

February 19, 2019

Mamta Homes
44 Aster Drive
Wasaga Beach, ON

Attention: Mr. Harjinder Kang

**Re: Transportation Study
Proposed Residential Development
1191 County Road 42, Stayner
Township of Clearview, County of Simcoe**

CGE Transportation Consulting is pleased to submit this Transportation Study Update for the proposed residential development located at the southeast corner of County Road 42 and Margaret Street, municipally known as 1191 County Road 42, in the Township of Clearview (Stayner), County of Simcoe.

Based on a transportation review, the study concludes that the incremental site traffic generated by the proposed development can be accommodated by the existing transportation network, no roadway improvements are required until year 2038 which is ten years after the post build out. The recommendation is to introduce a southbound left turn lane and a northbound right turn lane at the County Road 42 and Margaret Street intersection in order to improve overall intersection operations.

Should you have any questions regarding this study, please do not hesitate to contact the undersigned.

Yours truly,

CGE TRANSPORTATION CONSULTING



Casey Ge, P.Eng.
President

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1.0 INTRODUCTION

CGE Transportation Consulting was retained by Mamta Homes to prepare a Transportation Study for a proposed residential development located at the southeast corner of County Road 42 and Margaret Street, municipally known as 1191 County Road 42, in the Township of Clearview (Stayner), County of Simcoe. The location of the proposed development is illustrated in Figure 1.

The subject lands are currently vacant and the development proposal includes **67-unit condo townhomes, 2-unit semi-detached houses, 36-unit condo apartments, and one amenity building.**

There is a temporary full movement access provided via Margret Street. Additional site accesses are provided via roadway connections to the subdivision development (Village Green) located to the immediate east of the subject lands. The proposed draft plan is provided in Figure 2.

It is to be noted that there was a previous application submitted on the subject lands back in 2010 and the application consisted of *a Church with 625 seats, a 1375 square feet daycare, 1022 square feet fitness center, and 4000 square feet ancillary use, four single detached residential units, 82 semi-detached residential units and 66 low-rise apartment units.* The current development application is much smaller in scale than the previous one.

In consultation with Township of Clearview and the fact that this is a draft plan of subdivision approval process, the traffic study is to be a high-level assessment only. There has been a number of previous traffic studies undertaken for this area.

The study area consists of the following key intersections:

- *County Road 42 / Margaret Street*
- *Margaret Street / Proposed Site Access*

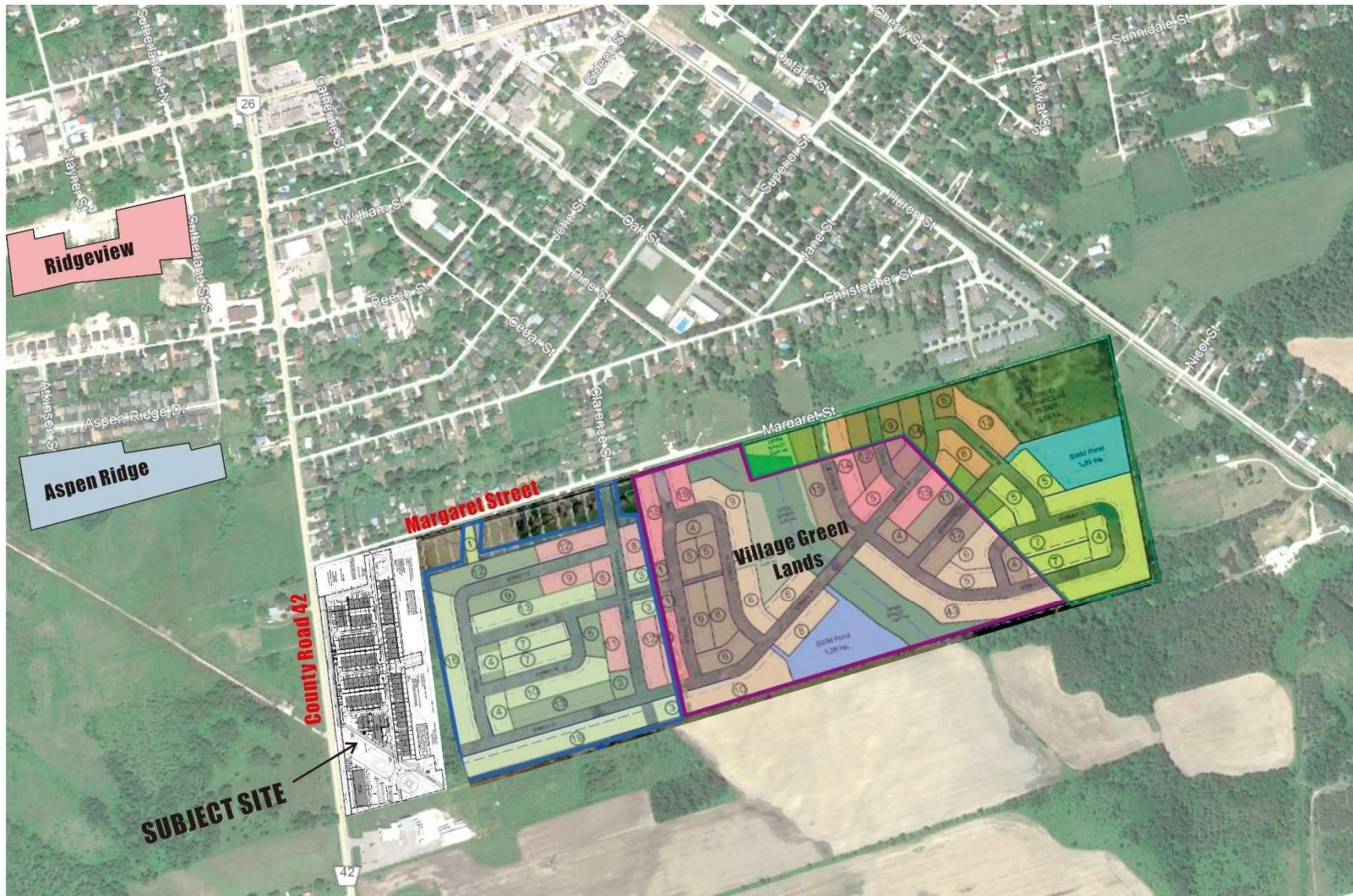
Estimation of site generated trip will utilize the *Trip Generation Manual*, published by the Institute of Transportation Engineer (ITE) 10th Edition. The analysis is developed for the weekday morning and weekday afternoon peak hours.

As per County of Simcoe guidelines, a 20-year assessment period is required, therefore we have determined the study time horizons to include the *existing conditions* (2018 data was collected), *future total conditions* (2028) and *10-year post build-out conditions* (2038).

In addition, projection of future traffic conditions was developed based on the growth rates and background developments provided by the previous traffic study undertaken by C.C. Tatham in November 2010, for the Clearview Community Church (The subject land's previous application).

Other assumptions such as trip distribution, background development trips, Synchro parameters, etc are also based on the C.C. Tatham traffic study. That particular study was based on traffic report submitted by UMA|AECOM, for a large residential subdivision development located to the immediate east of the subject lands (Village Green lands).

