

Traffic Impact Study

**Garden Hill Farmers Market,
Northumberland County**

D.M. Wills Project Number 21-11021

D.M. Wills Associates Limited

Partners in Engineering, Planning and
Environmental Services
Peterborough

March 2022

**Prepared for:
Ferguson Farms**



W I L L S

Summary of Revisions

Revision No.	Revision Title	Date of Release	Summary of Revisions
1	Final Report	March 9, 2022	Final Report Submitted

This report has been formatted considering the requirements of the Accessibility for Ontarians with Disabilities Act.

Executive Summary

D.M. Wills Associates Limited has been retained by Ferguson Farms to prepare a Traffic Impact Study to support a proposed Farmers Market, which is located at 8157 Hammill Road, Garden Hill, Northumberland County.

The proposed development will be a single-story commercial building that will house the Farmers Market. Based on the characteristics of the development and the surrounding area, the study area included the entrance of the development on County Road 9 (Ganaraska Road).

This study reviews the development details and the existing traffic conditions of the study area including the investigation of the available traffic volumes. Based on this review and the development details, a traffic operation analysis has been conducted using Synchro 9.0 to investigate the impact of the traffic generated from the proposed development on the study area. This analysis is carried out for the traffic condition with the consideration of the development impact. The analysis has covered the AM and PM peaks, as well as the current (i.e. 2022) and horizon years (i.e. 2027 and 2032) scenarios. The study reviews the need for auxiliary turn lanes at the entrance of the development on CR 9.

During the operation of the Farmers Market, the development is anticipated to generate about 11 entering and 11 exiting trips during the AM peak, and 11 and 12 entering and exiting trips during the PM peak, respectively. Based on the analysis, there is no impact of the development on CR 9 at the entrance of the development. The Level of Service (LOS) within the study area remains the same before and after considering the impact of the development for all the scenarios and it will operate consistently at LOS "A". These LOS levels reflect that the entrance of the development within the study area will operate at acceptable traffic operation levels. For auxiliary lanes warrant analysis, the results of the current and the horizon years show that there will be no need for any additional auxiliary lanes on the eastbound or the westbound directions at the entrance of the development.

Also, the sight distance and visibility requirements have been reviewed during a field visit to the development location. According to the Transportation Association of Canada (TAC) Manual, the review indicated that there is sufficient visibility for both sides (i.e. east and west) at the entrance of the development on CR 9.

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1.0 Introduction and Background

D.M. Wills Associates Limited (Wills) has been retained by Ferguson Farms to undertake a Traffic Impact Study (TIS) to support a proposed Farmers Market that will be located on Northumberland County Road (CR) 9 (Ganaraska Road), just to the east of Hammill Road.

The purpose of this TIS Report is to assess the impact of the proposed Farmers Market on traffic operations of CR 9 for future conditions, as well as to examine the need for auxiliary lanes at the entrance of the proposed development on CR 9. This study will assess the traffic operations in terms of the Level of Service (LOS) at the entrance. Therefore, the study area is defined here to include the entrance of the development.

The land, where the Farmers Market is proposed is currently undeveloped. The proposed development is located on the north side of CR 9 and to the east of Hammill Road. The lands surrounding the proposed development are a mix of rural residential homes and farmlands. An aerial photo sketching the location plan of the proposed development is included in **Appendix A**.

The proposed development is planned to include a single-story commercial building with an area of 500 m² as shown in **Appendix B**. The proposed development will directly access CR 9 as shown in the conceptual plan, which is included in **Appendix B**.

2.0 Background Traffic Analysis

2.1 Roadway Existing Conditions

Within the study area, CR 9 has a two-way two-lane rural cross-section with unpaved shoulders. The speed limit on this section of CR 9 within the study area is 60 km/hr.

2.2 Existing and Future Background Traffic Conditions

This study uses the traffic counts that were collected by Ontario Traffic Inc. on February 16, 2022, at the intersections of CR 9 and Wilsons Lane. The traffic counts collected at this intersection are included in **Appendix C**.

Based on the traffic data, the AM peak hour is identified between 8:30 am and 9:30 am, while the PM peak hour occurs between 4:00 pm and 5:00 pm. It is worth noting that only four pedestrians were observed during the whole count period, which is minimal. Therefore, for the purposes of this study, it is assumed that pedestrians do not have any adverse effect on traffic operations in the study area. Also, it has been noticed that there was no traffic (entering or exiting) on Wilsons Lane during the count period.

Since the counts were collected during the winter, a seasonal factor will be applied to adjust the collected counts to the summer season. Accordingly, the collected counts will be increased by 20% as a reasonable assumption to match traffic conditions in the summer.

To obtain traffic volumes for the horizon years 2027 and 2032, the future traffic counts were estimated using an annual growth rate of 2%. This assumed annual growth rate is estimated to be consistent with the traffic growth discussed in the Northumberland County Transportation Master Plan (NCTMP) in Tables 2.4 and 3.1. The collected traffic volumes during the peak hours and the adjusted volumes for the current year and horizon years are summarized in **Table 1**.

Table 1 - Estimated Current and Anticipated Background Traffic Volumes at the Intersection of CR 9 and Wilsons Lane

	EBR	EBT	WBT	WBL	NBL	NBR
AM Peak Hour						
2022 (Current)	0	71	98	0	0	0
2022 (Adjusted)	0	85	118	0	0	0
2027	0	94	130	0	0	0
2032	0	104	143	0	0	0
PM Peak Hour						
2022 (Current)	0	105	98	0	0	0
2022 (Adjusted)	0	126	118	0	0	0
2027	0	139	130	0	0	0
2032	0	154	143	0	0	0

As shown in the **Table 1**, the traffic volumes during the peak hours are low, even after the adjustment for the summer. Therefore, it is anticipated that this section will operate in the future to acceptable levels. Also, this section of CR 9 was not highlighted in the NCTMP to have any traffic operational or safety issues.

3.0 Traffic Operation Conditions with the Development Consideration

3.1 Trip Generation

The estimation of trips generated by the proposed development was derived from the *Trip Generation Manual, 11th Edition*¹, published by the Institute of Transportation Engineers (ITE). The ITE code of the land use, which closely describes a Farmers Market, and the corresponding trip generation rates are shown in **Table 2**. Also, the table shows the average trip generation rates for this land use for both the AM and the PM peaks and the percentages of entering and exiting.

¹ Trip Generation Manual, Vol. 1, 2, and 3, 11th ed. ITE, Washington, D.C., 2021.

Table 2 - Trip Generation Rates during AM and PM Peak Hours

Land Use	ITE Code	AM Peak			PM Peak		
		Avg. Rate	Entering	Exiting	Avg. Rate	Entering	Exiting
Farmers Market	858	174.9	50%	50%	179.8	48%	52%

The average trip generation rates provided by the ITE Manual for the peak hours of the generator (i.e. farmers market) were used. The number of trips generated from the Farmers Market can be estimated based on the area of the market in Acres (500 m² ~ 0.124 acres) as shown in **Table 3**.

