31.9	31.9		31.9	31.9	
Total Split (%)	15.1%	50.5%		15.1%	50.5%		34.4%	34.4%		34.4%	34.4%	
Maximum Green (s)	10.0	40.0		10.0	40.0		25.0	25.0		25.0	25.0	
Yellow Time (s)	3.0	4.6		3.0	4.6		4.6	4.6		4.6	4.6	
All-Red Time (s)	1.0	2.3		1.0	2.3		2.3	2.3		2.3	2.3	
Lost Time Adjust (s)	0.0	-2.9		0.0	-2.9		-2.9	-2.9		-2.9	-2.9	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	Max		None	Max		None	None		None	None	
Walk Time (s)		7.0			7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		11.0			11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effct Green (s)	45.3	44.1		45.4	44.2		19.8	19.8		19.8	19.8	
Actuated g/C Ratio	0.61	0.60		0.61	0.60		0.27	0.27		0.27	0.27	
v/c Ratio	0.04	0.25		0.04	0.41		0.60	0.40		0.15	0.29	
Control Delay	7.3	8.6		7.3	11.2		32.9	24.7		22.2	22.4	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay	7.3	8.6		7.3	11.2		32.9	24.7		22.2	22.4	
LOS	A	A		A	B		C	C		C	C	
Approach Delay		8.5			11.0			29.1			22.4	
Approach LOS		A			B			C			C	
Queue Length 50th (m)	0.7	7.3		0.8	20.3		21.2	16.2		4.1	10.3	
Queue Length 95th (m)	3.5	28.9		3.8	65.8		48.0	37.0		13.0	26.1	
Internal Link Dist (m)		116.1			207.1			95.4			173.1	
Turn Bay Length (m)	20.0			20.0			45.0			25.0		
Base Capacity (vph)	413	714		470	874		423	538		363	491	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.04	0.25		0.04	0.41		0.42	0.28		0.11	0.21	

Intersection Summary			
Area Type:	Other		
Cycle Length: 92.8			
Actuated Cycle Length: 73.9			
Natural Cycle: 60			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.60			
Intersection Signal Delay: 17.8		Intersection LOS: B	
Intersection Capacity Utilization 49.7%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 2: Dumfries Road & Cedar Creek Road

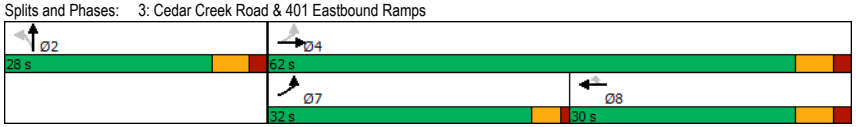


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	411	493	0	0	320	349	93	0	134	0	0	0
Future Volume (vph)	411	493	0	0	320	349	93	0	134	0	0	0
Ideal Flow (vphpl)	1775	1900	0	0	1900	1750	1550	1550	1550	0	0	0
Storage Length (m)	80.0		0.0	0.0		75.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	0		1	0		0	0		0
Taper Length (m)	80.0			7.5			7.5			7.5		
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	1.00
Ped Bike Factor	1.00					0.98						
Frt						0.850		0.920				
Flt Protected	0.950							0.980				
Satd. Flow (prot)	1441	1696	0	0	1624	1271	0	1257	0	0	0	0
Flt Permitted	0.425							0.980				
Satd. Flow (perm)	644	1696	0	0	1624	1243	0	1257	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						349		85				
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		192.4			182.9			72.3			56.5	
Travel Time (s)		8.7			8.2			3.3			2.5	
Confl. Peds. (#/hr)	1					1						
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	17%	12%	0%	0%	17%	17%	10%	0%	12%	0%	0%	0%
Adj. Flow (vph)	411	493	0	0	320	349	93	0	134	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	411	493	0	0	320	349	0	227	0	0	0	0
Turn Type	pm+pt	NA			NA	Perm	Perm	NA				
Protected Phases	7	4			8			2				
Permitted Phases	4					8	2					
Detector Phase	7	4			8	8	2	2				
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0	5.0	5.0	5.0				
Minimum Split (s)	9.5	24.0			24.0	24.0	24.0	24.0				
Total Split (s)	32.0	62.0			30.0	30.0	28.0	28.0				
Total Split (%)	35.6%	68.9%			33.3%	33.3%	31.1%	31.1%				
Maximum Green (s)	28.0	56.0			24.0	24.0	22.0	22.0				
Yellow Time (s)	3.0	4.0			4.0	4.0	4.0	4.0				
All-Red Time (s)	1.0	2.0			2.0	2.0	2.0	2.0				
Lost Time Adjust (s)	0.0	-2.0			-2.0	-2.0		-2.0				
Total Lost Time (s)	4.0	4.0			4.0	4.0		4.0				
Lead/Lag	Lead				Lag	Lag						
Lead-Lag Optimize?	Yes				Yes	Yes						
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0				
Recall Mode	None	Max			Max	Max	None	None				
Walk Time (s)		7.0			7.0	7.0	7.0	7.0				
Flash Dont Walk (s)		11.0			11.0	11.0	11.0	11.0				
Pedestrian Calls (#/hr)		0			0	0	0	0				
Act Effct Green (s)	58.2	58.2			37.3	37.3		16.6				
Actuated g/C Ratio	0.70	0.70			0.45	0.45		0.20				
v/c Ratio	0.67	0.41			0.44	0.46		0.71				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	12.1	7.4			22.1	5.1		31.4				
Queue Delay	0.0	0.0			0.0	0.0		0.0				
Total Delay	12.1	7.4			22.1	5.1		31.4				
LOS	B	A			C	A		C				
Approach Delay		9.5			13.2			31.4				
Approach LOS		A			B			C				
Queue Length 50th (m)	24.5	29.8			34.3	0.0		21.7				
Queue Length 95th (m)	53.0	61.2			81.6	22.2		46.5				
Internal Link Dist (m)		168.4			158.9			48.3			32.5	
Turn Bay Length (m)	80.0					75.0						
Base Capacity (vph)	722	1191			731	751		425				
Starvation Cap Reductn	0	0			0	0		0				
Spillback Cap Reductn	0	0			0	0		0				
Storage Cap Reductn	0	0			0	0		0				
Reduced v/c Ratio	0.57	0.41			0.44	0.46		0.53				

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 82.9			
Natural Cycle: 70			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.71			
Intersection Signal Delay: 13.7		Intersection LOS: B	
Intersection Capacity Utilization 74.4%		ICU Level of Service D	
Analysis Period (min) 15			

Splits and Phases: 3: Cedar Creek Road & 401 Eastbound Ramps



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	33	15	88	160	152	199
Future Volume (vph)	33	15	88	160	152	199
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.958				0.923	
Flt Protected	0.967			0.983		
Satd. Flow (prot)	1726	0	0	1831	1719	0
Flt Permitted	0.967			0.983		
Satd. Flow (perm)	1726	0	0	1831	1719	0
Link Speed (k/h)	80			80	80	
Link Distance (m)	103.3			197.1	151.4	
Travel Time (s)	4.6			8.9	6.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	33	15	88	160	152	199
Shared Lane Traffic (%)						
Lane Group Flow (vph)	48	0	0	248	351	0
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	46.8%	ICU Level of Service	A
Analysis Period (min)	15		

