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# **12148 Albion Vaughan Road Bolton, ON Traffic Impact & Parking Study**

Paradigm Transportation Solutions Limited

November 2020  
200185



# Project Summary



**Project Number**  
200185

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**Client**  
**Albion-Vaughan (12148) Inc.**  
27 Fenton Way  
Brampton ON L6P 0P4

**Client Contact**  
Mike Liburdi

**Consultant Project Team**  
Adrian Soo, P.Eng.  
Andrew Steinsky, P.Eng.

## 12148 Albion Vaughan Road Traffic Impact & Parking Study



Signing Licencee/Engineer, P.Eng.

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### 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](http://www.ptsl.com)

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# Executive Summary

## Content

This study has been prepared in support of a proposed residential development for a site located at the municipal address of 12148 Albion Vaughan Road in the community of Bolton, Town of Caledon, Peel Region.

The development as proposed consists of two townhouse blocks and two six-storey building towers. In total the overall development proposes a total of 250 residential dwelling units. A total of 453 parking spaces would be provided on-site to serve the development. Vehicular access would be provided via full-movement driveway connections with Albion Vaughan Road.

The study assesses the weekday AM and PM peak hour traffic impact of the proposed development, provides a review of the parking requirements, and a functional review of the proposed site plan.

## Conclusions

The conclusions of the study are as follows:

- ▶ Under base year conditions, all study area intersections operate at acceptable levels of service and within capacity.

The exception would be the Regional Road 50/Albion Vaughan Rd-Mayfield Rd intersection.

Under the AM peak hour, the overall intersection is reported to be approaching capacity (V/C ratio = 0.91). Additionally, the westbound left turn movement is reported to operate with a LOS F and a V/C ratio of 1.20 (over capacity).

The volume of traffic for this left turn movement exceeds 300 vehicles during the AM peak hour, which is the threshold where both the Highway Capacity Manual and the Transportation Association of Canada Geometric Design Guide for Canadian Roads recommend the consideration of dual left turn lanes.

- ▶ For the 2027 background traffic conditions (without subject development), all study area intersections are forecast to operate at acceptable levels of service and within capacity.

The exception would be the Regional Road 50/Albion Vaughan Rd-Mayfield Rd intersection.

The intersection was analyzed with a westbound dual left turn lane to mitigate the over-capacity condition determined under



base year conditions. Accounting for the intersection improvement, several critical movements were still identified. No further improvements were identified which would mitigate these issues.

- ▶ With the addition of the proposed residential development, the 2027 total traffic conditions (with subject development), all study area intersections are forecast to operate at acceptable levels of service and within capacity.

The exception would be the Regional Road 50/Albion Vaughan Rd-Mayfield Rd intersection, where the previously identified critical movements would continue to be reported, albeit slightly exacerbated.

- ▶ The overall impact of the proposed residential development is anticipated to be minimal. The development is estimated to generate and add a total of 86 and 111 vehicle trips to the adjacent transportation network during the AM and PM peak hours, respectively.

The additional traffic would be less than daily traffic variations typically experienced. It is determined the site generated traffic would increase volumes at the study area intersections between 0.40 – 2.04%.

In regard to the critical movements identified at Regional Road 50/Albion Vaughan Rd-Mayfield Rd. A potential quantum shift in travel demands and patterns may result due to the COVID-19 global pandemic. Employers are beginning to shift away from traditional office-based environments to work-from-home models and with commercial/retail and service-based businesses adapting by adjusting business hours and/or switching to web-based e-commerce storefronts, thus resulting in travel demands and patterns potentially changing from the previous norm.

In a post-COVID condition, it is plausible traffic volumes may never reach pre-COVID levels as a result of this quantum shift. With changes in travel demand, behaviour, and patterns post-COVID, the forecasts as analyzed are conservative (i.e., err on the high side) and potentially under post-COVID conditions, traffic volumes may be lower.

- ▶ At the central site access intersection with Albion Vaughan Road, it was determined an auxiliary northbound left turn lane would be warranted. It is noted that the auxiliary left turn lane is not required from an operational standpoint.



- ▶ The proposed parking supply exceeds the minimum zoning by-law requirements and is anticipated to adequately serve the residential development.
- ▶ A review of the site plan was undertaken. No conflicts or issues were identified for anticipated design vehicles expected on-site.

## Recommendations

The recommendations of the study are as follows:

- ▶ From a transportation perspective, the planning applications sought should be approved as the development is determined to have a minimal impact on the adjacent transportation network.
- ▶ The intersection volumes and operations at the Regional Road 50/Albion Vaughan Rd-Mayfield Rd intersection be monitored by the applicable jurisdiction to determine if and when dual westbound left turn lanes should be provided.
- ▶ A northbound auxiliary left turn lane should be provided at the central site access intersection on Albion Vaughan Road.



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# 1 Introduction

## 1.1 Overview

Paradigm Transportation Solutions Limited (Paradigm) was retained to conduct this Traffic Impact and Parking Study for a proposed residential development in the community of Bolton (Town of Caledon). **Figure 1.1** illustrates the location of the subject site located on the west side of Albion Vaughan Road, north of Regional Road 50.

## 1.2 Purpose and Scope

The purpose of this report is to identify and assess the potential traffic impacts of the proposed development. The scope of the study was developed in consultation with Town of Caledon staff via e-mail correspondence in October 2020. At the time of writing Peel Region staff had not responded to our request for pre-study consultation. **Appendix A** contains the terms of reference and pre-study consultation completed with Town staff.

The scope of this study is as follows:

- ▶ A study area comprising the following intersections:
  - Peel Regional Road 50 and Albion Vaughan Road-Mayfield Road;
  - Albion Vaughan Road and Kirby Road; and
  - Albion Vaughan Road and the proposed central site access driveway.
- ▶ Traffic forecasts for 2027, representing a five-year horizon following anticipated build-out/occupancy in 2022;
- ▶ Weekday AM and PM peak hour analysis time periods;
- ▶ A review of parking to confirm the proposed supply will be adequate for the proposed use; and
- ▶ Review of the design of the site accesses, internal circulation, and loading areas to confirm they will accommodate the vehicles expected on-site.

The methodology used in this study is summarized below:

- ▶ Estimate the future peak hour background traffic for the horizon year by applying a 2% per annum growth rate as advised by Town staff;
- ▶ Estimate the net increase in vehicular traffic with the proposed development;



- ▶ Combine the future background traffic with the net increase in site traffic to determine the total traffic volumes under the horizon year;
- ▶ Analyze existing, future background, and total traffic conditions;
- ▶ Determine the net impact on operational performance due to the site traffic, and the need for road and/or traffic control improvements to address the identified impacts; and
- ▶ Use of AutoTURN software to prepare on-site vehicle maneuvering diagrams.

This study has been carried out in general accordance with the Region's TIS Guidelines<sup>1</sup> and pre-study consultation comments received from Town staff. **Appendix A** contains the pre-study correspondence and comments.

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<sup>1</sup> Regional Municipality of Peel. *Traffic Impact Study Guidelines*. Accessed 9 November 2020 from <https://www.peelregion.ca/pw/transportation/business/traffic-impact-study.asp>





## Study Area and Site Location

## 2 Proposed Development

The subject site is located at the municipal address of 12148 Albion Vaughan Road. The subject lands are currently occupied by a detached single-family home which would be demolished to facilitate redevelopment of the lands.

**Figure 2.1** illustrates the site plan. The proposed residential development consists of two townhouse blocks and a six-storey building consisting of two towers. In total the overall development proposes a total of 250 residential dwelling units. The development statistics are as follows:

- ▶ Two six-storey residential building towers = 240 units total;
  - Tower A = 120 units; and
  - Tower B = 120 units.
- ▶ Two townhouse blocks = 10 units total;
  - Block 1 = 5 units; and
  - Block 2 = 5 units.

The entire development would be served by several at-grade parking spaces and a two-level underground parking structure. A total parking supply of 453 spaces serving residents and visitors are proposed on-site.

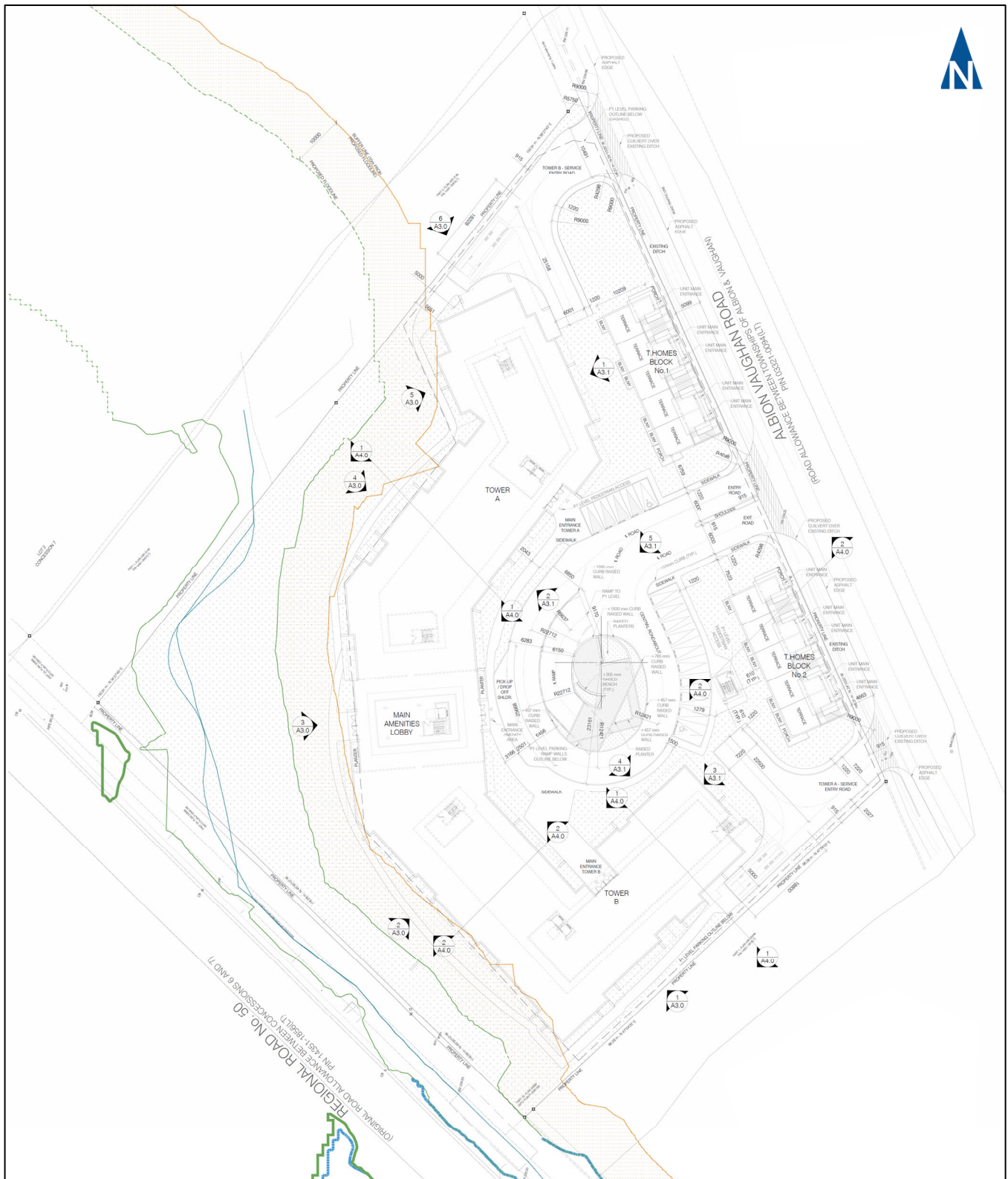
Long-term bicycle parking is proposed on-site, facilitated via secured storage rooms within the underground structure serving residents.

Three full-movement access driveways are proposed, with two of the three driveways providing dedicated access to the loading space serving each residential tower (i.e., service vehicles only). The main central vehicular access serving the development provides access for building residents and visitors.

It is anticipated full build-out and occupancy will occur by 2022.







## 3 Existing Conditions

### 3.1 Roads and Traffic Control

The characteristics of the roads and intersections in the vicinity of the subject site are described below. Reference is made to the Town of Caledon's Official Plan – Schedule J: Long Range Road Network. The main roadways that form the study area comprise Albion Vaughan Road-Mayfield Road, Regional Road 50, and Kirby Road. Each roadway is described as follows:

- ▶ **Albion Vaughan Road** is a north-south, two-lane, undivided roadway that operates under the jurisdiction of the Town of Caledon. The road is classified as a medium capacity arterial per the Town's Official Plan, additionally this roadway is identified as the Proposed Bolton Arterial Route (BAR). The roadway has a rural cross section, with gravel shoulders on both sides. The posted maximum speed limit is 60 km/h within the study area limits;
- ▶ **Mayfield Road (Peel Regional Road 14)** is an east-west, two-lane, undivided roadway that operates under the jurisdiction of the Regional Municipality of Peel. The road is classified as a major road under the Region's Official Plan and a high capacity arterial per the Town's Official Plan. The roadway has a semi-urban cross section. The posted maximum speed limit is 60 km/h within the study area limits;
- ▶ **Highway 50 (Peel Regional Road 50)** is a north-south four-lane undivided roadway that operates under the jurisdiction of the Regional Municipality of Peel. The road is classified as a major road under the Region's Official Plan and a high capacity arterial per the Town's Official Plan. The roadway has an urban cross section north of Albion Vaughan Road/Mayfield Road, and a semi-urban cross section south of Albion Vaughan Road/Mayfield Road. The posted maximum speed limit is 80 km/h within the study area limits;
- ▶ The intersection of Regional Road 50/Albion Vaughan Road-Mayfield Road is currently signalized with auxiliary left and right turn lanes are provided on each intersection approach; and
- ▶ The intersection of Albion Vaughan Road/Kirby Road forms an unsignalized "T" intersection. Stop control is provided on the westbound Kirby Road approach.

**Figure 3.1** illustrates the existing lane configurations and traffic control devices at the study area intersections.







### 3.2 Transit Services

The study area is currently served by limited transit routes/services.

Within the community of Bolton, the Town of Caledon has retained Voyago to provide local service (began November 11, 2019). The local transit line in Bolton includes 27 new bus stops along the route with service running during peak commute hours (Monday to Friday between 6:00 AM and 9:30 AM, and from 3:00 PM and 6:30 PM). Within the study area, local transit service operates along Regional Road 50.

GO Transit provides bus service to the Regional Road 50/Mayfield Road Park and Ride located on the southwest corner of the intersection of Regional Road 50/Albion Vaughan Road-Mayfield Road. The following routes are operated by GO Transit:

- ▶ **Route 38 (Bolton)** operates between Downtown Bolton, and the Malton GO Station. Service is provided Monday to Friday only, from 6:00 AM to 8:30 PM. Headways are approximately one hour during peak hour service, and two hours during off-peak hours.

### 3.3 Active Transportation

Sidewalk and separated bicycle infrastructure is not provided on Regional Road 50 or along Albion Vaughan Road. Pedestrians and cyclists are expected to utilize the gravel shoulder on either roadway or share the travelled roadways with vehicles.

A review of the Region of Peel's Active Transportation Plan did not identify any existing cycling or pedestrian facilities on the study area roadways. The Long-Term Regional Pedestrian Network (Caledon) proposes sidewalks on the west and east sides of Regional Road 50; however, no horizon year for their implementation is currently known.

The Proposed Long-Term Regional Cycling Network (Caledon) proposes bike lanes on Regional Road 50; however, no horizon year for their implementation is currently known as well. Further review of the Town of Caledon's "Explore Caledon" cycling map identified that no cycling facilities are provided on Albion Vaughan Road.

The walk phases incorporated into the signal timing plan for the Regional Road 50/Albion Vaughan Road-Mayfield Road intersection are push button actuated for pedestrians to cross Regional Road 50. The pedestrian phase is always provided for the both the northbound and southbound through phases. Pedestrian signal heads are provided for each approach crossing. The existing volume of crossing





pedestrians at this intersection during the weekday AM and PM peak hours was found to have zero pedestrian crossings.

### 3.4 Traffic Volumes

Turning movement counts (TMC) quantify the volume, and type of vehicles travelling through an intersection. The TMC data is typically collected during peak travel periods to capture peak traffic volumes and patterns.

Beginning in March 2020 the Province of Ontario implemented restrictions for day-to-day activities in response to the COVID-19 global pandemic. Restrictions included the closure of all school institutions under further notice, reduced gathering sizes which has results in limited operations at places of employment. At the time of writing, restrictions were in place to varying degree. As a result, typical travel volumes and travel patterns have been impacted and the collection of turning movement counts would not reflect typical volume conditions within the study area.

For the purposes of this report, Paradigm has referenced historical turning movement counts completed by Traffic Survey Analysis (TSA). TSA completed eight-hour turning movement counts at both intersections on Thursday November 24, 2016. These counts have been factored to a 2020 base year condition using a 2% compounded per annum growth rate per Town staff recommendation. The use of historical data and the growth rate signed-off on by Town staff during pre-study consultation.

The count at Regional Road 50 and Albion Vaughan Road/Mayfield Road was completed from 6:00 AM to 10:00 AM, and 2:00 PM to 6:00 PM. The count at Albion Vaughan Road and Kirby Road was completed from 6:00 to 9:00 AM, 11:30 AM to 1:30 PM, and from 3:00 AM to 6:00 PM. All traffic movements, including pedestrian crossings were counted in 15-minute intervals and vehicles were classified by type.

**Figure 3.2** illustrates the base year (2020) traffic volumes. **Appendix B** contains the raw count data for reference.

### 3.5 Traffic Observations

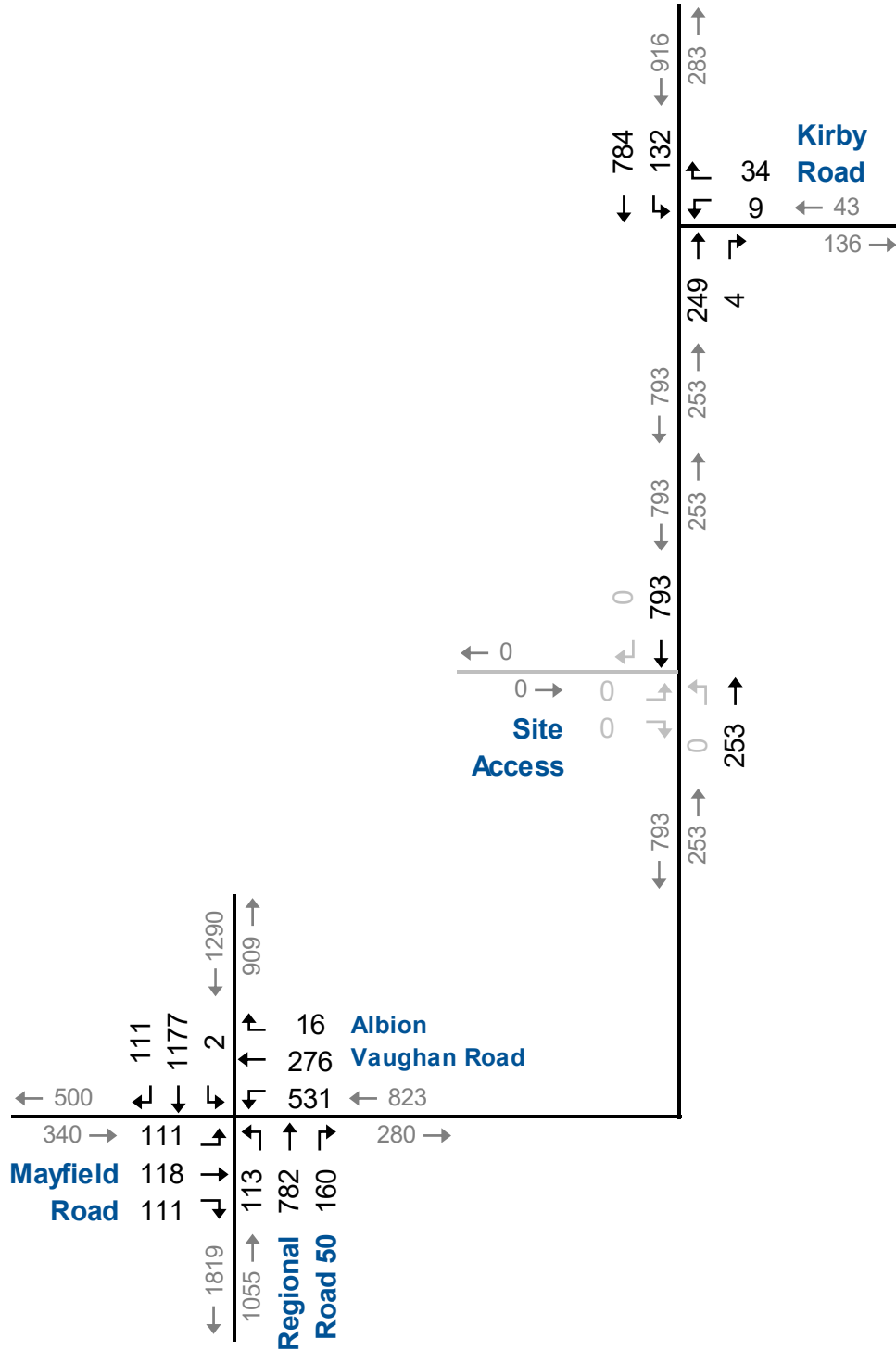
Based upon notes and observations conducted when the historical counts were collected in November 2016, it was noted that a good level of service was generally provided in the study area.