Figure 1 Site Location



Source: Google Maps



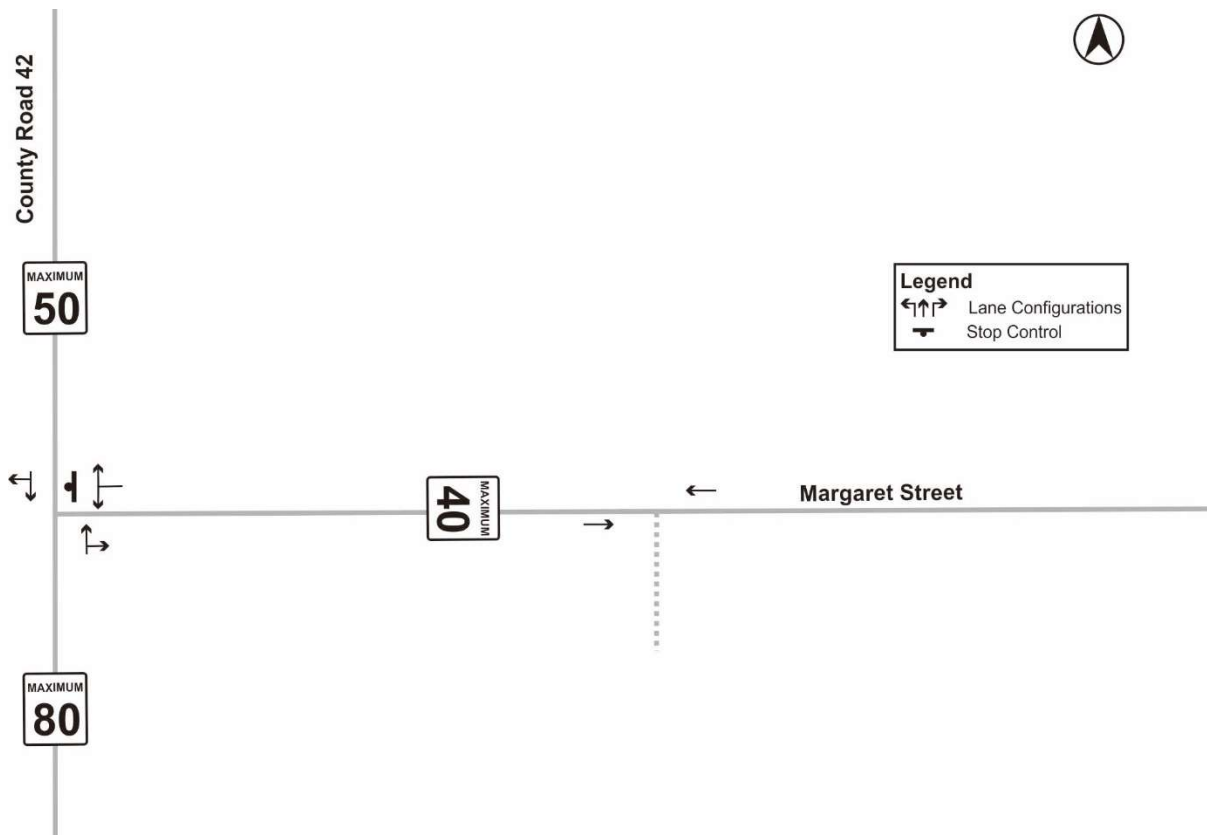
2.0 EXISTING AREA

2.1 Existing Road Network

The existing road network, lane configuration and existing traffic control for the study area are shown in **Error! Reference source not found.**. The details are described below:

- **County Road 42:** is a north-south two-lane arterial roadway under the jurisdictional control of the County of Simcoe. The maximum posted speed in the study area vicinity is 80 km/hour, south of Margaret Street and 50 km/hour north of Margaret Street.
- **Margaret Street:** is an east-west collector road under the jurisdictional control of the Township of Clearview. It currently terminates just east of Clarence Street, however, the plan is to ultimately connect Margaret Street to Warrington Road to the east, once the Village Green subdivisions are constructed. It has a posted speed limit of 40 km/hour.

Figure 3 Existing Road Network



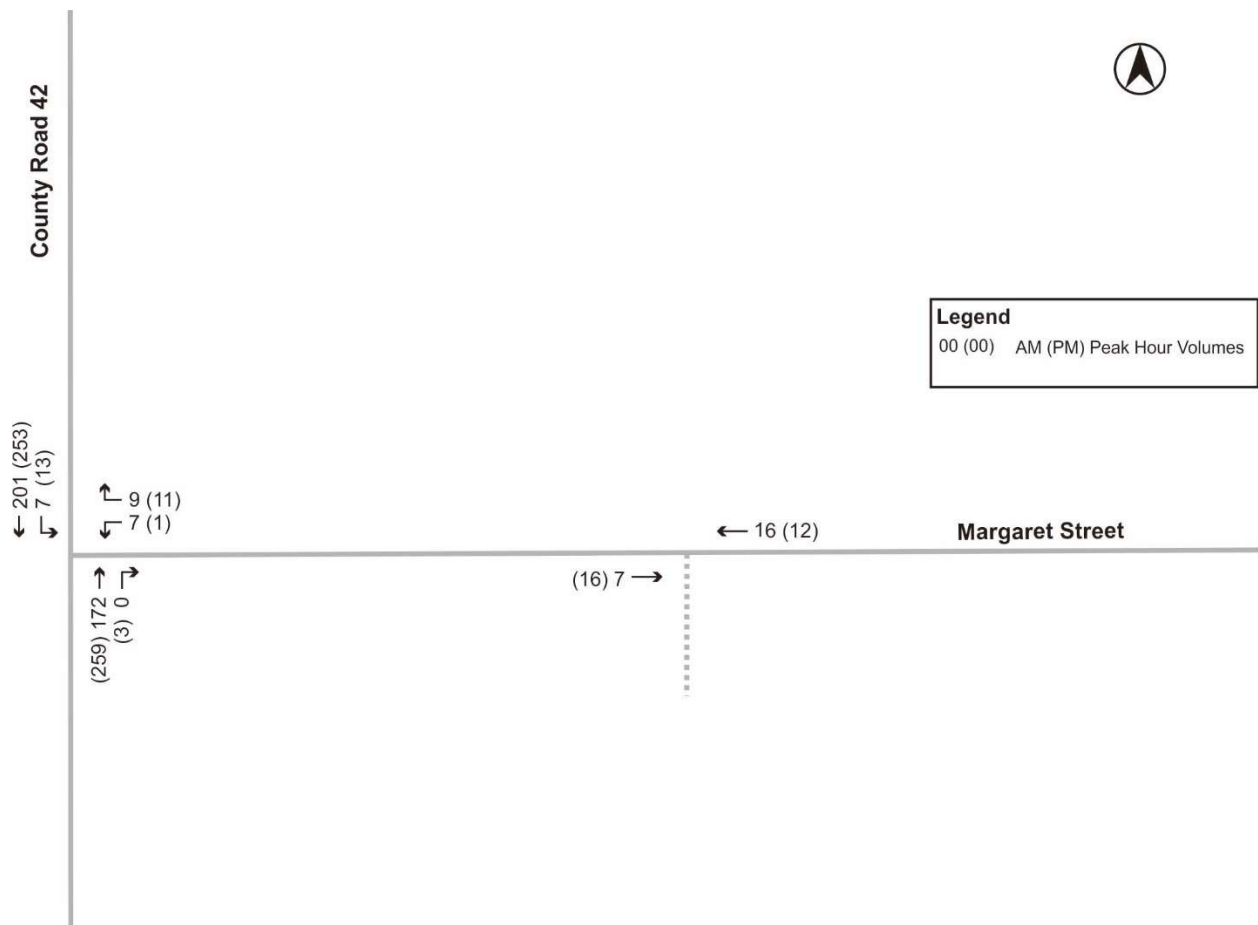
3.0 TRAFFIC VOLUMES

3.1 Existing Traffic Volumes

The existing traffic volumes for the intersection of County Road 42 and Margaret Street was collected by Ontario Traffic Inc. on Tuesday October 9, 2018 during the weekday AM (7:00 to 9:00) and PM (4:00 to 6:00) peak periods.

The existing traffic volumes are illustrated in Figure 4 and a copy of the data is provided in Appendix A.

Figure 4 Existing Traffic Volumes



3.2 Future Background Traffic Volumes

3.2.1 Background Developments

There are three background developments included in this traffic study and they are the following:

1. Village Green Residential Subdivision: *498 detached residential units & 143 Condo-Townhouse residential units.*
2. Ridgeview Subdivision: *116 detached residential units*
3. Aspen Ridge Subdivision: *30 Semi-Detached units*

Based on the traffic study prepared by UMA | AECOM, the Village Green Residential Subdivision will generate a total of 427 two-way trips in the morning, and 526 two-way trips in the afternoon. According to information received from the owner, the Village Green residential subdivisions will be under construction this year.

Based on the C.C. Tatham Traffic Study, the Ridgeview and Aspen Ridge residential subdivisions will generate a total of 134 two-way trips in the morning and 114 two-way trips in the afternoon.

Details are appended in Appendix B.