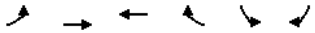
Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	33	15	88	160	152	199
Future Vol, veh/h	33	15	88	160	152	199
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	33	15	88	160	152	199

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	588	252	351	0	-	0
Stage 1	252	-	-	-	-	-
Stage 2	336	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	471	787	1208	-	-	-
Stage 1	790	-	-	-	-	-
Stage 2	724	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	433	787	1208	-	-	-
Mov Cap-2 Maneuver	433	-	-	-	-	-
Stage 1	727	-	-	-	-	-
Stage 2	724	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	12.9	2.9	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1208	-	504	-	-
HCM Lane V/C Ratio	0.073	-	0.095	-	-
HCM Control Delay (s)	8.2	0	12.9	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.2	-	0.3	-	-



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	66	177	354	88	15	11
Future Volume (vph)	66	177	354	88	15	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.973		0.943	
Flt Protected		0.987			0.972	
Satd. Flow (prot)	0	1839	1812	0	1707	0
Flt Permitted		0.987			0.972	
Satd. Flow (perm)	0	1839	1812	0	1707	0
Link Speed (k/h)		80	80		80	
Link Distance (m)		182.9	140.1		94.7	
Travel Time (s)		8.2	6.3		4.3	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	66	177	354	88	15	11
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	243	442	0	26	0
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 50.3%		ICU Level of Service A	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	66	177	354	88	15	11
Future Vol, veh/h	66	177	354	88	15	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	66	177	354	88	15	11

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	442	0	-	0	707	398
Stage 1	-	-	-	-	398	-
Stage 2	-	-	-	-	309	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1118	-	-	-	402	652
Stage 1	-	-	-	-	678	-
Stage 2	-	-	-	-	745	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1118	-	-	-	376	652
Mov Cap-2 Maneuver	-	-	-	-	376	-
Stage 1	-	-	-	-	634	-
Stage 2	-	-	-	-	745	-

Approach	EB	WB	SB
HCM Control Delay, s	2.3	0	13.3
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1118	-	-	-	458
HCM Lane V/C Ratio	0.059	-	-	-	0.057
HCM Control Delay (s)	8.4	0	-	-	13.3
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.2

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	75	231	81	41	319	108
Future Volume (vph)	75	231	81	41	319	108
Ideal Flow (vphpl)	1650	1650	1650	1650	1765	1765
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.898				0.966	
Flt Protected				0.968	0.964	
Satd. Flow (prot)	1425	0	0	1526	1580	0
Flt Permitted				0.968	0.964	
Satd. Flow (perm)	1425	0	0	1526	1580	0
Link Speed (k/h)	80			80	80	
Link Distance (m)	226.9			258.9	158.4	
Travel Time (s)	10.2			11.7	7.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	7%	3%	7%	0%	4%	4%
Adj. Flow (vph)	75	231	81	41	319	108
Shared Lane Traffic (%)						
Lane Group Flow (vph)	306	0	0	122	427	0
Sign Control	Free			Free	Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 64.7%		ICU Level of Service C	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	12.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	75	231	81	41	319	108
Future Vol, veh/h	75	231	81	41	319	108
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	7	3	7	0	4	4
Mvmt Flow	75	231	81	41	319	108

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	306	0	394	191
Stage 1	-	-	-	-	191	-
Stage 2	-	-	-	-	203	-
Critical Hdwy	-	-	4.17	-	6.44	6.24
Critical Hdwy Stg 1	-	-	-	-	5.44	-
Critical Hdwy Stg 2	-	-	-	-	5.44	-
Follow-up Hdwy	-	-	2.263	-	3.536	3.336
Pot Cap-1 Maneuver	-	-	1227	-	607	846
Stage 1	-	-	-	-	837	-
Stage 2	-	-	-	-	826	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1227	-	566	846
Mov Cap-2 Maneuver	-	-	-	-	566	-
Stage 1	-	-	-	-	837	-
Stage 2	-	-	-	-	770	-

Approach	EB	WB	NB
HCM Control Delay, s	0	5.4	22.8
HCM LOS			C

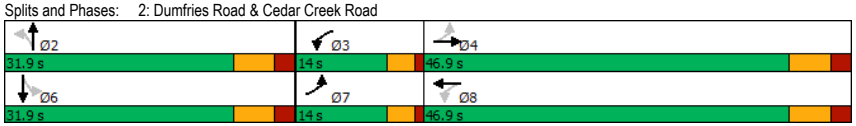
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	618	-	-	1227	-
HCM Lane V/C Ratio	0.691	-	-	0.066	-
HCM Control Delay (s)	22.8	-	-	8.1	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	5.5	-	-	0.2	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	24	330	143	21	212	55	110	168	19	101	236	21
Future Volume (vph)	24	330	143	21	212	55	110	168	19	101	236	21
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	20.0		0.0	20.0		0.0	45.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	100.0			100.0			100.0			100.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.955			0.969			0.985			0.988	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1547	1492	0	1394	1497	0	1506	1521	0	1686	1567	0
Flt Permitted	0.566			0.393			0.431			0.553		
Satd. Flow (perm)	922	1492	0	577	1497	0	683	1521	0	982	1567	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		31			19			6			5	
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		157.1			231.1			119.4			190.1	
Travel Time (s)		7.1			10.4			5.4			8.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	9%	5%	7%	21%	7%	6%	12%	3%	41%	0%	3%	16%
Adj. Flow (vph)	24	330	143	21	212	55	110	168	19	101	236	21
Shared Lane Traffic (%)												
Lane Group Flow (vph)	24	473	0	21	267	0	110	187	0	101	257	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	7	4		3	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	9.5	24.9		9.5	24.9		24.9	24.9		24.9	24.9	
Total Split (s)	14.0	46.9		14.0	46.9		31.9	31.9		31.9	31.9	
Total Split (%)	15.1%	50.5%		15.1%	50.5%		34.4%	34.4%		34.4%	34.4%	
Maximum Green (s)	10.0	40.0		10.0	40.0		25.0	25.0		25.0	25.0	
Yellow Time (s)	3.0	4.6		3.0	4.6		4.6	4.6		4.6	4.6	
All-Red Time (s)	1.0	2.3		1.0	2.3		2.3	2.3		2.3	2.3	
Lost Time Adjust (s)	0.0	-2.9		0.0	-2.9		-2.9	-2.9		-2.9	-2.9	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	Max		None	Max		None	None		None	None	
Walk Time (s)		7.0			7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		11.0			11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effct Green (s)	46.0	43.7		46.0	43.7		20.0	20.0		20.0	20.0	
Actuated g/C Ratio	0.61	0.58		0.61	0.58		0.26	0.26		0.26	0.26	
v/c Ratio	0.04	0.54		0.05	0.31		0.61	0.46		0.39	0.61	
Control Delay	6.9	14.5		7.0	11.1		40.6	26.9		28.3	31.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay	6.9	14.5		7.0	11.1		40.6	26.9		28.3	31.2	
LOS	A	B		A	B		D	C		C	C	
Approach Delay		14.2			10.8			32.0			30.4	
Approach LOS		B			B			C			C	
Queue Length 50th (m)	1.2	29.9		1.0	14.0		13.1	20.5		11.2	30.0	
Queue Length 95th (m)	4.7	93.6		4.3	45.8		34.4	44.7		28.3	61.9	
Internal Link Dist (m)		133.1			207.1			95.4			166.1	
Turn Bay Length (m)	20.0			20.0			45.0			25.0		
Base Capacity (vph)	659	876		469	874		257	575		369	592	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.04	0.54		0.04	0.31		0.43	0.33		0.27	0.43	