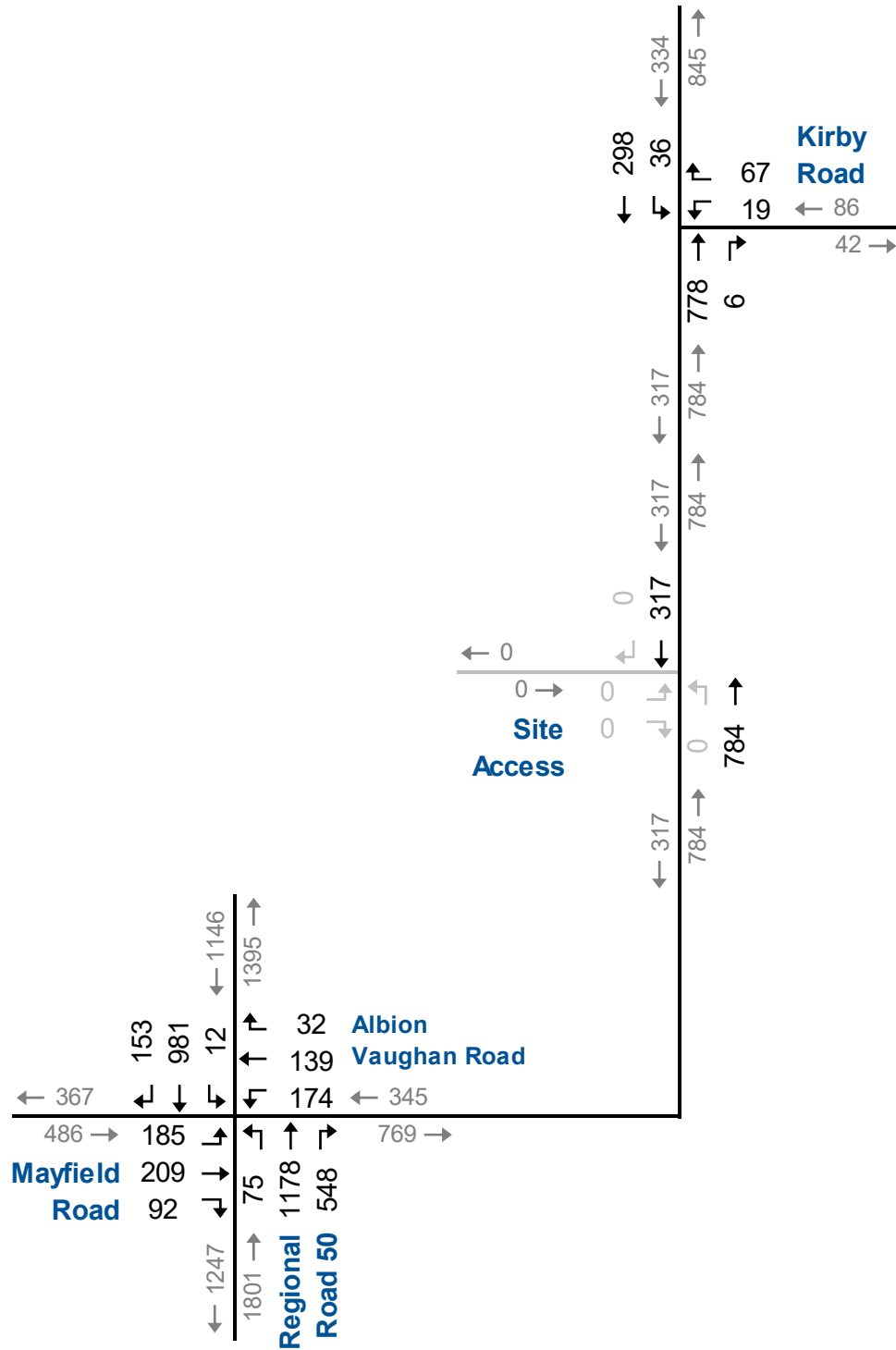


The exception being that the westbound left-turn movement on Albion Vaughan Road at Regional Road 50 was observed to experience a high level of delay in the AM peak hour.

This observation is further validated by the high volume of vehicles performing the movement. The raw unadjusted 2016 counts recorded 491 vehicles performing this movement exceeding 300 vehicles per hour during the AM peak hour, which is the threshold where both the Highway Capacity Manual and the Transportation Association of Canada Geometric Design Guide for Canadian Roads recommend the consideration of dual left turn lanes.







### 3.6 Traffic Operations

Intersection Level of Service (LOS) is a recognized method of quantifying the efficiency of traffic flow at intersections and is based on the delay experienced by individual vehicles executing the various movements. The delay is related to the number of vehicles desiring to make a movement, compared to the estimated capacity for that movement. The capacity is based on several criteria related to opposing traffic flows, and at signalized intersections, signal timing. Capacity is evaluated in terms of the ratio of demand flow to capacity with an at-capacity condition represented by a volume-to-capacity (V/C) ratio of 1.00 (i.e., volume demand equals capacity).

The highest possible rating is LOS A, under which the average total delay at signalized and unsignalized intersections is equal or less than 10 seconds per vehicle. When the average delay for a movement exceeds 80 seconds at signalized intersections, or 50 seconds at unsignalized intersections, the movement is classified as LOS F, and remedial measures are usually implemented, if they are feasible.

To adhere to the region of Peel guidelines for operational analysis, the following criteria have been used for the determination of the need for capacity or traffic control improvements to the study area intersections.

- ▶ When V/C ratios for overall intersection operations, through movements, or shared through/turning movements exceeds 0.90;
- ▶ When V/C ratios for dedicated turning movements exceeds 1.00; and/or
- ▶ When 95<sup>th</sup> percentile queue lengths for individual movements exceeds available lane storage.

To assess the base year traffic operating conditions, a level of service analysis has been conducted using Synchro software, which implements the methods of the Highway Capacity Manual (HCM). The following parameters have been utilized in the analysis:

- ▶ Existing lane configurations;
- ▶ Signal timing as provided by the Region (and included in **Appendix B** for reference);
- ▶ Heavy vehicles percentages and crossing pedestrian volumes as extracted from the turning movement counts;
- ▶ Lane widths as per the “Regional Guidelines for Using Synchro”
- ▶ Peak hour factors of 1.00 as per the “Regional Guidelines for Using Synchro”; and



- Synchro default values for all other inputs.

**Table 3.1** presents the operational analysis results including the level of service (LOS), average delay in seconds, volume to capacity (V/C) ratio, and 95<sup>th</sup> percentile queue length in metres. Any critical movements are highlighted in yellow.

**Appendix C** contains the Synchro analysis outputs for reference.

In summary, the base year operations represent acceptable levels of service. All traffic movements are currently found to operate acceptably and within capacity.

The exception would be at Regional Road 50/Albion Vaughan Road-Mayfield Road during the AM peak hour. The intersection overall is reports a V/C ratio of 0.91, in addition to the westbound left turn movement operating at a LOS F with a V/C ratio of 1.20.

Under existing conditions, no movement should be operating with a v/c greater than 1.00 since this would indicate the counted volume was unable to clear the intersection. This disparity is due the factoring of 2016 volumes to a 2020 condition, without modifying the signal timing plan to accommodate the increase in traffic volumes. The model has also not been calibrated to account for specific driver behaviours at the intersection, such as the number of vehicles clearing during the clearance intervals. The omission of these calibration elements likely underestimate the real capacity of the movement, and illustrates an overcapacity condition.

Aforementioned, the volume of traffic on the left turn movement exceeds 300 vehicles during the AM peak hour, which is the threshold where both the Highway Capacity Manual and the Transportation Association of Canada Geometric Design Guide for Canadian Roads recommend the consideration of dual left turn lanes.



**TABLE 3.1: BASE YEAR TRAFFIC OPERATIONS**

Intersection	Approach/ Movement		AM Peak Hour				PM Peak Hour			
			LOS <sup>1</sup>	Delay <sub>2</sub>	V/C <sup>3</sup>	Q <sup>4</sup>	LOS <sup>1</sup>	Delay <sub>2</sub>	V/C <sup>3</sup>	Q <sup>4</sup>
Regional Road 50/Albion Vaughan Rd- Mayfield Rd  <i>Signalized</i>	EB	Left	E	57	0.55	33	D	41	0.60	46
		Thru	E	64	0.58	47	D	49	0.66	61
		Right	D	55	0.10	16	D	39	0.08	12
	WB	Left	F	153	1.20	221	D	48	0.70	44
		Thru	D	51	0.64	90	D	44	0.47	43
		Right	D	40	0.01	< 1	D	38	0.02	< 1
	NB	Left	C	27	0.57	28	B	13	0.33	13
		Dual Thru	B	16	0.39	73	B	14	0.57	104
		Right	B	13	0.11	9	B	12	0.38	17
	SB	Left	C	21	0.01	2	B	15	0.07	5
		Dual Thru	C	35	0.76	181	C	20	0.56	109
		Right	C	21	0.08	11	B	15	0.10	11
	<i>Overall Intersection</i>		<i>D</i>	<i>50</i>	<i>0.91</i>	<i>-</i>	<i>C</i>	<i>22</i>	<i>0.62</i>	<i>-</i>
Albion Vaughan Rd/Kirby Rd <i>Unsignalized</i>	WB	Left/Right	C	18	0.13	3	C	21	0.27	8
	NB	Thru/Right	Unopposed Movement				Unopposed Movement			
	SB	Left/Thru	A	3	0.10	2	A	2	0.04	1

<sup>1</sup> Level of Service; <sup>2</sup> Average vehicle delay, seconds; <sup>3</sup> Volume to capacity ratio; <sup>4</sup> 95<sup>th</sup> percentile queue, metres



## 4 Future Traffic Conditions

### 4.1 Horizon Years

Consistent with the terms of reference established, traffic forecasts have been developed for a period five-years from year of build-out/occupancy. It is anticipated the residential development would be built and occupied by 2022; therefore a horizon year of 2027 will be analyzed.

### 4.2 Forecast Background Traffic

The future background traffic volumes in the study area are expected to comprise general background growth and specific traffic generated by approved or in-stream developments.

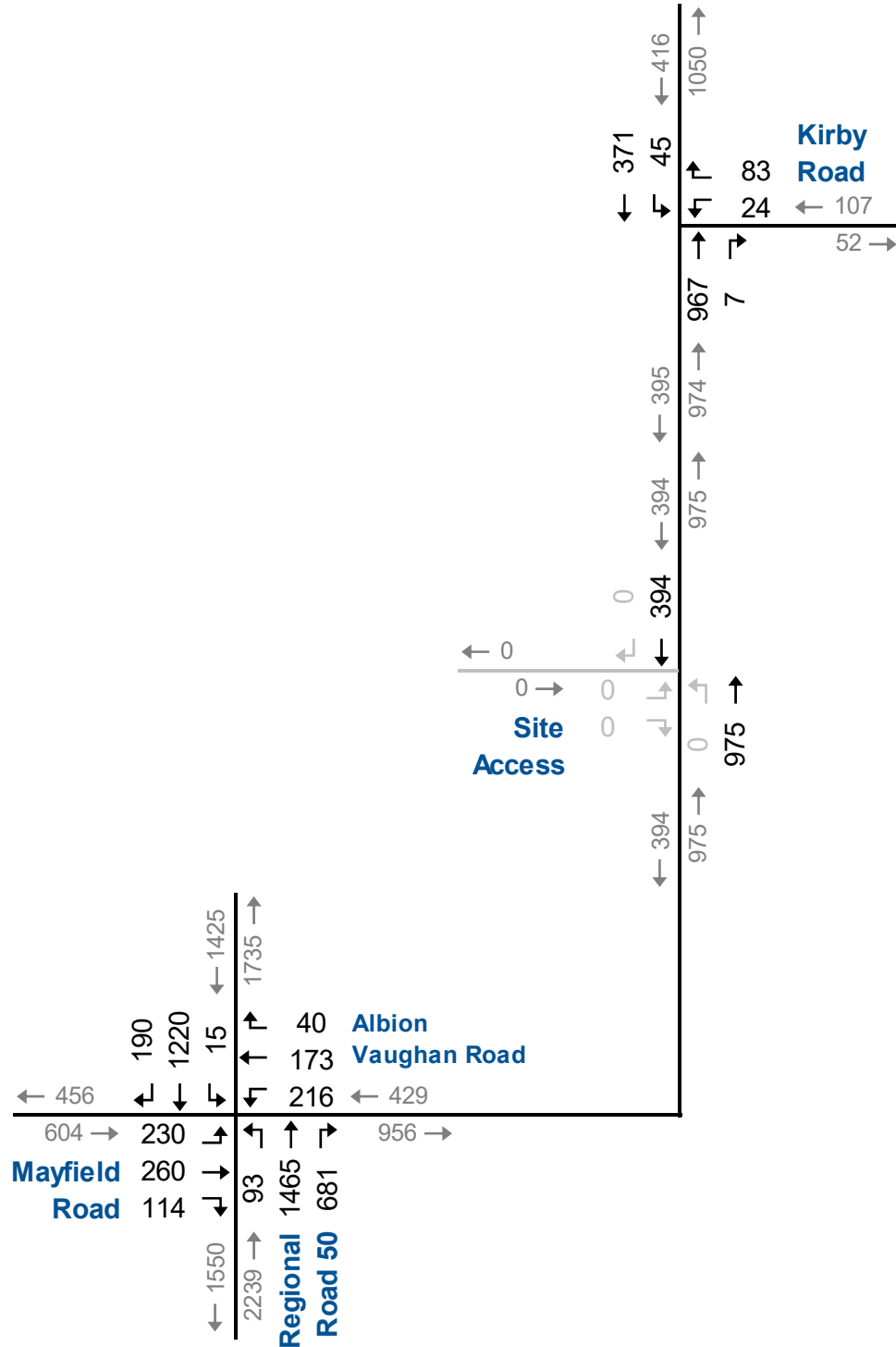
During pre-study consultation, Town staff advised the use of a 2% compounded per annum growth rate. This growth rate has been applied to all traffic movements. Town staff also confirmed there were no background developments to include as part of the traffic forecasts.

**Figure** illustrates the forecast background traffic volumes for the 2027 horizon year.









## 4.3 Site Trip Generation

### 4.3.1 Vehicle Trip Generation

The trip generation for the subject development has been estimated using information contained in Institute of Transportation Engineers (ITE) publication, “Trip Generation Manual, 10<sup>th</sup> Edition”. Land Use Code (LUC) 220 (Multifamily Housing (Low-Rise)) and LUC 221 (Multifamily Housing (Mid-Rise)) has been referenced. LUC 220 includes apartments, townhouses, and condominiums located within the same building with at least three other dwelling units and that have less than three levels (floors). LUC 221 includes the same characteristics, however, among buildings that have between three and ten levels (floors).

**Table** summarizes the trip generation estimates and indicates the site is forecast to generate a total of 111 new vehicle trips in the AM peak hour and 144 new vehicle trips in the PM peak hour.

No adjustments have been made to account for trips made by transit or alternative travel modes.

**TABLE 4.1: SITE TRIP GENERATION**

LUC	Units	AM Peak Hour				PM Peak Hour			
		Rate	In	Out	Total	Rate	In	Out	Total
220	10	Eqn. <sup>1</sup>	1	4	5	Eqn. <sup>2</sup>	5	3	8
221	240	Eqn. <sup>3</sup>	21	60	81	Eqn. <sup>4</sup>	63	40	103
<i>Total Trip Generation</i>			<i>22</i>	<i>64</i>	<i>86</i>		<i>68</i>	<i>43</i>	<i>111</i>

<sup>1</sup> – AM:  $\text{Ln}(T) = 0.98\text{Ln}(X) - 0.51$  (23% inbound, 77% outbound)

<sup>2</sup> – PM:  $\text{Ln}(T) = 0.89\text{Ln}(X) - 0.02$  (63% inbound, 37% outbound)

<sup>3</sup> – AM:  $\text{Ln}(T) = 0.98\text{Ln}(X) - 0.98$  (26% inbound, 74% outbound)

<sup>4</sup> – PM:  $\text{Ln}(T) = 0.96\text{Ln}(X) - 0.63$  (61% inbound, 39% outbound)

### 4.3.2 Site Trip Distribution and Assignment

The trip distribution for the subject site was based on existing peak direction travel patterns. **Table 4.2** summarizes the resultant distribution.



**TABLE 4.2: SITE TRIP DISTRIBUTION**

Origin/Destination	AM Peak Hour		PM Peak Hour	
	In	Out	In	Out
North via Regional Road 50	36%	26%	30%	36%
South via Regional Road 50	29%	52%	48%	32%
West via Mayfield Road	10%	14%	13%	10%
North via Albion Vaughan Road	25%	8%	9%	22%
<i>Total</i>	<i>100%</i>	<i>100%</i>	<i>100%</i>	<i>100%</i>

The estimated trip generation has been assigned to the study road network based on the distribution noted above. Based on the intended operation of the north and south driveway connections for service and delivery vehicles exclusively, all site traffic has been assigned to the central middle access driveway.