Table 3 - The Estimated Entering and Exiting Trips during AM and PM Peak Hours

Land Use	Area (acres)	AM Peak			PM Peak		
		Avg. Rate	Entering	Exiting	Avg. Rate	Entering	Exiting
Farmers Market	0.124	22	11	11	22	11	12
Total		22	11	11	22	11	12

3.2 Trip Distribution

Based on the existing turning movement ratios on CR 9, the trips generated from the development are distributed as shown in **Table 4**.

Table 4 - Trip Distribution Ratios at the Entrance of the Development on CR 9

At the Entrance	AM	
	Volume	Ratio
Westbound through traffic	98	0.580
Eastbound through traffic	71	0.420
At the Entrance	PM	
	Volume	Ratio
Westbound through traffic	98	0.483
Eastbound through traffic	105	0.517

Based on the ratios in **Table 4** and the number of trips generated by the development shown in **Table 3**, the trip distribution at the entrance of the development is presented in **Table 5**.

Table 5 - The Turning Movement Volumes Added to CR 9 at the Entrance of the Development due to the Development Impact

Peak Hour	EBL	EBT	WBT	WBR	SBL	SBR
AM	5	0	0	6	6	5
PM	6	0	0	5	6	6

It is worth mentioning that it is assumed that the trip generated from the development will not increase over the horizon years since there is no expansion anticipated within the development.

The volumes reported in **Table 5** are then added to the total background traffic to further investigate the impact of the development on the traffic operation. The updated traffic volumes (rounded) at the entrance of the development with the consideration of the development are in **Table 6**.

Table 6 - Estimated Future Traffic Volumes with the Development Consideration at the Entrance of the Development on CR 9

	EBL	EBT	WBT	WBR	SBL	SBR
AM Peak Hour						
2022 (Adjusted)	5	71	98	6	6	5
2027	5	85	118	6	6	5
2032	5	94	130	6	6	5
PM Peak Hour						
2022 (Adjusted)	6	105	98	5	6	6
2027	6	126	118	5	6	6
2032	6	139	130	5	6	6

3.3 Existing and Future Traffic Operation with the Development Consideration

Synchro 9 software was used to model the traffic at the adjacent intersection. The model aims at assessing the traffic operation within the study area including the entrance of the development on CR 9. Different scenarios with the consideration of the traffic generated from the development were assessed including the adjusted 2022 scenario and the horizon years (2027 and 2032) for both AM and PM peak hours. The traffic volumes used in this assessment are summarized in **Table 6**. The results summary is presented in **Table 7**. The LOS definitions and the details of the simulation models and full results can be found in **Appendix D** and **Appendix E**, respectively.

Based on the traffic operation performance for the traffic with the development consideration, the traffic operation performance measure (i.e. LOS) at the entrance of the development on CR 9 is consistently at LOS "A" over the study period. This reflects that the development will not have any impact on the traffic operation in this area of CR 9.

**Table 7 - LOS at the Development Entrance on CR 9
 based on Future Traffic Condition with the Development Consideration**

	EBL	WB	SB
AM Peak Hour			
2022 (Adjusted)	A	-	A
2027	A	-	A
2032	A	-	A
PM Peak Hour			
2022 (Adjusted)	A	-	A
2027	A	-	A
2032	A	-	A

In summary, the proposed development will have no impact on the traffic operation within the study area on CR 9 at the development entrance.

4.0 Warrants for Auxiliary Lanes with Proposed Development

The warrants for auxiliary lanes were examined on CR 9 at the proposed entrance of the development in accordance with Appendix 9A of MTO's *Design Supplement for the 2017 Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads*².

The need for a left-turn lane at an unsignalized intersection (i.e. at the entrance of the development on CR 9) as established by the Design Supplement, Chapter 9A is based on the advancing traffic volume (V_A), the opposing traffic volume (V_O), the left-turning traffic volume (V_L), and the percentage of left-turning traffic in the advancing volume (LT%). As shown in **Table 8**, the left-turning volumes are less than 10 vph in all the peak hours for the current and the horizon years. These low volumes range from 4% to 6% of the advancing volumes (LT%) for the AM and PM peak hours. Based on these percentages and for the 5% left-turning volume percentage chart in the design supplement, a left-turn lane installation on CR 9 at the entrance of the development is not warranted, as shown in **Appendix F**. It is assumed that the design speed is 80 km/h. This design speed is 20 km/h above the existing posted speed limit, which is 60 km/h within the study area.

² Transportation Association of Canada (TAC). *Geometric Design Guide for Canadian Roads: Design Controls, Classification and Consistency*. Transportation Association of Canada, 2017.

**Table 8 - Left Turning Volume Calculations
 at the Development Entrance on CR 9**

	V _L	V _A	LT%	V _O
AM Peak				
2022 (Adjusted)	5	76	6%	104
2027	5	90	5%	124
2032	5	99	5%	136
PM Peak				
2022 (Adjusted)	6	111	5%	103
2027	6	132	4%	123
2032	6	145	4%	135

For the right turn lanes, the TAC Manual specifies that right turn lanes should be considered “when the volume of decelerating or accelerating vehicles compared with through traffic volumes causes undue hazard.” For the entrance of the proposed development, the westbound right-turn volume is substantially low, which is 5 vph and 6 vph during the AM and PM Peak hours, respectively. These volumes are not anticipated to impede the through movement traffic at the entrance.

5.0 Sight Lines Review at Development Entrance

A site visit was conducted on Monday, March 7, 2022, to check the sight lines at the proposed entrance of the development. The centreline of the entrance is located about 109 m to the east of the centreline of Hammill Road. Based on the sight line review, the available sight distance is more than 250 m at the entrance of the development and looking to the east on CR 9. On the other hand, the available sight distance on the west side of CR 9 from the entrance of the development is about 237 m. The measurement of the sight lines assumed both the driver's eye and the object to be seen are 1.08 m above the roadway surface. Based on the measurement done in the field, the available sight distances fulfill the sight distance requirement (170 m for a design speed of 80 km/hr) in Table 9.9.4 in the TAC Geometric Design Guide for Canadian Roads (June 2017) and in conjunction with the latest “MTO Design Supplement For TAC Geometric Design Guide for Canadian Roads – April 2020” (MTO DS). Again, it is assumed that the design speed is 80 km/h. This design speed is 20 km/h above the existing posted speed limit, which is 60 km/h within the study area. **Figure 1** shows pictures that were taken during the site visit at the entrance of the development for both directions on CR 9.



Figure 1 - Pictures taken in the field at the proposed entrance of the Development on CR 9 – looking east [on the left] and looking west [on the right]

6.0 Conclusions and Recommendations

This Traffic Impact Study investigates and evaluates the impact of the proposed Garden Hill Farmers Market on CR 9, Northumberland County. The background traffic operation, and the traffic operation with the consideration of the traffic generated from the development at the intersections within the study area were assessed.