Intersection Summary			
Area Type:	Other		
Cycle Length: 92.8			
Actuated Cycle Length: 75.5			
Natural Cycle: 60			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.61			
Intersection Signal Delay: 21.2		Intersection LOS: C	
Intersection Capacity Utilization 62.3%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 2: Dumfries Road & Cedar Creek Road

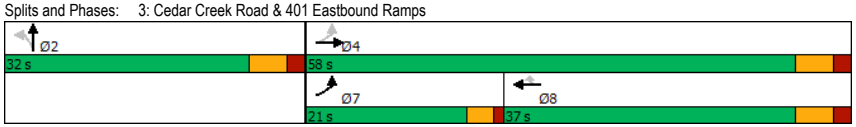


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	312	526	0	0	503	355	129	7	128	0	0	0
Future Volume (vph)	312	526	0	0	503	355	129	7	128	0	0	0
Ideal Flow (vphpl)	1775	1900	0	0	1900	1750	1550	1550	1550	0	0	0
Storage Length (m)	80.0		0.0	0.0		75.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	0		1	0		0	0		0
Taper Length (m)	80.0			7.5			7.5			7.5		
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	1.00
Frt						0.850		0.935				
Flt Protected	0.950							0.976				
Satd. Flow (prot)	1506	1638	0	0	1696	1271	0	1167	0	0	0	0
Flt Permitted	0.250							0.976				
Satd. Flow (perm)	396	1638	0	0	1696	1271	0	1167	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						355		55				
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		155.6			165.9			72.3			56.5	
Travel Time (s)		7.0			7.5			3.3			2.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	12%	16%	0%	0%	12%	17%	18%	67%	22%	0%	0%	0%
Adj. Flow (vph)	312	526	0	0	503	355	129	7	128	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	312	526	0	0	503	355	0	264	0	0	0	0
Turn Type	pm+pt	NA			NA	Perm	Perm	NA				
Protected Phases	7	4			8			2				
Permitted Phases	4					8	2					
Detector Phase	7	4			8	8	2	2				
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0	5.0	5.0	5.0				
Minimum Split (s)	9.5	24.0			24.0	24.0	24.0	24.0				
Total Split (s)	21.0	58.0			37.0	37.0	32.0	32.0				
Total Split (%)	23.3%	64.4%			41.1%	41.1%	35.6%	35.6%				
Maximum Green (s)	17.0	52.0			31.0	31.0	26.0	26.0				
Yellow Time (s)	3.0	4.0			4.0	4.0	4.0	4.0				
All-Red Time (s)	1.0	2.0			2.0	2.0	2.0	2.0				
Lost Time Adjust (s)	0.0	-2.0			-2.0	-2.0		-2.0				
Total Lost Time (s)	4.0	4.0			4.0	4.0		4.0				
Lead/Lag	Lead				Lag	Lag						
Lead-Lag Optimize?	Yes				Yes	Yes						
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0				
Recall Mode	None	Max			Max	Max	None	None				
Walk Time (s)		7.0			7.0	7.0	7.0	7.0				
Flash Dont Walk (s)		11.0			11.0	11.0	11.0	11.0				
Pedestrian Calls (#/hr)		0			0	0	0	0				
Act Effct Green (s)	54.3	54.3			36.4	36.4		21.6				
Actuated g/C Ratio	0.65	0.65			0.43	0.43		0.26				
v/c Ratio	0.71	0.50			0.69	0.47		0.78				
Control Delay	18.4	10.9			28.0	4.7		38.6				
Queue Delay	0.0	0.0			0.0	0.0		0.0				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay	18.4	10.9			28.0	4.7		38.6				
LOS	B	B			C	A		D				
Approach Delay		13.7			18.4			38.6				
Approach LOS		B			B			D				
Queue Length 50th (m)	21.7	42.7			70.7	0.0		32.7				
Queue Length 95th (m)	48.1	79.4			#134.3	18.5		61.5				
Internal Link Dist (m)		131.6			141.9			48.3			32.5	
Turn Bay Length (m)	80.0					75.0						
Base Capacity (vph)	482	1059			734	751		428				
Starvation Cap Reductn	0	0			0	0		0				
Spillback Cap Reductn	0	0			0	0		0				
Storage Cap Reductn	0	0			0	0		0				
Reduced v/c Ratio	0.65	0.50			0.69	0.47		0.62				

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 83.9			
Natural Cycle: 70			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.78			
Intersection Signal Delay: 19.1		Intersection LOS: B	
Intersection Capacity Utilization 73.8%		ICU Level of Service D	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 3: Cedar Creek Road & 401 Eastbound Ramps



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	180	80	20	247	267	45
Future Volume (vph)	180	80	20	247	267	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.958				0.981	
Flt Protected	0.967			0.996		
Satd. Flow (prot)	1726	0	0	1855	1827	0
Flt Permitted	0.967			0.996		
Satd. Flow (perm)	1726	0	0	1855	1827	0
Link Speed (k/h)	80			80	80	
Link Distance (m)	131.3			190.1	158.4	
Travel Time (s)	5.9			8.6	7.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	180	80	20	247	267	45
Shared Lane Traffic (%)						
Lane Group Flow (vph)	260	0	0	267	312	0
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	51.0%	ICU Level of Service	A
Analysis Period (min)	15		

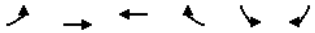
Intersection	
Int Delay, s/veh	5.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	180	80	20	247	267	45
Future Vol, veh/h	180	80	20	247	267	45
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	180	80	20	247	267	45

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	577	290	312	0	-	0
Stage 1	290	-	-	-	-	-
Stage 2	287	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	478	749	1248	-	-	-
Stage 1	759	-	-	-	-	-
Stage 2	762	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	469	749	1248	-	-	-
Mov Cap-2 Maneuver	469	-	-	-	-	-
Stage 1	745	-	-	-	-	-
Stage 2	762	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	18.2	0.6	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1248	-	530	-	-
HCM Lane V/C Ratio	0.016	-	0.491	-	-
HCM Control Delay (s)	7.9	0	18.2	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0	-	2.7	-	-



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	15	417	322	20	80	60
Future Volume (vph)	15	417	322	20	80	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.992		0.942	
Flt Protected		0.998			0.972	
Satd. Flow (prot)	0	1859	1848	0	1706	0
Flt Permitted		0.998			0.972	
Satd. Flow (perm)	0	1859	1848	0	1706	0
Link Speed (k/h)		80	80		80	
Link Distance (m)		165.9	157.1		97.9	
Travel Time (s)		7.5	7.1		4.4	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	15	417	322	20	80	60
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	432	342	0	140	0
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	48.9%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	2.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	15	417	322	20	80	60
Future Vol, veh/h	15	417	322	20	80	60
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	15	417	322	20	80	60