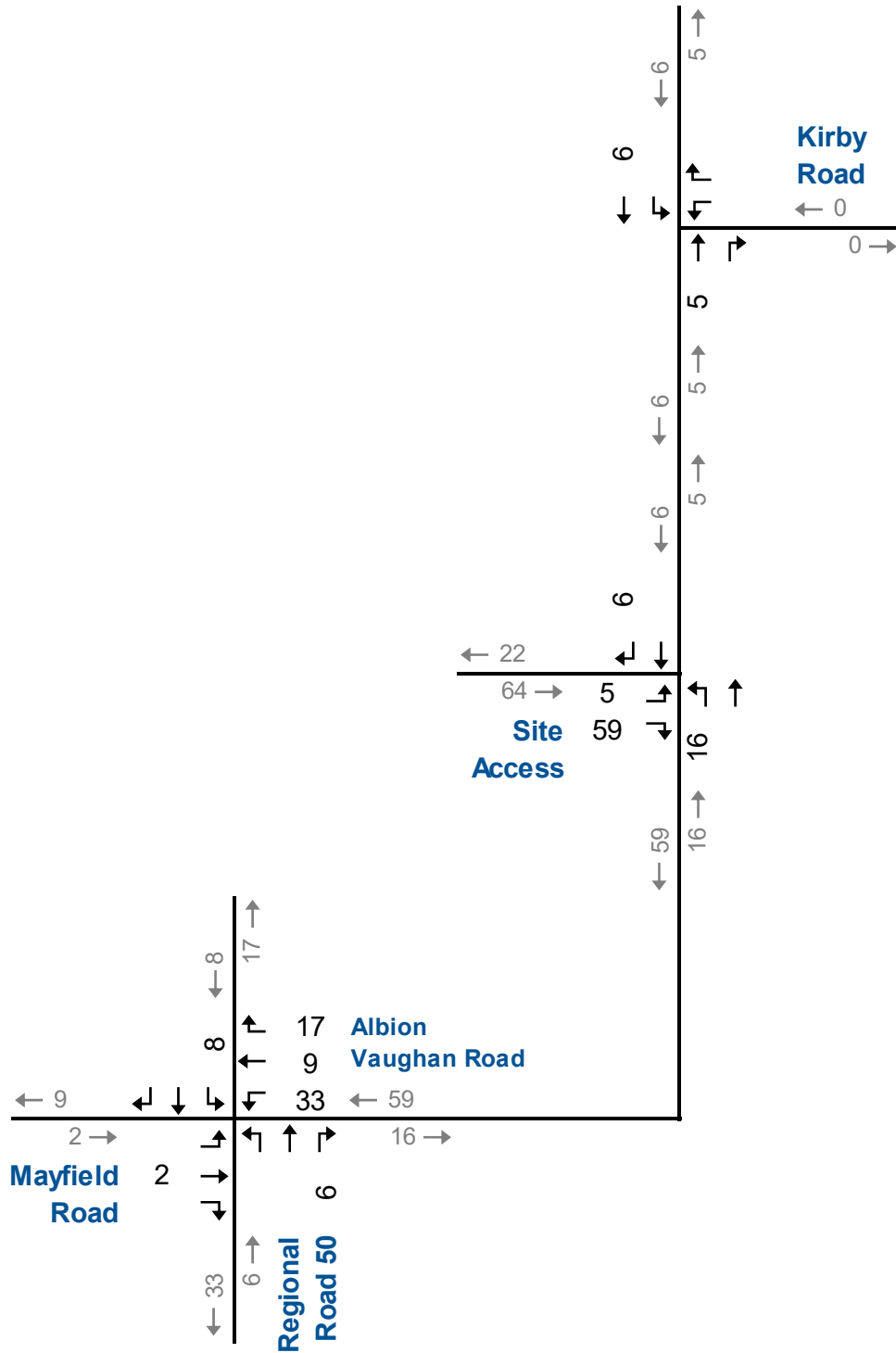
**Figure 4.2** illustrates the site-generated vehicle traffic assignment for the AM and PM peak hours. Slight differences from the trip generation estimates are due to rounding.

#### 4.4 Forecast Total Traffic

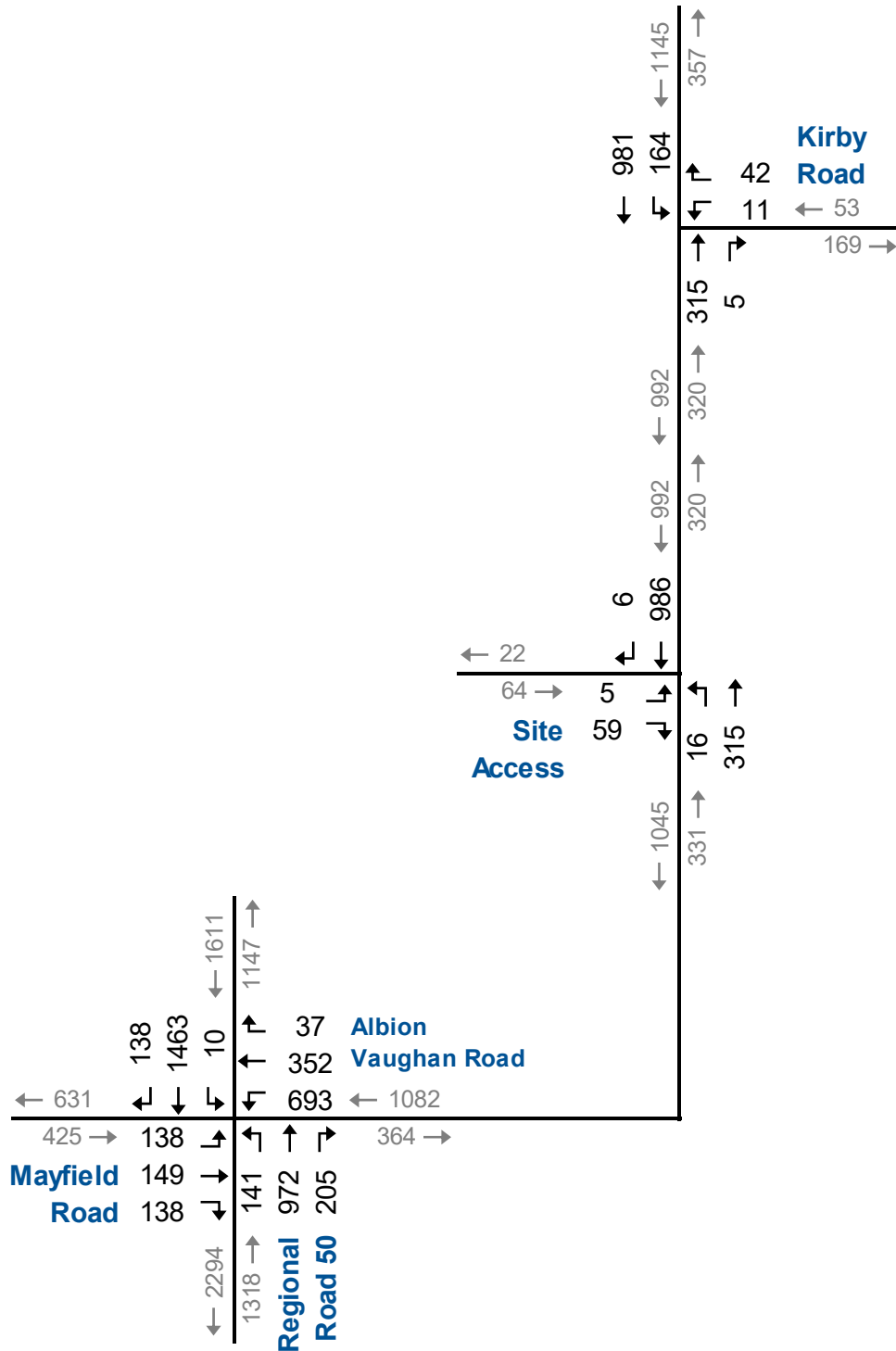
The future background traffic forecasts were combined with the site traffic assignments to estimate the future total traffic volumes for the 2027 future horizon year.

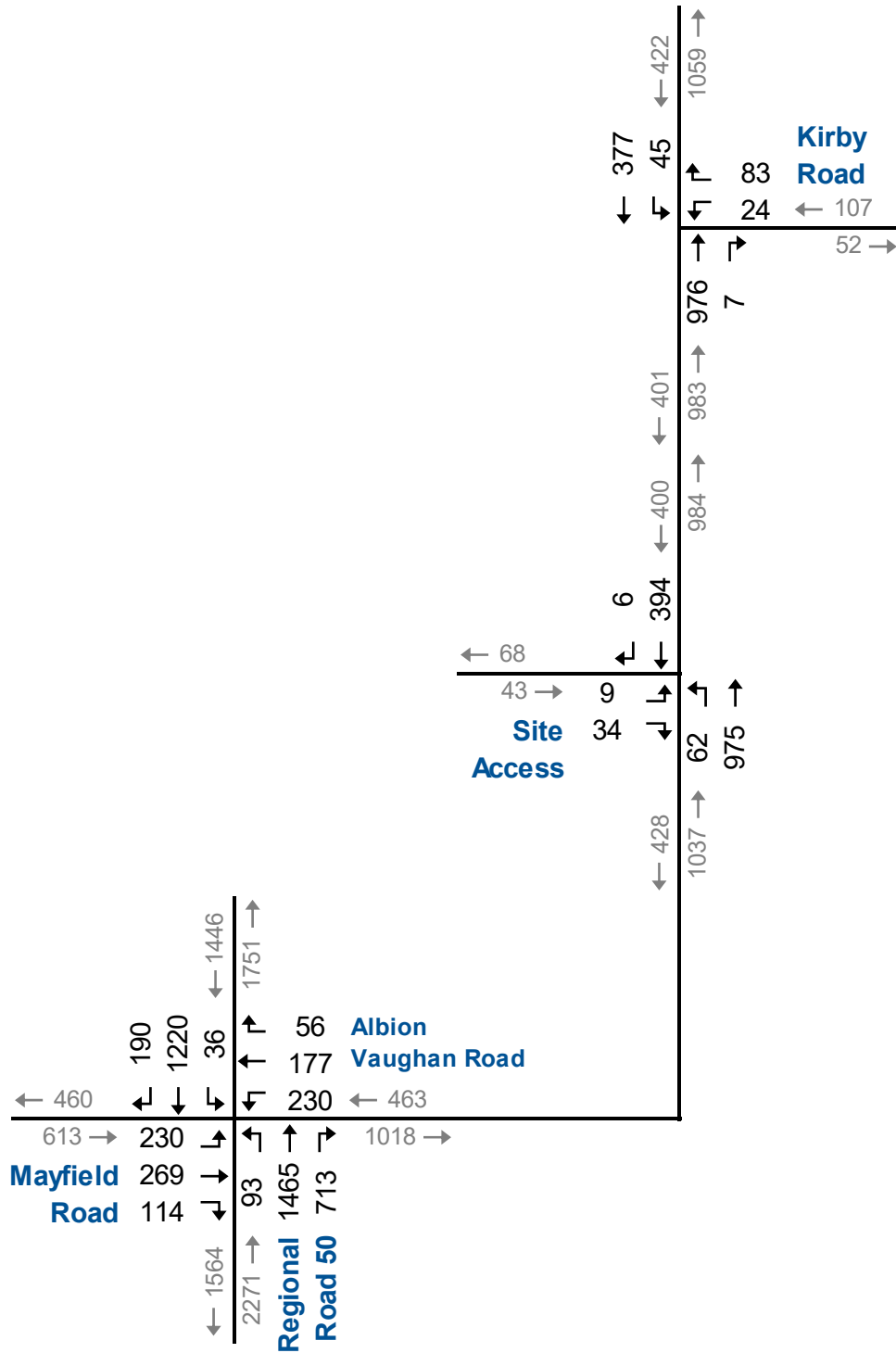
**Figure 4.3** illustrates the future total traffic forecasts for the 2027 horizon.













## 5 Transportation Impact Assessment

### 5.1 Future Background Traffic

To assess the operating conditions for the 2027 horizon year, analyses were undertaken using the same methodology, parameters, and traffic control devices as in the analysis of existing conditions. The exceptions would include:

- ▶ At the intersection of Regional Road 50/Albion Vaughan Road-Mayfield Road it was determined under base year conditions that intersection improvements would be required.
  - The Highway Capacity Manual and the Transportation Association of Canada Geometric Design Guide for Canadian Roads both recommend the consideration of dual left turn lanes at intersections where left turning volumes exceed 300 vehicles per hour. Therefore, based upon this guidance, dual left turn lanes would be required under base year conditions.
- ▶ Within the existing cycle length, advanced left turn phasing was introduced where necessary and signal timing splits were optimized to provide the best operations for all movements.

**Table 5.1** presents the operational analysis results including level of service (LOS), average vehicle delay in seconds, volume to capacity (V/C) ratio, and 95<sup>th</sup> percentile queues length in metres for the 2027 horizon. Critical movements are highlighted in yellow, if any.

**Appendix D** contains the detailed Synchro reports.

The analysis of background conditions (without the subject development) indicates the study area intersections are forecast to operate at acceptable conditions.

The exception would be at Regional Road 50/Albion Vaughan Road-Mayfield Road during the AM peak hour similar to under base year conditions. With the provision of westbound dual left turn lanes, several critical movements are reported. They are as follows:

- ▶ The overall intersection reports a V/C ratio of 0.99, approaching capacity;
- ▶ Westbound dual left turn movement is forecast to operate at a LOS F with a V/C ratio of 0.97;
- ▶ Northbound left turn movement is forecast to operate at a LOS F with a V/C ratio of 1.00; and



- ▶ Southbound dual through movement is forecast to operate at LOS E with a V/C ratio of 0.98.



**TABLE 5.1: 2027 BACKGROUND TRAFFIC OPERATIONS**

Intersection	Approach/ Movement		AM Peak Hour				PM Peak Hour			
			LOS <sup>1</sup>	Delay <sub>2</sub>	V/C <sup>3</sup>	Q <sup>4</sup>	LOS <sup>1</sup>	Delay <sub>2</sub>	V/C <sup>3</sup>	Q <sup>4</sup>
Regional Road 50/Albion Vaughan Rd- Mayfield Rd  <i>Signalized</i>	EB	Left	D	53	0.56	39	D	39	0.64	54
		Thru	E	68	0.64	59	D	51	0.71	76
		Right	E	56	0.13	18	D	38	0.10	13
	WB	Dual Left	F	86	0.97	140	E	60	0.70	41
		Thru	E	59	0.76	119	D	42	0.49	51
		Right	D	41	0.02	< 1	D	36	0.03	< 1
	NB	Left	F	124	1.00	76	C	31	0.64	27
		Dual Thru	C	22	0.52	116	C	23	0.78	173
		Right	B	17	0.14	12	B	19	0.56	65
	SB	Left	C	23	0.01	2	C	23	0.19	8
		Dual Thru	E	59	0.98	279	C	30	0.77	154
		Right	C	24	0.09	12	B	18	0.13	12
	<i>Overall Intersection</i>		<i>D</i>	<i>54</i>	<i>0.99</i>	<i>-</i>	<i>C</i>	<i>29</i>	<i>0.77</i>	<i>-</i>
Albion Vaughan Rd/Kirby Rd <i>Unsignalized</i>	WB	Left/Right	D	26	0.24	6	D	34	0.47	16
	NB	Thru/Right	Unopposed Movement				Unopposed Movement			
	SB	Left/Thru	A	3	0.13	3	A	2	0.06	1

<sup>1</sup> Level of Service; <sup>2</sup> Average vehicle delay, seconds; <sup>3</sup> Volume to capacity ratio; <sup>4</sup> 95<sup>th</sup> percentile queue, metres



## 5.2 Future Total Traffic

To assess operating conditions for future total conditions, an operational analysis was undertaken using the same methodology, parameters, and traffic control devices as in the analysis of background conditions.

**Table 5.2** presents the operational analysis results including level of service (LOS), average vehicle delay in seconds, volume to capacity (V/C) ratio, and 95<sup>th</sup> percentile queues length in metres for the 2027 horizon. Critical movements are highlighted in yellow, if any.

**Appendix E** contains the detailed Synchro reports.

The analysis of total conditions (with the subject development) indicates the study area intersections would continue to operate at acceptable conditions, albeit slightly exacerbated with the inclusion of site generated traffic.

The exception would be at Regional Road 50/Albion Vaughan Road-Mayfield Road during the AM peak hour similar to under base year conditions. With the provision of westbound dual left turn lanes, several critical movements are reported. They are as follows:

- ▶ The overall intersection reports a V/C ratio of 0.99, approaching capacity;
- ▶ Westbound dual left turn movement is forecast to operate at a LOS F with a V/C ratio of 0.99;
- ▶ Northbound left turn movement is forecast to operate at a LOS F with a V/C ratio of 1.00; and
- ▶ Southbound dual through movement is forecast to operate at LOS E with a V/C ratio of 0.98.

It is noted that these identified critical movements are reported to be the same as under background conditions. The exception would be the westbound dual left turn, where it increased from 0.97 to 0.99 under total traffic conditions.

The site access intersection with Albion Vaughan Road is noted to operate well within capacity.



**TABLE 5.2: 2027 TOTAL TRAFFIC OPERATIONS**

Intersection	Approach/ Movement		AM Peak Hour				PM Peak Hour			
			LOS <sup>1</sup>	Delay <sub>2</sub>	V/C <sup>3</sup>	Q <sup>4</sup>	LOS <sup>1</sup>	Delay <sub>2</sub>	V/C <sup>3</sup>	Q <sup>4</sup>
Regional Road 50/Albion Vaughan Rd- Mayfield Rd  <i>Signalized</i>	EB	Left	E	57	0.59	39	D	39	0.64	54
		Thru	E	69	0.66	60	D	51	0.73	79
		Right	E	57	0.13	18	D	37	0.10	13
	WB	Dual Left	F	91	0.99	145	E	63	0.75	45
		Thru	E	55	0.73	119	D	42	0.49	52
		Right	D	39	0.03	2	D	36	0.04	4
	NB	Left	F	124	1.00	75	C	32	0.65	28
		Dual Thru	C	22	0.52	112	C	24	0.78	173
		Right	B	17	0.14	12	C	21	0.60	80
	SB	Left	C	25	0.07	6	D	39	0.46	20
		Dual Thru	E	60	0.98	272	C	30	0.77	154
		Right	C	24	0.09	12	B	18	0.13	12
	<i>Overall Intersection</i>		<i>E</i>	<i>55</i>	<i>0.99</i>	<i>-</i>	<i>C</i>	<i>30</i>	<i>0.78</i>	<i>-</i>
Albion Vaughan Rd/Site Access <i>Unsignalized</i>	EB	Left/Right	C	22	0.23	6	C	17	0.12	3
	NB	Left/Thru	A	1	0.02	1	A	2	0.05	1
	SB	Thru/Right	Unopposed Movement				Unopposed Movement			
Albion Vaughan Rd/Kirby Rd <i>Unsignalized</i>	WB	Left/Right	D	26	0.24	6	D	35	0.47	16
	NB	Thru/Right	Unopposed Movement				Unopposed Movement			
	SB	Left/Thru	A	3	0.13	3	A	2	0.06	1

<sup>1</sup> Level of Service; <sup>2</sup> Average vehicle delay, seconds; <sup>3</sup> Volume to capacity ratio; <sup>4</sup> 95<sup>th</sup> percentile queue, metres



## 5.3 Impact Assessment Summary

### 5.3.1 Site Traffic

Overall, the incremental impact of the proposed residential development is considered minor. The additional traffic would be less than daily traffic variations typically experienced.

**Table 5.3** provides a summary of how much traffic volumes will increase by with the subject residential development.

**TABLE 5.3: TRAFFIC VOLUME INCREASE**

Intersection	2027 Background vs. 2027 Total % Volume Increase (Total Entering)	
	AM Peak Hour	PM Peak Hour
Regional Road 50/ Albion Vaughan Rd-Mayfield Rd	1.72%	2.04%
Albion Vaughan Rd/Kirby Rd	0.40%	0.40%

Under the estimated base year conditions, the westbound left turn movement at Regional Road 50/Albion Vaughan Rd-Mayfield Rd is found to be operating at an over-capacity condition during the AM peak hour. It is recognized that the estimated volumes developed from historical count data may not be actually realized.

With employers beginning to shift away from traditional office-based environments to work-from-home models and with commercial/retail and service-based businesses adapting by adjusting business hours and/or switching to web-based e-commerce storefronts, travel demands and patterns are changing.

In a post-COVID condition, it is plausible that traffic volumes may never reach pre-COVID levels as a result of this quantum shift that is being experienced. With changes in travel demand, behaviour, and patterns post-COVID due to changes in how office and business environments operate. The forecasts as analyzed are conservative and potentially under post-COVID conditions, traffic volumes may be considerably lower than forecast.

### 5.3.2 Intersection Improvements

#### Regional Road 50/Albion Vaughan Road-Mayfield Road

As identified under historical and estimated base year traffic conditions, at the intersection of Regional Road 50/Albion Vaughan



Road-Mayfield Road, the volume of westbound left turn traffic meets warrant thresholds for the consideration of dual left turn lanes.

#### Albion Vaughan Road/Site Access

From an operational standpoint, auxiliary turn lanes on Albion Vaughan Road are not necessary as the shared northbound left/through movement and the shared southbound through/right movement both are reported to operate at LOS A and the movements to be well within capacity.

Regardless, the warrants for left-turn lanes within the Ministry of Transportation's (MTO) *Design Supplement* to the *TAC Geometric Design Guide for Canadian Roads* (TAC Guide) were investigated. The warrant is based on a combination of the advancing and opposing design hour volumes, the design speed of the road, and the percentage of left-turning vehicles in the advancing volume.