3.2.2 Analysis Horizon Year

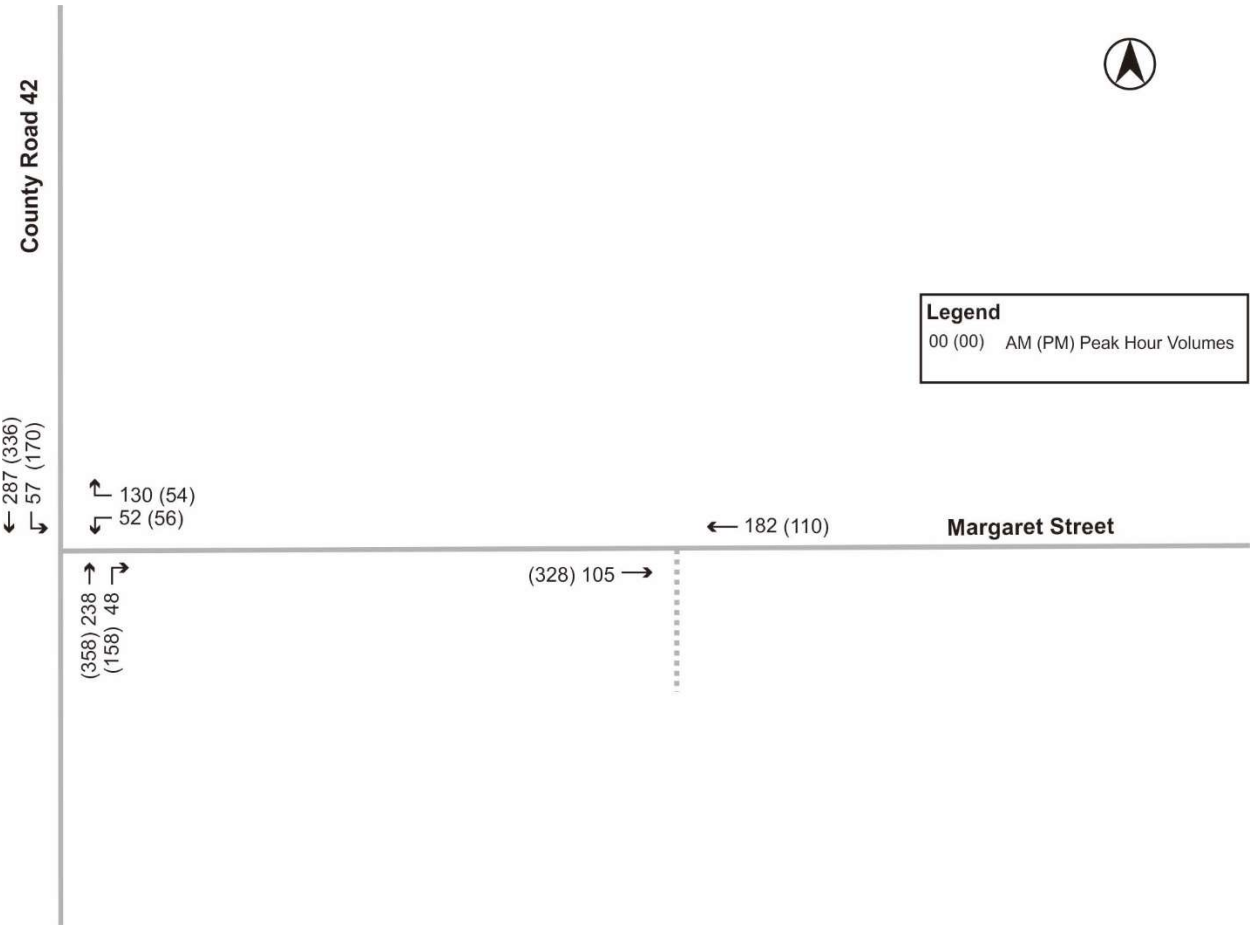
The following planning horizons were selected in accordance to the County of Simcoe and Township of Clearview requirements:

- *Year 2018– represents the existing conditions;*
- *Year 2028 – represents the full build-out of the proposed development; and,*
- *Year 2038 – represents 10 years after full build-out of the proposed development.*

3.2.3 Corridor Growth

The annual growth rate on County Road 42 is 2.5% per year, as adopted from the Village Green Traffic Study. Future background traffic volumes are illustrated in **Error! Reference source not found.**⁵ for the planning horizon 2028.

Figure 5 2028 Future Background Traffic Volumes



3.3 Site Traffic Projection

3.3.1 Trip Generation

The projection of new additional traffic volumes generated by the development proposal is estimated based on the *Trip Generation Manual, 10th Edition*, published by the Institute of Transportation Engineers (ITE) for “LUC 220: Multifamily Housing (Low-Rise)” & “LUC 221: Multifamily Housing (Mid-Rise)”. For a conservative analysis, no reductions were applied.

Table 1 summarizes the total site trip generation for the proposed development.

Table 1 Site Trip Generation

Land Use		Weekday AM Peak Hour			Weekday PM Peak Hour		
		In	Out	Total	In	Out	Total
Condo Townhouse / Semi-Detached Units (69 units)	Rates	0.11	0.37	0.49	0.39	0.23	0.62
	Trips	8	26	34	27	16	43
Condominium Apartment (36 units)	Rates	0.05	0.13	0.18	0.15	0.09	0.24
	Trips	3	9	13	10	6	16
TOTAL TRIPS		11	35	46	37	22	59

Based on the foregoing, the development proposal is anticipated to generate 46 two-way trips during the weekday morning peak hour and 59 two-way trips during the afternoon peak hour.

The current application is much smaller than the previous application submitted in 2010, which generated a total of 194 two-way trips in the weekday afternoon and 524 two-way trips during the Sunday peak hour.

3.3.2 Trip Distribution

The assumed trip distribution rates are based on the assumptions used in the Village Green Traffic Study.

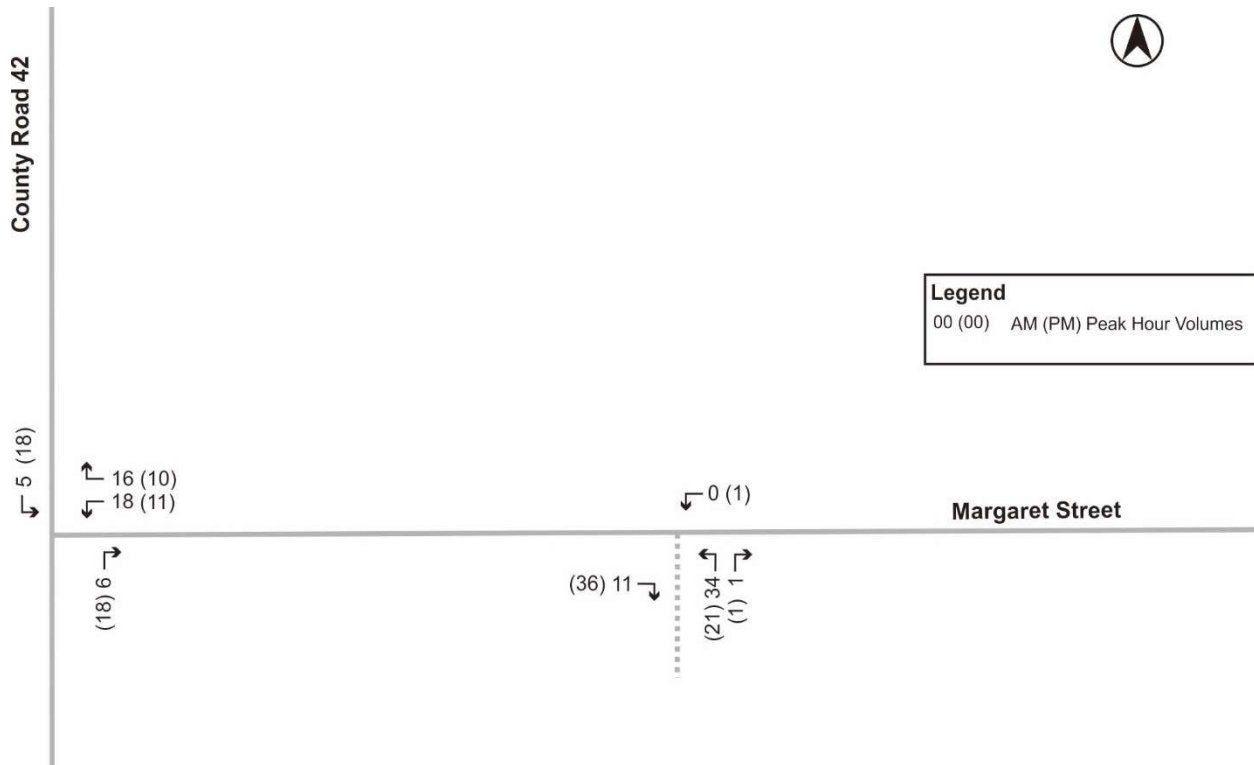
Table 2 summaries the applied trip distribution pattern.

Table 2 Site Trip Distribution

Direction	Via	Weekday AM Peak Hour	Weekday PM Peak Hour
		In / Out	
North	County Road 42	47%	47%
South	County Road 42	49%	49%
East	Margaret Street	4%	4%
Total		100%	100%

New site traffic volumes are illustrated in Figure 6.