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	342	0	-	0	779	332
Stage 1	-	-	-	-	332	-
Stage 2	-	-	-	-	447	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1217	-	-	-	364	710
Stage 1	-	-	-	-	727	-
Stage 2	-	-	-	-	644	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1217	-	-	-	358	710
Mov Cap-2 Maneuver	-	-	-	-	358	-
Stage 1	-	-	-	-	715	-
Stage 2	-	-	-	-	644	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	16.4
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1217	-	-	-	455
HCM Lane V/C Ratio	0.012	-	-	-	0.308
HCM Control Delay (s)	8	0	-	-	16.4
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	1.3

Appendix G

OTM Traffic Signal Control Justification 7 Signal Warrants

Signal Justification Calculation for Forecasted Volumes
(OTM Book 12 - Justification 7)

Horizon Year: 2025
Region/City/Township: North Dumfries

Major Street: Dumfries Road
Minor Street: Proposed Road

North/South?: Y

Number of Approach Lanes: 1
Tee Intersection? Y
Flow Conditions: Free

PM Forecast Only? N

Warrant Results		
150% Satisfied	No	Justification for new intersections with forecast traffic
120% Satisfied	No	Justification for existing intersections with forecast traffic

	Major Street						Minor Street						
	Dumfries Road						Proposed Road						
	Northbound			Southbound			Eastbound			Westbound			Peds Crossing
Time Period	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	Main Road
AM Peak Hour	88	160	0	0	152	199	33	0	15	0	0	0	0
PM Peak Hour	20	247	0	0	267	45	180	0	80	0	0	0	0
Average Hourly Volume	27	102	0	0	105	61	53	0	24	0	0	0	0

Warrant	AHV
1A - All	372
1B - Minor	77
2A - Major	295
2B - Cross	53

Warrant 1 - Minimum Vehicular Volume

	Approach Lanes	1		2 or more		Average Hourly Volume
1A	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	All Approaches	480	720	600	900	372
					% Fulfilled	77.4%

	Approach Lanes	1		2 or more		Average Hourly Volume
1B	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Minor Street Approaches	180	255	180	255	77
					% Fulfilled	42.8%

Warrant 2 - Delay To Cross Traffic

	Approach Lanes	1		2 or more		Average Hourly Volume
2A	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Major Street Approaches	480	720	600	900	295
					% Fulfilled	61.4%

	Approach Lanes	1		2 or more		Average Hourly Volume
2B	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Traffic Crossing Major Street	50	75	50	75	53
					% Fulfilled	106.5%

Signal Justification Calculation for Forecasted Volumes
(OTM Book 12 - Justification 7)

Horizon Year: 2025
Region/City/Township: North Dumfries

Major Street: Cedar Creek Road
Minor Street: Proposed Road

North/South?: N

Number of Approach Lanes: 1
Tee Intersection? Y
Flow Conditions: Free

PM Forecast Only? N

Warrant Results		
150% Satisfied	No	Justification for new intersections with forecast traffic
120% Satisfied	No	Justification for existing intersections with forecast traffic

	Major Street						Minor Street						
	Cedar Creek Road						Proposed Road						
	Eastbound			Westbound			Northbound			Southbound			Peds Crossing
Time Period	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	Main Road
AM Peak Hour	66	177	0	0	354	88	0	0	0	15	0	11	0
PM Peak Hour	15	417	0	0	322	20	0	0	0	80	0	60	0
Average Hourly Volume	20	149	0	0	169	27	0	0	0	24	0	18	0

Warrant	AHV
1A - All	406
1B - Minor	42
2A - Major	365
2B - Cross	24

Warrant 1 - Minimum Vehicular Volume

	Approach Lanes	1		2 or more		Average Hourly Volume
1A	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	All Approaches	480	720	600	900	406
					% Fulfilled	84.6%

	Approach Lanes	1		2 or more		Average Hourly Volume
1B	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Minor Street Approaches	180	255	180	255	42
					% Fulfilled	23.1%

Warrant 2 - Delay To Cross Traffic

	Approach Lanes	1		2 or more		Average Hourly Volume
2A	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Major Street Approaches	480	720	600	900	365
					% Fulfilled	76.0%

	Approach Lanes	1		2 or more		Average Hourly Volume
2B	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Traffic Crossing Major Street	50	75	50	75	24
					% Fulfilled	47.5%

Appendix H

Region of Waterloo Screening Tools

Region of Waterloo
Roundabout Feasibility Initial Screening Tool

September 2020

File
200319

Project
Regional Roads 97 at 47 Industrial Lands

Based On
Region of Waterloo
Roundabout Feasibility
Initial Screening Tool 1.0
January 2019

The intent of this screening tool is to provide a relatively quick assessment of the feasibility of a modern roundabout at a particular intersection in comparison to other appropriate forms of traffic control or road improvements including auxiliary lanes, traffic control signals, four-way stops, etc. The intended outcome of this tool is to proved enough information to assist staff in deciding whether or not to proceed to an Intersection Control Study to further investigate in more detail the feasibility of a roundabout.

1) Project Name / File Number

- Regional Roads 97 at 47 Industrial Lands

2) Intersection Locations

(Street/Road Names, distance from major intersection, etc.)

- Cedar Creek Road at Proposed Road
- Nearest major intersection: Cedar Creek Road and Dumfries Road – 650 metres to the east.

3) Brief Description of Intersection

(Number of legs, lanes on each leg, total AADT, AADT on each road, etc. Attach or sketch diagram showing existing and horizon-year turning movements)

- Three legs
- Proposed municipal intersection
- 10 year forecast AADT approximately 9,920 based on 2030 total PM peak hour forecasts

4) What operation problems are being experienced at this location?

- None.

5) Is it a new intersection or is it a retrofit of an existing intersection?

- Proposed municipal intersection with two way stop control

If existing, what is the existing traffic control?

6) Is the intersection in the vicinity of a railroad crossing or another intersection?

If so, how close and what type of traffic control exists at the adjacent intersection? Will queues be a problem?

- Nearest intersection is Cedar Creek Road and Dumfries Road approximately 650 metres to the east.
- Queueing not expected to be a problem.

7) Would the intersection be located within a coordinated signal system?

- No. Nearby signals are not coordinated.

8) Would the intersection be located on a Preferred Roundabout Corridor?

- No. This is not a Roundabout Corridor.

9) Is the intersection located within a corridor that is scheduled for improvements in the 10 Year Transportation Capital Program?

- There are no planned improvements.

10) What is the collision history of the intersection over the past five years?

Is there a collision problem that needs to be addressed?

- This is a proposed intersection, there is no historical collision data.

11) Are person with disabilities or horse and buggies frequent users of this intersection?

- No.

12) What traditional road improvements are proposed for this intersection?

(eg. Traffic signals, all-way stop, auxiliary lanes, etc.) Please attach a sketch of the traditional road improvements.

- Auxiliary eastbound left-turn lane.

13) If traffic control signals are being considered, are the traffic signal warrants met for the horizon year?

- Signals not warranted at the 2030 horizon, as the warrant calculations are not fulfilled to 150%.

14) What size of roundabout is being considered for this intersection?