A warrant analysis has been completed using the nomographs for two-lane, unsignalized intersections, with a design speed of 80 km/h (20 km/h over the posted maximum speed limit). **Table 5.4** summarizes the details of the left turn warrant analysis.

**TABLE 5.4: LEFT-TURN LANE WARRANT ANALYSIS**

Major Street	Albion Vaughan Road	
Minor Street	Site Access	
Approach Direction	Northbound	
Design Speed	80 km/h	
Peak Hour	AM	PM
Advancing Volume	331	1,037
Opposing Volume	995	400
Left Turn Volume	16	62
% Left Turns	5%	6%
<b>Warranted</b>	<b>No</b>	<b>No</b>
Storage Length	N/A	N/A

Based upon forecast 2027 total traffic volumes, a northbound auxiliary left turn lane with 40 metres storage is determined to be warranted.

Based upon the low forecast volume of southbound right turn volumes, it is determined an auxiliary right turn lane would not be necessary. As the forecast volume of turning traffic is low, it is anticipated these vehicles will not impede southbound traffic on Albion Vaughan Road or cause any undue hazard to through traffic.



## 6 Parking Review

### 6.1 Development Overview

The proposed residential development comprises two townhouse blocks and two six-storey buildings. In total the overall development proposes a total of 250 residential dwelling units. The development statistics are as follows:

- ▶ Two six-storey residential buildings = 240 units total;
  - Tower A = 120 units; and
  - Tower B = 120 units.
- ▶ Two townhouse blocks = 10 units total;
  - Block 1 = 5 units; and
  - Block 2 = 5 units.

A total of parking supply of 453 spaces serving residents and visitors are proposed on-site. The parking supply breakdown is as follows:

- ▶ 15 spaces at-grade;
- ▶ 294 spaces on parking level P1; and
- ▶ 144 spaces on parking level P2.

### 6.2 Zoning By-law Parking Requirements

**Table 6.1** presents a comparison of the required and proposed number of vehicle parking spaces under the Town of Caledon's Zoning By-law, Section 5: Parking, Loading, and Delivery Standards.

**TABLE 6.1: REQUIRED AND PROVIDED PARKING**

Type of Use	By-law Requirement	Parking Spaces		
		Required	Provided	Net Surplus (Deficiency)
Dwelling, Townhouse	2.0 spaces per dwelling unit + 0.25 spaces per unit for visitors	23	453	+10
Building, Apartment	1.5 spaces per dwelling unit + 0.25 spaces per unit for visitors	420		
<i>Total Site</i>		<i>443</i>	<i>453</i>	<i>+10</i>





## 6.3 Summary

Based on the information presented above, the proposed parking supply will meet minimum zoning requirements and will be sufficient in serving the proposed residential development.



## 7 Circulation Review

AutoTURN software was used to review and confirm that the design of the site accesses, internal circulation, and loading areas will accommodate the types of vehicles expected on-site. This involved the following tasks:

- ▶ Showing how a Peel Region waste collection vehicle would enter the site, access the loading spaces, and exit the site;
- ▶ Showing how a Pumper Fire Truck would enter the site, circulate the designated fire route, and exit the site;
- ▶ Showing how a TAC Medium Single-Unit (MSU) truck (design vehicle representing typical service and delivery truck) would enter the site, access the loading spaces, and exit the site; and
- ▶ Shown how a TAC Passenger Car (design vehicle representing a larger car) would enter the site, circulate, access the underground parking structure, and exit the site.

Our review of the underground parking levels noted that all parking spaces and drive aisle widths meeting zoning requirements. Furthermore, no dead-end drive aisles were noted and no parking spaces were flagged to have ingress or egress issues.

Each of the design vehicle manoeuvres described above are accommodated by the design of the site without issue or conflict.

**Appendix F** contains the vehicle maneuvering diagrams for reference.



## 8 Conclusions and Recommendations

### 8.1 Conclusions

The conclusions of the study are as follows:

- ▶ Under base year conditions, all study area intersections operate at acceptable levels of service and within capacity.

The exception would be the Regional Road 50/Albion Vaughan Rd-Mayfield Rd intersection.

Under the AM peak hour, the overall intersection is reported to be approaching capacity (V/C ratio = 0.91). Additionally, the westbound left turn movement is reported to operate with a LOS F and a V/C ratio of 1.20 (over capacity).

The volume of traffic for this left turn movement exceeds 300 vehicles during the AM peak hour, which is the threshold where both the Highway Capacity Manual and the Transportation Association of Canada Geometric Design Guide for Canadian Roads recommend the consideration of dual left turn lanes.

- ▶ For the 2027 background traffic conditions (without subject development), all study area intersections are forecast to operate at acceptable levels of service and within capacity.

The exception would be the Regional Road 50/Albion Vaughan Rd-Mayfield Rd intersection.

The intersection was analyzed with a westbound dual left turn lane to mitigate the over-capacity condition determined under base year conditions. Accounting for the intersection improvement, several critical movements were still identified. No further improvements were identified which would mitigate these issues.

- ▶ With the addition of the proposed residential development, the 2027 total traffic conditions (with subject development), all study area intersections are forecast to operate at acceptable levels of service and within capacity.

The exception would be the Regional Road 50/Albion Vaughan Rd-Mayfield Rd intersection, where the previously identified critical movements would continue to be reported, albeit slightly exacerbated.

- ▶ The overall impact of the proposed residential development is anticipated to be minimal. The development is estimated to generate and add a total of 86 and 111 vehicle trips to the adjacent transportation network during the AM and PM peak hours, respectively.



The additional traffic would be less than daily traffic variations typically experienced. It is determined the site generated traffic would increase volumes at the study area intersections between 0.40 – 2.04%.

In regard to the critical movements identified at Regional Road 50/Albion Vaughan Rd-Mayfield Rd. A potential quantum shift in travel demands and patterns may result due to the COVID-19 global pandemic. Employers are beginning to shift away from traditional office-based environments to work-from-home models and with commercial/retail and service-based businesses adapting by adjusting business hours and/or switching to web-based e-commerce storefronts, thus resulting in travel demands and patterns potentially changing from the previous norm.

In a post-COVID condition, it is plausible traffic volumes may never reach pre-COVID levels as a result of this quantum shift. With changes in travel demand, behaviour, and patterns post-COVID, the forecasts as analyzed are conservative (i.e., err on the high side) and potentially under post-COVID conditions, traffic volumes may be lower.

- ▶ At the central site access intersection with Albion Vaughan Road, it was determined an auxiliary northbound left turn lane would be warranted. It is noted that the auxiliary left turn lane is not required from an operational standpoint.
- ▶ The proposed parking supply exceeds the minimum zoning by-law requirements and is anticipated to adequately serve the residential development.
- ▶ A review of the site plan was undertaken. No conflicts or issues were identified for anticipated design vehicles expected on-site.

## 8.2 Recommendations

The recommendations of the study are as follows:

- ▶ From a transportation perspective, the planning applications sought should be approved as the development is determined to have a minimal impact on the adjacent transportation network.
- ▶ The intersection volumes and operations at the Regional Road 50/Albion Vaughan Rd-Mayfield Rd intersection be monitored by the applicable jurisdiction to determine if and when dual westbound left turn lanes should be provided.
- ▶ A northbound auxiliary left turn lane should be provided at the central site access intersection on Albion Vaughan Road.



# Appendix A

## Pre-Study Consultation Correspondence



## Adrian Soo

---

**From:** Arash Olia <Arash.Olia@caledon.ca>  
**Sent:** October 23, 2020 11:14 AM  
**To:** Andrew Steinsky; catherine.barnes@peelregion.ca  
**Cc:** Adrian Soo  
**Subject:** RE: 200428 - 12148 Albion Vaughan Road TIS Scope of Work

Hi Andrew,

Please see my comments below in red.

Thanks,

**Arash Olia, Ph.D., P.Eng.**

Manager, Transportation Engineering  
Finance & Infrastructure Services

Office: 905.584.2272 x.4073  
Cell: 416.452.7091  
Email: [arash.olia@caledon.ca](mailto:arash.olia@caledon.ca)

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**From:** Andrew Steinsky <asteinsky@ptsl.com>  
**Sent:** Thursday, October 22, 2020 10:45 AM  
**To:** catherine.barnes@peelregion.ca; Arash Olia <Arash.Olia@caledon.ca>  
**Cc:** Adrian Soo <asoo@ptsl.com>  
**Subject:** 200428 - 12148 Albion Vaughan Road TIS Scope of Work

**CAUTION:** This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the contents to be safe.

Hi Arash & Catherine,

We've been retained to prepare a Traffic Impact Study (TIS) for a residential development on the west side of Albion Vaughan Road, south of Kirby Road in Bolton. We're reaching out to both the Region and Town to confirm our scope of work. If you are not the correct point of contact, please let us know so we can contact the correct person. We would appreciate any comments by the week of November 2.

The development proposal includes 240 condominiums in a six-storey building, and 10 townhomes. Access is proposed through a new all-moves driveway connection to Albion Vaughan Road. Two separate driveway connections for loading and delivery vehicles are also proposed on the north and south edges of the site.

Based on the above, we propose the following work plan to carry out the TIS:

1. Analysis of AM and PM peak hours.
2. Horizon year five years ~~from date of study~~ (2025). **Please confirm. From completion/built out date**

3. Study area to include:
  - Highway 50 & Mayfield Road/Albion Vaughan Road; and
  - Albion Vaughan Road & Kirby Road.

We have turning movements completed at both intersections on Thursday November 24, 2016. Are these counts acceptable given the current impacts of COVID-19 on traffic volumes? **Please confirm** an appropriate growth rate to factor these volumes to a 2020 base year. **I suggest adopt 2%**

4. Background traffic to be forecast using a per annum growth rate. **Please confirm appropriate growth rate. 2%**
5. Background developments to be included? **Please confirm. No background development**
6. ITE *Trip Generation Manual (10<sup>th</sup> Edition)* rates to establish trip generation
7. Mode share based on TTS.
8. Trip distribution derived from turning movement counts and origin/destination information obtained from TTS.
9. AutoTURN assessment to include relevant design vehicles expected on the site, and swept path analysis.

Please let me and Adrian Soo (cc'd on this e-mail) if you have any questions on the above work plan.

Thanks,

**Andrew Steinsky, P.Eng.**  
*Transportation Engineer*



**Paradigm Transportation Solutions Limited**

5A-150 Pinebush Road, Cambridge ON N1R 8J8  
p: 416.479.9684 x507  
e: [asteinsky@ptsl.com](mailto:asteinsky@ptsl.com)  
w: [www.ptsl.com](http://www.ptsl.com)

*Since 1998, our unique "work at home" business model has enabled us to harness technology, offer high quality service and strong communication with our clients and now allows us to carry on our work for you during COVID-19.*

*Let's stay safe and look out for each other. We will get through this together.*

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# Appendix B

## Traffic Data



# Albion Vaughan Road & Highway 50

## Morning Peak Diagram

### Specified Period

**From:** 6:00:00

**To:** 10:00:00

### One Hour Peak

**From:** 7:15:00

**To:** 8:15:00

**Municipality:** Nobleton

**Site #:** 0000009401

**Intersection:** Highway 50 & Albion Vaughan Road

**TFR File #:** 1

**Count date:** 24-Nov-2016

### Weather conditions:

Cloudy / Rain

### Person(s) who counted:

### \*\* Signalized Intersection \*\*

**Major Road:** Highway 50 runs N/S

North Leg Total: 2032

North Entering: 1192

North Peds: 0

Peds Cross:  $\nlessgtr$

Heavys	3	31	1	35
Trucks	6	55	0	61
Cars	94	1001	1	1096
Totals	103	1087	2	

Heavys 23

Trucks 45

Cars 772

Totals 840

East Leg Total: 1020

East Entering: 761

East Peds: 0

Peds Cross:  $\nlessgtr$

Heavys	Trucks	Cars	Totals
30	51	381	462

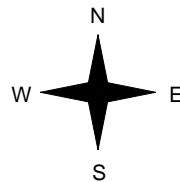


Albion Vaughan Road

Heavys	Trucks	Cars	Totals
4	9	90	103
9	10	90	109
26	21	56	103
39	40	236	



Highway 50



Cars	Trucks	Heavys	Totals
12	2	1	15
232	14	9	255
484	6	1	491
728	22	11	

Albion Vaughan Road



Cars	Trucks	Heavys	Totals
221	21	17	259

Peds Cross:  $\nlessgtr$

West Peds: 0

West Entering: 315

West Leg Total: 777

Cars 1541

Trucks 82

Heavys 58

Totals 1681



Cars	55	670	130	855
Trucks	31	34	11	76
Heavys	18	18	7	43
Totals	104	722	148	

Peds Cross:  $\nlessgtr$

South Peds: 0

South Entering: 974

South Leg Total: 2655

## Comments

# Albion Vaughan Road & Highway 50

## Afternoon Peak Diagram

### Specified Period

**From:** 14:00:00

**To:** 18:00:00

### One Hour Peak

**From:** 16:00:00

**To:** 17:00:00

**Municipality:** Nobleton

**Site #:** 0000009401

**Intersection:** Highway 50 & Albion Vaughan Road

**TFR File #:** 1

**Count date:** 24-Nov-2016

### Weather conditions:

Cloudy / Rain

### Person(s) who counted:

### \*\* Signalized Intersection \*\*

**Major Road:** Highway 50 runs N/S

North Leg Total: 2347

North Entering: 1058

North Peds: 0

Peds Cross:  $\nlessgtr$

Heavys	3	25	1	29
Trucks	6	35	1	42
Cars	132	846	9	987
Totals	141	906	11	

Heavys 41

Trucks 61

Cars 1187

Totals 1289

East Leg Total: 1029

East Entering: 319

East Peds: 0

Peds Cross:  $\nlessgtr$

Heavys	Trucks	Cars	Totals
40	26	272	338

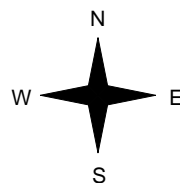


Albion Vaughan Road

Heavys	Trucks	Cars	Totals
2	9	160	171
11	9	173	193
20	10	55	85
33	28	388	



Highway 50



Cars	Trucks	Heavys	Totals
23	6	1	30
106	7	15	128
152	6	3	161
281	19	19	

Albion Vaughan Road



Cars	Trucks	Heavys	Totals
654	12	44	710

Peds Cross:  $\nlessgtr$

West Peds: 0

West Entering: 449

West Leg Total: 787

Cars 1053

Trucks 51

Heavys 48

Totals 1152



Cars	34	1004	472	1510
Trucks	13	46	2	61
Heavys	22	38	32	92
Totals	69	1088	506	

Peds Cross:  $\nlessgtr$

South Peds: 0

South Entering: 1663

South Leg Total: 2815

## Comments

# Albion Vaughan Road & Highway 50

## Total Count Diagram

**Municipality:** Nobleton

**Site #:** 0000009401

**Intersection:** Highway 50 & Albion Vaughan Road

**TFR File #:** 1

**Count date:** 24-Nov-2016

**Weather conditions:**

Cloudy / Rain

**Person(s) who counted:**

**\*\* Signalized Intersection \*\***

**Major Road:** Highway 50 runs N/S

North Leg Total: 14934

North Entering: 7544

North Peds: 0

Peds Cross:  $\nlessgtr$

Heavys	37	299	6	342
Trucks	49	394	7	450
Cars	759	5946	47	6752
Totals	845	6639	60	



Heavys 296

Trucks 423

Cars 6671

Totals 7390

East Leg Total: 6580

East Entering: 3502

East Peds: 1

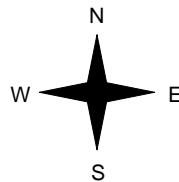
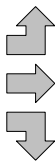
Peds Cross:  $\nlessgtr$

Heavys	Trucks	Cars	Totals
286	318	1982	2586



Albion Vaughan Road

Heavys	Trucks	Cars	Totals
22	44	800	866
62	79	832	973
208	163	299	670
292	286	1931	



Highway 50

Highway 50

Cars	Trucks	Heavys	Totals
123	18	8	149
926	82	50	1058
2184	65	46	2295
3233	165	104	



Albion Vaughan Road



Cars	Trucks	Heavys	Totals
2726	144	208	3078

Peds Cross:  $\nlessgtr$

West Peds: 0

West Entering: 2509

West Leg Total: 5095

Cars	8429
Trucks	622
Heavys	553
Totals	9604



Cars	297	5748	1847	7892
Trucks	187	361	58	606
Heavys	199	266	140	605
Totals	683	6375	2045	

Peds Cross:  $\nlessgtr$

South Peds: 2

South Entering: 9103

South Leg Total: 18707

**Comments**

# Albion Vaughan Road & Highway 50

## Traffic Count Summary

Intersection: Highway 50 & Albion Vaughan Road    Count Date: 24-Nov-2016    Municipality: Nobleton

North Approach Totals						North/South Total Approaches	South Approach Totals					
Hour Ending	Includes Cars, Trucks, & Heavys				Total Peds		Hour Ending	Includes Cars, Trucks, & Heavys				Total Peds
	Left	Thru	Right	Grand Total				Left	Thru	Right	Grand Total	
6:00:00	0	0	0	0	0	0	6:00:00	0	0	0	0	0
7:00:00	0	711	54	765	0	1354	7:00:00	58	457	74	589	0
8:00:00	3	1055	90	1148	0	2048	8:00:00	93	681	126	900	0
9:00:00	4	917	117	1038	0	1971	9:00:00	97	705	131	933	0
10:00:00	14	844	89	947	0	1752	10:00:00	85	634	86	805	2
14:00:00	0	0	0	0	0	0	14:00:00	0	0	0	0	0
15:00:00	17	637	127	781	0	2069	15:00:00	102	927	259	1288	0
16:00:00	9	723	134	866	0	2449	16:00:00	107	1103	373	1583	0
17:00:00	11	906	141	1058	0	2721	17:00:00	69	1088	506	1663	0
18:00:00	2	846	93	941	0	2283	18:00:00	72	780	490	1342	0
Totals:	60	6639	845	7544	0	16647		683	6375	2045	9103	2
East Approach Totals						East/West Total Approaches	West Approach Totals					
Hour Ending	Includes Cars, Trucks, & Heavys				Total Peds		Hour Ending	Includes Cars, Trucks, & Heavys				Total Peds
	Left	Thru	Right	Grand Total				Left	Thru	Right	Grand Total	
6:00:00	0	0	0	0	0	0	6:00:00	0	0	0	0	0
7:00:00	377	128	8	513	0	696	7:00:00	35	97	51	183	0
8:00:00	481	259	14	754	0	1053	8:00:00	79	102	118	299	0
9:00:00	451	154	22	627	0	926	9:00:00	126	90	83	299	0
10:00:00	278	109	17	404	0	715	10:00:00	102	107	102	311	0
14:00:00	0	0	0	0	0	0	14:00:00	0	0	0	0	0
15:00:00	178	73	18	269	0	587	15:00:00	136	91	91	318	0
16:00:00	178	105	25	308	0	656	16:00:00	127	137	84	348	0
17:00:00	161	128	30	319	0	768	17:00:00	171	193	85	449	0
18:00:00	191	102	15	308	1	610	18:00:00	90	156	56	302	0
Totals:	2295	1058	149	3502	1	6011		866	973	670	2509	0
Calculated Values for Traffic Crossing Major Street												
Hours Ending:	7:00	8:00	9:00	10:00			15:00	16:00	17:00	18:00		
Crossing Values:	540	819	731	491			405	442	525	437		

# Albion Vaughan Road & Kirby Road

## Morning Peak Diagram

### Specified Period

**From:** 6:00:00

**To:** 9:00:00

### One Hour Peak

**From:** 7:15:00

**To:** 8:15:00

**Municipality:** Nobleton

**Site #:** 0000009402

**Intersection:** Albion Vaughan Road & Kirby Road

**TFR File #:** 1

**Count date:** 24-Nov-2016

### Weather conditions:

Cloudy / Rain

### Person(s) who counted:

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

**Major Road:** Albion Vaughan Road runs N/S

North Leg Total: 1107

North Entering: 846

North Peds: 0

Peds Cross:  $\nlessgtr$

Heavys	5	2	7
Trucks	20	3	23
Cars	699	117	816
Totals	724	122	



Heavys	15
Trucks	17
Cars	229
Totals	261

East Leg Total: 165

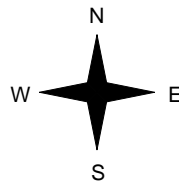
East Entering: 39

East Peds: 0

Peds Cross:  $\nlessgtr$



Albion Vaughan Road



Cars	Trucks	Heavys	Totals
24	3	4	31



Cars	Trucks	Heavys	Totals
1	3	4	8
25	6	8	

Kirby Road



Albion Vaughan Road



Cars	700
Trucks	23
Heavys	9
Totals	732



Cars	205	4	209
Trucks	14	0	14
Heavys	11	0	11
Totals	230	4	

Peds Cross:  $\nlessgtr$

South Peds: 0

South Entering: 234

South Leg Total: 966

## Comments

# Albion Vaughan Road & Kirby Road

## Mid-day Peak Diagram

### Specified Period

**From:** 11:30:00

**To:** 13:30:00

### One Hour Peak

**From:** 12:15:00

**To:** 13:15:00

**Municipality:** Nobleton

**Site #:** 0000009402

**Intersection:** Albion Vaughan Road & Kirby Road

**TFR File #:** 1

**Count date:** 24-Nov-2016

### Weather conditions:

Cloudy / Rain

### Person(s) who counted:

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

**Major Road:** Albion Vaughan Road runs N/S

North Leg Total: 497

North Entering: 270

North Peds: 0

Peds Cross:  $\nabla$

Heavys	18	0	18
Trucks	16	4	20
Cars	196	36	232
Totals	230	40	



Heavys	10
Trucks	16
Cars	201
Totals	227

East Leg Total: 74

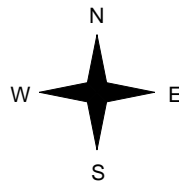
East Entering: 28

East Peds: 0

Peds Cross:  $\nabla$



Albion Vaughan Road



Cars	Trucks	Heavys	Totals
21	2	1	24
3	1	0	4
24	3	1	



Kirby Road



Cars	Trucks	Heavys	Totals
40	5	1	46

Albion Vaughan Road



Cars	199
Trucks	17
Heavys	18
Totals	234



Cars	180	4	184
Trucks	14	1	15
Heavys	9	1	10
Totals	203	6	

Peds Cross:  $\nabla$

South Peds: 0

South Entering: 209

South Leg Total: 443

## Comments

# Albion Vaughan Road & Kirby Road

## Afternoon Peak Diagram

### Specified Period

From: 15:00:00

To: 18:00:00

### One Hour Peak

From: 16:15:00

To: 17:15:00

**Municipality:** Nobleton

**Site #:** 0000009402

**Intersection:** Albion Vaughan Road & Kirby Road

**TFR File #:** 1

**Count date:** 24-Nov-2016

### Weather conditions:

Cloudy / Rain

### Person(s) who counted:

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

**Major Road:** Albion Vaughan Road runs N/S

North Leg Total: 1089

North Entering: 308

North Peds: 0

Peds Cross:  $\nabla$

Heavys	10	0	10
Trucks	8	1	9
Cars	257	32	289
Totals	275	33	



Heavys	10
Trucks	11
Cars	760
Totals	781

East Leg Total: 119

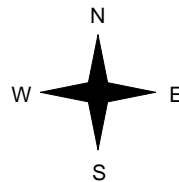
East Entering: 80

East Peds: 1

Peds Cross:  $\nabla$



Albion Vaughan Road



Cars	Trucks	Heavys	Totals
61	1	0	62
12	0	6	18
73	1	6	



Kirby Road



Cars	Trucks	Heavys	Totals
37	2	0	39

Albion Vaughan Road



Cars	269	Cars	699	5	704
Trucks	8	Trucks	10	1	11
Heavys	16	Heavys	10	0	10
Totals	293	Totals	719	6	



Peds Cross:  $\nabla$

South Peds: 0

South Entering: 725

South Leg Total: 1018

## Comments



# Albion Vaughan Road & Kirby Road

## Total Count Diagram

**Municipality:** Nobleton

**Site #:** 0000009402

**Intersection:** Albion Vaughan Road & Kirby Road

**TFR File #:** 1

**Count date:** 24-Nov-2016

**Weather conditions:**

Cloudy / Rain

**Person(s) who counted:**

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

**Major Road:** Albion Vaughan Road runs N/S

North Leg Total: 6632

North Entering: 3543

North Peds: 0

Peds Cross:  $\nabla$

Heavys	73	3	76
Trucks	120	16	136
Cars	2949	382	3331
Totals	3142	401	



Heavys	80
Trucks	110
Cars	2899
Totals	3089

East Leg Total: 818

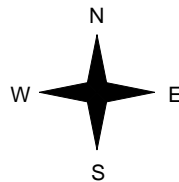
East Entering: 355

East Peds: 1

Peds Cross:  $\nabla$



Albion Vaughan Road



Cars	Trucks	Heavys	Totals
264	10	8	282
52	7	14	73
316	17	22	



Kirby Road



Cars	Trucks	Heavys	Totals
434	22	7	463

Albion Vaughan Road



Cars	3001
Trucks	127
Heavys	87
Totals	3215



Cars	2635	52	2687
Trucks	100	6	106
Heavys	72	4	76
Totals	2807	62	

Peds Cross:  $\nabla$

South Peds: 0

South Entering: 2869

South Leg Total: 6084

## Comments

# Albion Vaughan Road & Kirby Road Traffic Count Summary

Intersection: Albion Vaughan Road & Kirby Road    Count Date: 24-Nov-2016    Municipality: Nobleton

North Approach Totals						North/South Total Approaches	South Approach Totals					
Hour Ending	Includes Cars, Trucks, & Heavys				Total Peds		Hour Ending	Includes Cars, Trucks, & Heavys				Total Peds
	Left	Thru	Right	Grand Total				Left	Thru	Right	Grand Total	
6:00:00	0	0	0	0	0	0	6:00:00	0	0	0	0	0
7:00:00	41	549	0	590	0	764	7:00:00	0	168	6	174	0
8:00:00	128	732	0	860	0	1075	8:00:00	0	207	8	215	0
9:00:00	69	612	0	681	0	885	9:00:00	0	198	6	204	0
12:00:00	13	95	0	108	0	206	12:00:00	0	90	8	98	0
13:00:00	39	209	0	248	0	462	13:00:00	0	207	7	214	0
15:00:00	21	119	0	140	0	247	15:00:00	0	101	6	107	0
16:00:00	29	272	0	301	0	796	16:00:00	0	491	4	495	0
17:00:00	35	287	0	322	0	980	17:00:00	0	653	5	658	0
18:00:00	26	267	0	293	0	997	18:00:00	0	692	12	704	0
Totals:	401	3142	0	3543	0	6412		0	2807	62	2869	0
East Approach Totals						East/West Total Approaches	West Approach Totals					
Hour Ending	Includes Cars, Trucks, & Heavys				Total Peds		Hour Ending	Includes Cars, Trucks, & Heavys				Total Peds
	Left	Thru	Right	Grand Total				Left	Thru	Right	Grand Total	
6:00:00	0	0	0	0	0	0	6:00:00	0	0	0	0	0
7:00:00	2	0	9	11	0	11	7:00:00	0	0	0	0	0
8:00:00	8	0	23	31	0	31	8:00:00	0	0	0	0	0
9:00:00	7	0	29	36	0	36	9:00:00	0	0	0	0	0
12:00:00	3	0	13	16	0	16	12:00:00	0	0	0	0	0
13:00:00	6	0	26	32	0	32	13:00:00	0	0	0	0	0
15:00:00	5	0	7	12	0	12	15:00:00	0	0	0	0	0
16:00:00	12	0	64	76	0	76	16:00:00	0	0	0	0	0
17:00:00	13	0	55	68	1	68	17:00:00	0	0	0	0	0
18:00:00	17	0	56	73	0	73	18:00:00	0	0	0	0	0
Totals:	73	0	282	355	1	355		0	0	0	0	0
Calculated Values for Traffic Crossing Major Street												
Hours Ending:	7:00	8:00	9:00	13:00			15:00	16:00	17:00	18:00		
Crossing Values:	2	8	7	6			5	12	13	17		

# REGIONAL MUNICIPALITY OF PEEL

## Traffic Signal Timing Parameters

Database Date	October 2, 2019		Prepared Date	November 11, 2020
Database Rev	18		Completed By	S.J
Timing Card / Field rev	-		Checked By	A.P

Location	Highway 50 at Mayfield Road								
----------	-----------------------------	--	--	--	--	--	--	--	--

Phase #	Street Name - Direction	Vehicle Minimum (s)	Pedestrian Minimum (s)		Amber (s)	All Red (s)	TIME PERIOD (s) (Green+Amber+All Red)		
			WALK	FDWALK			AM SPLITS	PM-1 SPLITS	PM-2 SPLITS
1	Highway 50 - NBLT Prot. Perm.	5	-	-	3.0	-	25	25	22
2	Highway 50 - SB	20	8	23	4.6	2.0	63	50	39
3	Mayfield Road - WBLT Prot. Perm.	5	-	-	3.0	-	27	10	9
4	Mayfield Road - EB	12	8	25	4.0	2.5	45	40	40
5	Not In Use	-	-	-	-	-	-	-	-
6	Highway 50 - NB	20	8	23	4.6	2.0	88	75	61
7	Mayfield Road - EBLT Prot. Perm.	5	-	-	3.0	-	10	10	9
8	Mayfield Road - WB	12	8	25	4.0	2.5	62	40	40

<b>System Control</b> No <b>Semi-Actuated Mode</b> No, Fully Actuated	<b>TIME (M-F)</b>	<b>PEAK</b>	<b>CYCLE LENGTH (s)</b>	<b>OFFSET (s)</b>
	06:00 - 09:00	AM	160	27
	15:00 - 19:30	PM-1	125	72
	19:30 - 22:00	PM-2	110	7

# Appendix C

























## Existing Traffic Operations Reports



# Lanes, Volumes, Timings

## 1: Regional Road 50 & Mayfield Road/Albion Vaughan Road













Base Year: AM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	111	118	111	531	276	16	113	782	160	2	1177	111
Future Volume (vph)	111	118	111	531	276	16	113	782	160	2	1177	111
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.5
Storage Length (m)	100.0		90.0	170.0		70.0	125.0		180.0	35.0		150.0
Storage Lanes	1		1	1		1	1		1	1		1
Taper Length (m)	60.0			40.0			20.0			0.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1580	1642	1094	1767	1762	1331	1214	3411	1426	1190	3380	1465
Flt Permitted	0.590			0.511			0.110			0.356		
Satd. Flow (perm)	981	1642	1094	951	1762	1331	141	3411	1426	446	3380	1465
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			111			65			160			111
Link Speed (k/h)		60			60			70			70	
Link Distance (m)		289.2			563.9			378.1			686.1	
Travel Time (s)		17.4			33.8			19.4			35.3	
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 (%)	13%	17%	46%	1%	9%	20%	47%	7%	12%	50%	8%	9%
Adj. Flow (vph)	111	118	111	531	276	16	113	782	160	2	1177	111
Shared Lane Traffic (%)												
Lane Group Flow (vph)	111	118	111	531	276	16	113	782	160	2	1177	111
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane											Yes	
Headway Factor	1.01	0.99	1.01	1.01	0.99	1.01	1.01	0.99	1.01	1.01	0.99	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm

# Lanes, Volumes, Timings

## 1: Regional Road 50 & Mayfield Road/Albion Vaughan Road

Base Year: AM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases	7	4		3	8		1	6			2	
Permitted Phases	4		4	8		8	6		6	2		2
Detector Phase	7	4	4	3	8	8	1	6	6	2	2	2
Switch Phase												
Minimum Initial (s)	5.0	12.0	12.0	5.0	12.0	12.0	5.0	20.0	20.0	20.0	20.0	20.0
Minimum Split (s)	8.0	39.5	39.5	8.0	39.5	39.5	8.0	37.6	37.6	37.6	37.6	37.6
Total Split (s)	10.0	45.0	45.0	27.0	62.0	62.0	25.0	88.0	88.0	63.0	63.0	63.0
Total Split (%)	6.3%	28.1%	28.1%	16.9%	38.8%	38.8%	15.6%	55.0%	55.0%	39.4%	39.4%	39.4%
Maximum Green (s)	7.0	38.5	38.5	24.0	55.5	55.5	22.0	81.4	81.4	56.4	56.4	56.4
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.6	4.6	4.6	4.6	4.6
All-Red Time (s)	0.0	2.5	2.5	0.0	2.5	2.5	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.5	6.5	3.0	6.5	6.5	3.0	6.6	6.6	6.6	6.6	6.6
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead			Lag	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Recall Mode	None	None	None	None	None	None	None	Max	Max	Max	Max	Max
Walk Time (s)		8.0	8.0		8.0	8.0		8.0	8.0	8.0	8.0	8.0
Flash Dont Walk (s)		25.0	25.0		25.0	25.0		23.0	23.0	23.0	23.0	23.0
Pedestrian Calls (#/hr)		0	0		0	0		0	0	0	0	0
Act Effct Green (s)	27.7	17.2	17.2	47.7	34.2	34.2	85.1	81.5	81.5	63.5	63.5	63.5
Actuated g/C Ratio	0.20	0.12	0.12	0.34	0.25	0.25	0.61	0.59	0.59	0.46	0.46	0.46
v/c Ratio	0.49	0.58	0.48	1.13	0.64	0.04	0.56	0.39	0.18	0.01	0.76	0.15
Control Delay	44.2	69.0	16.3	123.1	53.9	0.2	26.3	16.5	2.5	25.5	36.8	5.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.2	69.0	16.3	123.1	53.9	0.2	26.3	16.5	2.5	25.5	36.8	5.1
LOS	D	E	B	F	D	A	C	B	A	C	D	A
Approach Delay		43.7			97.5			15.4			34.0	
Approach LOS		D			F			B			C	

### Intersection Summary

Area Type: Other

Cycle Length: 160

Actuated Cycle Length: 138.8

Natural Cycle: 95

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.13

Intersection Signal Delay: 44.3

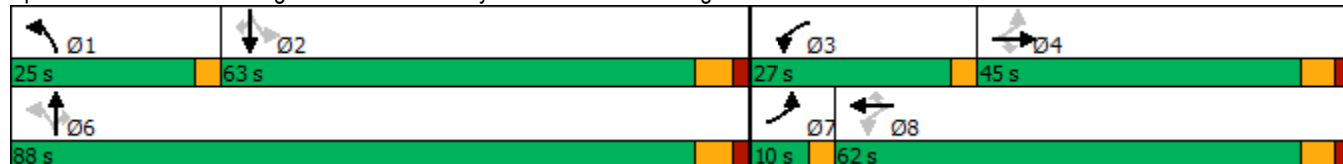
Intersection LOS: D

Intersection Capacity Utilization 97.5%

ICU Level of Service F

Analysis Period (min) 15













### Splits and Phases: 1: Regional Road 50 & Mayfield Road/Albion Vaughan Road



## Queues

### 1: Regional Road 50 & Mayfield Road/Albion Vaughan Road

Base Year: AM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	111	118	111	531	276	16	113	782	160	2	1177	111
v/c Ratio	0.49	0.58	0.48	1.13	0.64	0.04	0.56	0.39	0.18	0.01	0.76	0.15
Control Delay	44.2	69.0	16.3	123.1	53.9	0.2	26.3	16.5	2.5	25.5	36.8	5.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.2	69.0	16.3	123.1	53.9	0.2	26.3	16.5	2.5	25.5	36.8	5.1
Queue Length 50th (m)	19.7	28.6	0.0	~148.2	62.7	0.0	11.5	53.1	0.0	0.3	127.3	0.0
Queue Length 95th (m)	33.0	47.1	16.2	#221.0	90.0	0.0	27.7	72.7	9.2	2.2	180.6	11.1
Internal Link Dist (m)	265.2			539.9			354.1			662.1		
Turn Bay Length (m)	100.0		90.0	170.0		70.0	125.0		180.0	35.0		150.0
Base Capacity (vph)	225	456	383	468	705	571	256	2002	902	203	1545	730
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.49	0.26	0.29	1.13	0.39	0.03	0.44	0.39	0.18	0.01	0.76	0.15

#### Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

























# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

# HCM Signalized Intersection Capacity Analysis

## 1: Regional Road 50 & Mayfield Road/Albion Vaughan Road

Base Year: AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	111	118	111	531	276	16	113	782	160	2	1177	111
Future Volume (vph)	111	118	111	531	276	16	113	782	160	2	1177	111
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.5
Total Lost time (s)	3.0	6.5	6.5	3.0	6.5	6.5	3.0	6.6	6.6	6.6	6.6	6.6
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1580	1642	1094	1767	1762	1331	1214	3411	1426	1190	3380	1465
Flt Permitted	0.59	1.00	1.00	0.51	1.00	1.00	0.11	1.00	1.00	0.36	1.00	1.00
Satd. Flow (perm)	981	1642	1094	952	1762	1331	141	3411	1426	445	3380	1465
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	111	118	111	531	276	16	113	782	160	2	1177	111
RTOR Reduction (vph)	0	0	97	0	0	12	0	0	66	0	0	60
Lane Group Flow (vph)	111	118	14	531	276	4	113	782	94	2	1177	51
Heavy Vehicles (%)	13%	17%	46%	1%	9%	20%	47%	7%	12%	50%	8%	9%
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8		1	6			2	
Permitted Phases	4		4	8		8	6		6	2		2
Actuated Green, G (s)	24.2	17.2	17.2	44.2	34.2	34.2	81.5	81.5	81.5	63.5	63.5	63.5
Effective Green, g (s)	24.2	17.2	17.2	44.2	34.2	34.2	81.5	81.5	81.5	63.5	63.5	63.5
Actuated g/C Ratio	0.17	0.12	0.12	0.32	0.25	0.25	0.59	0.59	0.59	0.46	0.46	0.46
Clearance Time (s)	3.0	6.5	6.5	3.0	6.5	6.5	3.0	6.6	6.6	6.6	6.6	6.6
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)	201	203	135	444	434	327	198	2002	837	203	1546	670
v/s Ratio Prot	0.03	0.07		c0.21	0.16		c0.06	0.23			c0.35	
v/s Ratio Perm	0.07		0.01	c0.17		0.00	0.27		0.07	0.00		0.03
v/c Ratio	0.55	0.58	0.10	1.20	0.64	0.01	0.57	0.39	0.11	0.01	0.76	0.08
Uniform Delay, d1	51.0	57.4	53.9	44.9	46.7	39.5	20.4	15.3	12.7	20.5	31.3	21.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.5	6.4	0.7	108.3	4.2	0.0	6.2	0.6	0.3	0.1	3.6	0.2
Delay (s)	56.5	63.8	54.6	153.2	50.9	39.6	26.6	15.9	12.9	20.6	34.9	21.4
Level of Service	E	E	D	F	D	D	C	B	B	C	C	C
Approach Delay (s)		58.4			116.7			16.6			33.7	
Approach LOS		E			F			B			C	

### Intersection Summary

HCM 2000 Control Delay	50.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	138.8	Sum of lost time (s)	19.1
Intersection Capacity Utilization	97.5%	ICU Level of Service	F
Analysis Period (min)	15		










c Critical Lane Group



## Lanes, Volumes, Timings

### 2: Albion Vaughan Road & Kirby Road










Base Year: AM Peak Hour

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	9	34	249	4	132	784
Future Volume (vph)	9	34	249	4	132	784
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.7	3.5	3.7	3.5	3.7	3.7
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.893		0.998			
Flt Protected	0.990					0.993
Satd. Flow (prot)	1243	0	1730	0	0	1850
Flt Permitted	0.990					0.993
Satd. Flow (perm)	1243	0	1730	0	0	1850
Link Speed (k/h)	80		60			60
Link Distance (m)	414.0		186.1			286.8
Travel Time (s)	18.6		11.2			17.2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	88%	23%	11%	0%	4%	3%
Adj. Flow (vph)	9	34	249	4	132	784
Shared Lane Traffic (%)						
Lane Group Flow (vph)	43	0	253	0	0	916
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	0.99	1.01	0.99	1.01	0.99	0.99
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	75.2%			ICU Level of Service D		
Analysis Period (min)	15					

## HCM Unsignalized Intersection Capacity Analysis

### 2: Albion Vaughan Road & Kirby Road

























Base Year: AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	9	34	249	4	132	784
Future Volume (Veh/h)	9	34	249	4	132	784
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	9	34	249	4	132	784
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	1299	251			253	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1299	251			253	
tC, single (s)	7.3	6.4			4.1	
tC, 2 stage (s)						
tF (s)	4.3	3.5			2.2	
p0 queue free %	92	95			90	
cM capacity (veh/h)	107	739			1301	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	43	253	916			
Volume Left	9	0	132			
Volume Right	34	4	0			
cSH	331	1700	1301			
Volume to Capacity	0.13	0.15	0.10			
Queue Length 95th (m)	3.1	0.0	2.4			
Control Delay (s)	17.5	0.0	2.5			
Lane LOS	C		A			
Approach Delay (s)	17.5	0.0	2.5			
Approach LOS	C					
Intersection Summary						
Average Delay			2.5			
Intersection Capacity Utilization			75.2%	ICU Level of Service		D
Analysis Period (min)			15			

# Lanes, Volumes, Timings

## 1: Regional Road 50 & Mayfield Road/Albion Vaughan Road













Base Year: PM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	185	209	92	174	139	32	75	1178	548	12	981	153
Future Volume (vph)	185	209	92	174	139	32	75	1178	548	12	981	153
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.5
Storage Length (m)	100.0		90.0	170.0		70.0	125.0		180.0	35.0		150.0
Storage Lanes	1		1	1		1	1		1	1		1
Taper Length (m)	60.0			40.0			20.0			0.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1684	1746	1183	1684	1642	1298	1182	3380	1493	1513	3411	1507
Flt Permitted	0.628			0.455			0.202			0.221		
Satd. Flow (perm)	1113	1746	1183	807	1642	1298	251	3380	1493	352	3411	1507
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			92			84			518			153
Link Speed (k/h)		60			60			70			70	
Link Distance (m)		289.2			552.1			378.1			686.1	
Travel Time (s)		17.4			33.1			19.4			35.3	
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 (%)	6%	10%	35%	6%	17%	23%	51%	8%	7%	18%	7%	6%
Adj. Flow (vph)	185	209	92	174	139	32	75	1178	548	12	981	153
Shared Lane Traffic (%)												
Lane Group Flow (vph)	185	209	92	174	139	32	75	1178	548	12	981	153
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												Yes
Headway Factor	1.01	0.99	1.01	1.01	0.99	1.01	1.01	0.99	1.01	1.01	0.99	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm

# Lanes, Volumes, Timings

## 1: Regional Road 50 & Mayfield Road/Albion Vaughan Road

Base Year: PM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases	7	4		3	8		1	6			2	
Permitted Phases	4		4	8		8	6		6	2		2
Detector Phase	7	4	4	3	8	8	1	6	6	2	2	2
Switch Phase												
Minimum Initial (s)	5.0	12.0	12.0	5.0	12.0	12.0	5.0	20.0	20.0	20.0	20.0	20.0
Minimum Split (s)	8.0	39.5	39.5	8.0	39.5	39.5	8.0	37.6	37.6	37.6	37.6	37.6
Total Split (s)	10.0	40.0	40.0	10.0	40.0	40.0	25.0	75.0	75.0	50.0	50.0	50.0
Total Split (%)	8.0%	32.0%	32.0%	8.0%	32.0%	32.0%	20.0%	60.0%	60.0%	40.0%	40.0%	40.0%
Maximum Green (s)	7.0	33.5	33.5	7.0	33.5	33.5	22.0	68.4	68.4	43.4	43.4	43.4
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.6	4.6	4.6	4.6	4.6
All-Red Time (s)	0.0	2.5	2.5	0.0	2.5	2.5	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.5	6.5	3.0	6.5	6.5	3.0	6.6	6.6	6.6	6.6	6.6
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead			Lag	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Recall Mode	None	None	None	None	None	None	None	Max	Max	Max	Max	Max
Walk Time (s)		8.0	8.0		8.0	8.0		8.0	8.0	8.0	8.0	8.0
Flash Dont Walk (s)		25.0	25.0		25.0	25.0		23.0	23.0	23.0	23.0	23.0
Pedestrian Calls (#/hr)		0	0		0	0		0	0	0	0	0
Act Effect Green (s)	31.0	20.5	20.5	31.0	20.5	20.5	72.2	68.6	68.6	57.5	57.5	57.5
Actuated g/C Ratio	0.28	0.18	0.18	0.28	0.18	0.18	0.64	0.61	0.61	0.51	0.51	0.51
v/c Ratio	0.54	0.66	0.32	0.63	0.46	0.10	0.30	0.57	0.49	0.07	0.56	0.18
Control Delay	37.9	52.6	10.6	42.4	45.8	0.7	12.0	15.1	3.0	19.6	22.2	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.9	52.6	10.6	42.4	45.8	0.7	12.0	15.1	3.0	19.6	22.2	3.6
LOS	D	D	B	D	D	A	B	B	A	B	C	A
Approach Delay		39.0			39.9			11.3			19.7	
Approach LOS		D			D			B			B	

### Intersection Summary

Area Type: Other

Cycle Length: 125

Actuated Cycle Length: 112.2

Natural Cycle: 95

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.66

Intersection Signal Delay: 20.0








Intersection LOS: C

Intersection Capacity Utilization 89.6%

ICU Level of Service E

Analysis Period (min) 15













Splits and Phases: 1: Regional Road 50 & Mayfield Road/Albion Vaughan Road

 Ø1	 Ø2	 Ø3	 Ø4
25 s	50 s	10 s	40 s
 Ø6		 Ø7	 Ø8
75 s		10 s	40 s

## Queues

### 1: Regional Road 50 & Mayfield Road/Albion Vaughan Road

























Base Year: PM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	185	209	92	174	139	32	75	1178	548	12	981	153
v/c Ratio	0.54	0.66	0.32	0.63	0.46	0.10	0.30	0.57	0.49	0.07	0.56	0.18
Control Delay	37.9	52.6	10.6	42.4	45.8	0.7	12.0	15.1	3.0	19.6	22.2	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.9	52.6	10.6	42.4	45.8	0.7	12.0	15.1	3.0	19.6	22.2	3.6
Queue Length 50th (m)	29.1	39.5	0.0	27.2	25.3	0.0	5.3	69.0	2.2	1.2	71.0	0.0
Queue Length 95th (m)	46.2	61.4	12.0	43.9	42.5	0.0	12.8	103.5	16.5	5.3	108.8	10.9
Internal Link Dist (m)	265.2			528.1			354.1			662.1		
Turn Bay Length (m)	100.0		90.0	170.0		70.0	125.0		180.0	35.0		150.0
Base Capacity (vph)	343	522	418	277	491	447	344	2065	1113	180	1747	846
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.40	0.22	0.63	0.28	0.07	0.22	0.57	0.49	0.07	0.56	0.18
Intersection Summary												

# HCM Signalized Intersection Capacity Analysis

## 1: Regional Road 50 & Mayfield Road/Albion Vaughan Road

Base Year: PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	185	209	92	174	139	32	75	1178	548	12	981	153
Future Volume (vph)	185	209	92	174	139	32	75	1178	548	12	981	153
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.5
Total Lost time (s)	3.0	6.5	6.5	3.0	6.5	6.5	3.0	6.6	6.6	6.6	6.6	6.6
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1684	1746	1183	1684	1642	1298	1182	3380	1493	1513	3411	1507
Flt Permitted	0.63	1.00	1.00	0.45	1.00	1.00	0.20	1.00	1.00	0.22	1.00	1.00
Satd. Flow (perm)	1114	1746	1183	806	1642	1298	251	3380	1493	351	3411	1507
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	185	209	92	174	139	32	75	1178	548	12	981	153
RTOR Reduction (vph)	0	0	75	0	0	26	0	0	200	0	0	75
Lane Group Flow (vph)	185	209	17	174	139	6	75	1178	348	12	981	78
Heavy Vehicles (%)	6%	10%	35%	6%	17%	23%	51%	8%	7%	18%	7%	6%
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8		1	6			2	
Permitted Phases	4		4	8		8	6		6	2		2
Actuated Green, G (s)	27.5	20.5	20.5	27.5	20.5	20.5	69.2	69.2	69.2	57.5	57.5	57.5
Effective Green, g (s)	27.5	20.5	20.5	27.5	20.5	20.5	69.2	69.2	69.2	57.5	57.5	57.5
Actuated g/C Ratio	0.24	0.18	0.18	0.24	0.18	0.18	0.61	0.61	0.61	0.51	0.51	0.51
Clearance Time (s)	3.0	6.5	6.5	3.0	6.5	6.5	3.0	6.6	6.6	6.6	6.6	6.6
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)	306	317	214	250	298	235	225	2073	915	178	1738	768
v/s Ratio Prot	0.04	0.12		c0.04	0.08		0.03	c0.35			0.29	
v/s Ratio Perm	0.11		0.01	c0.13		0.00	0.18		0.23	0.03		0.05
v/c Ratio	0.60	0.66	0.08	0.70	0.47	0.02	0.33	0.57	0.38	0.07	0.56	0.10
Uniform Delay, d1	36.8	42.9	38.3	37.8	41.3	37.9	10.9	12.9	11.0	14.0	19.0	14.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.9	6.5	0.3	10.2	2.4	0.1	1.8	1.1	1.2	0.7	1.3	0.3
Delay (s)	41.7	49.4	38.6	48.0	43.7	38.0	12.8	14.1	12.2	14.8	20.4	14.6
Level of Service	D	D	D	D	D	D	B	B	B	B	C	B
Approach Delay (s)		44.5			45.3			13.4			19.5	
Approach LOS		D			D			B			B	

### Intersection Summary










HCM 2000 Control Delay	22.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	112.8	Sum of lost time (s)	19.1
Intersection Capacity Utilization	89.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

## Lanes, Volumes, Timings

### 2: Albion Vaughan Road & Kirby Road










Base Year: PM Peak Hour

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	19	67	778	6	36	298
Future Volume (vph)	19	67	778	6	36	298
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.7	3.5	3.7	3.5	3.7	3.7
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.895		0.999			
Flt Protected	0.989					0.995
Satd. Flow (prot)	1562	0	1861	0	0	1794
Flt Permitted	0.989					0.995
Satd. Flow (perm)	1562	0	1861	0	0	1794
Link Speed (k/h)	80		60			60
Link Distance (m)	414.0		186.1			286.8
Travel Time (s)	18.6		11.2			17.2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	33%	2%	3%	17%	3%	7%
Adj. Flow (vph)	19	67	778	6	36	298
Shared Lane Traffic (%)						
Lane Group Flow (vph)	86	0	784	0	0	334
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	0.99	1.01	0.99	1.01	0.99	0.99
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	57.7%			ICU Level of Service B		
Analysis Period (min)	15					

## HCM Unsignalized Intersection Capacity Analysis

### 2: Albion Vaughan Road & Kirby Road

Base Year: PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	19	67	778	6	36	298
Future Volume (Veh/h)	19	67	778	6	36	298
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	19	67	778	6	36	298
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	1151	781			784	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1151	781			784	
tC, single (s)	6.7	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.8	3.3			2.2	
p0 queue free %	90	83			96	
cM capacity (veh/h)	182	395			830	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	86	784	334			
Volume Left	19	0	36			
Volume Right	67	6	0			
cSH	314	1700	830			
Volume to Capacity	0.27	0.46	0.04			
Queue Length 95th (m)	7.6	0.0	1.0			
Control Delay (s)	20.7	0.0	1.5			
Lane LOS	C		A			
Approach Delay (s)	20.7	0.0	1.5			
Approach LOS	C					
<b>Intersection Summary</b>						
Average Delay			1.9			
Intersection Capacity Utilization			57.7%	ICU Level of Service		B
Analysis Period (min)			15			



# Appendix D













## Background Traffic Operations Reports



## Queues

### 1: Regional Road 50 & Mayfield Road/Albion Vaughan Road

Future Background: AM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	138	147	138	660	343	20	141	972	199	2	1463	138
v/c Ratio	0.52	0.64	0.51	0.96	0.76	0.05	0.99	0.52	0.23	0.01	0.98	0.19
Control Delay	39.8	72.6	14.9	85.1	62.2	0.2	112.8	22.8	2.9	26.5	59.2	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.8	72.6	14.9	85.1	62.2	0.2	112.8	22.8	2.9	26.5	59.2	4.7
Queue Length 50th (m)	25.0	38.0	0.0	91.5	86.1	0.0	28.0	83.2	0.0	0.3	200.1	0.0
Queue Length 95th (m)	39.4	59.2	18.0	#140.3	118.6	0.0	#76.4	116.0	11.6	2.1	#279.2	12.2
Internal Link Dist (m)	265.2			539.9			354.1			662.1		
Turn Bay Length (m)	100.0		90.0	170.0		70.0	125.0		180.0	35.0		150.0
Base Capacity (vph)	269	366	351	684	596	493	142	1879	874	153	1495	725
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.51	0.40	0.39	0.96	0.58	0.04	0.99	0.52	0.23	0.01	0.98	0.19

#### Intersection Summary

























# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

# HCM Signalized Intersection Capacity Analysis

## 1: Regional Road 50 & Mayfield Road/Albion Vaughan Road

Future Background: AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	138	147	138	660	343	20	141	972	199	2	1463	138
Future Volume (vph)	138	147	138	660	343	20	141	972	199	2	1463	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.5
Total Lost time (s)	3.0	6.5	6.5	3.0	6.5	6.5	3.0	6.6	6.6	6.6	6.6	6.6
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1580	1642	1094	3429	1762	1331	1214	3411	1426	1190	3380	1465
Flt Permitted	0.50	1.00	1.00	0.95	1.00	1.00	0.06	1.00	1.00	0.28	1.00	1.00
Satd. Flow (perm)	826	1642	1094	3429	1762	1331	75	3411	1426	348	3380	1465
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	138	147	138	660	343	20	141	972	199	2	1463	138
RTOR Reduction (vph)	0	0	119	0	0	15	0	0	89	0	0	77
Lane Group Flow (vph)	138	147	19	660	343	5	141	972	110	2	1463	61
Heavy Vehicles (%)	13%	17%	46%	1%	9%	20%	47%	7%	12%	50%	8%	9%
Turn Type	pm+pt	NA	Perm	Prot	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8		1	6			2	
Permitted Phases	4		4			8	6		6	2		2
Actuated Green, G (s)	33.1	20.8	20.8	29.5	38.0	38.0	81.5	81.5	81.5	65.5	65.5	65.5
Effective Green, g (s)	33.1	20.8	20.8	29.5	38.0	38.0	81.5	81.5	81.5	65.5	65.5	65.5
Actuated g/C Ratio	0.22	0.14	0.14	0.20	0.26	0.26	0.55	0.55	0.55	0.44	0.44	0.44
Clearance Time (s)	3.0	6.5	6.5	3.0	6.5	6.5	3.0	6.6	6.6	6.6	6.6	6.6
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)	247	230	153	683	452	341	141	1879	785	154	1496	648
v/s Ratio Prot	0.05	0.09		c0.19	c0.19		c0.09	0.28			0.43	
v/s Ratio Perm	0.08		0.02			0.00	c0.46		0.08	0.01		0.04
v/c Ratio	0.56	0.64	0.13	0.97	0.76	0.02	1.00	0.52	0.14	0.01	0.98	0.09
Uniform Delay, d1	48.8	60.0	55.6	58.7	50.7	41.0	48.3	20.8	16.1	23.1	40.5	24.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.6	7.9	0.8	27.1	8.5	0.0	75.8	1.0	0.4	0.2	18.6	0.3
Delay (s)	53.4	67.9	56.4	85.8	59.2	41.0	124.1	21.9	16.5	23.2	59.1	24.2
Level of Service	D	E	E	F	E	D	F	C	B	C	E	C
Approach Delay (s)		59.4			76.0			32.0			56.0	
Approach LOS		E			E			C			E	

### Intersection Summary










HCM 2000 Control Delay	53.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	147.9	Sum of lost time (s)	19.1
Intersection Capacity Utilization	94.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

## HCM Unsignalized Intersection Capacity Analysis

### 2: Albion Vaughan Road & Kirby Road













Future Background: AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	11	42	310	5	164	975
Future Volume (Veh/h)	11	42	310	5	164	975
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	11	42	310	5	164	975
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	1616	312			315	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1616	312			315	
tC, single (s)	7.3	6.4			4.1	
tC, 2 stage (s)						
tF (s)	4.3	3.5			2.2	
p0 queue free %	82	94			87	
cM capacity (veh/h)	63	681			1234	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	53	315	1139			
Volume Left	11	0	164			
Volume Right	42	5	0			
cSH	223	1700	1234			
Volume to Capacity	0.24	0.19	0.13			
Queue Length 95th (m)	6.3	0.0	3.2			
Control Delay (s)	26.1	0.0	3.4			
Lane LOS	D		A			
Approach Delay (s)	26.1	0.0	3.4			
Approach LOS	D					
Intersection Summary						
Average Delay			3.5			
Intersection Capacity Utilization			90.3%	ICU Level of Service		E
Analysis Period (min)			15			

## Queues

### 1: Regional Road 50 & Mayfield Road/Albion Vaughan Road

Future Background: PM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	230	260	114	216	173	40	93	1465	681	15	1220	190
v/c Ratio	0.58	0.71	0.34	0.70	0.49	0.12	0.62	0.78	0.65	0.19	0.77	0.24
Control Delay	35.1	54.1	9.4	64.9	44.3	0.7	33.0	24.7	8.3	28.2	31.1	3.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.1	54.1	9.4	64.9	44.3	0.7	33.0	24.7	8.3	28.2	31.1	3.7
Queue Length 50th (m)	35.5	51.0	0.0	22.9	31.9	0.0	8.2	119.2	20.9	1.8	109.0	0.0
Queue Length 95th (m)	54.2	76.3	13.0	#40.5	51.0	0.3	#27.4	173.3	65.4	7.5	153.7	12.3
Internal Link Dist (m)	265.2			528.1			354.1			662.1		
Turn Bay Length (m)	100.0		90.0	170.0		70.0	125.0		180.0	35.0		150.0
Base Capacity (vph)	394	497	419	309	482	440	149	1886	1048	81	1580	800
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.58	0.52	0.27	0.70	0.36	0.09	0.62	0.78	0.65	0.19	0.77	0.24

#### Intersection Summary

























# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

# HCM Signalized Intersection Capacity Analysis

## 1: Regional Road 50 & Mayfield Road/Albion Vaughan Road

Future Background: PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	230	260	114	216	173	40	93	1465	681	15	1220	190
Future Volume (vph)	230	260	114	216	173	40	93	1465	681	15	1220	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.5
Total Lost time (s)	3.0	6.5	6.5	3.0	6.5	6.5	3.0	6.6	6.6	6.6	6.6	6.6
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1684	1746	1183	3267	1642	1298	1182	3380	1493	1513	3411	1507
Flt Permitted	0.59	1.00	1.00	0.95	1.00	1.00	0.10	1.00	1.00	0.11	1.00	1.00
Satd. Flow (perm)	1045	1746	1183	3267	1642	1298	131	3380	1493	175	3411	1507
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	230	260	114	216	173	40	93	1465	681	15	1220	190
RTOR Reduction (vph)	0	0	90	0	0	31	0	0	215	0	0	102
Lane Group Flow (vph)	230	260	24	216	173	9	93	1465	466	15	1220	88
Heavy Vehicles (%)	6%	10%	35%	6%	17%	23%	51%	8%	7%	18%	7%	6%
Turn Type	pm+pt	NA	Perm	Prot	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8		1	6			2	
Permitted Phases	4		4			8	6		6	2		2
Actuated Green, G (s)	34.3	24.3	24.3	11.0	25.3	25.3	65.0	65.0	65.0	54.0	54.0	54.0
Effective Green, g (s)	34.3	24.3	24.3	11.0	25.3	25.3	65.0	65.0	65.0	54.0	54.0	54.0
Actuated g/C Ratio	0.29	0.21	0.21	0.09	0.22	0.22	0.56	0.56	0.56	0.46	0.46	0.46
Clearance Time (s)	3.0	6.5	6.5	3.0	6.5	6.5	3.0	6.6	6.6	6.6	6.6	6.6
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)	362	364	246	308	356	282	145	1887	833	81	1582	699
v/s Ratio Prot	0.05	c0.15		c0.07	0.11		0.04	c0.43			0.36	
v/s Ratio Perm	0.13		0.02			0.01	0.31		0.31	0.09		0.06
v/c Ratio	0.64	0.71	0.10	0.70	0.49	0.03	0.64	0.78	0.56	0.19	0.77	0.13
Uniform Delay, d1	34.1	42.8	37.2	51.1	39.9	35.9	18.4	20.0	16.5	18.3	26.0	17.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.0	8.0	0.4	8.8	2.2	0.1	12.5	3.2	2.7	5.0	3.7	0.4
Delay (s)	39.2	50.9	37.5	59.9	42.0	36.0	31.0	23.2	19.2	23.3	29.7	18.1
Level of Service	D	D	D	E	D	D	C	C	B	C	C	B
Approach Delay (s)		43.9			50.4			22.3			28.1	
Approach LOS		D			D			C			C	

### Intersection Summary










HCM 2000 Control Delay	29.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	116.4	Sum of lost time (s)	19.1
Intersection Capacity Utilization	99.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

## HCM Unsignalized Intersection Capacity Analysis

### 2: Albion Vaughan Road & Kirby Road

Future Background: PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	24	83	967	7	45	371
Future Volume (Veh/h)	24	83	967	7	45	371
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	24	83	967	7	45	371
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	1432	970			974	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1432	970			974	
tC, single (s)	6.7	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.8	3.3			2.2	
p0 queue free %	80	73			94	
cM capacity (veh/h)	118	307			704	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	107	974	416			
Volume Left	24	0	45			
Volume Right	83	7	0			
cSH	226	1700	704			
Volume to Capacity	0.47	0.57	0.06			
Queue Length 95th (m)	16.3	0.0	1.4			
Control Delay (s)	34.4	0.0	1.9			
Lane LOS	D		A			
Approach Delay (s)	34.4	0.0	1.9			
Approach LOS	D					
Intersection Summary						
Average Delay			3.0			
Intersection Capacity Utilization			70.3%	ICU Level of Service		C
Analysis Period (min)			15			

# Appendix E

## Total Traffic Operations Reports

















## Queues

### 1: Regional Road 50 & Mayfield Road/Albion Vaughan Road

Future Total: AM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	138	149	138	693	352	37	141	972	205	10	1463	138
v/c Ratio	0.54	0.66	0.51	0.99	0.73	0.09	0.99	0.52	0.23	0.07	0.98	0.19
Control Delay	42.5	74.2	15.2	90.6	58.2	2.4	111.3	22.8	2.9	27.5	60.3	4.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	42.5	74.2	15.2	90.6	58.2	2.4	111.3	22.8	2.9	27.5	60.3	4.6
Queue Length 50th (m)	24.8	38.6	0.0	97.0	86.4	0.0	28.0	84.2	0.0	1.5	201.8	0.0
Queue Length 95th (m)	39.4	60.1	18.4	#145.0	119.1	2.4	#74.5	112.4	11.5	5.8	#271.8	12.0
Internal Link Dist (m)	265.2			539.9			354.1			662.1		
Turn Bay Length (m)	100.0		90.0	170.0		70.0	125.0		180.0	35.0		150.0
Base Capacity (vph)	255	367	352	697	633	520	143	1872	875	152	1488	722
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.41	0.39	0.99	0.56	0.07	0.99	0.52	0.23	0.07	0.98	0.19

#### Intersection Summary

























# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

# HCM Signalized Intersection Capacity Analysis

## 1: Regional Road 50 & Mayfield Road/Albion Vaughan Road










Future Total: AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	138	149	138	693	352	37	141	972	205	10	1463	138
Future Volume (vph)	138	149	138	693	352	37	141	972	205	10	1463	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.5
Total Lost time (s)	3.0	6.5	6.5	3.0	6.5	6.5	3.0	6.6	6.6	6.6	6.6	6.6
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1580	1642	1094	3429	1762	1331	1214	3411	1426	1190	3380	1465
Flt Permitted	0.55	1.00	1.00	0.95	1.00	1.00	0.06	1.00	1.00	0.28	1.00	1.00
Satd. Flow (perm)	915	1642	1094	3429	1762	1331	75	3411	1426	348	3380	1465
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	138	149	138	693	352	37	141	972	205	10	1463	138
RTOR Reduction (vph)	0	0	119	0	0	27	0	0	92	0	0	77
Lane Group Flow (vph)	138	149	19	693	352	10	141	972	113	10	1463	61
Heavy Vehicles (%)	13%	17%	46%	1%	9%	20%	47%	7%	12%	50%	8%	9%
Turn Type	pm+pt	NA	Perm	Prot	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8		1	6			2	
Permitted Phases	4		4			8	6		6	2		2
Actuated Green, G (s)	30.4	20.4	20.4	30.0	40.4	40.4	81.0	81.0	81.0	65.0	65.0	65.0
Effective Green, g (s)	30.4	20.4	20.4	30.0	40.4	40.4	81.0	81.0	81.0	65.0	65.0	65.0
Actuated g/C Ratio	0.21	0.14	0.14	0.20	0.27	0.27	0.55	0.55	0.55	0.44	0.44	0.44
Clearance Time (s)	3.0	6.5	6.5	3.0	6.5	6.5	3.0	6.6	6.6	6.6	6.6	6.6
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)	233	227	151	697	482	364	141	1873	783	153	1489	645
v/s Ratio Prot	0.04	0.09		c0.20	c0.20		c0.09	0.28			0.43	
v/s Ratio Perm	0.08		0.02			0.01	c0.46		0.08	0.03		0.04
v/c Ratio	0.59	0.66	0.13	0.99	0.73	0.03	1.00	0.52	0.14	0.07	0.98	0.09
Uniform Delay, d1	51.0	60.2	55.7	58.7	48.6	39.2	48.1	21.0	16.3	23.8	40.7	24.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.0	8.9	0.8	32.6	6.8	0.1	75.8	1.0	0.4	0.8	19.5	0.3
Delay (s)	57.0	69.1	56.5	91.2	55.4	39.2	123.8	22.0	16.7	24.6	60.2	24.4
Level of Service	E	E	E	F	E	D	F	C	B	C	E	C
Approach Delay (s)		61.1			77.8			32.1			56.9	
Approach LOS		E			E			C			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			55.0									
HCM 2000 Volume to Capacity ratio			0.99									
Actuated Cycle Length (s)			147.5									
Intersection Capacity Utilization			95.6%									
Analysis Period (min)			15									
c Critical Lane Group												

## HCM Unsignalized Intersection Capacity Analysis

### 2: Albion Vaughan Road & Kirby Road










Future Total: AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	11	42	310	5	164	981
Future Volume (Veh/h)	11	42	310	5	164	981
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	11	42	310	5	164	981
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	1622	312			315	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1622	312			315	
tC, single (s)	7.3	6.4			4.1	
tC, 2 stage (s)						
tF (s)	4.3	3.5			2.2	
p0 queue free %	82	94			87	
cM capacity (veh/h)	62	681			1234	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	53	315	1145			
Volume Left	11	0	164			
Volume Right	42	5	0			
cSH	221	1700	1234			
Volume to Capacity	0.24	0.19	0.13			
Queue Length 95th (m)	6.3	0.0	3.2			
Control Delay (s)	26.3	0.0	3.4			
Lane LOS	D		A			
Approach Delay (s)	26.3	0.0	3.4			
Approach LOS	D					
Intersection Summary						
Average Delay			3.5			
Intersection Capacity Utilization			90.6%	ICU Level of Service		E
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 3: Albion Vaughan Road & Driveway













Future Total: AM Peak Hour

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	59	16	315	986	6
Future Volume (Veh/h)	5	59	16	315	986	6
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	5	59	16	315	986	6
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	1336	989	992			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1336	989	992			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	80	98			
cM capacity (veh/h)	165	299	697			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	64	331	992			
Volume Left	5	16	0			
Volume Right	59	0	6			
cSH	282	697	1700			
Volume to Capacity	0.23	0.02	0.58			
Queue Length 95th (m)	6.0	0.5	0.0			
Control Delay (s)	21.5	0.8	0.0			
Lane LOS	C	A				
Approach Delay (s)	21.5	0.8	0.0			
Approach LOS	C					
Intersection Summary						
Average Delay		1.2				
Intersection Capacity Utilization		62.8%		ICU Level of Service		B
Analysis Period (min)		15				

## Queues

### 1: Regional Road 50 & Mayfield Road/Albion Vaughan Road

Future Total: PM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	230	269	114	230	177	56	93	1465	713	36	1220	190
v/c Ratio	0.59	0.73	0.34	0.75	0.49	0.16	0.63	0.78	0.68	0.45	0.78	0.24
Control Delay	35.0	54.7	9.3	68.2	44.3	3.8	34.0	25.0	9.9	46.1	31.5	3.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.0	54.7	9.3	68.2	44.3	3.8	34.0	25.0	9.9	46.1	31.5	3.7
Queue Length 50th (m)	35.5	53.1	0.0	24.6	32.8	0.0	8.3	120.8	29.6	5.0	110.3	0.0
Queue Length 95th (m)	54.2	79.2	13.0	#44.6	52.2	4.4	#27.9	173.3	80.1	#20.0	153.7	12.3
Internal Link Dist (m)	265.2			528.1			354.1			662.1		
Turn Bay Length (m)	100.0		90.0	170.0		70.0	125.0		180.0	35.0		150.0
Base Capacity (vph)	393	495	417	308	480	439	147	1878	1041	80	1574	797
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.59	0.54	0.27	0.75	0.37	0.13	0.63	0.78	0.68	0.45	0.78	0.24

#### Intersection Summary

























# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

# HCM Signalized Intersection Capacity Analysis

## 1: Regional Road 50 & Mayfield Road/Albion Vaughan Road

Future Total: PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	230	269	114	230	177	56	93	1465	713	36	1220	190
Future Volume (vph)	230	269	114	230	177	56	93	1465	713	36	1220	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.5
Total Lost time (s)	3.0	6.5	6.5	3.0	6.5	6.5	3.0	6.6	6.6	6.6	6.6	6.6
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1684	1746	1183	3267	1642	1298	1182	3380	1493	1513	3411	1507
Flt Permitted	0.58	1.00	1.00	0.95	1.00	1.00	0.10	1.00	1.00	0.11	1.00	1.00
Satd. Flow (perm)	1032	1746	1183	3267	1642	1298	129	3380	1493	173	3411	1507
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	230	269	114	230	177	56	93	1465	713	36	1220	190
RTOR Reduction (vph)	0	0	90	0	0	44	0	0	212	0	0	102
Lane Group Flow (vph)	230	269	24	230	177	12	93	1465	501	36	1220	88
Heavy Vehicles (%)	6%	10%	35%	6%	17%	23%	51%	8%	7%	18%	7%	6%
Turn Type	pm+pt	NA	Perm	Prot	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8		1	6			2	
Permitted Phases	4		4			8	6		6	2		2
Actuated Green, G (s)	34.8	24.8	24.8	11.0	25.8	25.8	65.0	65.0	65.0	54.0	54.0	54.0
Effective Green, g (s)	34.8	24.8	24.8	11.0	25.8	25.8	65.0	65.0	65.0	54.0	54.0	54.0
Actuated g/C Ratio	0.30	0.21	0.21	0.09	0.22	0.22	0.56	0.56	0.56	0.46	0.46	0.46
Clearance Time (s)	3.0	6.5	6.5	3.0	6.5	6.5	3.0	6.6	6.6	6.6	6.6	6.6
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)	362	370	250	307	362	286	143	1879	830	79	1575	696
v/s Ratio Prot	0.05	c0.15		c0.07	0.11		0.04	c0.43			0.36	
v/s Ratio Perm	0.13		0.02			0.01	0.31		0.34	0.21		0.06
v/c Ratio	0.64	0.73	0.10	0.75	0.49	0.04	0.65	0.78	0.60	0.46	0.77	0.13
Uniform Delay, d1	34.1	42.9	37.0	51.6	39.8	35.8	18.7	20.3	17.3	21.4	26.4	18.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.0	8.5	0.4	11.4	2.2	0.1	13.4	3.3	3.2	17.8	3.8	0.4
Delay (s)	39.1	51.4	37.4	63.1	42.0	36.0	32.1	23.6	20.6	39.2	30.1	18.3
Level of Service	D	D	D	E	D	D	C	C	C	D	C	B
Approach Delay (s)		44.2			51.7			23.0			28.8	
Approach LOS		D			D			C			C	

### Intersection Summary










HCM 2000 Control Delay	30.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	116.9	Sum of lost time (s)	19.1
Intersection Capacity Utilization	99.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

## HCM Unsignalized Intersection Capacity Analysis

### 2: Albion Vaughan Road & Kirby Road










Future Total: PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	24	83	967	7	45	377
Future Volume (Veh/h)	24	83	967	7	45	377
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	24	83	967	7	45	377
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	1438	970			974	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1438	970			974	
tC, single (s)	6.7	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.8	3.3			2.2	
p0 queue free %	80	73			94	
cM capacity (veh/h)	117	307			704	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	107	974	422			
Volume Left	24	0	45			
Volume Right	83	7	0			
cSH	225	1700	704			
Volume to Capacity	0.47	0.57	0.06			
Queue Length 95th (m)	16.4	0.0	1.4			
Control Delay (s)	34.6	0.0	1.9			
Lane LOS	D		A			
Approach Delay (s)	34.6	0.0	1.9			
Approach LOS	D					
Intersection Summary						
Average Delay			3.0			
Intersection Capacity Utilization			70.6%	ICU Level of Service		C
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 3: Albion Vaughan Road & Driveway

Future Total: PM Peak Hour

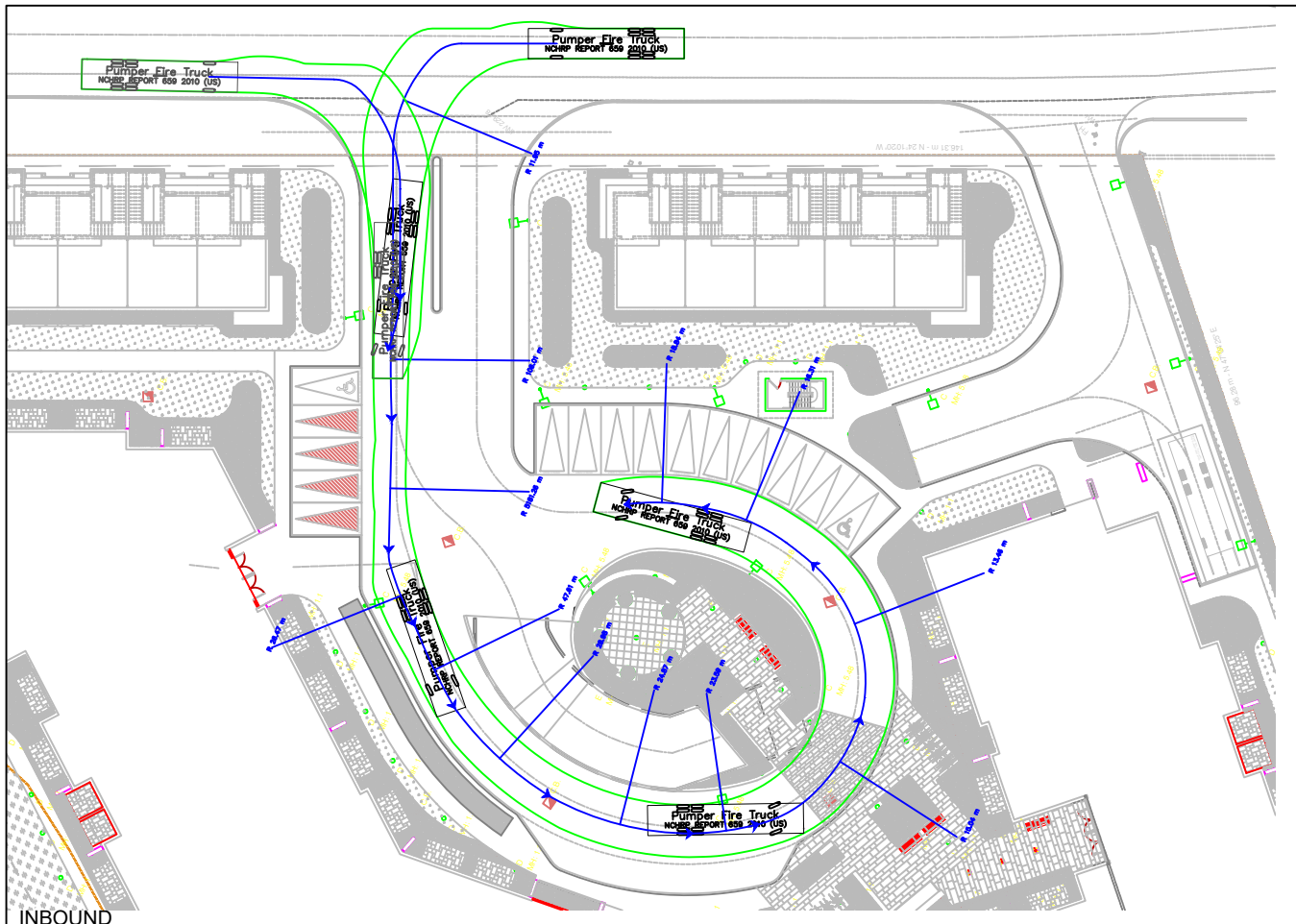
						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	9	34	62	975	394	6
Future Volume (Veh/h)	9	34	62	975	394	6
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	9	34	62	975	394	6
Pedestrians						
Lane Width (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	1496	397	400			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1496	397	400			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	93	95	95			
cM capacity (veh/h)	128	652	1159			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	43	1037	400			
Volume Left	9	62	0			
Volume Right	34	0	6			
cSH	351	1159	1700			
Volume to Capacity	0.12	0.05	0.24			
Queue Length 95th (m)	2.9	1.2	0.0			
Control Delay (s)	16.7	1.5	0.0			
Lane LOS	C	A				
Approach Delay (s)	16.7	1.5	0.0			
Approach LOS	C					
Intersection Summary						
Average Delay		1.5				
Intersection Capacity Utilization		89.2%		ICU Level of Service		E
Analysis Period (min)		15				



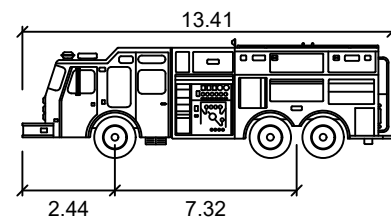
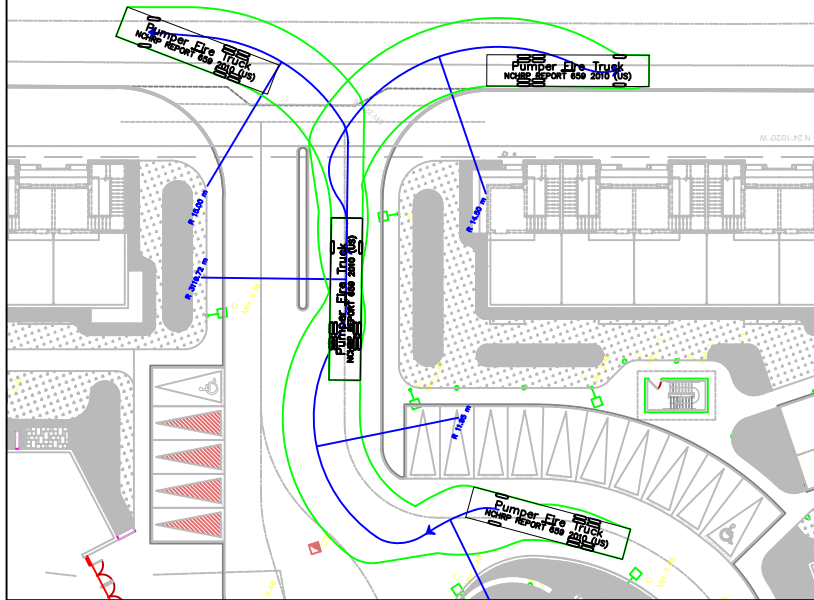
# Appendix F