Figure 6 Site Traffic Volumes



3.4 Future Total Traffic Volumes

Future total traffic volumes were established by adding site generated traffic to the future background traffic, and they are illustrated in **Error! Reference source not found.** and **Error! Reference source not found.**8 for planning horizon 2028 and 2038, respectively.

4.0 OPERATION ANALYSIS

Analysis Methodology:

Intersection capacity analyses contained in this study were undertaken using the Synchro software, which is based on the methodologies and procedures outlined in the Highway Capacity Manual (HCM) 2000 published by the Transportation Research Board.

Analysis Summary:

The analysis results are summarized in Table 3. Detailed Synchro calculations are provided in Appendix C.

Figure 7 2028 Future Total Traffic Volumes

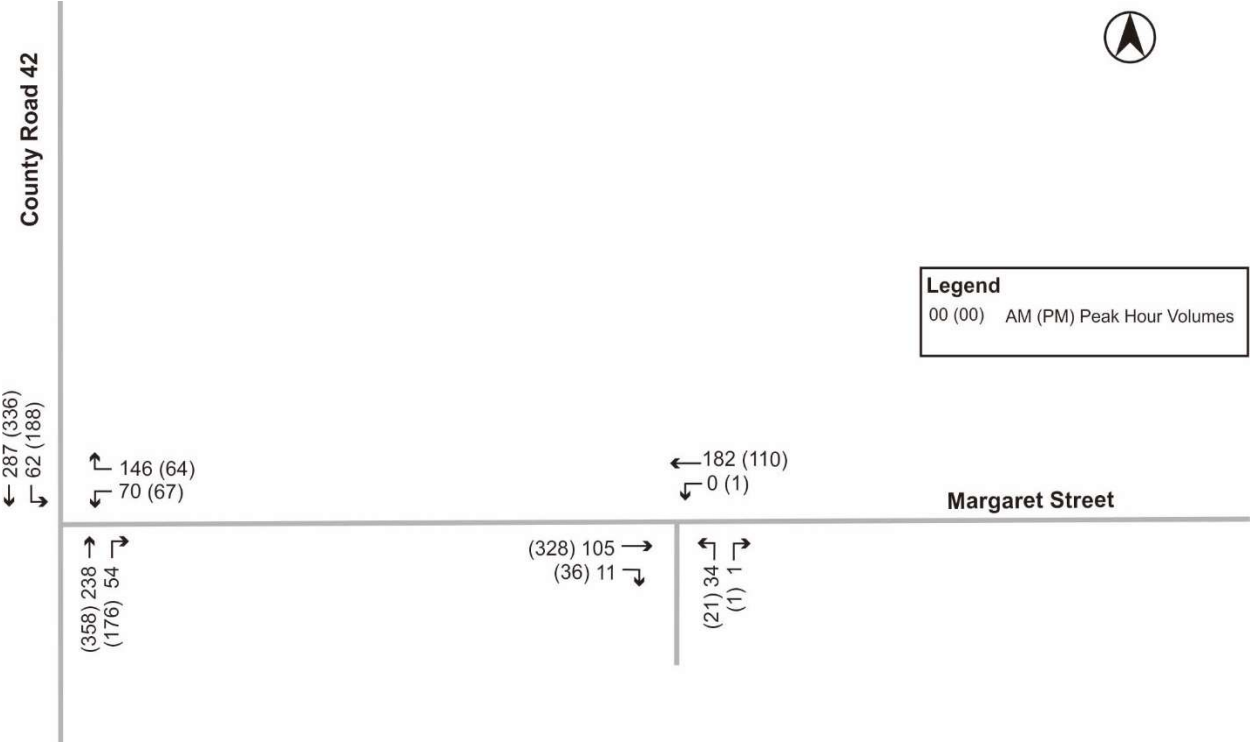


Figure 8 2038 Future Total Traffic Volumes

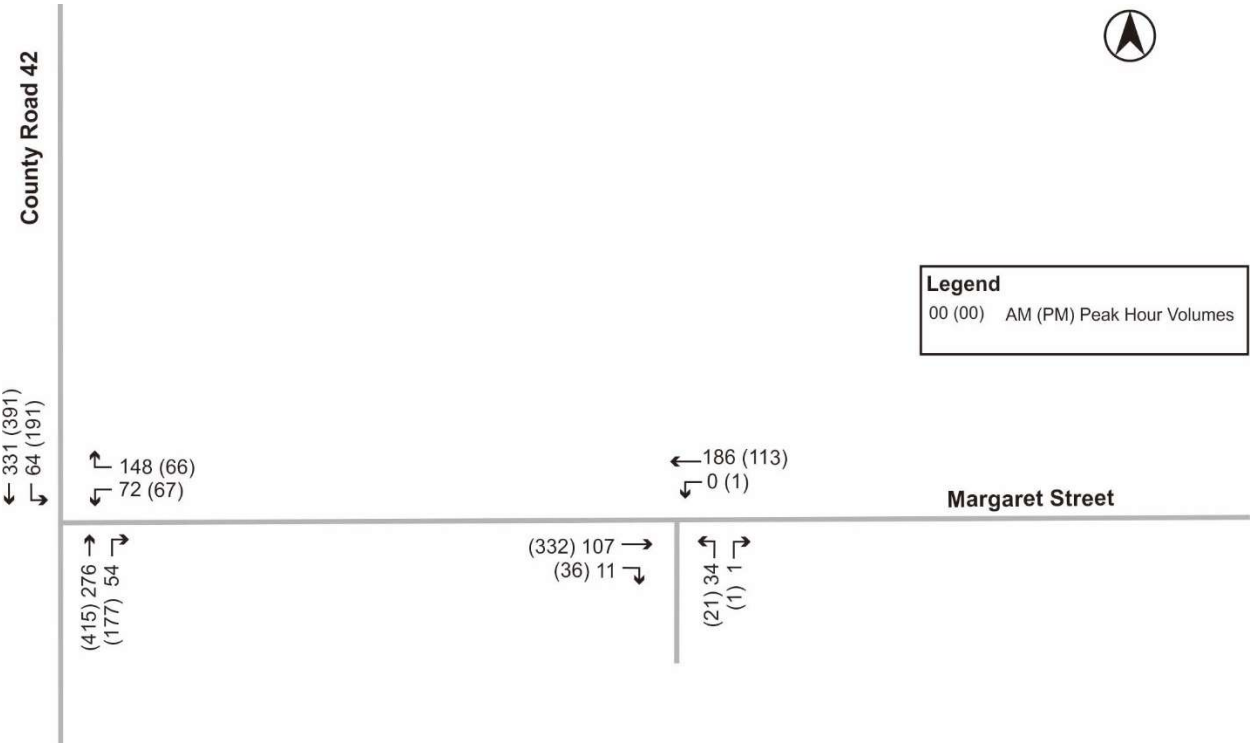


Table 3 Intersection Analysis Summary

Intersection	Movement	Existing				2028 Future Background				2028 Future Total				2038 Future Total			
		LOS	v/c	Delays	Queue	LOS	v/c	Delays	Queue	LOS	v/c	Delays	Queue	LOS	v/c	Delays	Queue
WEEKDAY AM																	
County Road 42 / Margaret Street	WBLR	B	0.02	10.2	0.6	B	0.34	14.3	11.9	C	0.42	16	16.5	C	0.47	18.2	19.8
(unsignalized)	SBLT	A	0.01	0.3	0.1	A	0.05	1.7	1.3	A	0.05	1.9	1.4	A	0.06	1.8	1.5
Margaret Street / Proposed Site Access (unsignalized)	NBLR	N/A								B	0.06	10.6	1.4	B	0.06	10.7	1.4
WEEKDAY PM																	
County Road 42 / Margaret Street	WBLR	B	0.02	10.1	0.4	D	0.47	31	18.6	E	0.61	41.4	28.3	F	0.73	60.2	37.7
(unsignalized)	SBLT	A	0.01	0.5	0.3	A	0.18	4.6	5.3	A	0.21	5.0	6.2	A	0.22	5.2	6.7
Margaret Street / Proposed Site Access (unsignalized)	NBLR	N/A								B	0.04	12	1.1	B	0.05	12.1	1.1

Under all analysis scenarios, the study intersections are operating with acceptable delays (LOS 'E' or better) and sufficient capacity (below v/c ratio of 1.00 or better), except for the westbound left turn movement in the weekday PM peak hour period, for the intersection of County Road 42 and Margaret Street.