- 40 m single-lane

15) 20-Year Life Cycle Cost Estimate

10-Year AADT: 9,920

Non-injury Social Collision Cost: $5,000

Injury Social Collision Cost: $60,500

Fatal Social Collision Cost: $1,656,500

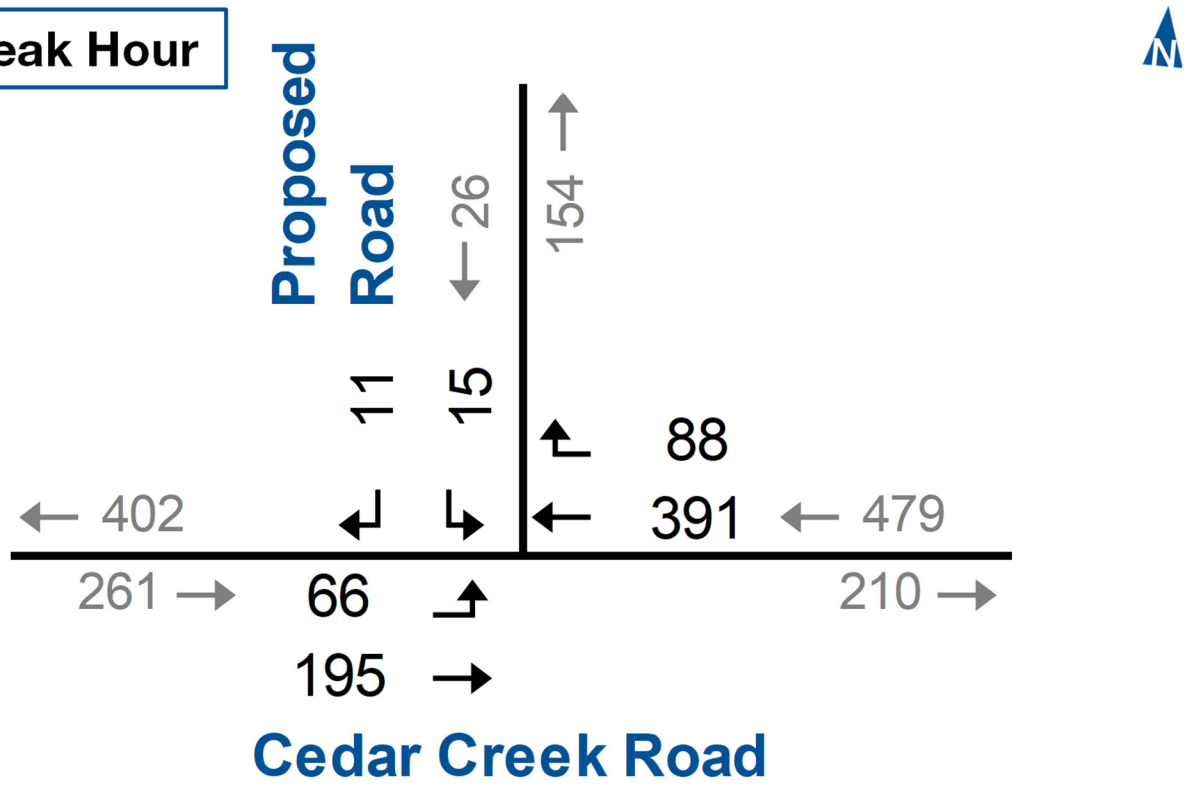
Discount Rate (i): 6%

20 Year Life-Cycle Cost Comparison		
Cost Item	**Other Traffic Control**	**Roundabout**
Implementation Cost	$250,000	$750,000
Injury Collision Cost (Present Value)	$593,144	$417,252
Total Life Cycle Cost	**$843,144**	**$1,167,252**

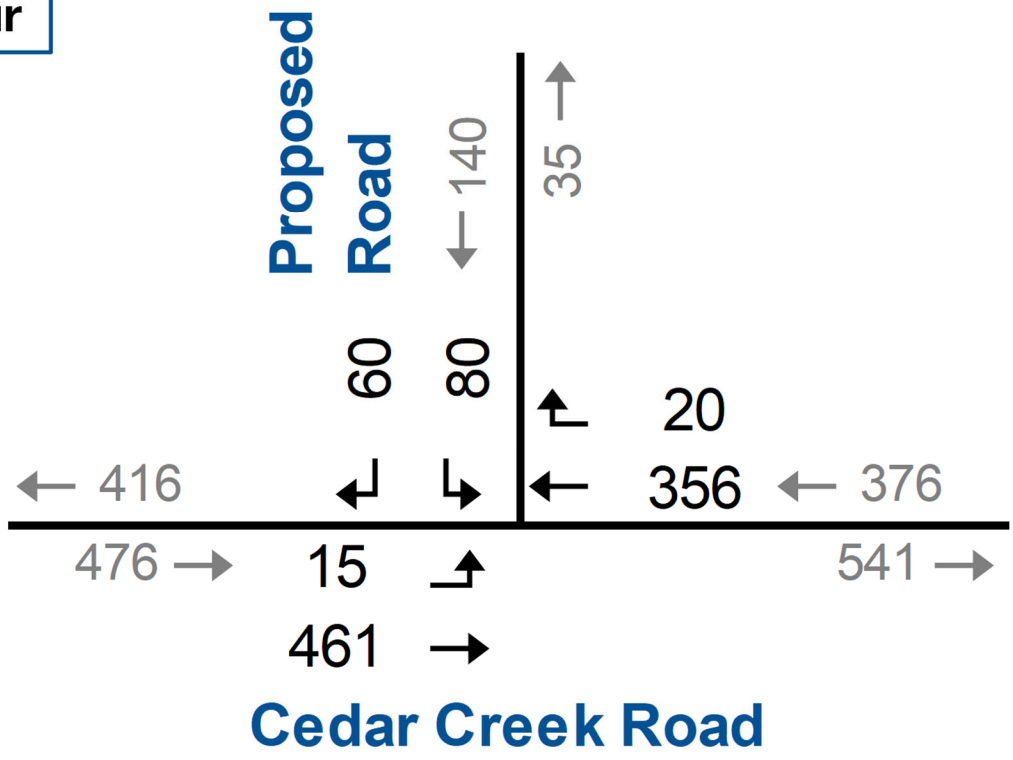
Conclusions and Recommendations

- Roundabout cost greater than two-way stop control.
- Do not proceed to Intersection Control Study.