## AutoTURN Analysis – Vehicle Maneuvering Diagrams



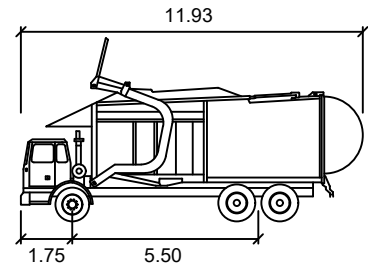
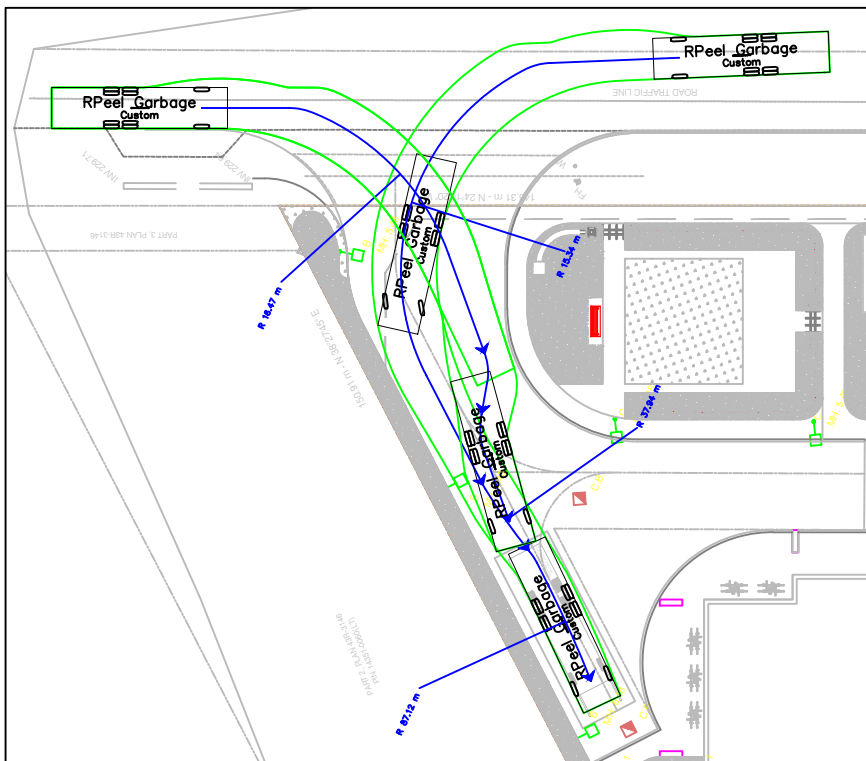


INBOUND  
OUTBOUND



Pumper Fire Truck

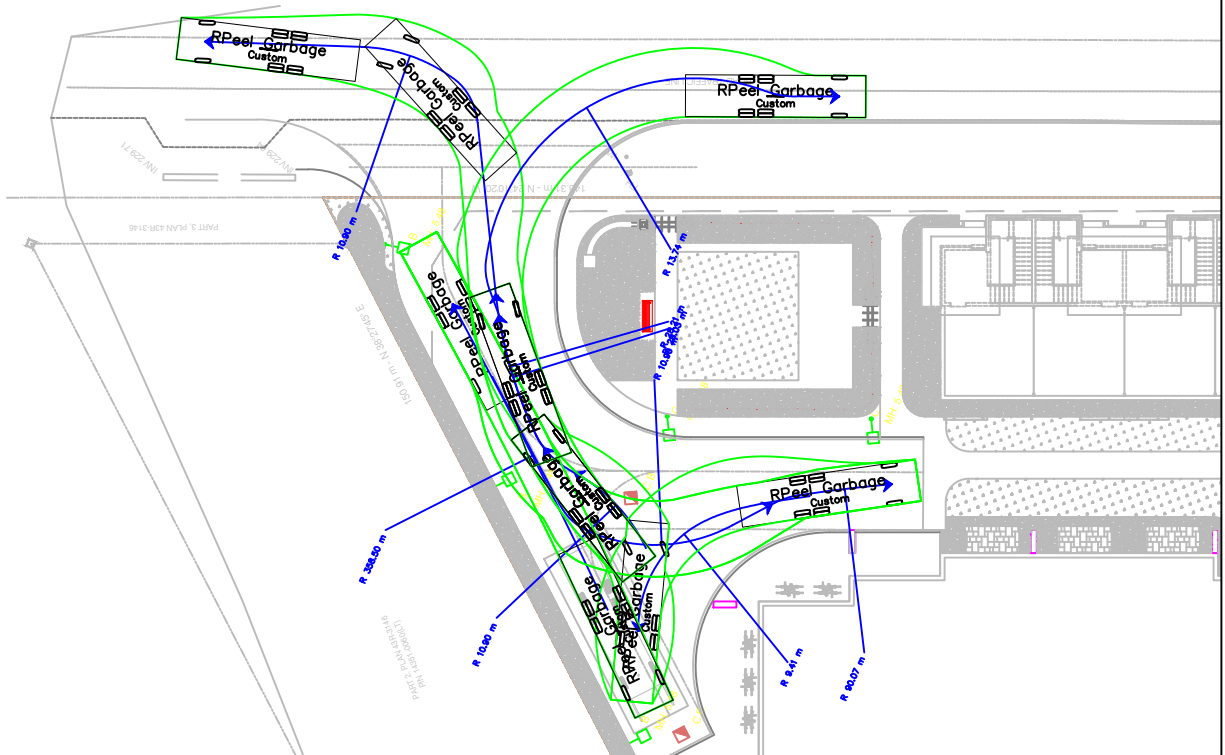
	units
Width	: 2.59
Track	: 2.59
Lock to Lock Time	: 6.0
Steering Angle	: 37.8



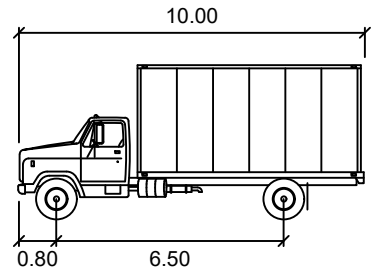
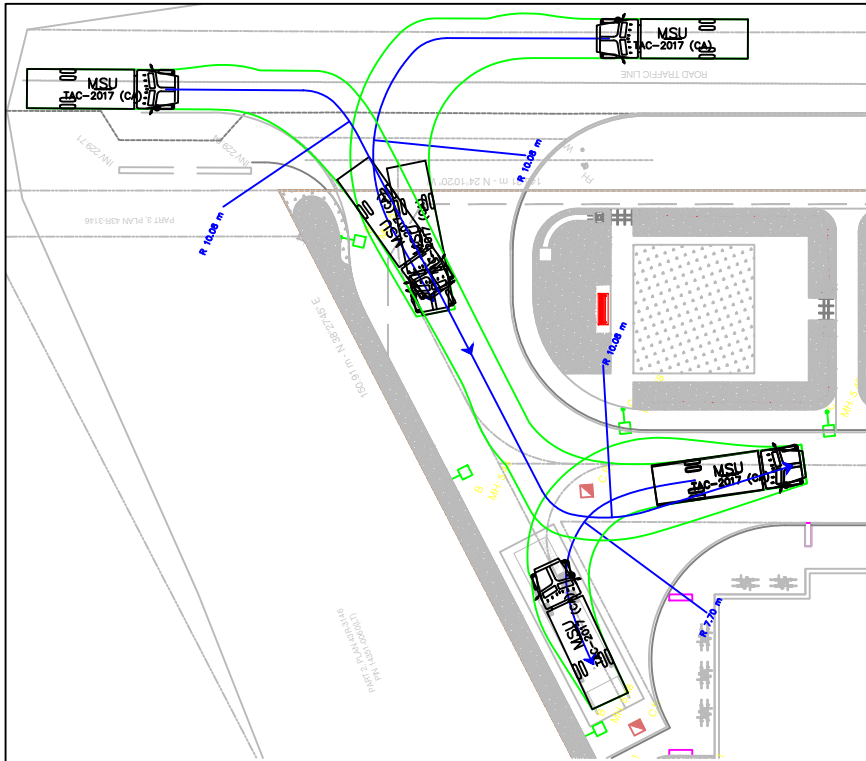
RPeel Garbage

	meters
Width	: 2.77
Track	: 2.77
Lock to Lock Time	: 6.0
Steering Angle	: 30.3

OUTBOUND





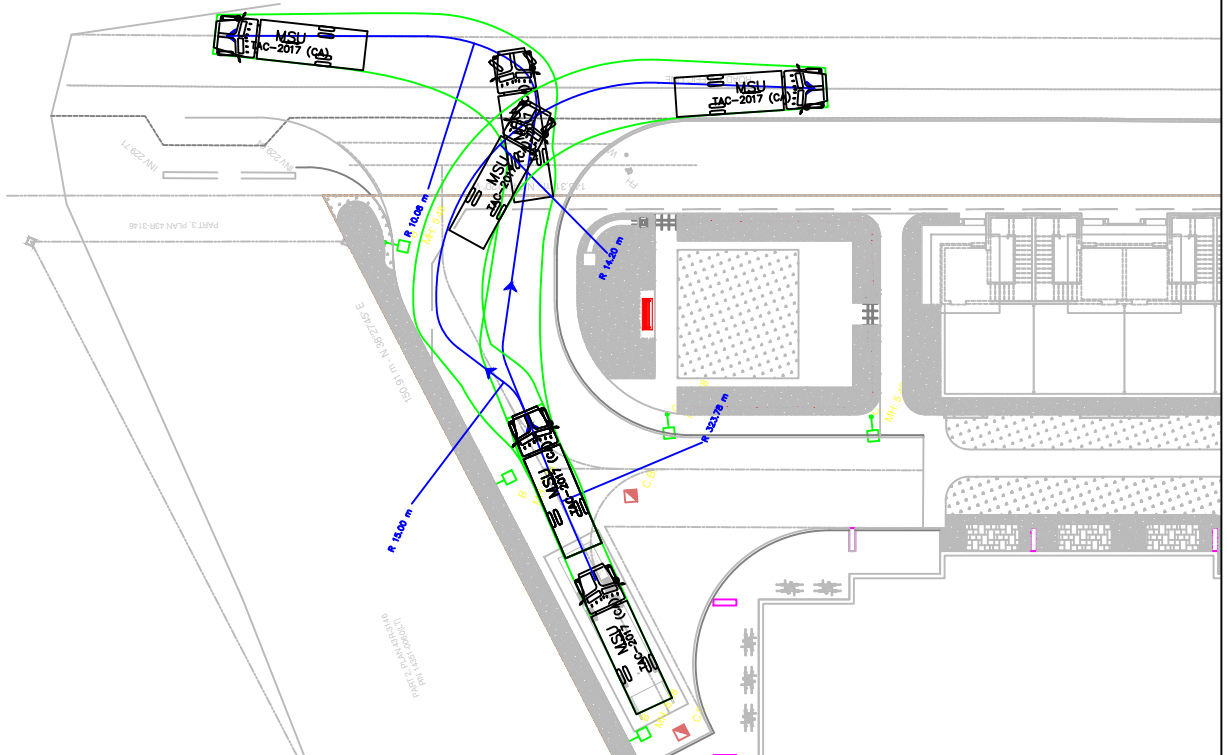


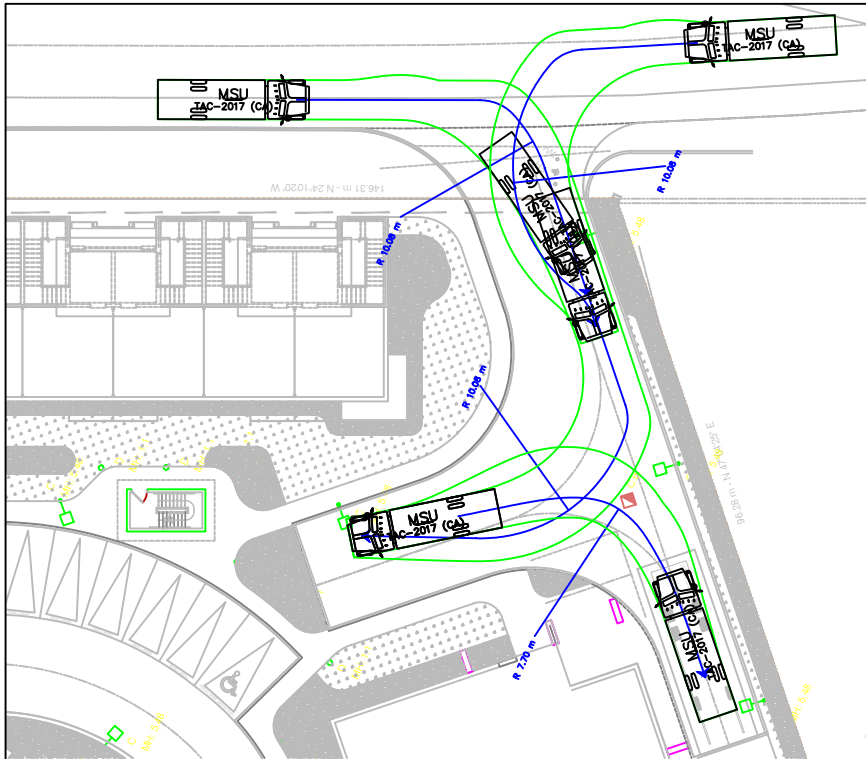
MSU

	meters
Width	: 2.60
Track	: 2.60
Lock to Lock Time	: 6.0
Steering Angle	: 40.2

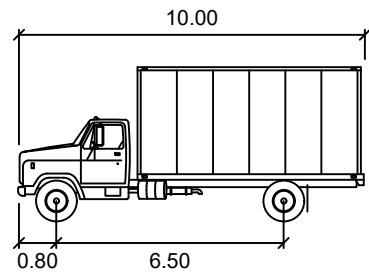
INBOUND

OUTBOUND





INBOUND

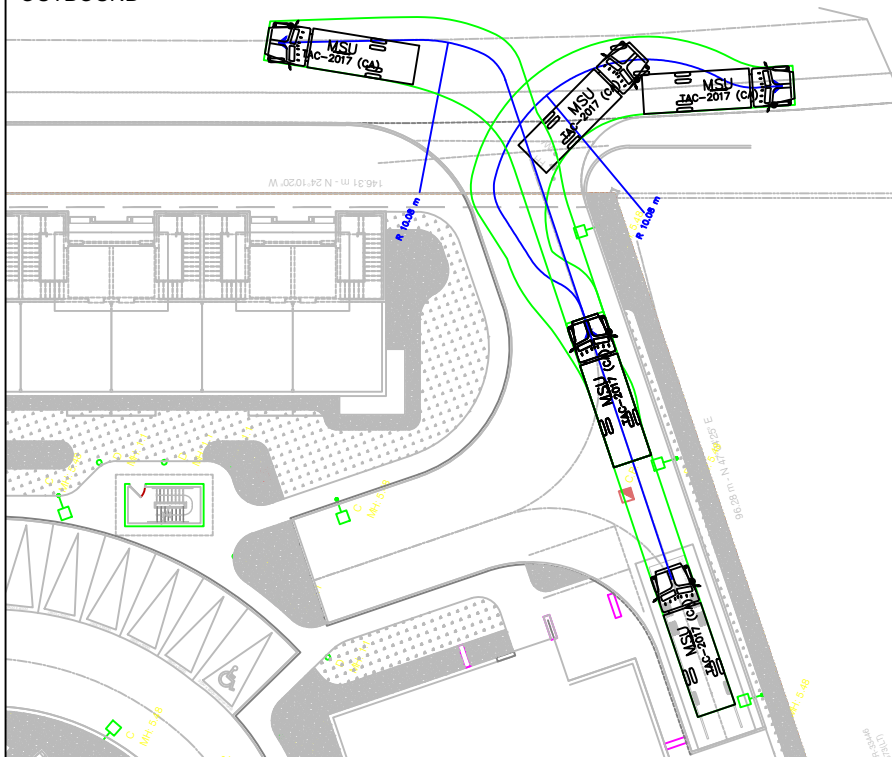


MSU

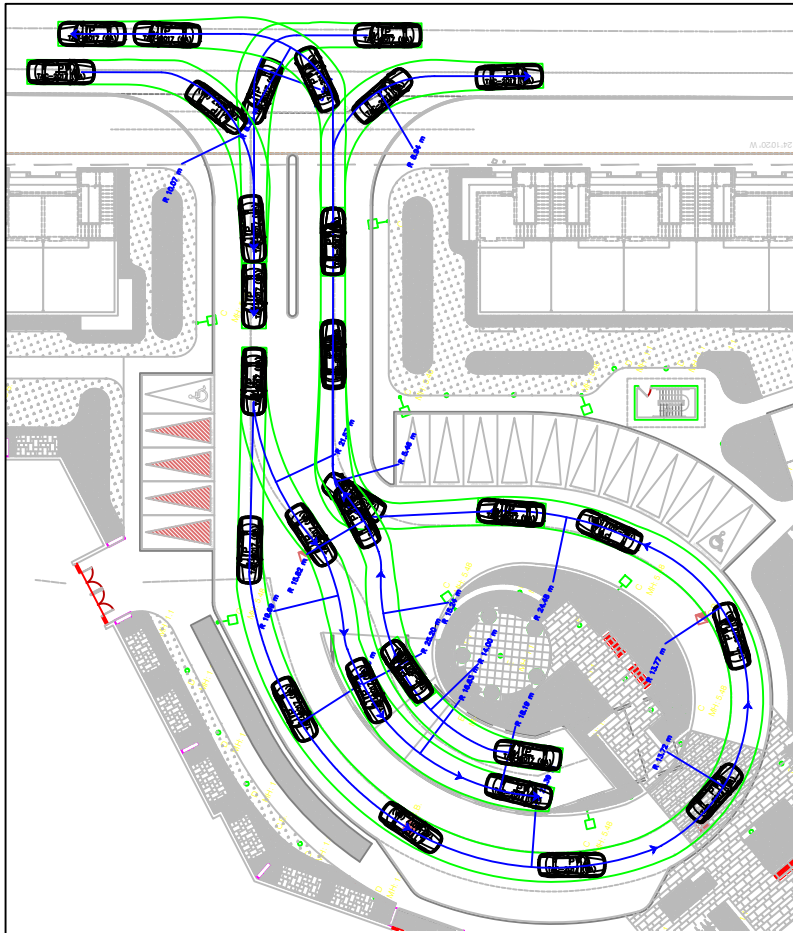
meters

Width : 2.60  
Track : 2.60  
Lock to Lock Time : 6.0  
Steering Angle : 40.2

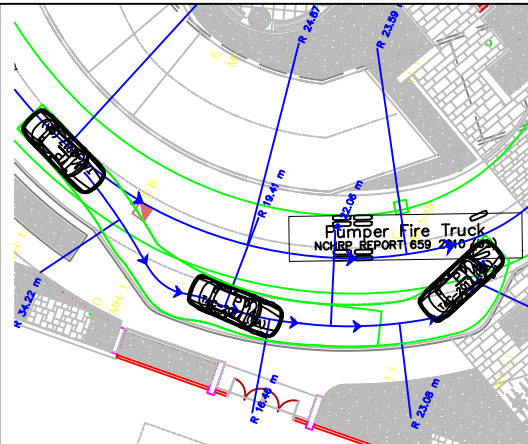
OUTBOUND



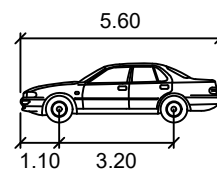




SURFACE LEVEL



LAYBY



P

	metres
Width	: 2.00
Track	: 2.00
Lock to Lock Time	: 6.0
Steering Angle	: 35.9

UNDERGROUND LEVEL