Under the 2038 future total PM scenario, there are 67 westbound left turning vehicles and the conflicting movements are the northbound and southbound movements at the intersection, which has 592 vehicles in the northbound direction and 582 vehicles in the southbound direction. The critical WBL turning movement fails on delay as the above table indicates that the delay is 60.2 seconds while the volume capacity ratio is still under 1.00.

Since there are only 67 left turning volumes (equivalent to 1 vehicle per minute), it is not expected that this intersection will meet the signal warrant requirement. It is suggested that the intersection be monitored after year 2038 and if more developments occur by 2038 and the increased volumes warrants a signal then it can be installed at the decision of the Municipality.

5.0 SIGNAL WARRANT REVIEW

As an examination, a one-hour signal warrant assessment was undertaken to determine if the warrant has been met for the County Road 42 and Margaret Street intersection to be signalized.

The assessment uses calculations contained in Ontario Traffic Manual (OTM) Book 12, Justification 7. The result of the signal warrant indicates that the subject intersection does not need a signal under the 2038 future total scenario. Warrant 1 is met at 52% while warrant 2 is met at only 20%. In order for the signal to be warranted, either warrant 1 or 2 needs to be met at 100% or both warrants should be met at 80%.

The one-hour signal warrant is attached in Appendix D.

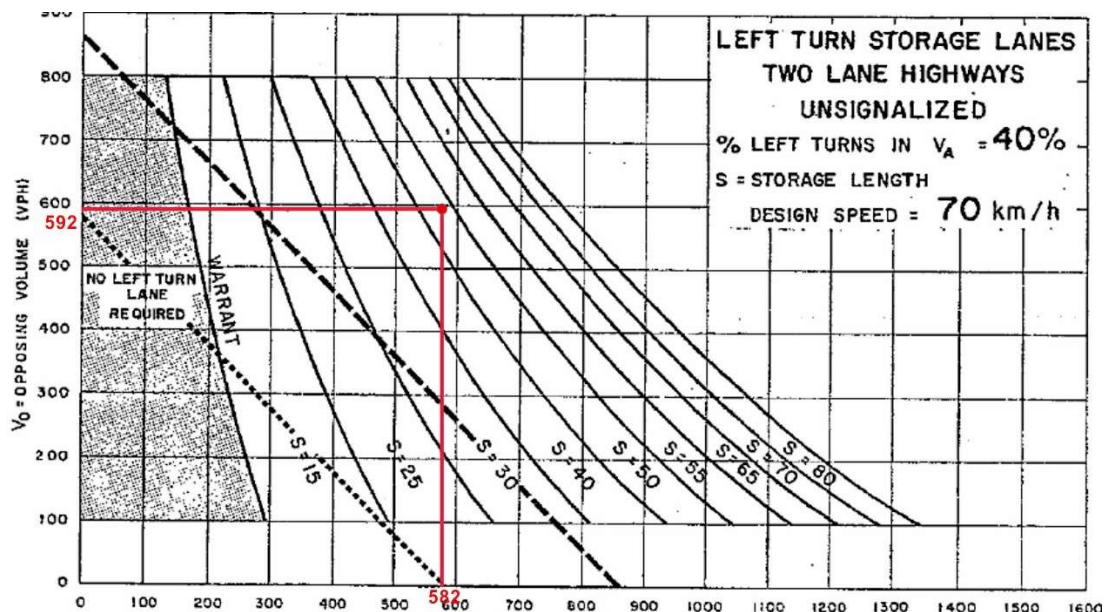
6.0 INTERSECTION IMPROVEMENTS

6.1 Southbound Left Turn Lane

Based on the MTO's left turn lane requirement, the southbound left turn is warranted with 40-meter storage length. The 2038 future total traffic weekday PM volumes were used because it is the highest combined volumes. The southbound left turn has 191 vehicles, and the southbound through volume has 391 vehicles. In the opposite direction, the combined northbound volume has 592 vehicles.

The design speed of 70 km/hour is used because the section of County Road, north of Margaret Street has a posted speed limit of 50 km/hour. Figure 9 illustrates the left turn lane nomograph analysis.

Figure 9 MTO Left Turn Warrant



6.2 Northbound Right Turn Lane

MTO guidelines for right turn lane requirement indicates that right turn lanes should be considered if the turning volumes exceed 60 vehicles per hour and have the potential to interfere with through traffic.

During the 2038 future total PM scenario, the northbound right turn volume is 177 vehicles and the westbound right turn volume is 66 vehicles. It is our opinion that a short northbound right turn lane is to be provided, for better operations of the intersection. The westbound right turn lane isn't as critical as it only borderlines the MTO criteria, and the westbound through movement volume is fairly low. We analyzed the 2038 future total PM volumes in Synchro, with an additional southbound left turn and northbound right turn lane and the result is shown in Table 4.

Table 4 Intersection Analysis Summary – Improved Lane Configuration

Intersection	Movement	2038 Future Total			
		LOS	v/c	Delays	Queue
County Road 42 / Margaret Street (unsignalized)	WBLR	E	0.64	45.1	30.7
	SBLT	A	0.22	9.9	6.7

Based on the above table result, it is found that the intersection operates acceptably with the additional SBL and NBR turn lane.

7.0 CONCLUSIONS

The key findings are summarized below:

- The subject lands will have 67-unit condo townhomes, 2-unit semi-detached houses, 36-unit condo apartments, and one amenity building.
- ITE Trip Generation Handbook 10th Edition is used for the trip generation calculations. Land use code 220 Low-Rise Multi-family housing and land use code 221 Mid-Rise Multi-family are used.
- The subject site will generate 46 two-way trips during the weekday morning peak hour and 59 two-way trips during the afternoon peak hour.
- Based on the site plan provided, there will be a temporary full movement access via Margaret Street before the road network for the adjacent Village Green Lands are constructed.
- Additional site accesses are provided via internal roadway connections to the adjacent subdivision.
- Three analysis time horizons are selected: 1) 2018 Existing conditions, 2) Year 2028 full build out scenario and 3) Year 2038 post build out scenario.
- Three background developments are considered in this study: 1) Village Green Subdivision, 2) Ridgeview Subdivision and 3) Aspen Ridge Subdivision

- All intersection movements operate at excellent levels of service, except for westbound left-right movement at County Road 42 / Margaret Street, during 2038 future total weekday PM scenario. The movement operates at acceptable volume capacity ratio but fails on delay, due to the higher north-south through volumes along County Road 42.
- Signal warrant assessment indicates that a signal warrant is not met at the County Road 42 and Margaret Street intersection for the 2038 horizon year.
- The T-intersection should continue to operate at stop controlled on minor approach, however a southbound left turn and northbound right lane should be introduced in order to improve the overall operations of the intersection.

Appendix A: Existing Traffic Volumes

Ontario Traffic Inc.

Morning Peak Diagram

Specified Period

From: 7:00:00

To: 9:00:00

One Hour Peak

From: 8:00:00

To: 9:00:00

Municipality: Clearview

Site #: 1834100001

Intersection: Hwy 42 & Margaret St

TFR File #: 1

Count date: 9-Oct-18

Weather conditions:

Person(s) who counted:

**** Non-Signalized Intersection ****

Major Road: Hwy 42 runs N/S

North Leg Total: 389

North Entering: 208

North Peds: 0

Peds Cross: \nlessgtr

Cyclists	0	0	0
Trucks	11	1	12
Cars	190	6	196
Totals	201	7	



Cyclists	0
Trucks	21
Cars	160
Totals	181

East Leg Total: 23

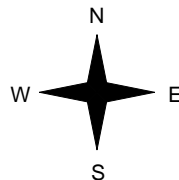
East Entering: 16

East Peds: 4

Peds Cross: \nlessgtr



Hwy 42



Cars	Trucks	Cyclists	Totals
7	2	0	9



Cars	Trucks	Cyclists	Totals
7	0	0	7
14	2	0	

Margaret St



Hwy 42



Cars	197
Trucks	11
Cyclists	0
Totals	208



Cars	153	0	153
Trucks	19	0	19
Cyclists	0	0	0
Totals	172	0	

Cars	Trucks	Cyclists	Totals
6	1	0	7

Peds Cross: \nlessgtr

South Peds: 0

South Entering: 172

South Leg Total: 380

Comments

Ontario Traffic Inc.