Based on the analysis completed in this study, the new trips generated by the development will have no impact on CR 9 at the entrance of the development in the existing or the future scenarios. The LOS with the consideration of the development will remain at LOS "A" for all the scenarios, which reflect a smooth traffic operation in the area.

Additionally, this study examines the need for auxiliary turn lanes at the entrance of the development. The results show that there is no need for any right-turn or left-turn lanes at the entrance of the development on CR 9.

Also, the sight distance and visibility requirements have been reviewed during a field visit to the development location. According to the TAC Manual, the review indicated that there is sufficient visibility for both sides (i.e. east and west) at the entrance of the development on CR 9.

It is anticipated that the entrance of the development will be designed and constructed according to the Northumberland County requirements.

Sincerely,



Mostafa H Tawfeek, Ph.D., P.Eng., RSP1
Traffic Project Engineer
D.M. Wills Associates Limited



Wes Kingdon, P.Eng.
Project Engineer
D.M. Wills Associates Limited

MT/jh

Appendix A

Location Plan



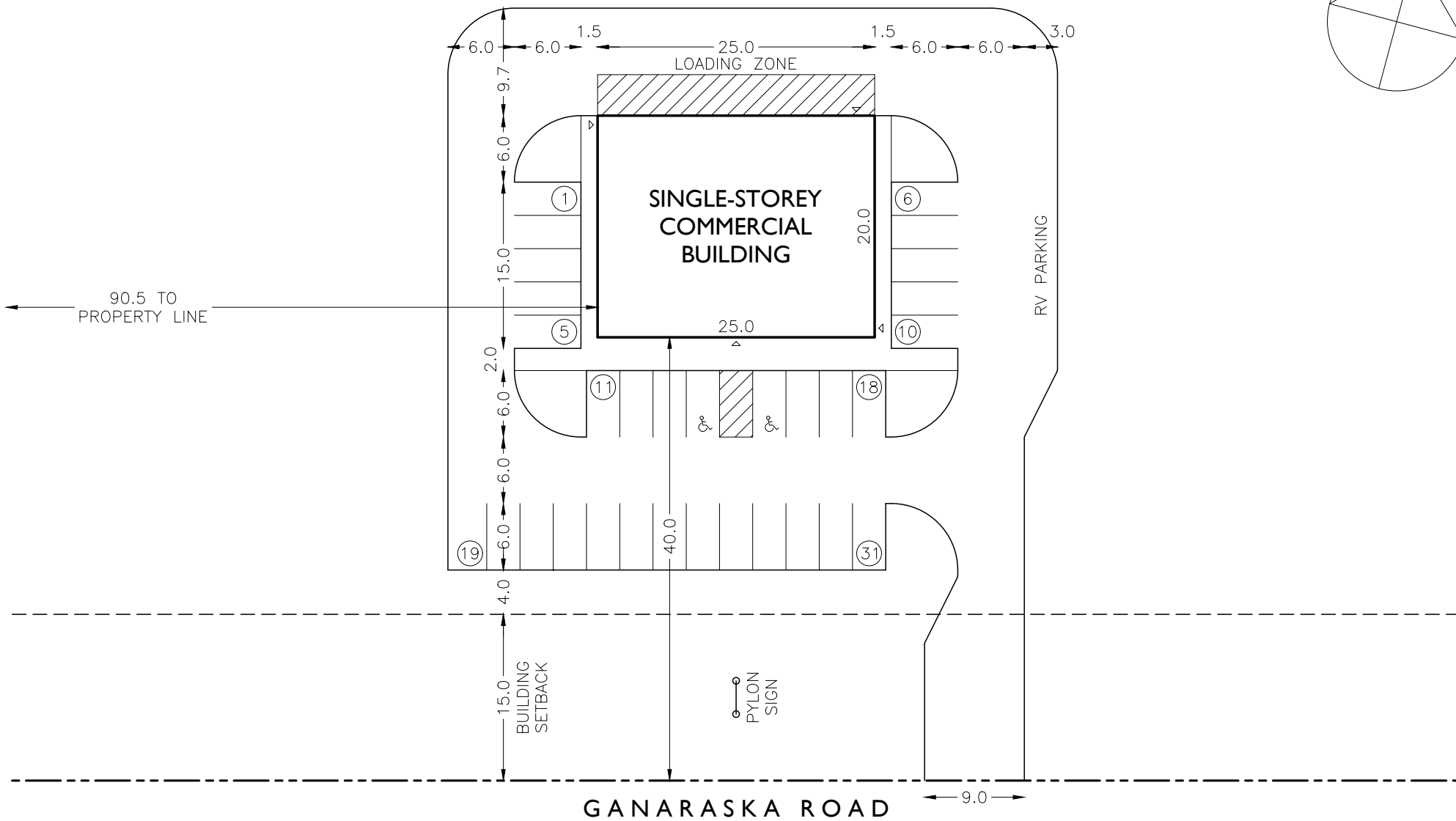
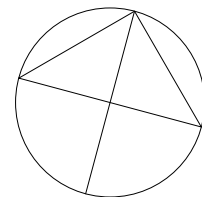


***For illustration purposes only and not to scale**

Appendix B

Site Plan

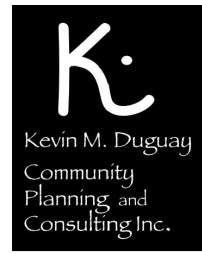




SCALE 1:500
ALL DIMENSIONS IN METRES

PROPOSED SITE PLAN - DETAIL
8157 HAMMILL ROAD
GARDEN HILL, ONTARIO
R04 2021-09-19

NAME	AREA m ²	%
SITE	41 200.0	100.0
BUILDING	500.0	1.2
PARKING	2 188.9	5.3



Appendix C

Traffic Data





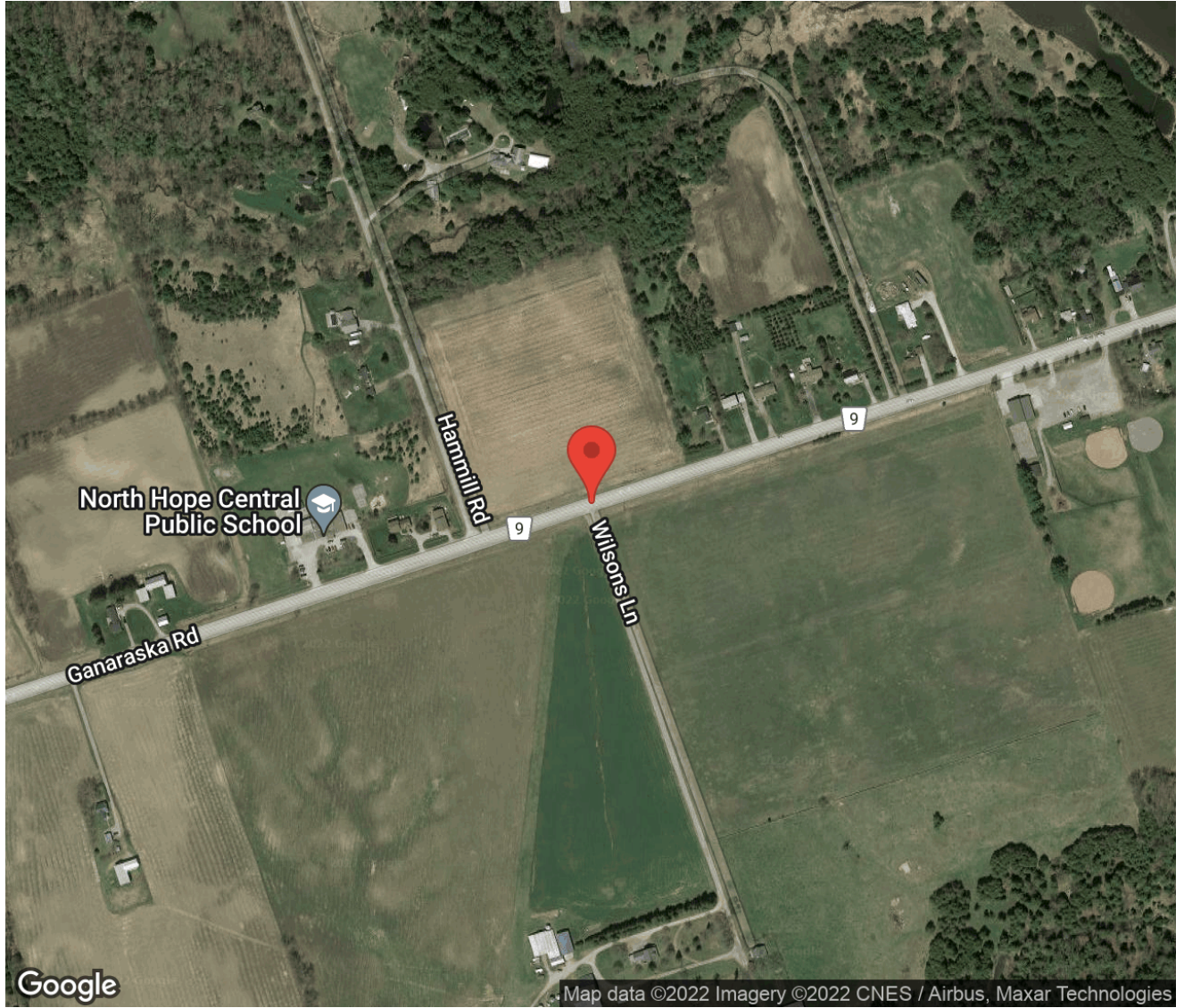
Project #22-024 - D.M. Wills Associates

Intersection Count Report

Intersection:	Ganaraska Rd & Wilsons Lane
Municipality:	Campbellcroft
Count Date:	Feb 16, 2022
Site Code:	2202400001
Count Categories:	Cars, Trucks, Bicycles, Pedestrians
Count Period:	07:00-18:00
Weather:	Clear

Traffic Count Map

Intersection: Ganaraska Rd & Wilsons Lane
Site Code: 220240001
Municipality: Campbellcroft
Count Date: Feb 16, 2022



Traffic Count Summary

Intersection: Ganaraska Rd & Wilsons Lane
 Site Code: 2202400001
 Municipality: Campbellcroft
 Count Date: Feb 16, 2022

Ganaraska Rd - Traffic Summary

Hour	East Approach Totals						West Approach Totals						Total
	Includes Cars, Trucks, Bicycles						Includes Cars, Trucks, Bicycles						
	Left	Thru	Right	U-Turn	Total	Peds	Left	Thru	Right	U-Turn	Total	Peds	
07:00 - 08:00	0	100	0	0	100	0	0	36	0	0	36	1	136
08:00 - 09:00	0	96	0	0	96	0	0	59	0	0	59	0	155
09:00 - 10:00	0	85	0	0	85	1	0	70	0	0	70	0	155
10:00 - 11:00	0	68	0	0	68	0	0	61	0	0	61	0	129
11:00 - 12:00	0	78	0	0	78	0	0	77	0	0	77	0	155
12:00 - 13:00	0	92	0	0	92	0	0	95	0	0	95	0	187
13:00 - 14:00	0	98	0	0	98	0	0	83	0	0	83	1	181
14:00 - 15:00	0	64	0	0	64	0	0	59	0	0	59	0	123
15:00 - 16:00	0	87	0	0	87	0	0	95	0	0	95	0	182
16:00 - 17:00	0	98	0	0	98	0	0	105	0	0	105	0	203
17:00 - 18:00	0	71	0	0	71	1	0	81	0	0	81	0	152
GRAND TOTAL	0	937	0	0	937	2	0	821	0	0	821	2	1758



Traffic Count Data

Intersection: Ganaraska Rd & Wilsons Lane
 Site Code: 2202400001
 Municipality: Campbellcroft
 Count Date: Feb 16, 2022

East Approach - Ganaraska Rd

Start Time	Cars					Trucks					Bicycles					Total Peds
	←	↑	→	↻	Total	←	↑	→	↻	Total	←	↑	→	↻	Total	
07:00	0	25	0	0	25	0	1	0	0	1	0	0	0	0	0	0
07:15	0	24	0	0	24	0	1	0	0	1	0	0	0	0	0	0
07:30	0	25	0	0	25	0	2	0	0	2	0	0	0	0	0	0
07:45	0	19	0	0	19	0	3	0	0	3	0	0	0	0	0	0
08:00	0	19	0	0	19	0	3	0	0	3	0	0	0	0	0	0
08:15	0	20	0	0	20	0	2	0	0	2	0	0	0	0	0	0
08:30	0	21	0	0	21	0	5	0	0	5	0	0	0	0	0	0
08:45	0	21	0	0	21	0	5	0	0	5	0	0	0	0	0	0
09:00	0	19	0	0	19	0	3	0	0	3	0	0	0	0	0	0
09:15	0	21	0	0	21	0	3	0	0	3	0	0	0	0	0	1
09:30	0	16	0	0	16	0	3	0	0	3	0	0	0	0	0	0
09:45	0	15	0	0	15	0	5	0	0	5	0	0	0	0	0	0
10:00	0	16	0	0	16	0	1	0	0	1	0	0	0	0	0	0
10:15	0	11	0	0	11	0	4	0	0	4	0	0	0	0	0	0
10:30	0	13	0	0	13	0	3	0	0	3	0	0	0	0	0	0
10:45	0	15	0	0	15	0	5	0	0	5	0	0	0	0	0	0
11:00	0	17	0	0	17	0	5	0	0	5	0	0	0	0	0	0
11:15	0	14	0	0	14	0	5	0	0	5	0	0	0	0	0	0
11:30	0	14	0	0	14	0	4	0	0	4	0	0	0	0	0	0
11:45	0	16	0	0	16	0	3	0	0	3	0	0	0	0	0	0

Start Time	Cars					Trucks					Bicycles					Total Peds
	←	↑	→	↻	Total	←	↑	→	↻	Total	←	↑	→	↻	Total	
12:00	0	14	0	0	14	0	6	0	0	6	0	0	0	0	0	0
12:15	0	17	0	0	17	0	3	0	0	3	0	0	0	0	0	0
12:30	0	21	0	0	21	0	2	0	0	2	0	0	0	0	0	0
12:45	0	24	0	0	24	0	5	0	0	5	0	0	0	0	0	0
13:00	0	22	0	0	22	0	3	0	0	3	0	0	0	0	0	0
13:15	0	23	0	0	23	0	3	0	0	3	0	1	0	0	1	0
13:30	0	25	0	0	25	0	0	0	0	0	0	0	0	0	0	0
13:45	0	19	0	0	19	0	2	0	0	2	0	0	0	0	0	0
14:00	0	16	0	0	16	0	1	0	0	1	0	0	0	0	0	0
14:15	0	12	0	0	12	0	1	0	0	1	0	0	0	0	0	0
14:30	0	16	0	0	16	0	2	0	0	2	0	0	0	0	0	0
14:45	0	15	0	0	15	0	1	0	0	1	0	0	0	0	0	0
15:00	0	17	0	0	17	0	3	0	0	3	0	0	0	0	0	0
15:15	0	17	0	0	17	0	3	0	0	3	0	0	0	0	0	0
15:30	0	20	0	0	20	0	4	0	0	4	0	0	0	0	0	0
15:45	0	19	0	0	19	0	4	0	0	4	0	0	0	0	0	0
16:00	0	21	0	0	21	0	3	0	0	3	0	0	0	0	0	0
16:15	0	26	0	0	26	0	5	0	0	5	0	0	0	0	0	0
16:30	0	18	0	0	18	0	2	0	0	2	0	0	0	0	0	0
16:45	0	19	0	0	19	0	4	0	0	4	0	0	0	0	0	0
17:00	0	16	0	0	16	0	2	0	0	2	0	0	0	0	0	1
17:15	0	15	0	0	15	0	3	0	0	3	0	0	0	0	0	0
17:30	0	16	0	0	16	0	4	0	0	4	0	0	0	0	0	0
17:45	0	13	0	0	13	0	2	0	0	2	0	0	0	0	0	0
SUBTOTAL	0	802	0	0	802	0	134	0	0	134	0	1	0	0	1	2
GRAND TOTAL	0	802	0	0	802	0	134	0	0	134	0	1	0	0	1	2



Traffic Count Data

Intersection: Ganaraska Rd & Wilsons Lane
 Site Code: 2202400001
 Municipality: Campbellcroft
 Count Date: Feb 16, 2022

West Approach - Ganaraska Rd

Start Time	Cars					Trucks					Bicycles					Total Peds
	←	↑	→	↻	Total	←	↑	→	↻	Total	←	↑	→	↻	Total	
07:00	0	9	0	0	9	0	1	0	0	1	0	0	0	0	0	0
07:15	0	5	0	0	5	0	1	0	0	1	0	0	0	0	0	1
07:30	0	11	0	0	11	0	1	0	0	1	0	0	0	0	0	0
07:45	0	8	0	0	8	0	0	0	0	0	0	0	0	0	0	0
08:00	0	9	0	0	9	0	3	0	0	3	0	0	0	0	0	0
08:15	0	10	0	0	10	0	2	0	0	2	0	0	0	0	0	0
08:30	0	17	0	0	17	0	1	0	0	1	0	0	0	0	0	0
08:45	0	13	0	0	13	0	4	0	0	4	0	0	0	0	0	0
09:00	0	12	0	0	12	0	4	0	0	4	0	0	0	0	0	0
09:15	0	17	0	0	17	0	3	0	0	3	0	0	0	0	0	0
09:30	0	15	0	0	15	0	4	0	0	4	0	0	0	0	0	0
09:45	0	13	0	0	13	0	2	0	0	2	0	0	0	0	0	0
10:00	0	16	0	0	16	0	1	0	0	1	0	0	0	0	0	0
10:15	0	11	0	0	11	0	3	0	0	3	0	0	0	0	0	0
10:30	0	12	0	0	12	0	3	0	0	3	0	0	0	0	0	0
10:45	0	13	0	0	13	0	2	0	0	2	0	0	0	0	0	0
11:00	0	14	0	0	14	0	6	0	0	6	0	0	0	0	0	0
11:15	0	17	0	0	17	0	3	0	0	3	0	0	0	0	0	0
11:30	0	16	0	0	16	0	4	0	0	4	0	0	0	0	0	0
11:45	0	15	0	0	15	0	2	0	0	2	0	0	0	0	0	0

Start Time	Cars					Trucks					Bicycles					Total Peds
	←	↑	→	↺	Total	←	↑	→	↺	Total	←	↑	→	↺	Total	
12:00	0	16	0	0	16	0	4	0	0	4	0	0	0	0	0	0
12:15	0	18	0	0	18	0	4	0	0	4	0	0	0	0	0	0
12:30	0	27	0	0	27	0	2	0	0	2	0	0	0	0	0	0
12:45	0	20	0	0	20	0	4	0	0	4	0	0	0	0	0	0
13:00	0	18	0	0	18	0	3	0	0	3	0	0	0	0	0	1
13:15	0	20	0	0	20	0	4	0	0	4	0	0	0	0	0	0
13:30	0	17	0	0	17	0	0	0	0	0	0	0	0	0	0	0
13:45	0	18	0	0	18	0	3	0	0	3	0	0	0	0	0	0
14:00	0	13	0	0	13	0	3	0	0	3	0	0	0	0	0	0
14:15	0	12	0	0	12	0	2	0	0	2	0	0	0	0	0	0
14:30	0	11	0	0	11	0	2	0	0	2	0	0	0	0	0	0
14:45	0	15	0	0	15	0	1	0	0	1	0	0	0	0	0	0
15:00	0	21	0	0	21	0	3	0	0	3	0	0	0	0	0	0
15:15	0	21	0	0	21	0	2	0	0	2	0	0	0	0	0	0
15:30	0	19	0	0	19	0	4	0	0	4	0	0	0	0	0	0
15:45	0	22	0	0	22	0	3	0	0	3	0	0	0	0	0	0
16:00	0	21	0	0	21	0	3	0	0	3	0	0	0	0	0	0
16:15	0	22	0	0	22	0	6	0	0	6	0	0	0	0	0	0
16:30	0	23	0	0	23	0	4	0	0	4	0	0	0	0	0	0
16:45	0	23	0	0	23	0	3	0	0	3	0	0	0	0	0	0
17:00	0	21	0	0	21	0	2	0	0	2	0	0	0	0	0	0
17:15	0	20	0	0	20	0	2	0	0	2	0	0	0	0	0	0
17:30	0	16	0	0	16	0	2	0	0	2	0	0	0	0	0	0
17:45	0	17	0	0	17	0	1	0	0	1	0	0	0	0	0	0
SUBTOTAL	0	704	0	0	704	0	117	0	0	117	0	0	0	0	0	2
GRAND TOTAL	0	704	0	0	704	0	117	0	0	117	0	0	0	0	0	2

Peak Hour Diagram

Specified Period

From: 07:00:00
To: 10:00:00

One Hour Peak

From: 08:30:00
To: 09:30:00

Intersection: Ganaraska Rd & Wilsons Lane
Site Code: 2202400001
Count Date: Feb 16, 2022

Weather conditions: Clear

**** Unsignalized Intersection ****

Major Road: Ganaraska Rd runs E/W

East Approach

	Out	In	Total
	82	59	141
	16	12	28
	0	0	0
Totals	98	71	169

Ganaraska Rd

			Totals
0	0	0	0
0	12	59	71
0	0	0	0

Peds: 0

Peds: 0



Peds: 1

Peds: 0

Ganaraska Rd

Totals			
0	0	0	0
98	82	16	0
0	0	0	0

West Approach

Out	In	Total
59	82	141
12	16	28
0	0	0
71	98	169

Totals			
0	0	0	0
0	0	0	0
0	0	0	0

Wilsons Lane

South Approach

Out	In	Total
0	0	0
0	0	0
0	0	0
0	0	0

- Cars

- Trucks

- Bicycles

Comments



Peak Hour Summary

Intersection: Ganaraska Rd & Wilsons Lane
 Site Code: 2202400001
 Count Date: Feb 16, 2022
 Period: 07:00 - 10:00

Peak Hour Data (08:30 - 09:30)

Start Time	North Approach				South Approach Wilsons Lane				East Approach Ganaraska Rd				West Approach Ganaraska Rd				Total Vehicles										
	←	↑	→	↻	Peds	Total	←	↑	→	↻	Peds	Total	←	↑	→	↻		Peds	Total								
08:30					0		0		0	0	0	0	0	26			0	0	26			18	0	0	0	18	44
08:45					0		0		0	0	0	0	0	26			0	0	26			17	0	0	0	17	43
09:00					0		0		0	0	0	0	0	22			0	0	22			16	0	0	0	16	38
09:15					0		0		0	0	0	0	0	24			0	1	24			20	0	0	0	20	44
Grand Total					0	0	0	0	0	0	0	0	0	98	0	1	98	71	0	0	0	71	169				
Approach %					-	-	0	0	0	-	0	100	0	-	100	0	0	-	-								
Totals %					0	0	0	0	0	0	0	58	0	58	42	0	0	42									
PHF					0	0	0	0	0	0	0	0.94	0	0.94	0.89	0	0	0.89	0.96								
Cars					0	0	0	0	0	0	0	82	0	82	59	0	0	59	141								
% Cars					0	0	0	0	0	0	0	83.7	0	83.7	83.1	0	0	83.1	83.4								
Trucks					0	0	0	0	0	0	0	16	0	16	12	0	0	12	28								
% Trucks					0	0	0	0	0	0	0	16.3	0	16.3	16.9	0	0	16.9	16.6								
Bicycles					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
% Bicycles					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
Peds					0	-			0	-			1	-			0	-	1								
% Peds					0	-			0	-			100	-			0	-									

Peak Hour Diagram

Specified Period

From: 10:00:00
To: 14:00:00

One Hour Peak

From: 12:30:00
To: 13:30:00

Intersection: Ganaraska Rd & Wilsons Lane
Site Code: 2202400001
Count Date: Feb 16, 2022

Weather conditions: Clear

**** Unsignalized Intersection ****

Major Road: Ganaraska Rd runs E/W

East Approach

	Out	In	Total
	90	85	175
	13	13	26
	1	0	1
Totals	104	98	202

Ganaraska Rd

			Totals
0	0	0	0
0	13	85	98
0	0	0	0

Peds: 0



Peds: 1

Peds: 0

Peds: 0

Ganaraska Rd

Totals			
0	0	0	0
104	90	13	1
0	0	0	0

West Approach

	Out	In	Total
	85	90	175
	13	13	26
	0	1	1
Totals	98	104	202

Totals			
0	0	0	0
0	0	0	0
0	0	0	0

Wilsons Lane

South Approach

	Out	In	Total
	0	0	0
	0	0	0
	0	0	0
Totals	0	0	0

- Cars

- Trucks

- Bicycles

Comments



Peak Hour Summary

Intersection: Ganaraska Rd & Wilsons Lane
 Site Code: 2202400001
 Count Date: Feb 16, 2022
 Period: 10:00 - 14:00

Peak Hour Data (12:30 - 13:30)

Start Time	North Approach				South Approach Wilsons Lane				East Approach Ganaraska Rd				West Approach Ganaraska Rd				Total Vehicles									
	←	↑	→	↻	Peds	Total	←	↑	→	↻	Peds	Total	←	↑	→	↻		Peds	Total							
12:30					0		0		0	0	0	0	0	23			0	0	23		29	0	0	0	29	52
12:45					0		0		0	0	0	0	0	29			0	0	29		24	0	0	0	24	53
13:00					0		0		0	0	0	0	0	25			0	0	25		21	0	0	1	21	46
13:15					0		0		0	0	0	0	0	27			0	0	27		24	0	0	0	24	51
Grand Total					0	0	0	0	0	0	0	0	0	104	0	0	0	0	104	98	0	0	1	98	202	
Approach %					-		0	0	0	-	0	100	0	-	100	0	0	-								
Totals %					0		0	0	0	0	0	51.5	0	51.5	48.5	0	0	48.5								
PHF					0	0	0	0	0	0	0	0.9	0	0.9	0.84	0	0	0.84	0.95							
Cars					0		0	0	0	0	0	90	0	90	85	0	0	85							175	
% Cars					0		0	0	0	0	0	86.5	0	86.5	86.7	0	0	86.7							86.6	
Trucks					0		0	0	0	0	0	13	0	13	13	0	0	13							26	
% Trucks					0		0	0	0	0	0	12.5	0	12.5	13.3	0	0	13.3							12.9	
Bicycles					0		0	0	0	0	0	1	0	1	0	0	0	0							1	
% Bicycles					0		0	0	0	0	0	1	0	1	0	0	0	0							0.5	
Peds					0	-			0	-			0	-			1	-							1	
% Peds					0	-			0	-			0	-			100	-								

Peak Hour Diagram

Specified Period

From: 14:00:00
To: 18:00:00

One Hour Peak

From: 16:00:00
To: 17:00:00

Intersection: Ganaraska Rd & Wilsons Lane
Site Code: 2202400001
Count Date: Feb 16, 2022