AM Peak Hour



PM Peak Hour



paradigm TRANSPORTATION SOLUTIONS LIMITED

2030 Total Traffic Forecasts
Cedar Creek Road at Proposed Road

INTERSECTION CONTROL STUDIES
SAFETY ASSESSMENT METHODOLOGY

Region of Waterloo

Last Rev Jan 2019

Scenario: Total 2030

Major Road: Cedar Creek Road

Minor Road: Proposed Road

Major Road Direction:	East / West
Urban or Rural:	Rural
Proposed Control:	Stop Control
Proposed Config.	3-Leg Intersection

LT Lanes Proposed (non roundabout):		RT Lanes Proposed (non roundabout):	
Major	1 Approach	**Major**	No RT Lanes
Minor	No LT Lanes	**Minor**	No RT Lanes

Is there going to be any fully protected left-turn phasing? NO

Number of approaches with FPLTP: N/A

Is the proposed intersection "new" or is it existing: NEW

Does control and number of approaches remain the same: YES

Will the proposed intersection have illumination: YES

NOTE: No collision history required

5-Year Total Collisions: N/A

5-Year PDO Collisions: N/A

Proposed Multi-Lane or Single Lane RA? SINGLE LANE ROUNDABOUT

Major Road (mid-block) 10-Year Horizon AADT: 9,170

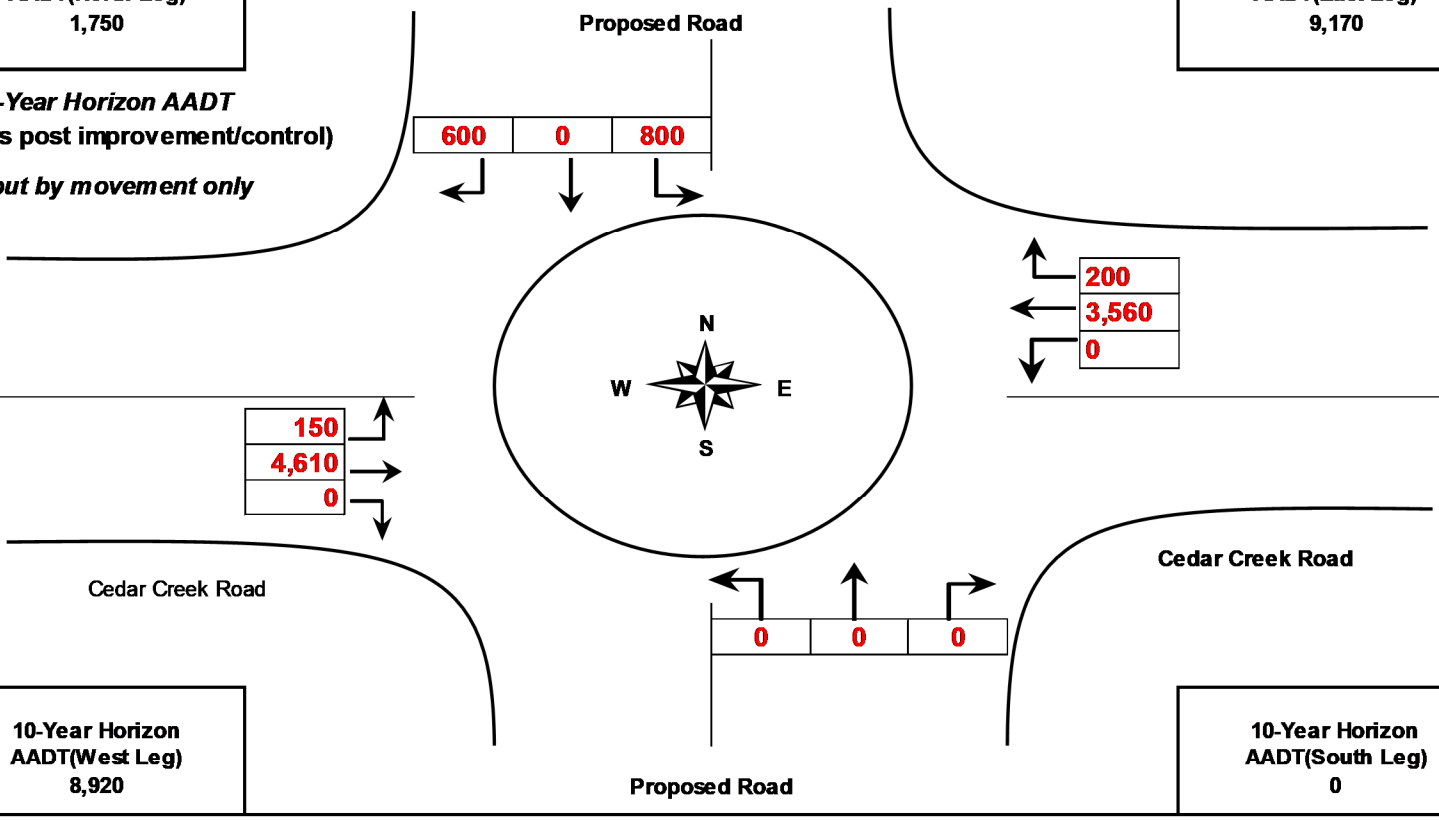
Minor Road (mid-block) 10-Year Horizon AADT: 1,750

10-Year Horizon AADT(North Leg) 1,750

10-Year Horizon AADT(East Leg) 9,170

10-Year Horizon AADT (10ys post improvement/control)

Input by movement only



10-Year Horizon AADT(West Leg) 8,920

10-Year Horizon AADT(South Leg) 0

Direct Capital Costs

Fatal = $1,656,500

Injury = $60,500

PDO = $5,000

Discount Rate = 0.06

20-Year Present Value Collision Costs (DIRECT CAPITAL COSTS)

Collisions by Severity	Total	PDO	Injury	Fatal
Stop Control	$593,144.04	$38,997.73	$326,147.21	$227,999.09
Roundabout	$417,252.35	$177,974.94	$239,277.42	$0.00

Region of Waterloo

INTERSECTION CONTROL STUDIES
SAFETY ASSESSMENT METHODOLOGY (HSM)

Last Rev Jan 2019

Scenario: Total 2030

Major Road: Cedar Creek Road
Minor Road: Proposed Road

Major Road Direction: East / West

Urban or Rural: Rural

Proposed Control: Stop Control

Proposed Config. 3-Leg Intersection

Roundabout Conflicts: 5350

5-Year Total Collisions: N/A

5-Year PDO Collisions: N/A

Estimated **ANNUAL (1-YEAR ONLY)** Collisions				
Future Expected Collisions by Severity	**Total**	**PDO**	**Injury**	**Fatal**
Stop Control	1.16	0.68	0.47	0.01
Roundabout	3.45	3.10	0.34	0.00

TOTAL CRASH COEFFICIENTS USED IN CALCULATION						Fatal/Inj. Ratio	Collision Factor
Control	Intersection Config	Intercept	AADTmaj	AADTmin	Overdispersion		
Stop Control	3-Leg Intersection	-9.86	0.79	0.49	N/A	0.025	n/a

PDO CRASH COEFFICIENTS USED IN CALCULATION						Fatal/Inj. Ratio	Collision Factor
Control	Intersection Config	Intercept	AADTmaj	AADTmin	Overdispersion		
Stop Control	3-Leg Intersection	-9.86	0.79	0.49	N/A	0.025	0.585

Collision Modification Factors (cmf's)	Left Turn Lane	Right Turn Lane	Calibration Factor	Empirical Bays Weighting	
			0.47	Total	PDO
				N/A	N/A
	Illumination	Protected LT Phasing			
	0.90	1.00			

Comments:

Region of Waterloo
Roundabout Feasibility Initial Screening Tool

September 2020

File
200319

Project
Regional Roads 97 at 47 Industrial Lands

Based On
Region of Waterloo
Roundabout Feasibility
Initial Screening Tool 1.0
January 2019

The intent of this screening tool is to provide a relatively quick assessment of the feasibility of a modern roundabout at a particular intersection in comparison to other appropriate forms of traffic control or road improvements including auxiliary lanes, traffic control signals, four-way stops, etc. The intended outcome of this tool is to proved enough information to assist staff in deciding whether or not to proceed to an Intersection Control Study to further investigate in more detail the feasibility of a roundabout.