Afternoon Peak Diagram

Specified Period

From: 16:00:00

To: 18:00:00

One Hour Peak

From: 16:15:00

To: 17:15:00

Municipality: Clearview

Site #: 1834100001

Intersection: Hwy 42 & Margaret St

TFR File #: 1

Count date: 9-Oct-18

Weather conditions:

Person(s) who counted:

**** Non-Signalized Intersection ****

Major Road: Hwy 42 runs N/S

North Leg Total: 536

North Entering: 266

North Peds: 2

Peds Cross: \bowtie

Cyclists	0	0	0
Trucks	11	0	11
Cars	242	13	255
Totals	253	13	



Cyclists	0
Trucks	17
Cars	253
Totals	270

East Leg Total: 28

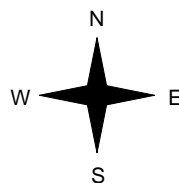
East Entering: 12

East Peds: 0

Peds Cross: \bowtie



Hwy 42



Cars	Trucks	Cyclists	Totals
11	0	0	11
1	0	0	1
12	0	0	



Margaret St



Cars	Trucks	Cyclists	Totals
16	0	0	16

Hwy 42



Cars	243
Trucks	11
Cyclists	0
Totals	254



Cars	242	3	245
Trucks	17	0	17
Cyclists	0	0	0
Totals	259	3	

Peds Cross: \bowtie

South Peds: 0

South Entering: 262

South Leg Total: 516

Comments

Ontario Traffic Inc.

Total Count Diagram

Municipality: Clearview
Site #: 1834100001
Intersection: Hwy 42 & Margaret St
TFR File #: 1
Count date: 9-Oct-18

Weather conditions:
Person(s) who counted:

**** Non-Signalized Intersection ****

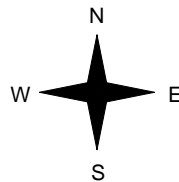
Major Road: Hwy 42 runs N/S

North Leg Total: 1677
 North Entering: 865
 North Peds: 2
 Peds Cross: \bowtie

Cyclists	0	0	0
Trucks	49	1	50
Cars	776	39	815
Totals	825	40	

Cyclists	0
Trucks	62
Cars	750
Totals	812

East Leg Total: 101
 East Entering: 53
 East Peds: 4
 Peds Cross: \bowtie



Cars	Trucks	Cyclists	Totals
41	2	0	43
10	0	0	10
51	2	0	

Margaret St



Hwy 42

Cars	786
Trucks	49
Cyclists	0
Totals	835

Cars	709	8	717
Trucks	60	0	60
Cyclists	0	0	0
Totals	769	8	

Cars	Trucks	Cyclists	Totals
47	1	0	48

Peds Cross: \bowtie
 South Peds: 1
 South Entering: 777
 South Leg Total: 1612

Comments

Ontario Traffic Inc.

Traffic Count Summary

Intersection: Hwy 42 & Margaret St

Count Date: 9-Oct-18

Municipality: Clearview

North Approach Totals						North/South Total Approaches	South Approach Totals					
Hour Ending	Includes Cars, Trucks, & Cyclists				Total Peds		Hour Ending	Includes Cars, Trucks, & Cyclists				Total Peds
	Left	Thru	Right	Grand Total				Left	Thru	Right	Grand Total	
7:00:00	0	0	0	0	0	0	7:00:00	0	0	0	0	0
8:00:00	3	188	0	191	0	329	8:00:00	0	137	1	138	1
9:00:00	7	201	0	208	0	380	9:00:00	0	172	0	172	0
16:00:00	0	4	0	4	0	4	16:00:00	0	0	0	0	0
17:00:00	14	244	0	258	2	520	17:00:00	0	259	3	262	0
18:00:00	16	188	0	204	0	409	18:00:00	0	201	4	205	0

Calculated Values for Traffic Crossing Major Street

Hours Ending:	7:00	8:00	9:00	16:00	17:00	17:00	18:00	18:00
Crossing Values:	0	3	7	0	3	3	0	0

[illegible]

Count Date: 9-Oct-18 **Site #:** 1834100001

[illegible]

[illegible]

Count Date: 9-Oct-18 Site #: 1834100001

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Ontario Traffic Inc.

Count Date: 9-Oct-18	Site #: 1834100001
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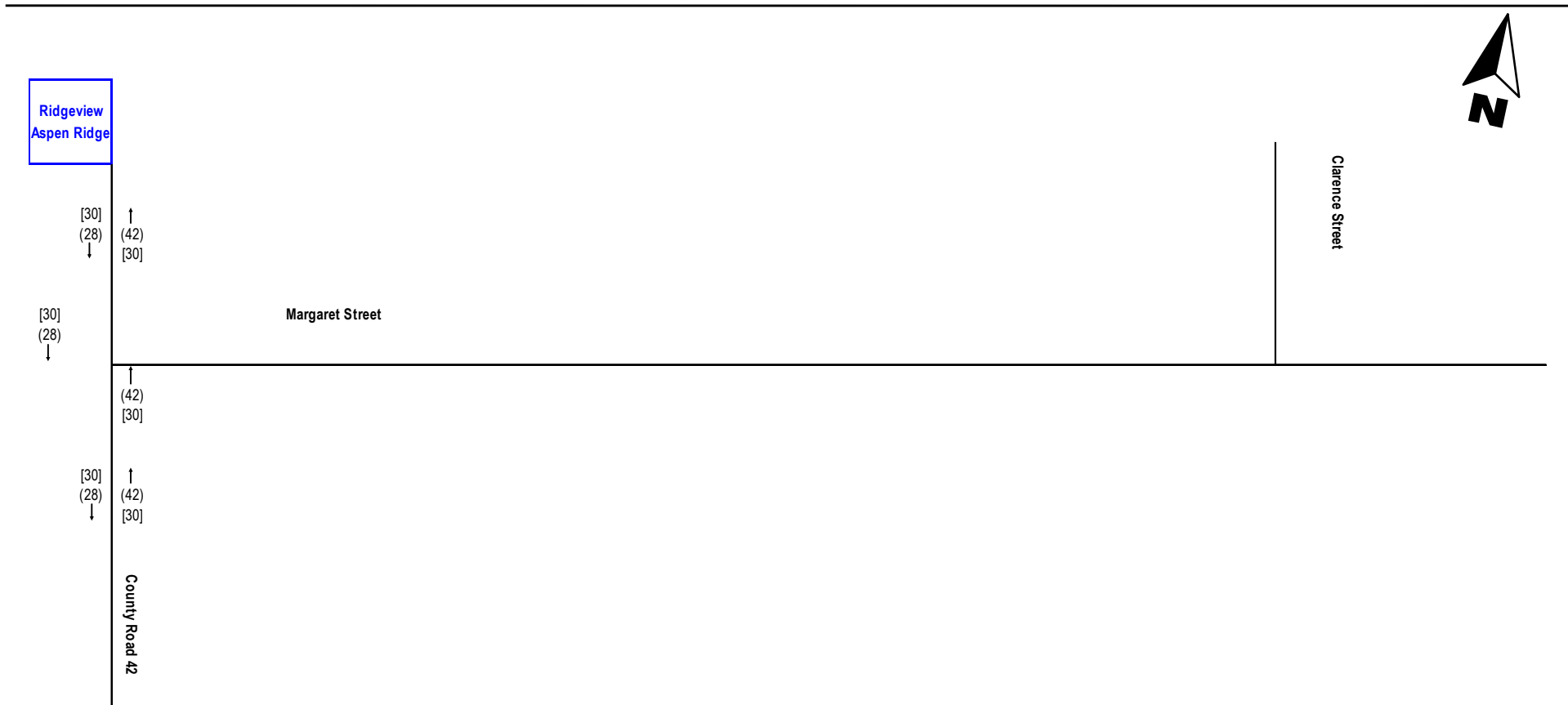
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Count Date: 9-Oct-18 **Site #:** 1834100001

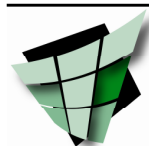
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Appendix B

Background Developments Information



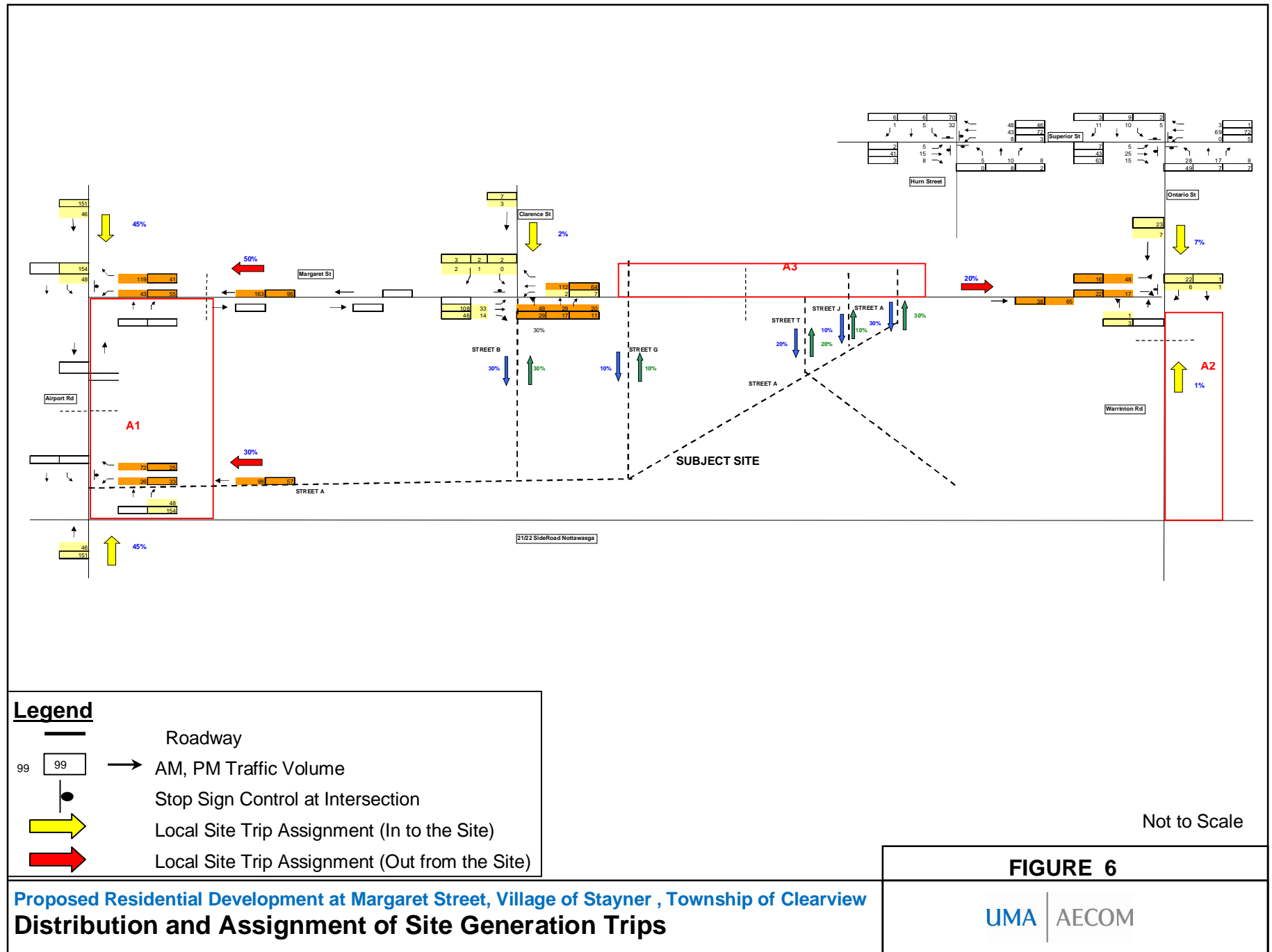
(100) Weekday PM peak hour
[100] Sunday peak hour



C.C. Tatham & Associates Ltd.
Consulting Engineers

Clearview Community Church Ridgeview and Aspen Ridge (2015) Traffic Volumes

**Figure
10**



Appendix C










Synchro Analysis Outputs

- Existing 2018
- Future Background 2028
 - Future Total 2028
 - Future Total 2038

HCM Unsignalized Intersection Capacity Analysis

3: County Road 42 & Margaret Street










EXISTING AM
2019-02-15

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	7	9	172	0	7	201
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	10	187	0	8	218
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	421	187			187	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	421	187			187	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			99	
cM capacity (veh/h)	586	855			1387	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	17	187	226			
Volume Left	8	0	8			
Volume Right	10	0	0			
cSH	712	1700	1387			
Volume to Capacity	0.02	0.11	0.01			
Queue Length 95th (m)	0.6	0.0	0.1			
Control Delay (s)	10.2	0.0	0.3			
Lane LOS	B		A			
Approach Delay (s)	10.2	0.0	0.3			
Approach LOS	B					
Intersection Summary						
Average Delay		0.6				
Intersection Capacity Utilization		26.2%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

3: County Road 42 & Margaret Street










EXISTING PM
2019-02-15

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	1	11	259	3	13	253
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	12	282	3	14	275
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	586	283			285	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	586	283			285	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	98			99	
cM capacity (veh/h)	467	756			1277	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	13	285	289			
Volume Left	1	0	14			
Volume Right	12	3	0			
cSH	719	1700	1277			
Volume to Capacity	0.02	0.17	0.01			
Queue Length 95th (m)	0.4	0.0	0.3			
Control Delay (s)	10.1	0.0	0.5			
Lane LOS	B		A			
Approach Delay (s)	10.1	0.0	0.5			
Approach LOS	B					
Intersection Summary						
Average Delay		0.5				
Intersection Capacity Utilization		33.9%	ICU Level of Service	A		
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

3: County Road 42 & Margaret Street

2028 Future Background AM
2019-02-15










						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	52	130	238	48	57	287
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	57	141	259	52	62	312
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	721	285			311	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	721	285			311	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	85	81			95	
cM capacity (veh/h)	375	754			1250	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	198	311	374			
Volume Left	57	0	62			
Volume Right	141	52	0			
cSH	585	1700	1250			
Volume to Capacity	0.34	0.18	0.05			
Queue Length 95th (m)	11.9	0.0	1.3			
Control Delay (s)	14.3	0.0	1.7			
Lane LOS	B		A			
Approach Delay (s)	14.3	0.0	1.7			
Approach LOS	B					
Intersection Summary						
Average Delay		3.9				
Intersection Capacity Utilization		54.6%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

3: County Road 42 & Margaret Street

2028 Future Background PM










2019-02-15

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	56	54	358	158	170	336
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	61	59	389	172	185	365
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1210	475			561	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1210	475			561	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	63	90			82	
cM capacity (veh/h)	165	590			1010	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	120	561	550			
Volume Left	61	0	185			
Volume Right	59	172	0			
cSH	255	1700	1010			
Volume to Capacity	0.47	0.33	0.18			
Queue Length 95th (m)	18.6	0.0	5.3			
Control Delay (s)	31.0	0.0	4.6			
Lane LOS	D		A			
Approach Delay (s)	31.0	0.0	4.6			
Approach LOS	D					
Intersection Summary						
Average Delay		5.1				
Intersection Capacity Utilization		72.0%		ICU Level of Service		C
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

1: Site Access & Margaret Street










2028 Future Total AM
2019-02-15

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	105	11	0	182	34	1
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	114	12	0	198	37	1
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			126		318	120
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			126		318	120
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		95	100
cM capacity (veh/h)			1460		675	931
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	126	198	38			
Volume Left	0	0	37			
Volume Right	12	0	1			
cSH	1700	1460	681			
Volume to Capacity	0.07	0.00	0.06			
Queue Length 95th (m)	0.0	0.0	1.4			
Control Delay (s)	0.0	0.0	10.6			
Lane LOS			B			
Approach Delay (s)	0.0	0.0	10.6			
Approach LOS			B			
Intersection Summary						
Average Delay			1.1			
Intersection Capacity Utilization			19.6%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

3: County Road 42 & Margaret Street










2028 Future Total AM
2019-02-15

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	146	238	54	62	287
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	159	259	59	67	312
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	735	288			317	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	735	288			317	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	79	79			95	
cM capacity (veh/h)	366	751			1243	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	235	317	379			
Volume Left	76	0	67			
Volume Right	159	59	0			
cSH	560	1700	1243			
Volume to Capacity	0.42	0.19	0.05			
Queue Length 95th (m)	16.5	0.0	1.4			
Control Delay (s)	16.0	0.0	1.9			
Lane LOS	C		A			
Approach Delay (s)	16.0	0.0	1.9			
Approach LOS	C					
Intersection Summary						
Average Delay		4.8				
Intersection Capacity Utilization		57.2%		ICU Level of Service	B	
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

1: Site Access & Margaret Street










2028 Future Total PM
2019-02-15

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	328	36	1	110	21	1
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	357	39	1	120	23	1
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			396		498	376
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			396		498	376
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		96	100
cM capacity (veh/h)			1163		531	670
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	396	121	24			
Volume Left	0	1	23			
Volume Right	39	0	1			
cSH	1700	1163	536			
Volume to Capacity	0.23	0.00	0.04			
Queue Length 95th (m)	0.0	0.0	1.1			
Control Delay (s)	0.0	0.1	12.0			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.1	12.0			
Approach LOS			B			
Intersection Summary						
Average Delay			0.6			
Intersection Capacity Utilization			29.4%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

3: County Road 42 & Margaret Street










2028 Future Total PM
2019-02-15

									
Movement	WBL	WBR	NBT	NBR	SBL	SBT			
Lane Configurations									
Volume (veh/h)	67	64	358	176	188	336			
Sign Control	Stop		Free			Free			
Grade	0%		0%			0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92			
Hourly flow rate (vph)	73	70	389	191	204	365			
Pedestrians									
Lane Width (m)									
Walking Speed (m/s)									
Percent Blockage									
Right turn flare (veh)									
Median type			None			None			
Median storage veh									
Upstream signal (m)									
pX, platoon unblocked									
vC, conflicting volume	1259	485			580				
vC1, stage 1 conf vol									
vC2, stage 2 conf vol									
vCu, unblocked vol	1259	485			580				
tC, single (s)	6.4	6.2			4.1				
tC, 2 stage (s)									
tF (s)	3.5	3.3			2.2				
p0 queue free %	51	88			79				
cM capacity (veh/h)	150	582			994				
Direction, Lane #	WB 1	NB 1	SB 1						
Volume Total	142	580	570						
Volume Left	73	0	204						
Volume Right	70	191	0						
cSH	235	1700	994						
Volume to Capacity	0.61	0.34	0.21						
Queue Length 95th (m)	28.3	0.0	6.2						
Control Delay (s)	41.4	0.0	5.0						
Lane LOS	E		A						
Approach Delay (s)	41.4	0.0	5.0						
Approach LOS	E								
Intersection Summary									
Average Delay		6.8							
Intersection Capacity Utilization		75.3%	ICU Level of Service	D					
Analysis Period (min)		15							

HCM Unsignalized Intersection Capacity Analysis

1: Site Access & Margaret Street










2038 Future Total AM
2019-02-15

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	107	11	0	186	34	1
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	116	12	0	202	37	1
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			128		324	122
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			128		324	122
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		94	100
cM capacity (veh/h)			1458		669	929
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	128	202	38			
Volume Left	0	0	37			
Volume Right	12	0	1			
cSH	1700	1458	675			
Volume to Capacity	0.08	0.00	0.06			
Queue Length 95th (m)	0.0	0.0	1.4			
Control Delay (s)	0.0	0.0	10.7			
Lane LOS			B			
Approach Delay (s)	0.0	0.0	10.7			
Approach LOS			B			
Intersection Summary						
Average Delay			1.1			
Intersection Capacity Utilization			19.8%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

3: County Road 42 & Margaret Street










2038 Future Total AM
2019-02-15

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	72	148	276	54	64	331
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	78	161	300	59	70	360
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	828	329			359	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	828	329			359	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	76	77			94	
cM capacity (veh/h)	321	712			1200	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	239	359	429			
Volume Left	78	0	70			
Volume Right	161	59	0			
cSH	509	1700	1200			
Volume to Capacity	0.47	0.21	0.06			
Queue Length 95th (m)	19.8	0.0	1.5			
Control Delay (s)	18.2	0.0	1.8			
Lane LOS	C		A			
Approach Delay (s)	18.2	0.0	1.8			
Approach LOS	C					
Intersection Summary						
Average Delay		5.0				
Intersection Capacity Utilization		61.9%	ICU Level of Service	B		
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

1: Site Access & Margaret Street










2038 Future Total PM
2019-02-15

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	332	36	1	113	21	1
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	361	39	1	123	23	1
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			400		505	380
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			400		505	380
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		96	100
cM capacity (veh/h)			1159		526	667
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	400	124	24			
Volume Left	0	1	23			
Volume Right	39	0	1			
cSH	1700	1159	531			
Volume to Capacity	0.24	0.00	0.05			
Queue Length 95th (m)	0.0	0.0	1.1			
Control Delay (s)	0.0	0.1	12.1			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.1	12.1			
Approach LOS			B			
Intersection Summary						
Average Delay			0.5			
Intersection Capacity Utilization			29.7%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

3: County Road 42 & Margaret Street












2038 Future Total PM
2019-02-15

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	67	66	415	177	191	391
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	73	72	451	192	208	425
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1388	547			643	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1388	547			643	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	41	87			78	
cM capacity (veh/h)	123	537			941	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	145	643	633			
Volume Left	73	0	208			
Volume Right	72	192	0			
cSH	199	1700	941			
Volume to Capacity	0.73	0.38	0.22			
Queue Length 95th (m)	37.7	0.0	6.7			
Control Delay (s)	60.2	0.0	5.2			
Lane LOS	F		A			
Approach Delay (s)	60.2	0.0	5.2			
Approach LOS	F					
Intersection Summary						
Average Delay		8.4				
Intersection Capacity Utilization		81.5%	ICU Level of Service	D		
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis 2038 Future Total PM - SBL & NBR added

3: County Road 42 & Margaret Street

2019-02-15

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	67	66	415	177	191	391
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	73	72	451	192	208	425
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1291	451			643	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1291	451			643	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	48	88			78	
cM capacity (veh/h)	140	608			941	
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	145	451	192	208	425	
Volume Left	73	0	0	208	0	
Volume Right	72	0	192	0	0	
cSH	227	1700	1700	941	1700	
Volume to Capacity	0.64	0.27	0.11	0.22	0.25	
Queue Length 95th (m)	30.7	0.0	0.0	6.7	0.0	
Control Delay (s)	45.1	0.0	0.0	9.9	0.0	
Lane LOS	E			A		
Approach Delay (s)	45.1	0.0		3.2		
Approach LOS	E					
Intersection Summary						
Average Delay			6.0			
Intersection Capacity Utilization			50.2%		ICU Level of Service	A
Analysis Period (min)			15			

Appendix D

One Hour Signal Warrant

Signal Warrant Calculation

Major Street: County Road 42

Minor Street: Margaret Street

Comment 2038 Future Total Scenario

Number of Approaches: 1 ☐ 2 ☒

Tee Intersection Configuration: Yes ☒ No ☐

Flow Condition: Free Flow (Rural) ☐
Restricted Flow (Urban) ☒

VOLUME	AM	PM	AVH
1A - All	2,568	2,970	1,384
1B - Minor	220	133	88
2A - Major	725	1,174	475
2B - Cross	72	67	35

OVERALL WARRANT

150% Satisfied: Yes ☐ No ☒ Warrant for new intersection with forecast traffic
 120% Satisfied: Yes ☐ No ☒ Warrant for existing intersection with forecast traffic
 100% Satisfied: Yes ☐ No ☒ Warrant for existing intersection with existing traffic *
 COMBO 80% Satisfied: Yes ☐ No ☒ Warrant for existing intersection with existing traffic
 80% Satisfied: Yes ☐ No ☒

* Consider full underground provisions if 100% for forecast traff

WARRANT 1 - MINIMUM VEHICULAR VOLUME

APPROACH LANES	1	2 OR MORE	
FLOW CONDITION	FREE FLOW	REST. FLOW	AVERAGE HOUR PERIOD
ALL APPROACHES	480	720	1384
			154%
APPROACH LANES	1	2 OR MORE	
FLOW CONDITION	FREE FLOW	REST. FLOW	AVERAGE HOUR PERIOD
MINOR STREET APPROACHES	120	170	88
			52%

150% Satisfied: Yes ☐ No ☒
 120% Satisfied: Yes ☐ No ☒
 100% Satisfied: Yes ☐ No ☒
 80% Satisfied: Yes ☐ No ☒

WARRANT 2 - DELAY TO CROSS TRAFFIC

APPROACH LANES	1	2 OR MORE	
FLOW CONDITION	FREE FLOW	REST. FLOW	AVERAGE HOUR PERIOD
MAJOR STREET APPROACHES	480	720	475
			53%
APPROACH LANES	1	2 OR MORE	
FLOW CONDITION	FREE FLOW	REST. FLOW	AVERAGE HOUR PERIOD
TRAFFIC CROSSING MAJOR STREET	50	75	35
			20%

150% Satisfied: Yes ☐ No ☒
 120% Satisfied: Yes ☐ No ☒
 100% Satisfied: Yes ☐ No ☒
 80% Satisfied: Yes ☐ No ☒