Weather conditions: Clear

**** Unsignalized Intersection ****

Major Road: Ganaraska Rd runs E/W

East Approach

	Out	In	Total
	84	89	173
	14	16	30
	0	0	0
Totals	98	105	203

Ganaraska Rd

			Totals
0	0	0	0
0	16	89	105
0	0	0	0

Peds: 0



Peds: 0

Peds: 0

Ganaraska Rd

Totals			
0	0	0	0
98	84	14	0
0	0	0	0

Peds: 0

West Approach

	Out	In	Total
	89	84	173
	16	14	30
	0	0	0
Totals	105	98	203

Totals			
0	0	0	0
0	0	0	0
0	0	0	0

Wilsons Lane

South Approach

	Out	In	Total
	0	0	0
	0	0	0
	0	0	0
Totals	0	0	0

- Cars

- Trucks

- Bicycles

Comments



Peak Hour Summary

Intersection: Ganaraska Rd & Wilsons Lane
 Site Code: 2202400001
 Count Date: Feb 16, 2022
 Period: 14:00 - 18:00

Peak Hour Data (16:00 - 17:00)

Start Time	North Approach				South Approach Wilson's Lane				East Approach Ganaraska Rd				West Approach Ganaraska Rd				Total Vehicles									
	←	↑	→	↻	Peds	Total	←	↑	→	↻	Peds	Total	←	↑	→	↻		Peds	Total							
16:00					0		0		0	0	0	0	0	24			0	0	24		24	0	0	0	24	48
16:15					0		0		0	0	0	0	0	31			0	0	31		28	0	0	0	28	59
16:30					0		0		0	0	0	0	0	20			0	0	20		27	0	0	0	27	47
16:45					0		0		0	0	0	0	0	23			0	0	23		26	0	0	0	26	49
Grand Total					0	0	0	0	0	0	0	0	0	98	0	0	0	0	98	105	0	0	0	105	203	
Approach %					-		0	0	0	-			0	100	0	-				100	0	0	-			
Totals %						0		0	0		0	48.3		48.3		48.3		51.7	0	0		51.7				
PHF					0	0	0	0	0	0	0	0.79	0	0.79	0	0.79	0.94	0	0		0.94	0.86				
Cars					0	0	0	0	0	0	0	84	0	84	0	84	89	0	0	89	173					
% Cars					0	0	0	0	0	0	0	85.7	0	85.7	0	85.7	84.8	0	0	84.8	85.2					
Trucks					0	0	0	0	0	0	0	14	0	14	0	14	16	0	0	16	30					
% Trucks					0	0	0	0	0	0	0	14.3	0	14.3	0	14.3	15.2	0	0	15.2	14.8					
Bicycles					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
% Bicycles					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Peds					0	-			0	-			0	-					0	-	0					
% Peds					0	-			0	-			0	-					0	-						

Appendix D

Level of Service Criteria for Unsignalized Intersections



According to the HCM 2010, T-intersections with a stop sign on the stem of the T are considered Two-way Stop-Controlled intersections and have the same Level of Service (LOS) definitions and criteria as any Two-way Stop-Controlled intersection. For this type of intersection, the LOS is determined based on the control delay and is determined for each minor road lane group and the left-turn movement of the major road. The control delay, in this case, includes the delay due to deceleration to stop from the free-flow speed at the back of a queue (formed because of the stop sign), the move-up time within the queue, stopped delay at the front of the queue, and delay due to acceleration back to free-flow speed. The calculation of the control delay of a specific movement is a function of the flow rate and the capacity of this specific movement.

The description and criteria of the LOS at Two-way Stop-Controlled intersections are summarized in the table below.

LOS for Two-Way Stop-Controlled Intersections

Description of Conditions	Control Delay (sec/veh)	LOS by v/c Ratio	
		v/c ≤ 1.0	v/c > 1.0
No delay for stop-controlled approaches	0 - 10	A	F
Operations with minor delay	> 10 - 15	B	F
Operations with moderate delay	> 15 - 25	C	F
Operations with some delay	> 25 - 35	D	F
Operations with high delay	> 35 - 50	E	F
Operation with extreme congestion with very high delay	> 50	F	F

Appendix E

**Synchro Reports for the Traffic Conditions with the
Development**



Intersection

Int Delay, s/veh 0.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↶	↷		↶	
Traffic Vol, veh/h	5	71	98	6	6	5
Future Vol, veh/h	5	71	98	6	6	5
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	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	77	107	7	7	5

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	114	0	-	0	198
Stage 1	-	-	-	-	111
Stage 2	-	-	-	-	87
Critical Hdwy	4.12	-	-	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	2.218	-	-	-	3.518
Pot Cap-1 Maneuver	1475	-	-	-	791
Stage 1	-	-	-	-	914
Stage 2	-	-	-	-	936
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1475	-	-	-	788
Mov Cap-2 Maneuver	-	-	-	-	788
Stage 1	-	-	-	-	910
Stage 2	-	-	-	-	936

Approach	EB	WB	SB
HCM Control Delay, s	0.5	0	9.3
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1475	-	-	-	851
HCM Lane V/C Ratio	0.004	-	-	-	0.014
HCM Control Delay (s)	7.5	0	-	-	9.3
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection

Int Delay, s/veh 0.6

Movement EBL EBT WBT WBR SBL SBR

Lane Configurations		↕	↕		↕	
Traffic Vol, veh/h	5	85	118	6	6	5
Future Vol, veh/h	5	85	118	6	6	5
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	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	92	128	7	7	5

Major/Minor Major1 Major2 Minor2

Conflicting Flow All	135	0	-	0	234	132
Stage 1	-	-	-	-	132	-
Stage 2	-	-	-	-	102	-
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	1449	-	-	-	754	917
Stage 1	-	-	-	-	894	-
Stage 2	-	-	-	-	922	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1449	-	-	-	751	917
Mov Cap-2 Maneuver	-	-	-	-	751	-
Stage 1	-	-	-	-	890	-
Stage 2	-	-	-	-	922	-

Approach EB WB SB

HCM Control Delay, s 0.4 0 9.5
 HCM LOS A

Minor Lane/Major Mvmt EBL EBT WBT WBR SBLn1

Capacity (veh/h)	1449	-	-	-	818
HCM Lane V/C Ratio	0.004	-	-	-	0.015
HCM Control Delay (s)	7.5	0	-	-	9.5
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection

Int Delay, s/veh 0.6

Movement EBL EBT WBT WBR SBL SBR

Lane Configurations		↶	↷		↶	
Traffic Vol, veh/h	5	94	130	6	6	5
Future Vol, veh/h	5	94	130	6	6	5
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	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	102	141	7	7	5