1) Project Name / File Number

- Regional Roads 97 at 47 Industrial Lands

2) Intersection Locations

(Street/Road Names, distance from major intersection, etc.)

- Dumfries Road at Proposed Road
- Nearest major intersection: Cedar Creek Road and Dumfries Road – 520 metres to the south.

3) Brief Description of Intersection

(Number of legs, lanes on each leg, total AADT, AADT on each road, etc. Attach or sketch diagram showing existing and horizon-year turning movements)

- Three legs
- Proposed municipal intersection
- 10 year forecast AADT approximately 8,940 based on 2030 total PM peak hour forecasts

4) What operation problems are being experienced at this location?

- None.

5) Is it a new intersection or is it a retrofit of an existing intersection?

- Proposed municipal intersection with two way stop control

If existing, what is the existing traffic control?

6) Is the intersection in the vicinity of a railroad crossing or another intersection?

If so, how close and what type of traffic control exists at the adjacent intersection? Will queues be a problem?

- Nearest railroad approximately 680 metres to the north.
- Nearest intersection is Cedar Creek Road and Dumfries Road approximately 520 metres to the south.
- Queueing not expected to be a problem.

7) Would the intersection be located within a coordinated signal system?

- No. Nearby signals are not coordinated.

8) Would the intersection be located on a Preferred Roundabout Corridor?

- No. This is not a Roundabout Corridor.

9) Is the intersection located within a corridor that is scheduled for improvements in the 10 Year Transportation Capital Program?

- There are no planned improvements.

10) What is the collision history of the intersection over the past five years?

Is there a collision problem that needs to be addressed?

- This is a proposed intersection, there is no historical collision data.

11) Are person with disabilities or horse and buggies frequent users of this intersection?

- No.

12) What traditional road improvements are proposed for this intersection?

(eg. Traffic signals, all-way stop, auxiliary lanes, etc.) Please attach a sketch of the traditional road improvements.

- Auxiliary northbound left-turn lane.

13) If traffic control signals are being considered, are the traffic signal warrants met for the horizon year?

- Signals not warranted at the 2030 horizon, as the warrant calculations are not fulfilled to 150%.

14) What size of roundabout is being considered for this intersection?

- 40 m single-lane

15) 20-Year Life Cycle Cost Estimate

10-Year AADT: 8,940

Non-injury Social Collision Cost: $5,000

Injury Social Collision Cost: $60,500

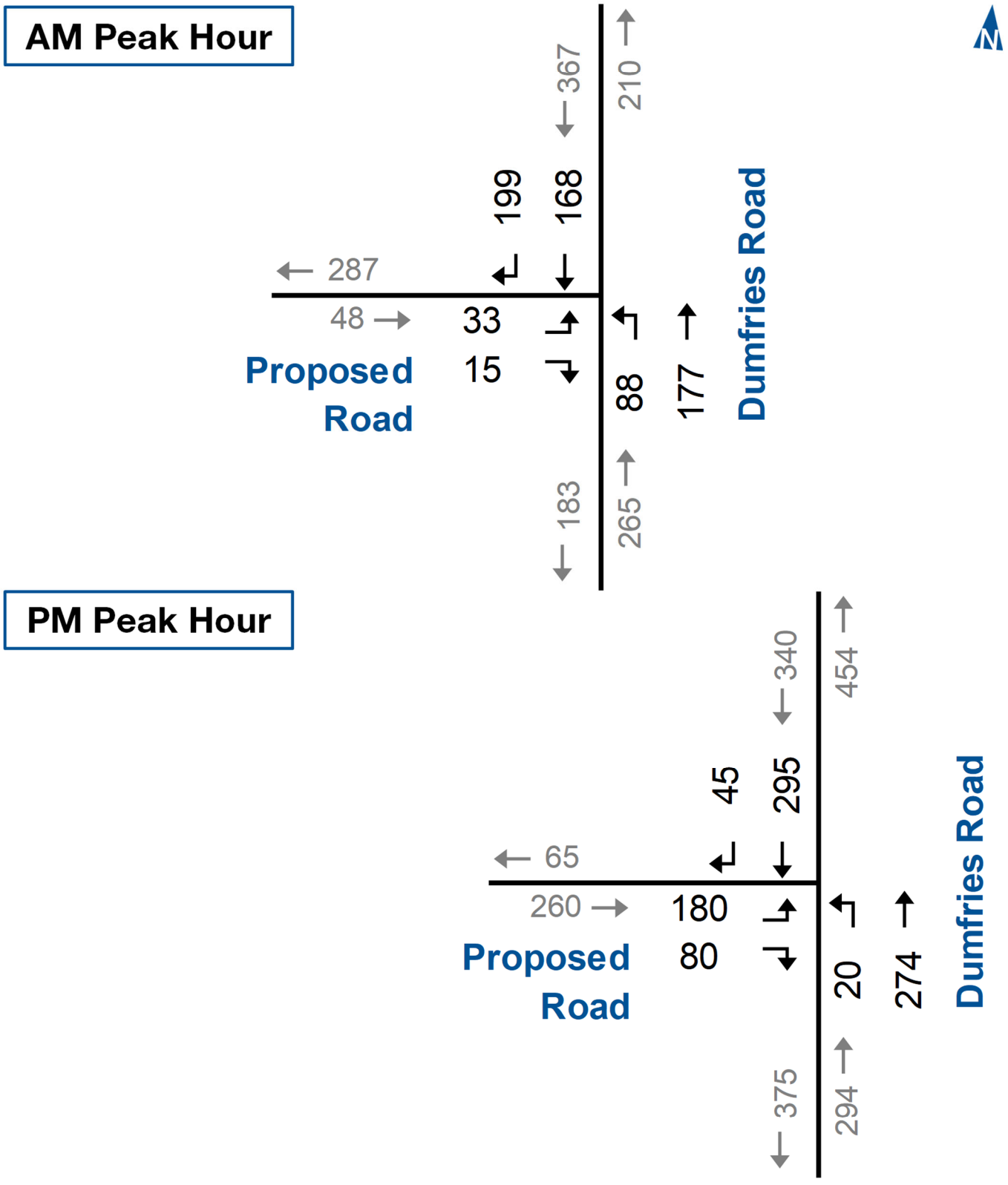
Fatal Social Collision Cost: $1,656,500

Discount Rate (i): 6%

20 Year Life-Cycle Cost Comparison		
Cost Item	**Other Traffic Control**	**Roundabout**
Implementation Cost	$250,000	$750,000
Injury Collision Cost (Present Value)	$701,627	$637,460
Total Life Cycle Cost	**$951,627**	**$1,387,460**

Conclusions and Recommendations

- Roundabout cost greater than two-way stop control.
- Do not proceed to Intersection Control Study.



paradigm TRANSPORTATION SOLUTIONS LIMITED

2030 Total Traffic Forecasts
Proposed Road at Dumfries Road

INTERSECTION CONTROL STUDIES
SAFETY ASSESSMENT METHODOLOGY

Region of Waterloo

Last Rev Jan 2019

Scenario: Total 2030

Major Road: Dumfries Road

Minor Road: Proposed Road

Major Road Direction:	North / South
Urban or Rural:	Rural
Proposed Control:	Stop Control
Proposed Config.	3-Leg Intersection