Major/Minor Major1 Major2 Minor2

Conflicting Flow All	148	0	-	0	257	145
Stage 1	-	-	-	-	145	-
Stage 2	-	-	-	-	112	-
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	1434	-	-	-	732	902
Stage 1	-	-	-	-	882	-
Stage 2	-	-	-	-	913	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1434	-	-	-	729	902
Mov Cap-2 Maneuver	-	-	-	-	729	-
Stage 1	-	-	-	-	878	-
Stage 2	-	-	-	-	913	-

Approach EB WB SB

HCM Control Delay, s	0.4	0	9.6
HCM LOS			A

Minor Lane/Major Mvmt EBL EBT WBT WBR SBLn1

Capacity (veh/h)	1434	-	-	-	799
HCM Lane V/C Ratio	0.004	-	-	-	0.015
HCM Control Delay (s)	7.5	0	-	-	9.6
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection

Int Delay, s/veh 0.6

Movement EBL EBT WBT WBR SBL SBR

Lane Configurations		↶	↷		↶	
Traffic Vol, veh/h	5	105	98	5	6	6
Future Vol, veh/h	5	105	98	5	6	6
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	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	114	107	5	7	7

Major/Minor Major1 Major2 Minor2

Conflicting Flow All	112	0	-	0	234	110
Stage 1	-	-	-	-	110	-
Stage 2	-	-	-	-	124	-
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	1478	-	-	-	754	943
Stage 1	-	-	-	-	915	-
Stage 2	-	-	-	-	902	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1478	-	-	-	751	943
Mov Cap-2 Maneuver	-	-	-	-	751	-
Stage 1	-	-	-	-	911	-
Stage 2	-	-	-	-	902	-

Approach EB WB SB

HCM Control Delay, s 0.3 0 9.4
 HCM LOS A

Minor Lane/Major Mvmt EBL EBT WBT WBR SBLn1

Capacity (veh/h)	1478	-	-	-	836
HCM Lane V/C Ratio	0.004	-	-	-	0.016
HCM Control Delay (s)	7.4	0	-	-	9.4
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection

Int Delay, s/veh 0.6

Movement EBL EBT WBT WBR SBL SBR

Lane Configurations		↕	↔		↕	
Traffic Vol, veh/h	5	126	118	5	6	6
Future Vol, veh/h	5	126	118	5	6	6
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	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	137	128	5	7	7

Major/Minor Major1 Major2 Minor2

Conflicting Flow All	133	0	-	0	278	131
Stage 1	-	-	-	-	131	-
Stage 2	-	-	-	-	147	-
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	1452	-	-	-	712	919
Stage 1	-	-	-	-	895	-
Stage 2	-	-	-	-	880	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1452	-	-	-	709	919
Mov Cap-2 Maneuver	-	-	-	-	709	-
Stage 1	-	-	-	-	891	-
Stage 2	-	-	-	-	880	-

Approach EB WB SB

HCM Control Delay, s 0.3 0 9.6
 HCM LOS A

Minor Lane/Major Mvmt EBL EBT WBT WBR SBLn1

Capacity (veh/h)	1452	-	-	-	800
HCM Lane V/C Ratio	0.004	-	-	-	0.016
HCM Control Delay (s)	7.5	0	-	-	9.6
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection

Int Delay, s/veh 0.5

Movement EBL EBT WBT WBR SBL SBR

Lane Configurations		↕	↔		↕	
Traffic Vol, veh/h	5	139	130	5	6	6
Future Vol, veh/h	5	139	130	5	6	6
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	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	151	141	5	7	7

Major/Minor Major1 Major2 Minor2

Conflicting Flow All	146	0	-	0	305	144
Stage 1	-	-	-	-	144	-
Stage 2	-	-	-	-	161	-
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	1436	-	-	-	687	903
Stage 1	-	-	-	-	883	-
Stage 2	-	-	-	-	868	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1436	-	-	-	684	903
Mov Cap-2 Maneuver	-	-	-	-	684	-
Stage 1	-	-	-	-	879	-
Stage 2	-	-	-	-	868	-

Approach EB WB SB

HCM Control Delay, s	0.3	0	9.7
HCM LOS			A

Minor Lane/Major Mvmt EBL EBT WBT WBR SBLn1

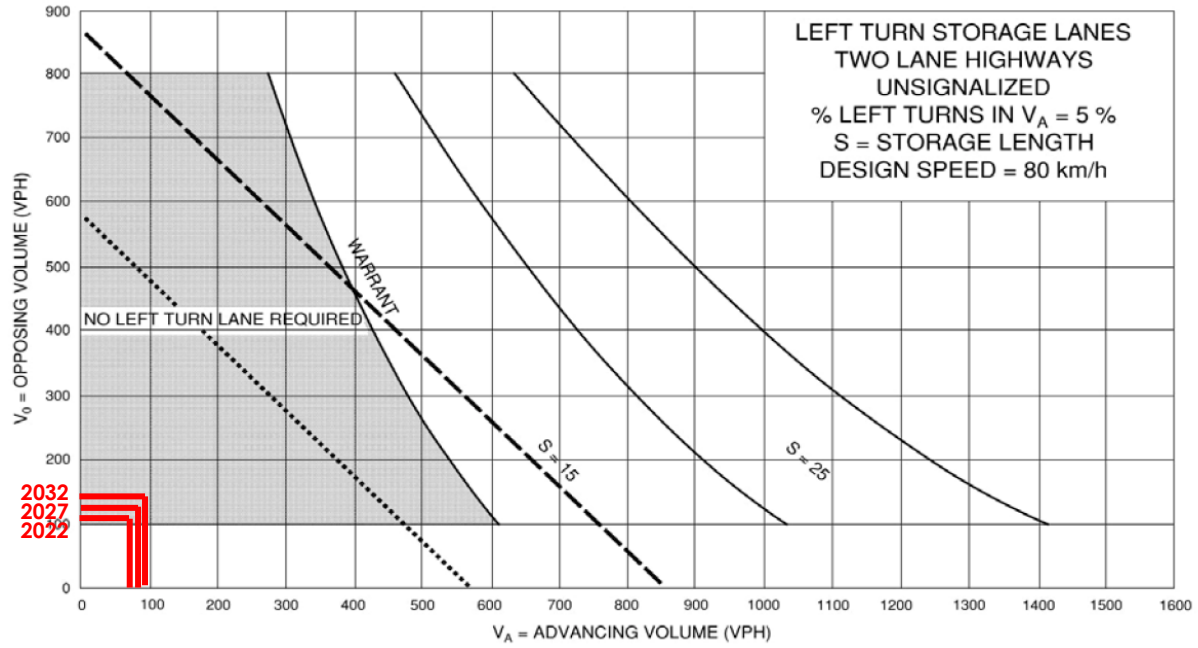
Capacity (veh/h)	1436	-	-	-	778
HCM Lane V/C Ratio	0.004	-	-	-	0.017
HCM Control Delay (s)	7.5	0	-	-	9.7
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Appendix F

Left-Turn Lane Warrant Charts



AM Peak Hours



PM Peak Hours