LT Lanes Proposed (non roundabout):		RT Lanes Proposed (non roundabout):	
Major	1 Approach	**Major**	No RT Lanes
Minor	No LT Lanes	**Minor**	No RT Lanes

Is there going to be any fully protected left-turn phasing? NO

Number of approaches with FPLTP: N/A

Is the proposed intersection "new" or is it existing: NEW

Does control and number of approaches remain the same: YES

Will the proposed intersection have illumination: YES

NOTE: No collision history required

5-Year Total Collisions: N/A

5-Year PDO Collisions: N/A

Proposed Multi-Lane or Single Lane RA? SINGLE LANE ROUNDABOUT

Major Road (mid-block) 10-Year Horizon AADT: 7,940

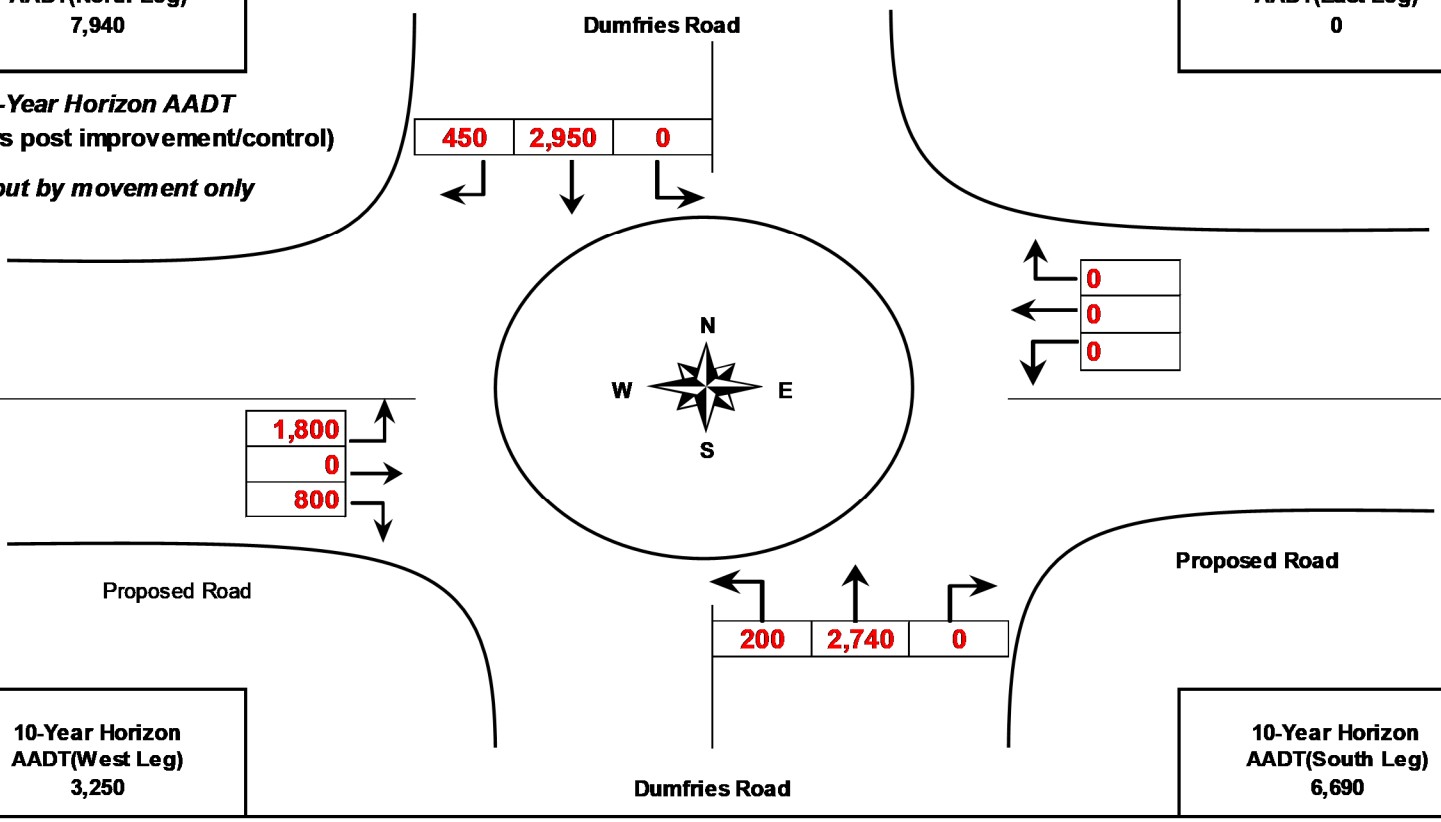
Minor Road (mid-block) 10-Year Horizon AADT: 3,250

10-Year Horizon AADT(North Leg) 7,940

10-Year Horizon AADT(East Leg) 0

***10-Year Horizon AADT** (10ys post improvement/control)*

Input by movement only



10-Year Horizon AADT(West Leg) 3,250

Dumfries Road

10-Year Horizon AADT(South Leg) 6,690

Direct Capital Costs

Fatal = $1,656,500

Injury = $60,500

PDO = $5,000

Discount Rate = 0.06

20-Year Present Value Collision Costs (DIRECT CAPITAL COSTS)

Collisions by Severity	Total	PDO	Injury	Fatal
Stop Control	$701,626.55	$47,026.68	$388,600.93	$265,998.94
Roundabout	$637,459.99	$271,902.36	$365,557.62	$0.00

INTERSECTION CONTROL STUDIES
SAFETY ASSESSMENT METHODOLOGY (HSM)

Region of Waterloo

Last Rev Jan 2019

Scenario: Total 2030

Major Road: Dumfries Road
Minor Road: Proposed Road

Major Road Direction: North / South

Urban or Rural: Rural

Proposed Control: Stop Control

Proposed Config. 3-Leg Intersection

Roundabout Conflicts: 9000

5-Year Total Collisions: N/A

5-Year PDO Collisions: N/A

Estimated **ANNUAL (1-YEAR ONLY)** Collisions				
Future Expected Collisions by Severity	**Total**	**PDO**	**Injury**	**Fatal**
Stop Control	1.40	0.82	0.56	0.01
Roundabout	5.27	4.74	0.53	0.00

TOTAL CRASH COEFFICIENTS USED IN CALCULATION						Fatal/Inj. Ratio	Collision Factor
Control	Intersection Config	Intercept	AADTmaj	AADTmin	Overdispersion		
Stop Control	3-Leg Intersection	-9.86	0.79	0.49	N/A	0.025	n/a

PDO CRASH COEFFICIENTS USED IN CALCULATION						Fatal/Inj. Ratio	Collision Factor
Control	Intersection Config	Intercept	AADTmaj	AADTmin	Overdispersion		
Stop Control	3-Leg Intersection	-9.86	0.79	0.49	N/A	0.025	0.585

Collision Modification Factors (cmf's)	Left Turn Lane	Right Turn Lane	Calibration Factor	Empirical Bays Weighting	
			0.47	Total	PDO
				N/A	N/A
	Illumination	Protected LT Phasing			
	0.90	1.00			

Comments: