245 Riverbank Drive

Transportation Impact Study

Paradigm Transportation Solutions Limited

2024-04
230691

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Project Summary

245 Riverbank Drive
Transportation Impact Study

Project Number:

230691

Date and Version:

2024-04
1.0.0

Client:

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Disclaimer

Executive Summary

Content

Intermarket Properties retained Paradigm Transportation Solutions Limited (Paradigm) to prepare this Transportation Impact Study and Access and Circulation Review for a proposed residential development at 245 Riverbank Drive in the City of Cambridge.

The purpose of this study is to estimate the transportation related impacts of the proposed development on the surrounding transportation network and identify how these impacts (if any) might be mitigated.

Development Concept

The subject site is on the east side of Riverbank Drive, near where Riverbank Drive transitions from an east-west direction to a north-south direction. The lands are occupied by a single-family home. The surrounding land uses are primarily low-density residential. To the east, the property is bounded by the North Cambridge Business Park.

The property owner is submitting an Official Plan Amendment (OPA) and Zoning By-law Amendment Application to support a concept plan comprising 53 street townhouses and 56 stacked townhouses. Vehicle access is proposed via a connection to Riverbank Drive near the northwest corner of the site. Redevelopment is planned by 2026.

Conclusions

Based on the analyses contained herein, the findings of this report are as follows:

- Under existing (2023) conditions, the study intersections (King Street East and Riverbank Drive, and Riverbank Drive and Allendale Road) are operating at acceptable levels of service and within capacity. There are no critical movements.
- Under future background (2029) traffic conditions, (that is, *without the proposed development*) the study intersections are forecast to operate at acceptable levels of service and within capacity. In the weekday PM peak hour, the westbound left-turn movement on Riverbank Drive at King Street East is forecast to operate at LOS F, with a v/c ratio of 1.22. These analyses assume an extension of Boychuk Drive to King Street.

- Development of the site is forecast to generate 51 trips in the weekday AM peak hour and 62 trips in the weekday PM peak hour.
- Under future total (2029) traffic conditions (that is, *with the proposed development*) the study intersections are forecast to operate similar to background traffic conditions. In the weekday PM peak hour, the westbound left-turn movement on Riverbank Drive at King Street East is forecast to operate at LOS F, with a v/c ratio of 1.40.
- Under future total (2029) traffic conditions, without the full build-out of the North Cambridge Business Park, the study intersections are forecast to operate at acceptable levels of service and within capacity in the weekday AM peak hour. In the weekday PM peak hour, the westbound left-turn movement on Riverbank Drive at King Street East is forecast to operate at LOS F, with a v/c ratio of 0.70.
- Under future total (2029) traffic conditions, with a full closure of Allendale Road at Riverbank Drive, the study intersections are forecast operate at acceptable levels of service in the weekday AM peak hour. In the weekday PM peak hour, the westbound left-turn movement on Riverbank Drive at King Street East is forecast to operate at LOS F, with a v/c ratio of 0.46.
- Traffic control signals are not warranted at King Street East and Riverbank Drive;
- A southbound left-turn lane is not warranted on Riverbank Drive at the site driveway; and
- An eastbound right-turn lane is not warranted on Riverbank Drive at the site driveway.

Based on the findings of this study it is concluded that development of the site is forecast to have a minor impact on traffic operations at King Street East and Riverbank Drive, and a negligible impact at Riverbank Drive and Allendale Drive.

Upon completion of the North Cambridge Business Park, the operation of the westbound left-turn movement on Riverbank Drive at King Street East is forecast to deteriorate. Operations are considered critical based on Waterloo Region guidelines with or without the proposed development.

At the request of City of Cambridge transportation planning staff, Paradigm conducted a sensitivity analysis assuming the possibility of closing Allendale Road at Riverbank Drive. The closure of Allendale Road at Riverbank Drive would significantly, if not entirely, reduce the number of non-local trips on Riverbank Drive. It would also improve traffic operations at King Street East and Riverbank Drive by reducing traffic volumes on the westbound left-turn movement.

Recommendations

Based on the conclusions of this study it is recommended the site be considered for approval with no requirement for off-site transportation network improvements on Riverbank Drive.

Independent of the development proposal it is recommended the City of Cambridge and Region of Waterloo monitor traffic volumes at King Street East and Riverbank Drive in response to future road network improvements to identify if or when intersection control improvements may be warranted.

Traffic control signals are not warranted at King Street East and Riverbank Drive and a roundabout may not be feasible given the intersection's proximity to the single-track level crossing of the Canadian Pacific Kansas City (CPKC) Waterloo Subdivision and property constraints on the west side of King Street East

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1 Introduction

1.1 Overview

Intermarket Properties retained Paradigm Transportation Solutions Limited (Paradigm) to prepare this Transportation Impact Study and Access and Circulation Review for a proposed residential development at 245 Riverbank Drive in the City of Cambridge. **Figure 1.1** illustrates the site location.

1.2 Purpose and Scope

The purpose of this study is to estimate the transportation related impacts of the proposed development on the surrounding transportation network and identify how these impacts (if any) might be mitigated.

The scope of this study, developed in consultation with City of Cambridge transportation planning staff via email in December 2023 and January 2024 comprises:

- An analysis of current and future traffic conditions and operations at:
  - Allendale Road and Riverbank Drive (unsignalized);
  - Riverbank Drive and King Street East (unsignalized); and
- Estimates of the trip generation of the proposed development;
- An analysis of future traffic operations at the study intersections (with and without the proposed development) for a horizon year five years from the date of this study; and
- An analysis of on-site vehicle circulation.

Appendix A contains the pre-study correspondence material.

This study has been completed in general accordance with the Region's *Transportation Impact Study Guidelines*[1] and comments received from the City during pre-study consultation.

[1] Region of Waterloo, *Transportation Impact Study Guidelines*, (Kitchener: Region of Waterloo, 2014).

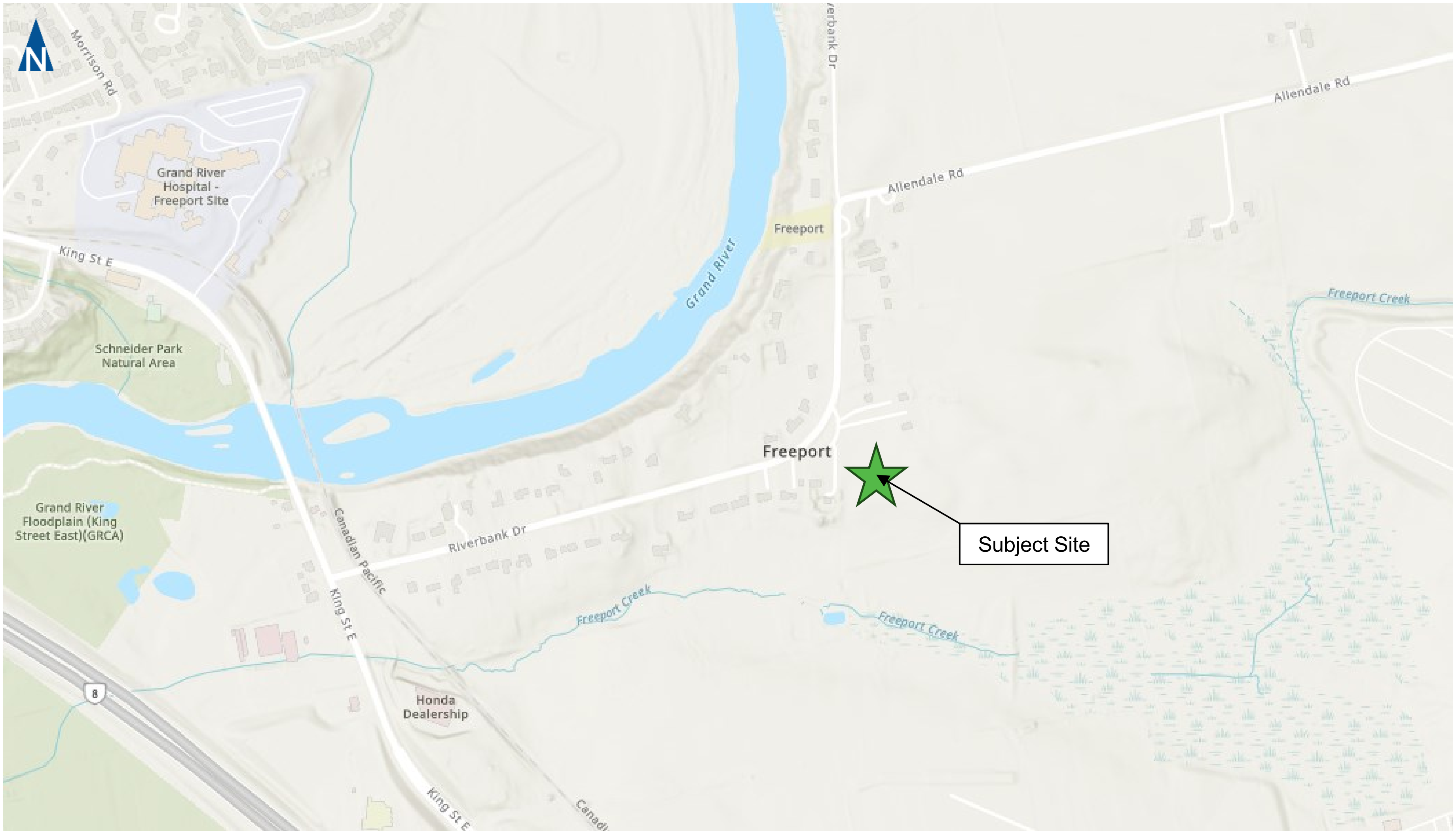

Image Source: ESRI ArcGIS Online Worldmap

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Location of Subject Site

Figure 1.1

2 Existing Conditions

2.1 Road Network

The main roads in the study area comprise King Street East, Riverbank Drive, and Allendale Road, each of which is described as follows:

- **King Street East** is a north-south, two-lane regional road that operates under Region of Waterloo jurisdiction as Regional Road 8. The road comprises a two-lane urban cross-section with one travel lane per direction. Sidewalks and cycling facilities are not provided on either side of the road. The posted speed limit is 60 km/h.
- **Riverbank Drive** is an east-west to north-south two-lane collector road[2] with a rural cross-section. The road comprises one travel lane per direction and parking is prohibited on both sides of the road. Sidewalks and dedicated cycling facilities are not provided on either side of the road; however, the road is a signed bike route. The posted speed limit is 50 km/h.

  The segment of Riverbank Drive between King Street and Allendale Drive includes several traffic calming devices in the form of speed humps. These are intended to discourage cut-through traffic along this segment of Riverbank Drive.
- **Allendale Road** is an east-west, two-lane collector road with a semi-urban cross-section. East of Riverbank Drive, the road has been recently reconstructed to support a new two-lane roundabout at Allendale Road and Intermarket Drive.

Figure 2.1 illustrates the existing lane configurations and traffic control at the two intersections. The Canadian Pacific Kansas City (CPKC) Waterloo Subdivision intersects Riverbank Drive at a single-track level crossing approximately 30 metres east of King Street East.

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2 City of Cambridge, *Official Plan Map 7A Major Transportation Facilities and Hydro Corridors*, (Cambridge: City of Cambridge, 2018).

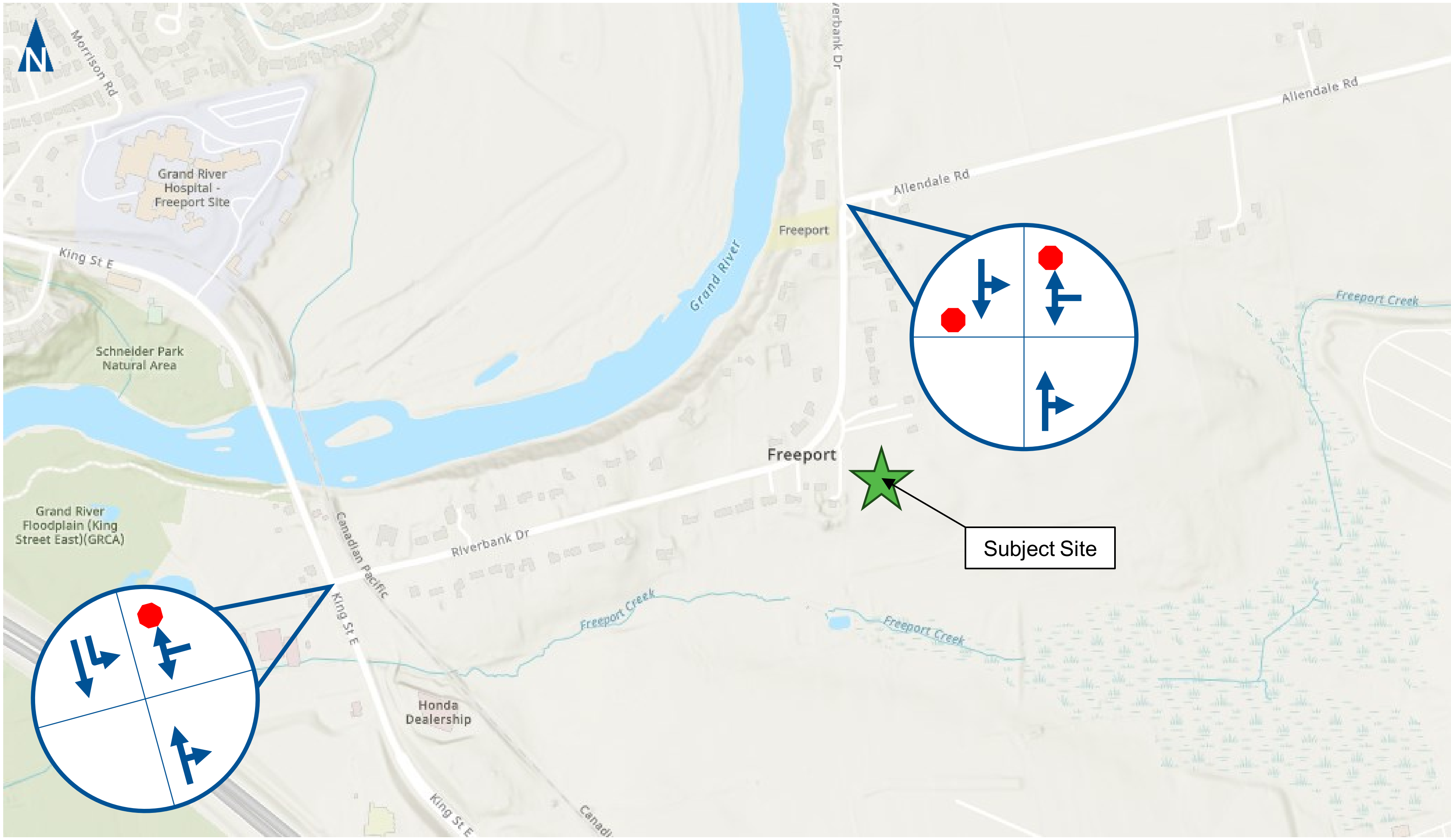

Image Source: ESRI ArcGIS Online Worldmap

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Existing Lane Configurations and Traffic Control

Figure 2.1

2.2 Transit Services

Grand River Transit (GRT) is the public transit operator in the Region of Waterloo and operates one route near the site: 206 Coronation. The route operates between Fairway station and Southwood Drive and St. Andrews Street. The nearest stop is at the Grand River General Hospital Fairview Campus, a 15-minute walk from the site. **Figure 2.2** illustrates the existing GRT routes near the site. A future GRT station is proposed on Intermarket Road approximately a two-minute walk from the subject site.

Service from Fairway Station is provided on Mondays to Fridays from 5:59 AM to 11:58 PM, with 20-minute to 30-minute headways. Saturday service is provided from 6:15 AM to midnight, with 30-minute headways. Sunday service is provided from 7:45 AM to midnight, with 30-minute headways.

2.3 Traffic Volumes

To assess intersection operations, turning movement counts (TMCs) are used to quantify the movement of vehicles through an intersection or roadway segment. Existing traffic data at an intersection or a road section forms the foundation for the operational analyses. The counts are usually conducted so that they capture peak traffic demands. This ensures the level of service analysis reflects worst case operating conditions.

Paradigm conducted eight-hour turning movement counts at the study intersections on Thursday December 7, 2023 from 7:30 AM to 10:30 AM, noon to 2:00 PM, and 3:00 PM to 6:00 PM. All vehicle, pedestrian, and cyclist movements were recorded in 15-minute intervals. **Appendix B** contains the comprehensive turning movement count data.

Figure 2.3 illustrates the existing traffic volumes in the weekday AM peak hour and the weekday PM peak hour.

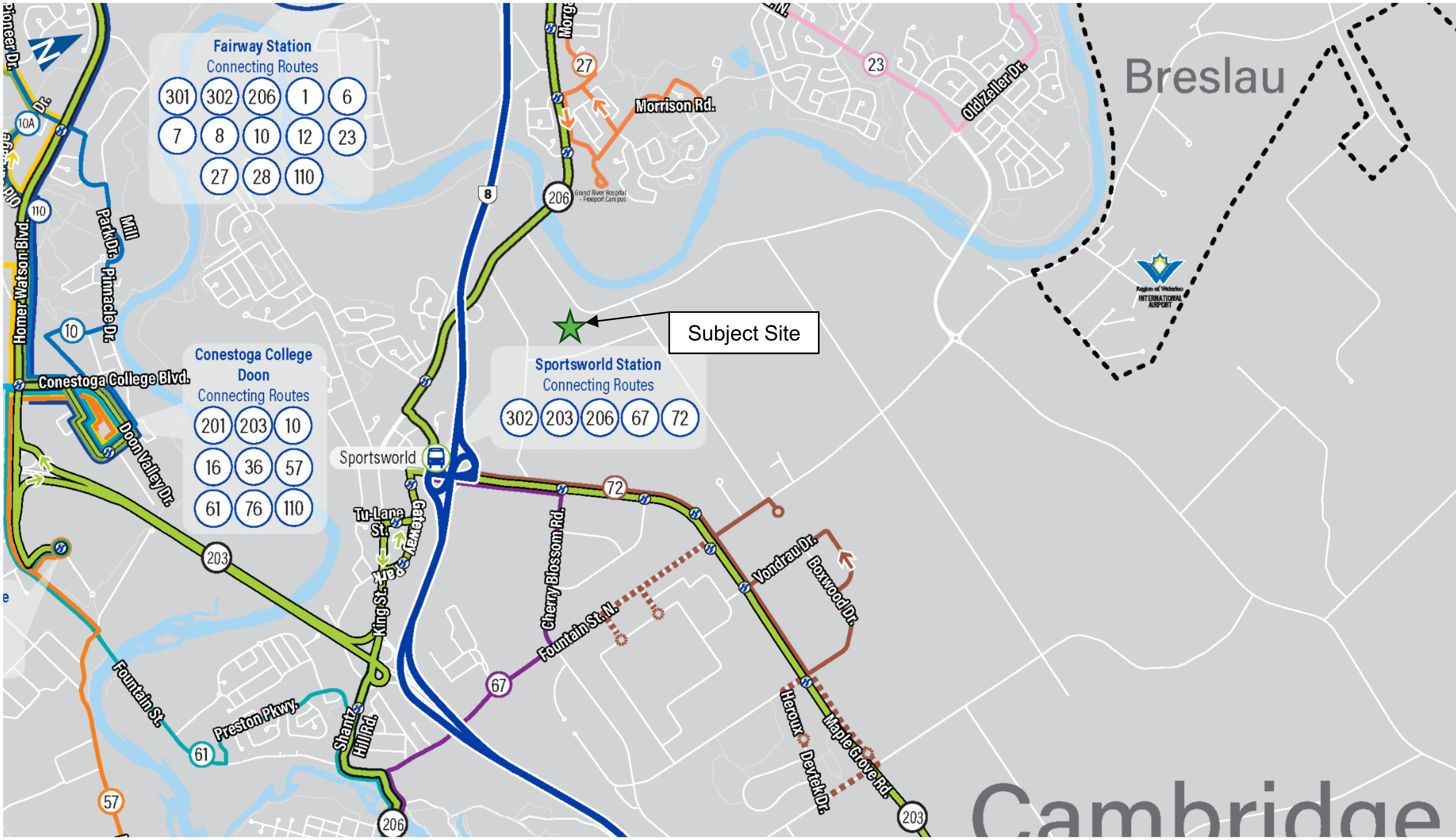

Image Source: Grand River Transit System Map.

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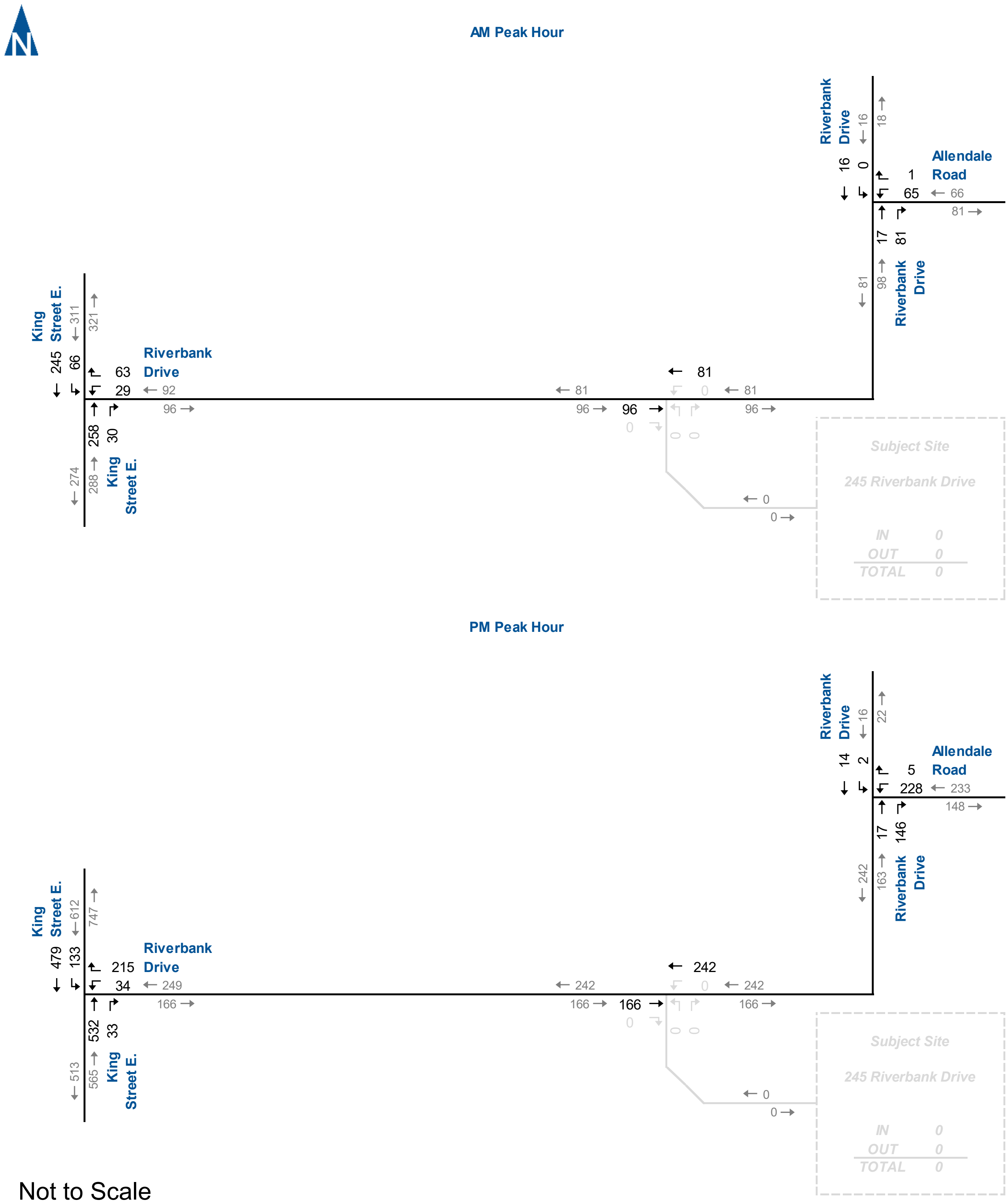
Existing Transit Services

245 Riverbank Drive Transportation Impact Study
230691

Figure 2.2



Not to Scale

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Existing Traffic Volumes

Figure 2.3

2.4 Traffic Operations

Intersection Level of Service (LOS) is a recognized method of quantifying the efficiency of vehicular 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.=

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 signalized intersections, the movement is classified as LOS F.

While the LOS and volume-to-capacity (v/c) ratio for each movement are related, they are calculated independently. Therefore, it is possible to have a poor level of service associated with a low v/c ratio, or a good level of service associated with a high v/c ratio. Volume-to-capacity ratios exceeding 1.00 indicate a movement is exceeding its theoretical capacity.

The Region of Waterloo *Transportation Impact Study Guidelines*[3] identify critical intersections as those where the average control delay per vehicle is greater than 55 seconds (for signalized intersections) or 35 seconds (for unsignalized intersections). Both delays correspond to LOS E.

Critical movements, regardless of intersection control type, are defined as those where:

- The average control delay is greater than 55 seconds;
- The estimated 95th percentile queue length for an exclusive movement exceeds the available lane storage, or blocks an existing access;
- Exclusive turning lanes are inaccessible because of queue lengths in adjacent through lanes; or
- There is a poor quality of service for non-auto modes.

3 Region of Waterloo, *Transportation Impact Study Guidelines*, (Kitchener: Region of Waterloo, 2014), 12/

The operations of the driveway connections have been modelled and analyzed using Synchro 11, which implements the methodology of the Highway Capacity Manual (HCM), with the following parameters:

- Existing lane geometry and traffic control
- Saturation flow rates and peak hour factors as defined in the Region of Waterloo Transportation Impact Study Requirements for Capacity Analysis, Roundabouts, and Signal Warrants[4];
- Heavy vehicle percentages, and pedestrian volumes, as extracted from the turning movement counts; and
- Synchro defaults for all other inputs.

The analysis also assumes the intersection of Riverbank Drive and Allendale Road operates with stop control only on Allendale Road because HCM does not support the analysis of the existing traffic control at this intersection.

The analysis considers three separate measures of performance:

- The level of service (LOS) and average delay for each turning movement, measured in seconds (s);
- The volume to capacity (v/c) ratio for each movement; and
- The 95th percentile queue length, in metres (m).

Table 2.1 summarizes the existing level of service conditions. The results indicate the study intersection is operating at acceptable levels of service and within capacity in both the AM peak hour and PM peak hour. In the PM peak hour westbound queuing on Riverbank Drive at King Street East does extend to the level crossing, and this was confirmed by Paradigm staff through a review of the turning movement count video footage. **Appendix C** contains the detailed Synchro reports.

[4] Region of Waterloo, *Transportation Impact Studies, Requirements for Capacity Analysis, Roundabouts, and Signal Warrants*, (Kitchener: Region of Waterloo, n.d.).

TABLE 2.1: EXISTING TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	King Street East and Riverbank Drive	TWSC	LOS					B		>	**B**		UM	>	**UM**	A	UM		**A**	
			Delay					12		>	**12**		-	>		8	-		**2**	
			V/C					0.15		>			-	>		0.05	-			
			Q					4		>			-	>		1	-			
			Ex					-		>			-	>		30	-			
			Avail.					-		>			-	>		29	-			
	Riverbank Drive and Allendale Road	TWSC	LOS					A		>	**A**		UM	>	**UM**	<	A		**A**	
			Delay					9		>	**9**		-	>		<	0		**0**	
			V/C					0.07		>			-	>		<	0.00			
			Q					1		>			-	>		<	0			
			Ex					-		>			-	>		<	-			
			Avail.					-		>			-	>		<	-			
PM Peak Hour	King Street East and Riverbank Drive	TWSC	LOS					D		>	**D**		UM	>	**UM**	A	UM		**A**	
			Delay					27		>	**27**		-	>		9	-		**2**	
			V/C					0.62		>			-	>		0.13	-			
			Q					28		>			-	>		3	-			
			Ex					-		>			-	>		30	-			
			Avail.					-		>			-	>		27	-			
	Riverbank Drive and Allendale Road	TWSC	LOS					B		>	**B**		UM	>	**UM**	<	A		**A**	
			Delay					10		>	**10**		-	>		<	8		**1**	
			V/C					0.26		>			-	>		<	0.00			
			Q					7		>			-	>		<	0			
			Ex					-		>			-	>		<	-			
			Avail.					-		>			-	>		<	-			

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds
Q - 95th Percentile Queue Length
Ex. - Existing Available Storage
Avail. - Available Storage
TWSC - Two-Way Stop Control
< - Shared Through/Left
> - Shared Through/Right
UM - Unopposed Movement

3 Development Concept

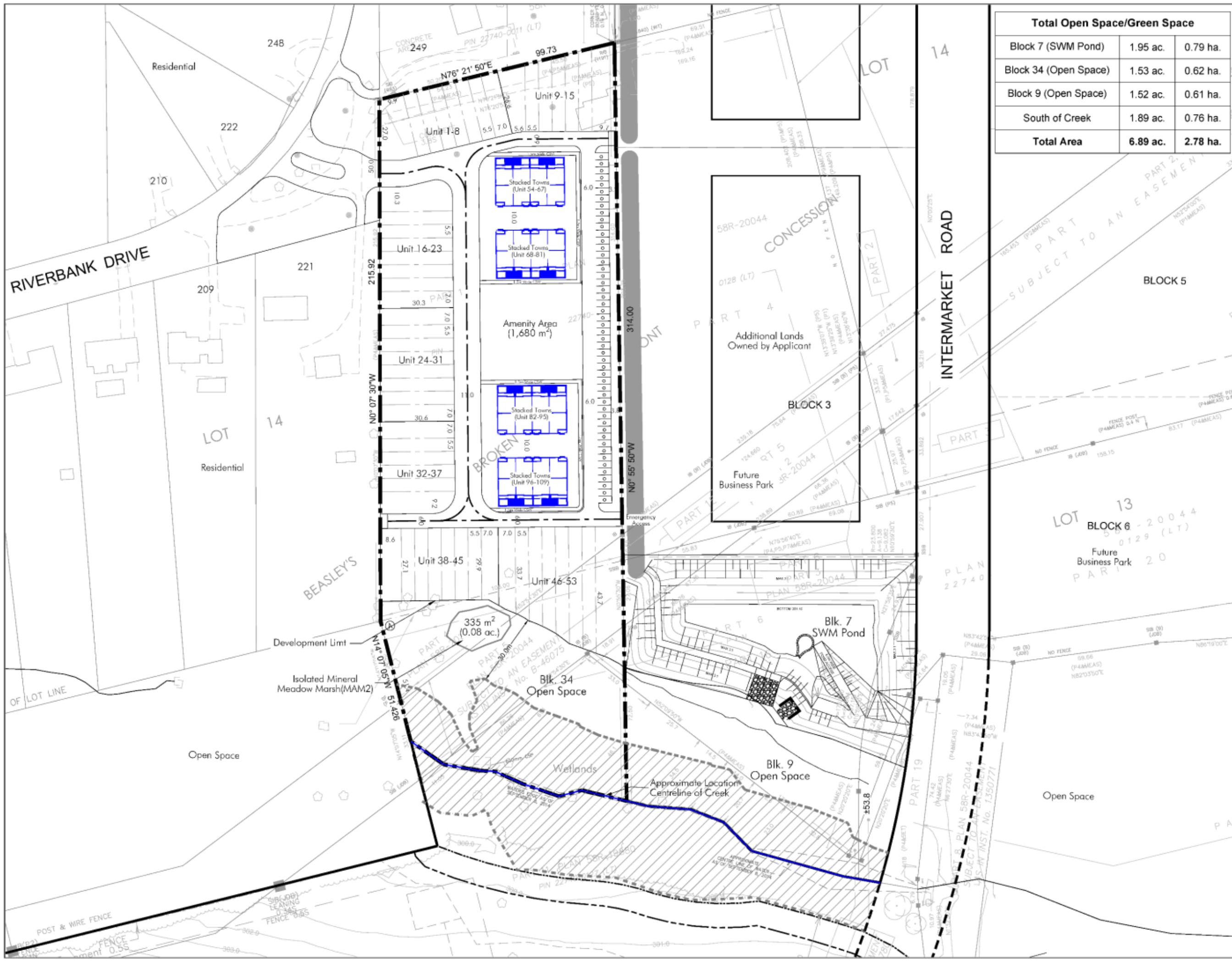
3.1 Site Description and Proposed Development

3.1.1 Site Description

The subject site is on the east side of Riverbank Drive, near where Riverbank Drive transitions from an east-west direction to a north-south direction. The lands are occupied by a single-family home. The surrounding land uses are primarily low-density residential. To the east, the property is bounded by the North Cambridge Business Park.

3.1.2 Proposed Development

The property owner is submitting an Official Plan Amendment (OPA) and Zoning By-law Amendment Application to support a concept plan comprising 53 street townhouses and 56 stacked townhouses. Vehicle access is proposed via a connection to Riverbank Drive near the northwest corner of the site. **Figure 3.1** illustrates the conceptual site plan.



Total Open Space/Green Space		
Block 7 (SWM Pond)	1.95 ac.	0.79 ha.
Block 34 (Open Space)	1.53 ac.	0.62 ha.
Block 9 (Open Space)	1.52 ac.	0.61 ha.
South of Creek	1.89 ac.	0.76 ha.
Total Area	**6.89 ac.**	**2.78 ha.**

Concept Plan A

Part of Lot 13 & 14, Beasley's Front Concession
City of Cambridge,
Regional Municipality of Waterloo

LEGEND

Subject Lands

RM3 Zone Provisions - Cluster Development City of Cambridge Zoning By-law 150-85		
	Required (min)	Provided
Gross Lot Area	-	28,577m²
Environmentally Constrained Area	-	6,176m²
Net Lot Area	-	22,401m²
Lot Frontage	20.0m	50.0m
Density (max.)	40 units/ha.	49 units/ha.
Front Yard	6.0m	TBD
Rear Yard	7.5m	TBD
Int. Side Yard	7.5m	TBD
Ext. SideYard	7.5m	TBD
Number of Attached dwelling Units (max.)	6	8
Distance Between Buildings (side walls)	3.0m	n/a
Distance Between Buildings (real walls)	10.0m	10.0m
Lot Coverage (max.)	40%	TBD
Private Amenity Area	$40m^2$/unit (Row housing)	TBD
Common Amenity Area	$1,680m^2$ - $30m^2$/unit (Stacked towns)	$1,680m^2$
Parking (Stacked Towns)	70 spaces (1.25 space/unit)	70 spaces (1.25 space/unit)
Number of Units - 109 Row housing - 53 Stacked towns - 56		

Notes:
1. Topographic Information: exp Geomatics Inc., March 2018 and MTE September 2014
2. Servicing Easement Locations: MTE, September 2014
3. Boundary Information: Plan of Survey provided by J.D. Barnes Limited, August 2018.
4. Limit of Wetland and Limit of Dripline provided by J.D. Barnes Limited, September 2014
5. Contour Interval 1.0m
6. Adjacent parcel fabric approximate

DATE February 28, 2024

SCALE 1:1,500

DRN PL

FILE 0667A

north

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE

Conceptual Site Plan

Figure 3.1

4 Future Conditions

4.1 Future Road Network Improvements

The subject site is proximate to the North Cambridge Business Park, which includes two new roads: Boychuk Drive and Intermarket Drive. At the time of writing, Intermarket Drive had been constructed between Boychuk Drive and Allendale Road, and Boychuk Drive had been constructed between Intermarket Drive and Maple Grove Road. Boychuk Drive is to be extended westward to King Street East which will to provide an alternate route for existing traffic using Riverbank Drive.

The 2018 Region of Waterloo *Transportation Master Plan*[5] does not identify any road improvements or expansion projects in the study area up to 2041. However, the City of Cambridge *Transportation Master Plan*[6] identifies a future widening of Allendale Road between Intermarket Drive and Fountain Street North between 2031 and 2041.

4.2 Forecast Background Traffic

Consistent with the Region of Waterloo *Transportation Impact Study Guidelines*[7] future traffic forecasts and analyses correspond to five years from the date of this study, represented as Year 2029.

The background traffic forecasts include traffic expected to be generated by the three phases on the North Cambridge Business Park, as well as the development of 895 Riverbank Drive. The estimated traffic volumes for these developments are based on those estimated in the following studies:

- **North Cambridge Business Park Phase 1 & 2:** *Creekside Phase 2, Cambridge Transportation Impact Study, February 2020*[8];

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5 Region of Waterloo, “New Strategies,” chap. 5 in *Moving Forward – 2018 Transportation Master Plan*, (Kitchener: Region of Waterloo, 2018), 8.

6 City of Cambridge, *Transportation Master Plan,* (Cambridge: City of Cambridge, 2019), 47.

7 Region of Waterloo, *Transportation Impact Study Guidelines*, (Kitchener: Region of Waterloo, 2014), 7.

8 Paradigm Transportation Solutions Limited, *Creekside Phase 2 Cambridge Transportation Impact Study*, (Cambridge: PTSL, 2018).

- **North Cambridge Business Park Phase 3**: *IPort Industrial Lands Cambridge, ON Transportation Impact Study Update*[9]*; and*
- **895 Riverbank Drive**: *Residential Subdivision, 895 Riverbank Drive, Cambridge, Transportation Impact Study*.[10]

The Creekside Phase 2 TIS which was completed in February 2020 included updated trip generation estimates for Phase 1. Both the *Creekside Phase 2 TIS* and the *IPort Industrial Lands TIS Update* assumed site traffic would not use Riverbank Drive to connect between King Street East and Allendale Drive. Instead, traffic would use the combination of Intermarket Drive and Boychuk Drive. This assumption has been carried forward in this study, and the trip assignments for each phase of the North Cambridge Industrial Park reflect those detailed in the above-noted transportation impact studies.

Future background growth unrelated to nearby developments has been assumed using a growth rate of 2% compounded per annum. This growth rate is consistent with that assumed in both above noted transportation impact studies for the North Cambridge Business Park.

The background traffic forecasts assume the westward extension of Boychuk Drive to King Street East will be completed by 2029. This extension in combination with Intermarket Drive will provide an alternative route to Riverbank Drive between King Street East and Allendale Road.

Consistent with the Creekside Phase 2, Cambridge Transportation Impact Study and the IPort Industrial Lands Transportation Impact Study Update, the future background traffic forecasts include a partial reassignment of traffic at both study intersections. Fifty percent of the westbound left-turn movement at Allendale Road and Riverbank Drive, and fifty percent of the northbound right-turn at King Street East and Riverbank Drive are assumed to use the Boychuk Drive extension at the 2029 horizon year.

Figure 4.1 illustrates the estimated future background traffic volumes at the 2029 horizon year, including the partial reassignment of the above noted movements.

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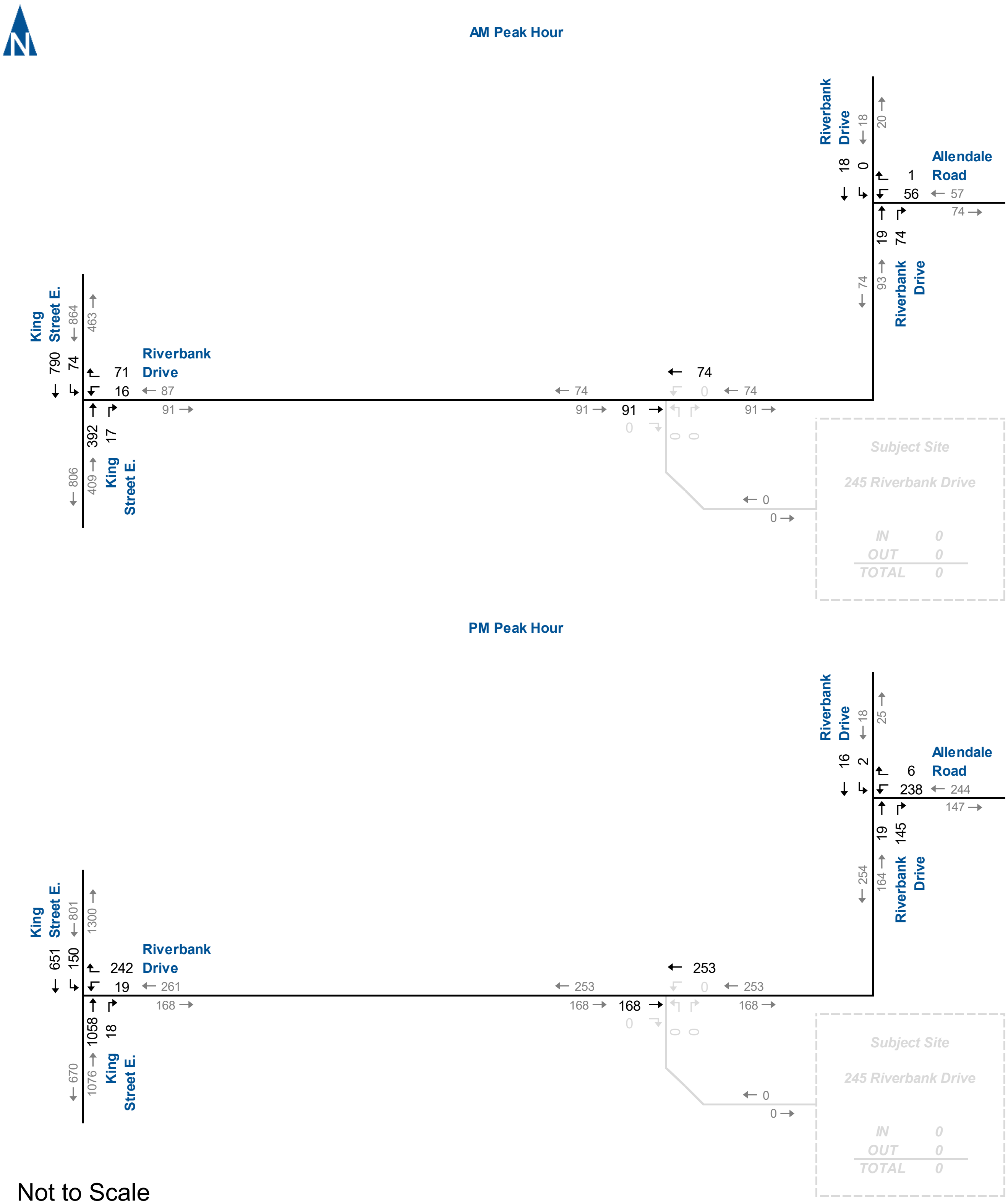
[9] Paradigm Transportation Solutions Limited, *IPort Industrial Lands Cambridge, ON Transportation Impact Study*, (Cambridge, PTSL, 2020)

[10] Paradigm Transportation Solutions Limited, *Residential Subdivision, 895 Riverbank Drive, Cambridge, Transportation Impact Study*, (Cambridge: PTSL, 2023).



Not to Scale

2029 Background Traffic Volumes

4.3 Forecast Site Traffic

4.3.1 Trip Generation

The site trip generation reflects information in the Institute of Transportation Engineers (ITE) *Trip Generation Manual*[11] for land use code 215 (Single Family Attached Housing). LUC 215 is described as "any single-family housing unit that shares a wall with an adjoining dwelling unit, whether the walls are for living space, a vehicle garage, or storage space."

Table 4.1 summarizes the estimated trip generation based on the number of units. The site is forecast to generate 51 trips in the weekday AM peak hour and 62 trips in the weekday PM peak hour. **Appendix D** contains the applicable data sheets, as extracted from the *Trip Generation Manual*.

TABLE 4.1: ESTIMATED TRIP GENERATION

LUC	AM Peak Hour				PM Peak Hour			
	Rate	In	Out	Total	Rate	In	Out	Total
215 (109 units)	Eqn.[1]	16	35	51	Eqn.[2]	35	27	62
Total		**16**	**35**	**51**		**35**	**27**	**62**

Notes:

1. LUC 215 (AM): T = 0.52(X) – 5.70, 31% entering, 69% exiting
2. LUC 215 (PM): T = 0.60(X) – 3.93, 57% entering, 43% exiting

4.3.2 Trip Distribution

The trip distribution developed for this study is based on existing travel patterns at the study intersections. Given the similarity of the proposed land use with nearby development, it is assumed existing travel patterns provide a reasonable estimate of trip patterns to and from the subject site.

Table 4.2 summarizes the estimated distribution. **Figure 4.2** illustrates the site generated traffic assignments.

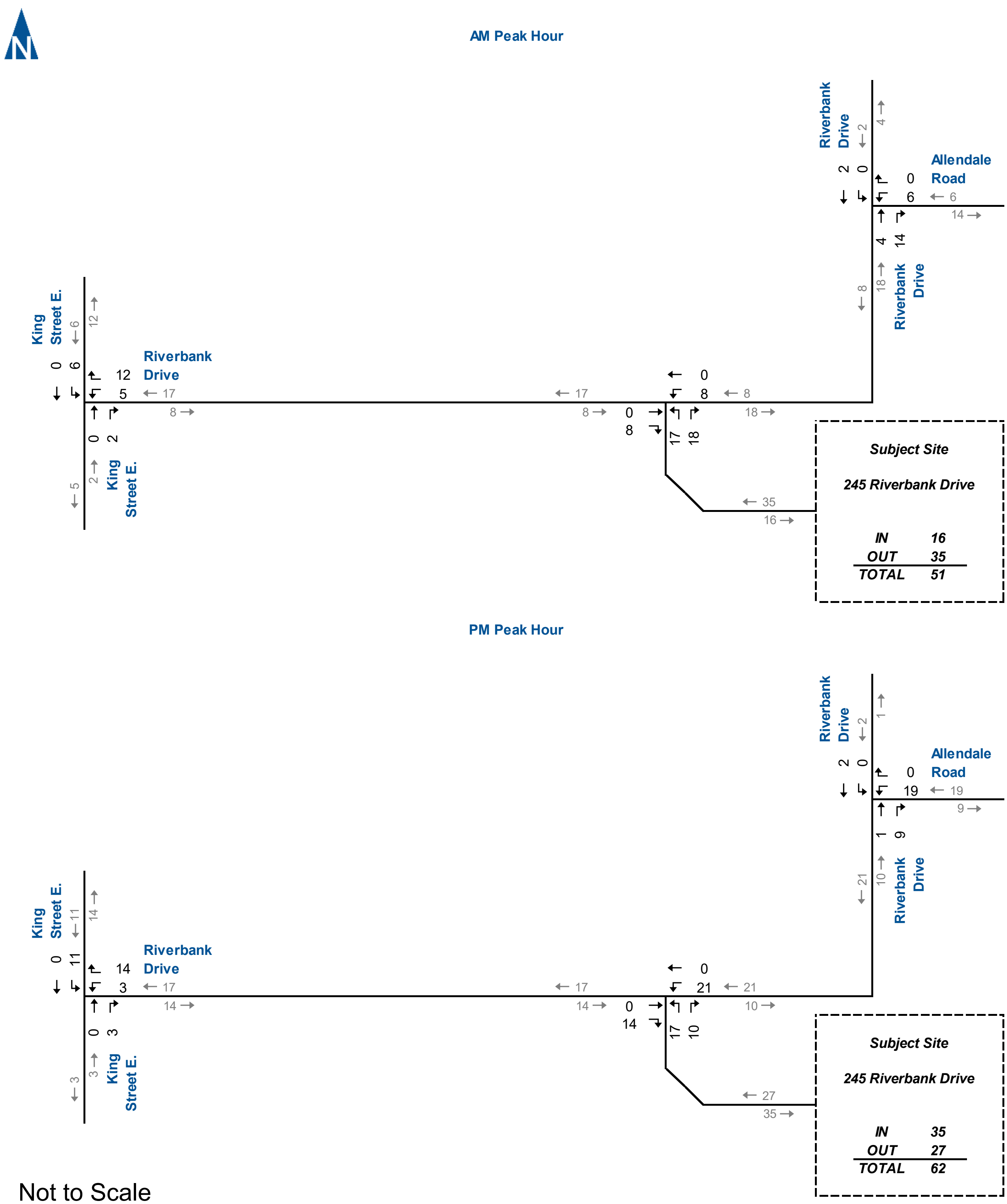
[11] Institute of Transportation Engineers, *Trip Generation Manual*, 11th ed., (Washington DC: ITE, 2021).

TABLE 4.2: ESTIMATED TRIP DISTRIBUTION

Origin/Destination	AM Peak Hour		PM Peak Hour	
	In	Out	In	Out
North via King Street East	40%	35%	30%	50%
North via Riverbank Drive	10%	10%	5%	5%
East via Allendale Drive	35%	40%	55%	35%
South via King Street East	15%	15%	10%	10%
Total	**100%**	**100%**	**100%**	**100%**

4.4 Future Total Traffic

Figure 4.3 illustrates the future total traffic volumes at the 2029 horizon year. The future total traffic volumes represent the summation of the site generated traffic volumes (**Figure 4.2**) and the background traffic volumes (**Figure 4.1**).

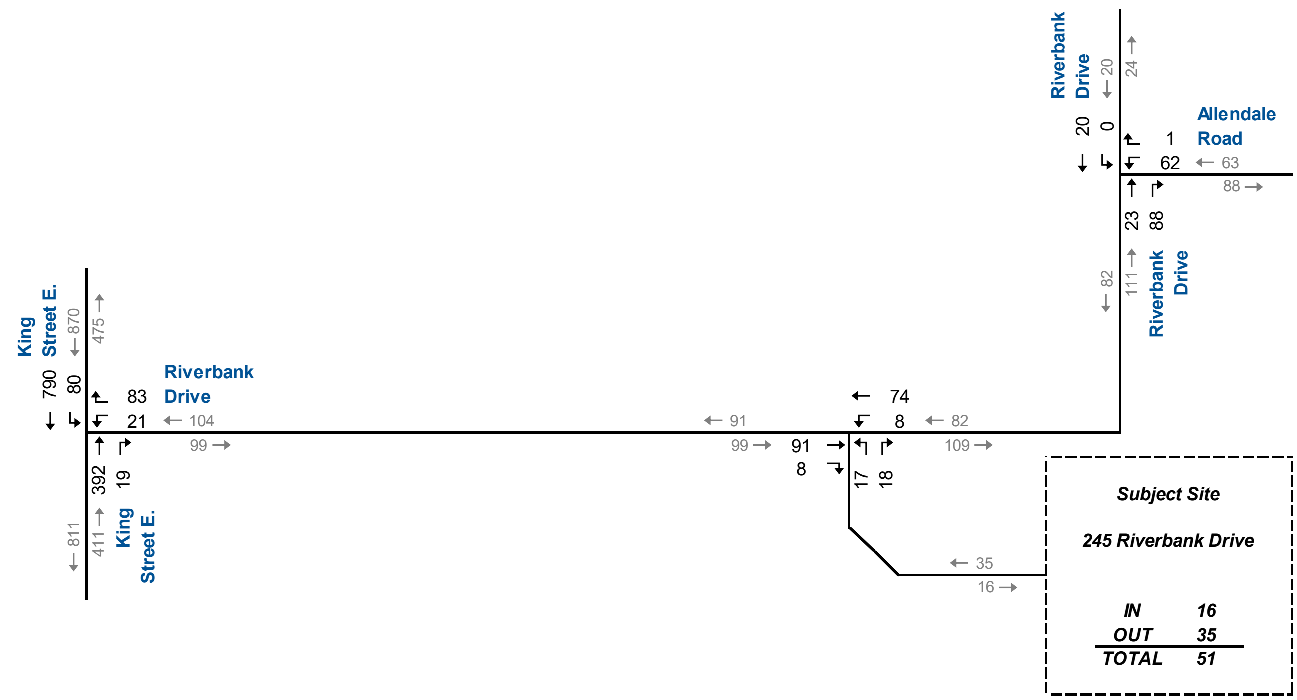


Not to Scale

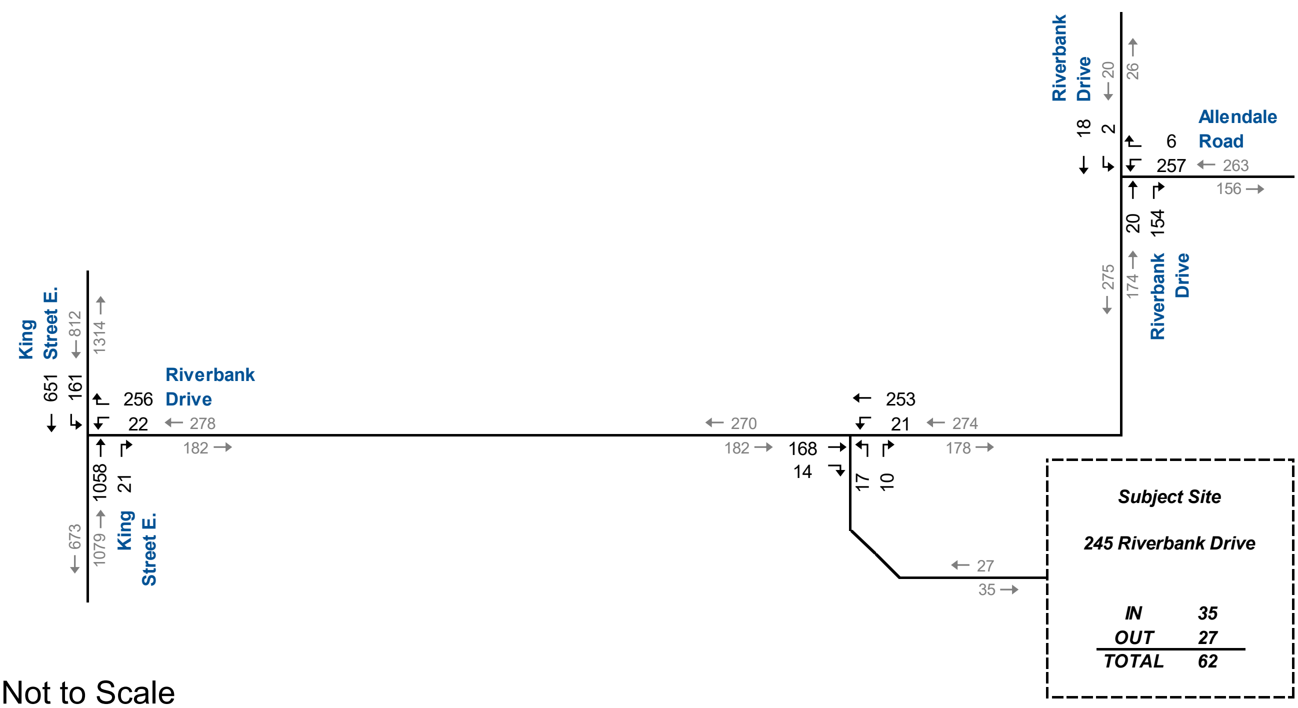
Site Generated Traffic Volumes

Figure 4.2

AM Peak Hour



PM Peak Hour



Not to Scale

2029 Total Traffic Volumes

5 Traffic Operations Assessment

5.1 Background Traffic Operations

Analysis of background traffic conditions uses the same methodology as existing traffic conditions. **Table 5.1** summarizes the 2029 background traffic level of service conditions and critical movements are highlighted in yellow.

In the weekday PM peak hour, the westbound approach on Riverbank Drive and King Street East is forecast to operate at LOS F, with a v/c ratio of 1.27. This level of service condition reflects the large volume of forecast traffic on King Street East, which provides limited opportunities (that is, gaps) for side-street traffic to enter the traffic flow.

Appendix E contains the detailed Synchro reports.

5.2 Total Traffic Operations

Analysis of total traffic conditions uses the same methodology as background traffic conditions. **Table 5.2** summarizes the 2029 total traffic level of service conditions and critical movements are highlighted in yellow.

In the weekday PM peak hour, the westbound approach on Riverbank Drive and King Street East is forecast to operate at LOS F, with a v/c ratio of 1.40 (10% higher than background traffic conditions). As noted in **Section 5.1** this level of service condition reflects the large volume of forecast traffic on King Street East, which provides limited opportunities (that is, gaps) for side-street traffic to enter the traffic flow.

The site driveway is forecast to operate at LOS B or better, with v/c ratios no greater than 0.04. **Appendix F** contains the detailed Synchro reports.

TABLE 5.1: BACKGROUND TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Eastbound Left	Eastbound Through	Eastbound Right	Eastbound Approach	Westbound Left	Westbound Through	Westbound Right	Westbound Approach	Northbound Left	Northbound Through	Northbound Right	Northbound Approach	Southbound Left	Southbound Through	Southbound Right	Southbound Approach	Overall
AM Peak Hour	King Street East and Riverbank Drive	TWSC	LOS					C		>	**C**		UM	>	**UM**	A	UM		**A**	
			Delay					16		>	**16**		-	>		8	-		**1**	
			V/C					0.21		>			-	>		0.07	-			
			Q					6		>			-	>		1	-			
			Ex					-		>			-	>		30	-			
			Avail.					-		>			-	>		29	-			
	Riverbank Drive and Allendale Road	TWSC	LOS					A		>	**A**		UM	>	**UM**	<	A		**A**	
			Delay					9		>	**9**		-	>		<	0		**0**	
			V/C					0.06		>			-	>		<	0.00			
			Q					1		>			-	>		<	0			
			Ex					-		>			-	>		<	-			
			Avail.					-		>			-	>		<	-			
PM Peak Hour	King Street East and Riverbank Drive	TWSC	LOS					F		>	**F**		UM	>	**UM**	B	UM		**A**	
			Delay					202		>	**202**		-	>		12	-		**2**	
			V/C					1.27		>			-	>		0.23	-			
			Q					98		>			-	>		5	-			
			Ex					-		>			-	>		30	-			
			Avail.					-		>			-	>		25	-			
	Riverbank Drive and Allendale Road	TWSC	LOS					B		>	**B**		UM	>	**UM**	<	A		**A**	
			Delay					11		>	**11**		-	>		<	8		**1**	
			V/C					0.28		>			-	>		<	0.00			
			Q					8		>			-	>		<	0			
			Ex					-		>			-	>		<	-			
			Avail.					-		>			-	>		<	-			

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds
Q - 95th Percentile Queue Length
Ex. - Existing Available Storage
Avail. - Available Storage
TWSC - Two-Way Stop Control
< - Shared Through/Left
> - Shared Through/Right
UM - Unopposed Movement

TABLE 5.2: TOTAL TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	King Street East and Riverbank Drive	TWSC	LOS					C		>	C		UM	>	UM	A	UM		A	
			Delay					18		>	18		-	>		9	-		1	
			V/C					0.27		>			-	>		0.07	-			
			Q					8		>			-	>		1	-			
			Ex					-		>			-	>		30	-			
			Avail.					-		>			-	>		29	-			
	Riverbank Drive and Allendale Road	TWSC	LOS					A		>	A		UM	>	UM	<	A		A	
			Delay					9		>	9		-	>		<	0		0	
			V/C					0.07		>			-	>		<	0.00			
			Q					1		>			-	>		<	0			
			Ex					-		>			-	>		<	-			
			Avail.					-		>			-	>		<	-			
	Riverbank Drive and Site Driveway	TWSC	LOS		UM	>	UM	<	A		A	A		>	A					
			Delay		-	>		<	7		1	9		>	9					
			V/C		-	>		<	0.01			0.04		>						
			Q		-	>		<	0			1		>						
			Ex		-	>		<	-			-		>						
			Avail.		-	>		<	-			-		>						
PM Peak Hour	King Street East and Riverbank Drive	TWSC	LOS					F		>	F		UM	>	UM	B	UM		A	
			Delay					255		>	255		-	>		12	-		2	
			V/C					1.40		>			-	>		0.25	-			
			Q					115		>			-	>		5	-			
			Ex					-		>			-	>		30	-			
			Avail.					-		>			-	>		25	-			
	Riverbank Drive and Allendale Road	TWSC	LOS					B		>	B		UM	>	UM	<	A		A	
			Delay					11		>	11		-	>		<	8		1	
			V/C					0.30		>			-	>		<	0.00			
			Q					9		>			-	>		<	0			
			Ex					-		>			-	>		<	-			
			Avail.					-		>			-	>		<	-			
	Riverbank Drive and Site Driveway	TWSC	LOS		UM	>	UM	<	A		A	B		>	B					
			Delay		-	>		<	8		1	11		>	11					
			V/C		-	>		<	0.02			0.04		>						
			Q		-	>		<	0			1		>						
			Ex		-	>		<	-			-		>						
			Avail.		-	>		<	-			-		>						

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds
Q - 95th Percentile Queue Length
Ex. - Existing Available Storage
Avail. - Available Storage
TWSC - Two-Way Stop Control
< - Shared Through/Left
> - Shared Through/Right
UM - Unopposed Movement

5.3 Total Traffic Operations without Background Developments

The results of the analyses in **Section 5.1** and **Section 5.2** indicate the westbound approach on Riverbank Drive at King Street East is forecast to operate at LOS F in the weekday PM peak hour, with or without the development of 245 Riverbank Drive. These findings are consistent with those in both traffic impact studies for Phase 2[12], and Phase 3[13] of the North Cambridge Business Park.

This level of service condition reflects the increased northbound and southbound volumes on King Street East, driven primarily by the build-out of the three phases of the North Cambridge Business Park. These increased northbound and southbound volumes provide limited opportunities for side-street traffic from Riverbank Drive to enter King Street East.

Paradigm conducted a sensitivity analysis of the 2029 future total conditions without the estimated traffic from the North Cambridge Business Park to determine if critical operations remain. **Figure 5.1** illustrates the estimated 2029 future total traffic volumes without traffic generated by the North Cambridge Business Park.

Table 5.3 summarizes the results of the analysis and indicates that the westbound left-turn movement on Riverbank Drive at King Street East is forecast to operate at LOS D, in the weekday PM peak hour, and with a v/c ratio of 0.68. **Appendix G** contains the detailed Synchro reports.

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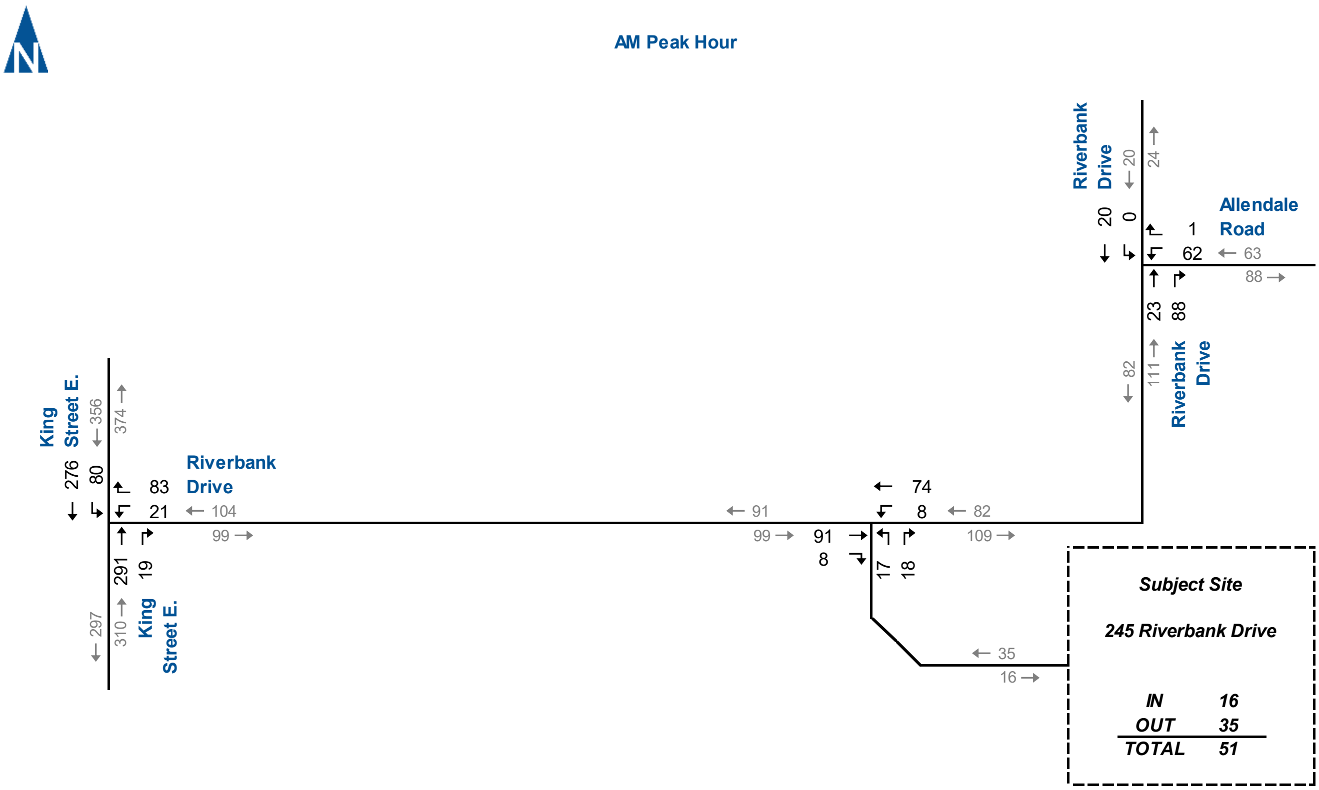
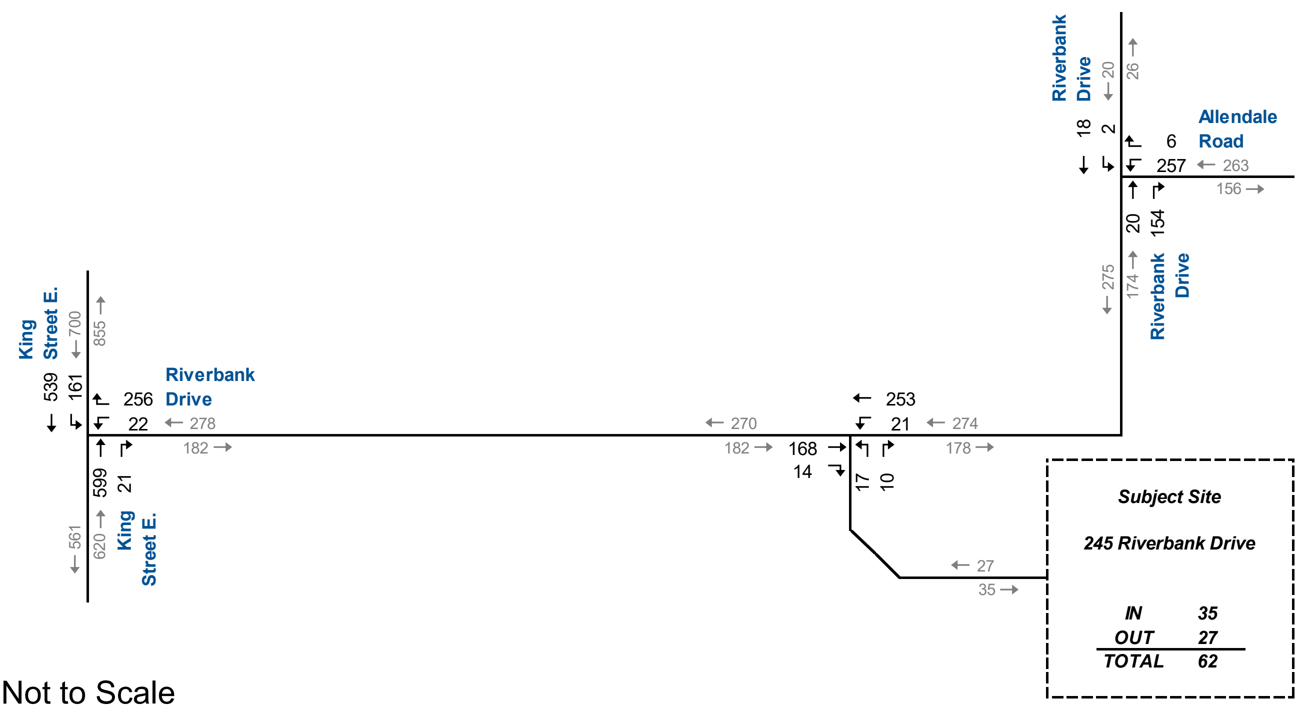
[12] Paradigm Transportation Solutions Limited, *Creekside Phase 2 Cambridge Transportation Impact Study*, (Cambridge: PTSL, 2018), 20-28.

[13] Paradigm Transportation Solutions Limited, *IPort Industrial Lands Cambridge, ON Transportation Impact Study*, (Cambridge, PTSL, 2020), 18-37.

AM Peak Hour



PM Peak Hour



Not to Scale

2029 Total Traffic Volumes without Background Developments

TABLE 5.3: 2029 TOTAL TRAFFIC OPERATIONS - WITHOUT BACKGROUND DEVELOPMENTS

Analysis Period	Intersection	Control Type	MOE	Eastbound Left	Eastbound Through	Eastbound Right	Eastbound Approach	Westbound Left	Westbound Through	Westbound Right	Westbound Approach	Northbound Left	Northbound Through	Northbound Right	Northbound Approach	Southbound Left	Southbound Through	Southbound Right	Southbound Approach	Overall
AM Peak Hour	King Street East and Riverbank Drive	TWSC	LOS					B		>	**B**		UM	>	**UM**	A	UM		**A**	
			Delay					12		>	**12**		-	>		8	-		**2**	
			V/C					0.17		>			-	>		0.07	-			
			Q					4		>			-	>		1	-			
			Ex					-		>			-	>		30	-			
			Avail.					-		>			-	>		29	-			
	Riverbank Drive and Allendale Road	TWSC	LOS					A		>	**A**		UM	>	**UM**	<	A		**A**	
			Delay					9		>	**9**		-	>		<	0		**0**	
			V/C					0.07		>			-	>		<	0.00			
			Q					1		>			-	>		<	0			
			Ex					-		>			-	>		<	-			
			Avail.					-		>			-	>		<	-			
	Riverbank Drive and Site Driveway	TWSC	LOS		UM	>	**UM**	<	A		**A**	A		>	**A**					
			Delay		-	>		<	7		**1**	9		>	**9**					
			V/C		-	>		<	0.01			0.04		>						
			Q		-	>		<	0			1		>						
			Ex		-	>		<	-			-		>						
			Avail.		-	>		<	-			-		>						
PM Peak Hour	King Street East and Riverbank Drive	TWSC	LOS					D		>	**D**		UM	>	**UM**	A	UM		**A**	
			Delay					33		>	**33**		-	>		9	-		**2**	
			V/C					0.70		>			-	>		0.17	-			
			Q					36		>			-	>		3	-			
			Ex					-		>			-	>		30	-			
			Avail.					-		>			-	>		27	-			
	Riverbank Drive and Allendale Road	TWSC	LOS					B		>	**B**		UM	>	**UM**	<	A		**A**	
			Delay					11		>	**11**		-	>		<	8		**1**	
			V/C					0.30		>			-	>		<	0.00			
			Q					9		>			-	>		<	0			
			Ex					-		>			-	>		<	-			
			Avail.					-		>			-	>		<	-			
	Riverbank Drive and Site Driveway	TWSC	LOS		UM	>	**UM**	<	A		**A**	B		>	**B**					
			Delay		-	>		<	8		**1**	11		>	**11**					
			V/C		-	>		<	0.02			0.04		>						
			Q		-	>		<	0			1		>						
			Ex		-	>		<	-			-		>						
			Avail.		-	>		<	-			-		>						

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Avail. - Available Storage
TWSC - Two-Way Stop Control
< - Shared Through/Left
> - Shared Through/Right
UM - Unopposed Movement

5.4 Total Traffic Conditions – Full Closure of Allendale Road

During pre-study consultation, City of Cambridge staff requested a sensitivity analysis of the study area intersections assuming a full closure of Allendale Road at Riverbank Drive. **Figure 5.2** illustrates the assumed termination of Allendale Road in the form of a cul-de-sac at Riverbank Drive.

The forecasts and analysis in **Section 4** and **Section 5** assumed fifty percent of the westbound left-turn movement at Allendale Road and Riverbank Drive, and fifty percent of the northbound right-turn at King Street East and Riverbank Drive would use the Boychuk Drive extension at the 2029 horizon year, with Allendale Road remaining accessible to Riverbank Drive.

If Allendale Road terminates at Intermarket Road, it is assumed all existing northbound right-turn and westbound left-turn movements at Riverbank Drive and Allendale Road would use the Boychuk Drive extension and Intermarket Drive to travel between King Street and Allendale Road. **Figure 5.3** illustrates the 2029 total traffic volumes assuming a full closure of Allendale Road at Riverbank Drive.

Table 5.4 summarizes the results of the operational analysis assuming a full closure of Allendale Road. Critical movements are highlighted in yellow. **Appendix H** contains the detailed Synchro reports.

Consistent with the analysis summarized in **Table 5.1**, **Table 5.2** and **Table 5.3**, the westbound left-turn movement on Riverbank Drive at King Street is forecast to operate at LOS F in the weekday PM peak hour. However, the volume-to-capacity ratio is forecast to be no greater than 0.46, and queues are not forecast to extend to the single-track level crossing of the Canadian Pacific Kansas City (CPKC) Waterloo Subdivision.

The projected v/c ratio is also less than that forecast in **Table 5.3** (2029 Future Total Conditions without Background Developments) and **Table 5.2** (2029 Future Total Conditions with background Developments) and is largely due to the reassignment of existing traffic connecting between King Street East and Allendale Road via Riverbank Drive.

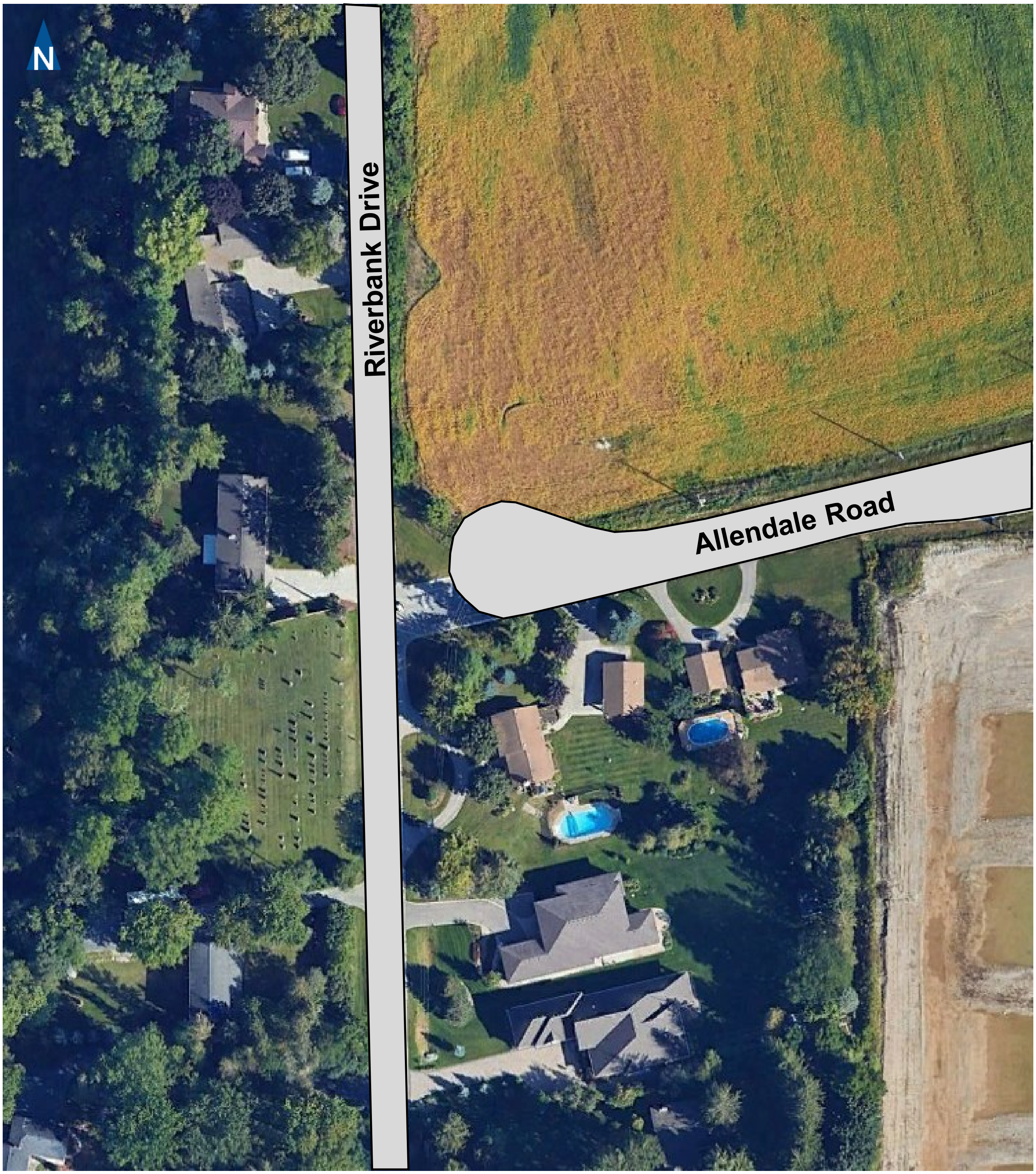
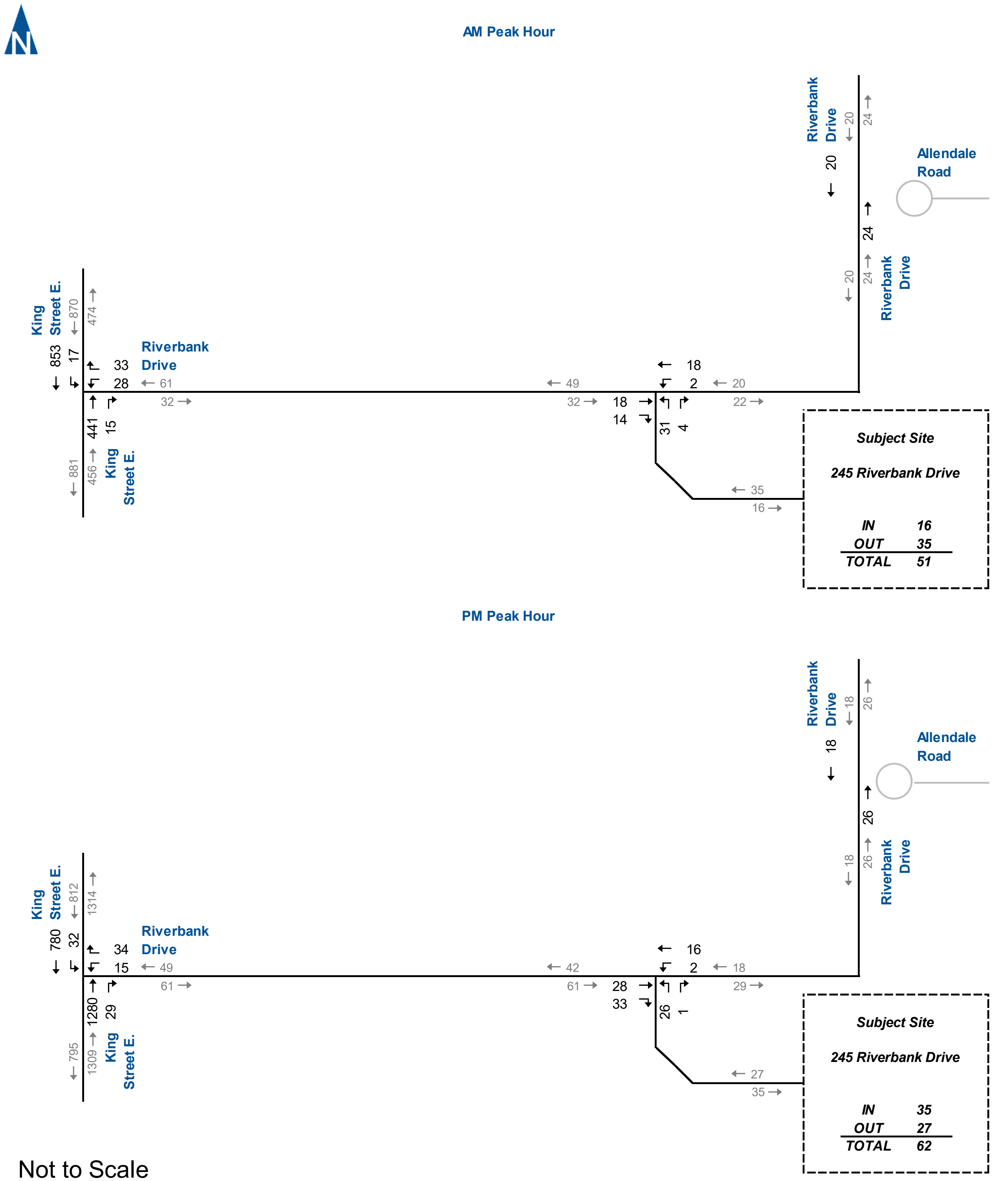


Image Source: Google Earth 2024. Not to Scale

paradigm TRANSPORTATION SOLUTIONS LIMITED

Assumed Termination of Allendale Road

Figure 5.2



Not to Scale

2029 Total Traffic Volumes – Full Closure of Allendale Road

TABLE 5.4: 2029 TOTAL TRAFFIC OPERATIONS – FULL CLOSURE OF ALLENDALE ROAD

Analysis Period	Intersection	Control Type	MOE	Eastbound Left	Eastbound Through	Eastbound Right	Eastbound Approach	Westbound Left	Westbound Through	Westbound Right	Westbound Approach	Northbound Left	Northbound Through	Northbound Right	Northbound Approach	Southbound Left	Southbound Through	Southbound Right	Southbound Approach	Overall
AM Peak Hour	King Street East and Riverbank Drive	TWSC	LOS					C		>	**C**		UM	>	**UM**	A	UM		**A**	
			Delay					22		>	**22**		-	>		8	-		**0**	
			V/C					0.22		>			-	>		0.02	-			
			Q					6		>			-	>		0	-			
			Ex					-		>			-	>		30	-			
			Avail.					-		>			-	>		30	-			
	Riverbank Drive and Allendale Road	TWSC	LOS										UM		**UM**		UM		**UM**	
			Delay										-				-			
			V/C										-				-			
			Q										-				-			
			Ex										-				-			
			Avail.										-				-			
	Riverbank Drive and Site Driveway	TWSC	LOS		UM	>	**UM**	<	A		**A**	A		>	**A**					
			Delay		-	>		<	7		**1**	9		>	**9**					
			V/C		-	>		<	0.00			0.04		>						
			Q		-	>		<	0			1		>						
			Ex		-	>		<	-			-		>						
			Avail.		-	>		<	-			-		>						
PM Peak Hour	King Street East and Riverbank Drive	TWSC	LOS					F		>	**F**		UM	>	**UM**	B	UM		**A**	
			Delay					64		>	**64**		-	>		12	-		**1**	
			V/C					0.46		>			-	>		0.06	-			
			Q					14		>			-	>		1	-			
			Ex					-		>			-	>		30	-			
			Avail.					-		>			-	>		29	-			
	Riverbank Drive and Allendale Road	TWSC	LOS										UM		**UM**		UM		**UM**	
			Delay										-				-			
			V/C										-				-			
			Q										-				-			
			Ex										-				-			
			Avail.										-				-			
	Riverbank Drive and Site Driveway	TWSC	LOS		UM	>	**UM**	<	A		**A**	A		>	**A**					
			Delay		-	>		<	7		**1**	9		>	**9**					
			V/C		-	>		<	0.00			0.03		>						
			Q		-	>		<	0			1		>						
			Ex		-	>		<	-			-		>						
			Avail.		-	>		<	-			-		>						

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds
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Avail. - Available Storage
TWSC - Two-Way Stop Control
< - Shared Through/Left
> - Shared Through/Right
UM - Unopposed Movement

6 Remedial Measures

6.1 Auxiliary Turn Lanes

6.1.1 Left-Turn Lanes

The forecast traffic operations summarized in **Table 5.2** and **Table 5.3** indicate the driveway is forecast to operate at acceptable levels of service. Based on the results of the operational analysis, off-site remedial measures are not likely required on Riverbank Drive; however, the need for a southbound left-turn lane has been assessed to confirm if a southbound left-turn lane is warranted.

The Transportation Association of Canada (TAC) *Geometric Design Guide for Canadian Roads* states “when the number of left-turning vehicles at intersections is such that it creates a hazard and reduces capacity, consideration should be given to the provision of a separate left-turn lane.”[14]

The Ministry of Transportation (MTO) *Design Supplement*[15] to the TAC Geometric Design Guide for Canadian Roads contains the warrants for left-turn lanes. 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.

The warrant analysis has been completed using the nomographs for a two-lane unsignalized intersection with a design speed of 60 km/h. This reflects the two-lane configuration on Riverbank Drive, and a design speed 10 km/h above the posted speed limit. The MTO *Design Supplement* provides left-turn lane warrant nomographs for left-turn percentages ranging from 5% to 40%, at 5% intervals. Left-turn lanes are not typically warranted when the left-turn percentage is less than 5%.

Appendix I contains the left-turn lane warrant and indicates a southbound left-turn lane is not warranted at the site driveway.

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[14] Transportation Association of Canada, “Left-Turn Lanes,” chap. 9.17 in *Geometric Design Guide for Canadian Roads*, (Ottawa: TAC, 2017, 122.

[15] Ministry of Transportation, Ontario, *Design Supplement for the TAC Geometric Design Guide for Canadian Roads, Appendix 9A for Section 9.17 (Left-Turn Lanes)*, (Toronto: MTO, 2017).

6.1.2 Right-Turn Lanes

Although right-turn movements are generally made more efficiently than left-turn movements, exclusive right-turn lanes are often provided for many of the same reasons that left-turn lanes are provided.

The MTO *Geometric Design Standards for Ontario Highways*[16] notes that right-turn lanes or tapers may be considered where right-turn volumes exceed 60 vehicles per hour (vph) and/or where right-turning vehicles create a hazard or reduce capacity at the intersection.

The traffic forecasts in both **Figure 4.3** and **Figure 5.1** indicate a right-turn volume of 8 vehicles in the weekday AM peak hour and 14 vehicles in the PM peak hour. An eastbound right-turn lane is not warranted at the site driveway.

6.2 Traffic Control Improvements

The operational analyses in **Section 5** indicate the westbound left-turn movement on Riverbank Drive at King Street East is forecast to operate at LOS F with or without a full closure of Allendale Road at Riverbank Drive. Traffic control signals could be installed, if warranted, to designate the right-of-way between traffic on King Street East and traffic on Riverbank Drive.

The warrant analysis for traffic control signals at King Street East and Riverbank Drive is based on Justification 7 outlined in Ontario Traffic Manual (OTM) Book 12 (Traffic Signals). [17] Justification 7 uses projected traffic volumes to determine the need for traffic control signals at an intersection.

Appendix J contains the warrant analysis worksheets, which is based on 2029 total traffic volumes, with and without the closure of Allendale Road. **Table 6.1** summarizes the results of the warrant analysis, indicating traffic control signals are not under either scenario.

A roundabout could also be considered to regulate the right-of-way between traffic on King Street East and traffic on Riverbank Drive. However, the intersection's proximity to the single-track level crossing of the Canadian Pacific Kansas City (CPKC) Waterloo Subdivision and property constraints on the west side of King Street East may affect the feasibility of a roundabout at this location.

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16 Ontario Ministry of Transportation, *Geometric Design Standards for Ontario Highways*, (Toronto, Queen's Printer of Ontario, 1985), E8-1.

17 Ontario Ministry of Transportation, *Ontario Traffic Manual Book 12: Traffic Signals*, (Toronto: Queen's Printer for Ontario, 2012).

TABLE 6.1: OTM WARRANT SUMMARY - KING STREET EAST AND RIVERBANK DRIVE

Horizon/Scenario	Justification				Warranted[1]
	1A	1B	2A	2B	
2029 Total (without Allendale Road closure)	123%	38%	110%	14%	No
2029 Total (with Allendale Road closure)	123%	11%	120%	14%	No

Notes:

For existing intersections with forecast traffic, both Justification 1A and 1B, or Justification 2A and 2B must be greater than 120%.

7 Conclusions and Recommendations

7.1 Findings and Conclusions

Based on the analyses contained herein, the findings of this report are as follows:

- Under existing (2023) conditions, the study intersections (King Street East and Riverbank Drive, and Riverbank Drive and Allendale Road) are operating at acceptable levels of service and within capacity. There are no critical movements.
- Under future background (2029) traffic conditions, (that is, *without the proposed development*) the study intersections are forecast to operate at acceptable levels of service and within capacity. In the weekday PM peak hour, the westbound left-turn movement on Riverbank Drive at King Street East is forecast to operate at LOS F, with a v/c ratio of 1.22. These analyses assume an extension of Boychuk Drive to King Street.
- Development of the site is forecast to generate 51 trips in the weekday AM peak hour and 62 trips in the weekday PM peak hour.
- Under future total (2029) traffic conditions (that is, *with the proposed development*) the study intersections are forecast to operate similar to background traffic conditions. In the weekday PM peak hour, the westbound left-turn movement on Riverbank Drive at King Street East is forecast to operate at LOS F, with a v/c ratio of 1.40.
- Under future total (2029) traffic conditions, without the full build-out of the North Cambridge Business Park, the study intersections are forecast to operate at acceptable levels of service and within capacity in the weekday AM peak hour. In the weekday PM peak hour, the westbound left-turn movement on Riverbank Drive at King Street East is forecast to operate at LOS F, with a v/c ratio of 0.70.
- Under future total (2029) traffic conditions, with a full closure of Allendale Road at Riverbank Drive, the study intersections are forecast operate at acceptable levels of service in the weekday AM peak hour. In the weekday PM peak hour, the westbound left-turn movement on Riverbank Drive at King Street East is forecast to operate at LOS F, with a v/c ratio of 0.46.
- Traffic control signals are not warranted at King Street East and Riverbank Drive;

- A southbound left-turn lane is not warranted on Riverbank Drive at the site driveway; and
- An eastbound right-turn lane is not warranted on Riverbank Drive at the site driveway.

Based on the findings of this study it is concluded that development of the site is forecast to have a minor impact on traffic operations at King Street East and Riverbank Drive, and a negligible impact at Riverbank Drive and Allendale Drive.

Upon completion of the North Cambridge Business Park, the operation of the westbound left-turn movement on Riverbank Drive at King Street East is forecast to deteriorate. Operations are considered critical based on Waterloo Region guidelines with or without the proposed development.

At the request of City of Cambridge transportation planning staff, Paradigm conducted a sensitivity analysis assuming the possibility of closing Allendale Road at Riverbank Drive. The closure of Allendale Road at Riverbank Drive would significantly, if not entirely, reduce the number of non-local trips on Riverbank Drive. It would also improve traffic operations at King Street East and Riverbank Drive by reducing traffic volumes on the westbound left-turn movement.

7.2 Recommendations

Based on the conclusions of this study it is recommended the site be considered for approval with no requirement for off-site transportation network improvements on Riverbank Drive.

Independent of the development proposal it is recommended the City of Cambridge and Region of Waterloo monitor traffic volumes at King Street East and Riverbank Drive in response to future road network improvements to identify if or when intersection control improvements may be warranted.

Traffic control signals are not warranted at King Street East and Riverbank Drive and a roundabout may not be feasible given the intersection’s proximity to the single-track level crossing of the Canadian Pacific Kansas City (CPKC) Waterloo Subdivision and property constraints on the west side of King Street East.

Appendix A

Pre-Study Consultation Notes

Andrew Steinsky

From: Melissa Lachance <lachancem@cambridge.ca>
Sent: March 12, 2024 2:20 PM
To: Andrew Steinsky; Sylvia Rafalski-Misch; Laura Dewar
Cc: Shannon Noonan
Subject: RE: 245 Riverbank Drive TIS - Terms of Reference
Attachments: Outlook-mlqjivud

Hi Andrew,

I can confirm that the access design for that intersection will be for a full closure.

Let me know if you require anything further.

Melissa Lachance
Transportation Engineering Technologist
Engineering & Transportation Services
Community Development
T: 519-623-1340 ext. 4077
www.cambridge.ca

City Hall • 50 Dickson St • Cambridge ON • N1R 5W8

From: Andrew Steinsky <asteinsky@ptsl.com>
Sent: Tuesday, March 12, 2024 9:58 AM
To: Melissa Lachance <lachancem@cambridge.ca>; Sylvia Rafalski-Misch <rafalskimiss@cambridge.ca>; Laura Dewar <dewarl@cambridge.ca>
Cc: Shannon Noonan <NoonanS@cambridge.ca>
Subject: RE: 245 Riverbank Drive TIS - Terms of Reference

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This message came from outside your organization.

Hi Melissa,

Just following on my email from late February. Can you please clarify the configuration of a partial closure at Riverbank Drive and Allendale Road? Specifically, which movements would remain in place, and which would no longer be permissible?

@Laura Dewar and @Sylvia Rafalski-Misch are there any other background developments that should be included beyond the three phases of the North Cambridge Business Park?

Thanks,

Andrew Steinsky, P.Eng., PTP
Project Manager, Associate
(he/him)

5A-150 Pinebush Road, Cambridge ON N1R 8J8
p: 416.479.9684 x507
m: 416.316.0654
e: asteinsky@ptsl.com
w: www.ptsl.com

From: Andrew Steinsky
Sent: Thursday, February 22, 2024 2:41 PM
To: 'Melissa Lachance' <lachancem@cambridge.ca>; Sylvia Rafalski-Misch <rafalskimiss@cambridge.ca>; Laura Dewar <dewarl@cambridge.ca>
Cc: Shannon Noonan <NoonanS@cambridge.ca>
Subject: RE: 245 Riverbank Drive TIS - Terms of Reference

Hi Melissa,

Thank you for these comments. Can you please clarify the configuration of a partial closure at Riverbank Drive and Allendale Road? Specifically, which movements would remain in place, and which would no longer be permissible?

@Laura Dewar and @Sylvia Rafalski-Misch are there any other background developments that should be included beyond the three phases of the North Cambridge Business Park?

Thanks,

Andrew Steinsky, P.Eng., PTP
Project Manager, Associate
(he/him)

5A-150 Pinebush Road, Cambridge ON N1R 8J8
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e: asteinsky@ptsl.com
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From: Melissa Lachance <lachancem@cambridge.ca>
Sent: Wednesday, February 21, 2024 1:41 PM
To: Andrew Steinsky <asteinsky@ptsl.com>
Cc: Sylvia Rafalski-Misch <rafalskimiss@cambridge.ca>; Laura Dewar <dewarl@cambridge.ca>; Shannon Noonan <NoonanS@cambridge.ca>
Subject: Re: 245 Riverbank Drive TIS - Terms of Reference

Hi Andrew,

My apologies with the delay in response. I have been trying to accumulate the data that you have requested.

I have ccd Laura Dewar (Supervisor of Special Projects - Planning Develpment) and Sylvia Rafalski-Misch (Manager of Develpment Planning) for their input regarding the development inquiries and growth rate. Please connect with them regarding those matters.

I have highlighted my responses below.

1. **Study Area**: We are reviewing and analyzing the following intersections for the weekday AM peak hour and PM peak hour:
    1. Allendale Road and Riverbank Drive (unsignalized);
    2. Riverbank Drive and King Street East (unsignalized); and
    Please include a full closure and partial closure (exit only) options in your analysis at Riverbank @ Allendale

2. **Traffic Data**: We conducted eight-hour turning movement counts at the two existing study intersections on Thursday December 7, 2023 from 7:30 AM to 10:30 AM, noon to 2:00 PM, and 3:00 PM to 6:00 PM; OK

3. **Horizon Years**: Five years from the date of study; OK

4. **Background Traffic**: We have estimated future background traffic by applying a growth rate of 2% per annum to the existing traffic volumes and including approved or in-stream developments near the site. This growth rate is consistent with that referenced in the traffic impact studies for the North Cambridge Business Park. We are also including the three phases of the North Cambridge Business Park, based on traffic forecasts in the TIS for Phase 2 (prepared by Paradigm in 2018) and Phase 3 (prepared by Paradigm in 2020). The TIS for Phase 2 included traffic forecasts for Phase 1. **Can the City confirm if any other developments should be included in the background traffic forecasts, and if there is a more appropriate growth rate we should use?**
    Please confirm with Laura and/or Sylvia ccd in this email

5. **Future Road Improvements**: Our review of the December 2022 TMP Update did not identify any road improvements in the study area. **Can the City confirm the scope and timing of any planned road or intersection improvements in the study area, if applicable?** None

6. **Trip Generation**: We have estimated the trip generation of the site using the ITE *Trip Generation Manual*. Trips have been assigned to the road network based on existing travel patterns. OK

7. **Operational Analyses**: We are analyzing the operations of the study intersections using Synchro.
    Please include a full closure and partial closure (exit only) options in your analysis at Riverbank @ Allendale

Melissa Lachance
Transportation Engineering Technologist
Engineering & Transportation Services
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City Hall • 50 Dickson St • Cambridge ON • N1R 5W8

From: Andrew Steinsky <asteinsky@ptsl.com>
Sent: February 1, 2024 9:42 AM
To: Melissa Lachance <lachancem@cambridge.ca>
Subject: [External] RE: 245 Riverbank Drive TIS - Terms of Reference

Hi Melissa,

Thank you for reaching out. Paradigm has not had any previous discussions with the City on this application. I'll note that the development concept has been modified from 160 townhouse units to 109 townhouse units. Vehicle access is still proposed via one all-moves driveway connection to Riverbank Drive. As we've been working on the study since December, we've updated the work plan below slightly to reflect our work to date. The work plan based on the *City of Cambridge Pre-consultation Application Comments Checklist* dated 5 October 2023, and attached for reference. **Items in bold are requests for information from the City.**

Unfortunately, our client is looking to submit their application shortly. Is it possible to provide comments by email, in lieu of a meeting?

1. **Study Area**: We are reviewing and analyzing the following intersections for the weekday AM peak hour and PM peak hour:
   1. Allendale Road and Riverbank Drive (unsignalized);
   2. Riverbank Drive and King Street East (unsignalized); and

2. **Traffic Data**: We conducted eight-hour turning movement counts at the two existing study intersections on Thursday December 7, 2023 from 7:30 AM to 10:30 AM, noon to 2:00 PM, and 3:00 PM to 6:00 PM;

3. **Horizon Years**: Five years from the date of study;

4. **Background Traffic**: We have estimated future background traffic by applying a growth rate of 2% per annum to the existing traffic volumes and including approved or in-stream developments near the site. This growth rate is consistent with that referenced in the traffic impact studies for the North Cambridge Business Park. We are also including the three phases of the North Cambridge Business Park, based on traffic forecasts in the TIS for Phase 2 (prepared by Paradigm in 2018) and Phase 3 (prepared by Paradigm in 2020). The TIS for Phase 2 included traffic forecasts for Phase 1. **Can the City confirm if any other developments should be included in the background traffic forecasts, and if there is a more appropriate growth rate we should use?**

5. **Future Road Improvements**: Our review of the December 2022 TMP Update did not identify any road improvements in the study area. **Can the City confirm the scope and timing of any planned road or intersection improvements in the study area, if applicable?**

6. **Trip Generation**: We have estimated the trip generation of the site using the ITE *Trip Generation Manual*. Trips have been assigned to the road network based on existing travel patterns.

7. **Operational Analyses**: We are analyzing the operations of the study intersections using Synchro.

The study is being carried out in accordance with the Region of Waterloo *Transportation Impact Study Guidelines* (2014).

Please let us know if you have any questions or comments on the above work plan.

Thanks,

Andrew Steinsky, P.Eng., PTP
Project Manager, Associate
(he/him)

5A-150 Pinebush Road, Cambridge ON N1R 8J8
p: 416.479.9684 x507
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From: Melissa Lachance <lachancem@cambridge.ca>
Sent: Thursday, February 1, 2024 8:56 AM
To: Andrew Steinsky <asteinsky@ptsl.com>
Subject: 245 Riverbank Drive TIS - Terms of Reference

Good Morning Andrew,

I was forwarded your contact information in regards to 245 Riverbank Drive.

I will be reviewing this location on behalf of transportation engineering and would like to set up a meeting to discuss your work plan. Currently, I have availability to meet the 14th or 16th of this month; Let me know if either of those days will work for you.

As I am fairly new to the City, it may be beneficial to forward me any previous documents/conversations that you think would be helpful for me to review prior to meeting.

Thanks in advance,

Melissa Lachance
Transportation Engineering Technologist
Engineering & Transportation Services
Community Development
T: 519-623-1340 ext. 4077
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the presence of viruses. Paradigm Transportation Solutions Limited accepts no liability for any damage caused by any virus transmitted by this e-mail.

Appendix B

Turning Movement Count Data

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Allendale Road & Riverbank Drive
Site Code: 230691 230692
Start Date: 12/07/2023

Turning Movement Data

Start Time	Allendale Road Westbound					Riverbank Drive Northbound					Riverbank Drive Southbound					
	Left	Right	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Int. Total
7:30 AM	20	0	0	0	20	3	18	0	0	21	0	3	0	0	3	44
7:45 AM	11	1	0	0	12	2	24	0	0	26	0	8	0	0	8	46
Hourly Total	31	1	0	0	32	5	42	0	0	47	0	11	0	0	11	90
8:00 AM	20	0	0	0	20	7	27	0	0	34	0	5	0	0	5	59
8:15 AM	14	0	0	0	14	5	12	0	0	17	0	0	0	0	0	31
8:30 AM	17	0	0	0	17	2	19	0	0	21	1	3	0	0	4	42
8:45 AM	12	0	0	0	12	2	11	0	0	13	1	2	0	0	3	28
Hourly Total	63	0	0	0	63	16	69	0	0	85	2	10	0	0	12	160
9:00 AM	4	0	0	0	4	2	15	0	0	17	1	0	0	0	1	22
9:15 AM	11	0	0	0	11	3	6	0	0	9	2	1	0	0	3	23
9:30 AM	9	2	0	0	11	0	9	0	0	9	1	4	0	0	5	25
9:45 AM	13	1	0	0	14	0	11	0	0	11	0	1	0	0	1	26
Hourly Total	37	3	0	0	40	5	41	0	0	46	4	6	0	0	10	96
10:00 AM	12	0	0	0	12	2	18	0	0	20	0	2	0	0	2	34
10:15 AM	12	0	0	0	12	2	9	0	0	11	1	0	0	0	1	24
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	24	0	0	0	24	4	27	0	0	31	1	2	0	0	3	58
12:00 PM	7	1	0	0	8	4	18	0	0	22	1	7	0	0	8	38
12:15 PM	9	1	0	0	10	7	7	0	0	14	0	0	0	0	0	24
12:30 PM	5	0	0	0	5	3	13	0	0	16	1	0	0	0	1	22
12:45 PM	9	0	0	0	9	1	13	0	0	14	1	2	0	0	3	26
Hourly Total	30	2	0	0	32	15	51	0	0	66	3	9	0	0	12	110
1:00 PM	12	0	0	0	12	3	5	0	0	8	0	3	0	0	3	23
1:15 PM	8	0	0	0	8	3	16	0	0	19	0	3	0	0	3	30
1:30 PM	10	0	0	0	10	2	12	0	0	14	0	2	0	0	2	26
1:45 PM	5	0	0	0	5	3	10	0	0	13	1	3	0	0	4	22
Hourly Total	35	0	0	0	35	11	43	0	0	54	1	11	0	0	12	101
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3:00 PM	31	1	0	0	32	3	24	0	0	27	1	4	0	0	5	64
3:15 PM	23	3	0	0	26	3	24	0	0	27	1	0	0	0	1	54
3:30 PM	29	0	0	0	29	2	18	0	0	20	0	1	0	0	1	50
3:45 PM	44	2	0	0	46	7	13	0	0	20	1	2	0	0	3	69
Hourly Total	127	6	0	0	133	15	79	0	0	94	3	7	0	0	10	237
4:00 PM	58	2	0	0	60	4	31	0	0	35	0	3	0	0	3	98
4:15 PM	66	3	0	0	69	5	22	0	0	27	0	3	0	0	3	99
4:30 PM	55	0	0	0	55	3	46	0	0	49	0	4	0	0	4	108

4:45 PM	62	0	0	0	62	3	35	0	0	38	0	2	0	0	2	102
Hourly Total	241	5	0	0	246	15	134	0	0	149	0	12	0	0	12	407
5:00 PM	45	2	0	0	47	6	43	0	1	49	2	5	0	0	7	103
5:15 PM	36	0	0	0	36	3	26	0	0	29	0	1	0	0	1	66
5:30 PM	23	1	0	0	24	6	10	0	0	16	1	1	0	0	2	42
5:45 PM	23	1	0	0	24	4	18	0	1	22	0	2	0	0	2	48
Hourly Total	127	4	0	0	131	19	97	0	2	116	3	9	0	0	12	259
Grand Total	715	21	0	0	736	105	583	0	2	688	17	77	0	0	94	1518
Approach %	97.1	2.9	0.0	-	-	15.3	84.7	0.0	-	-	18.1	81.9	0.0	-	-	-
Total %	47.1	1.4	0.0	-	48.5	6.9	38.4	0.0	-	45.3	1.1	5.1	0.0	-	6.2	-
Motorcycles	1	0	0	-	1	0	0	0	-	0	0	0	0	-	0	1
% Motorcycles	0.1	0.0	-	-	0.1	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.1
Cars & Light Goods	705	21	0	-	726	102	574	0	-	676	16	73	0	-	89	1491
% Cars & Light Goods	98.6	100.0	-	-	98.6	97.1	98.5	-	-	98.3	94.1	94.8	-	-	94.7	98.2
Buses	3	0	0	-	3	2	3	0	-	5	0	1	0	-	1	9
% Buses	0.4	0.0	-	-	0.4	1.9	0.5	-	-	0.7	0.0	1.3	-	-	1.1	0.6
Single-Unit Trucks	4	0	0	-	4	1	5	0	-	6	0	0	0	-	0	10
% Single-Unit Trucks	0.6	0.0	-	-	0.5	1.0	0.9	-	-	0.9	0.0	0.0	-	-	0.0	0.7
Articulated Trucks	1	0	0	-	1	0	0	0	-	0	1	0	0	-	1	2
% Articulated Trucks	0.1	0.0	-	-	0.1	0.0	0.0	-	-	0.0	5.9	0.0	-	-	1.1	0.1
Bicycles on Road	1	0	0	-	1	0	1	0	-	1	0	3	0	-	3	5
% Bicycles on Road	0.1	0.0	-	-	0.1	0.0	0.2	-	-	0.1	0.0	3.9	-	-	3.2	0.3
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	-	-
Pedestrians	-	-	-	0	-	-	-	-	2	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Allendale Road & Riverbank Drive
Site Code: 230691 230692
Start Date: 12/07/2023

Riverbank Drive [N]

Out	In	Total
0	0	0
123	89	212
2	1	3
1	0	1
0	4	4
126	**94**	**220**

T	L	U	P
0	0	0	0
73	16	0	0
1	0	0	0
0	0	0	0
3	1	0	0
77	**17**	**0**	**0**

Allendale Road [E]

Out	In	Total
0	1	1
590	726	1316
3	3	6
5	4	9
2	2	4
600	**736**	**1336**

R	L	U	P
0	1	0	0
21	705	0	0
0	3	0	0
0	4	0	0
0	2	0	0
21	**715**	**0**	**0**

12/07/2023 7:30 AM
Ending At
12/07/2023 6:00 PM

Motorcycles
Cars & Light Goods
Buses
Single-Unit Trucks
Other

U	T	R	P
0	0	0	0
0	102	574	0
0	2	3	0
0	1	5	0
0	0	1	2
0	**105**	**583**	**2**

Out	In	Total
1	0	1
778	676	1454
4	5	9
4	6	10
5	1	6
792	**688**	**1480**

Riverbank Drive [S]

Turning Movement Data Plot

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Turning Movement Peak Hour Data (7:30 AM)

Start Time	Allendale Road Westbound					Riverbank Drive Northbound					Riverbank Drive Southbound					
	Left	Right	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Int. Total
7:30 AM	20	0	0	0	20	3	18	0	0	21	0	3	0	0	3	44
7:45 AM	11	1	0	0	12	2	24	0	0	26	0	8	0	0	8	46
8:00 AM	20	0	0	0	20	7	27	0	0	34	0	5	0	0	5	59
8:15 AM	14	0	0	0	14	5	12	0	0	17	0	0	0	0	0	31
Total	65	1	0	0	66	17	81	0	0	98	0	16	0	0	16	180
Approach %	98.5	1.5	0.0	-	-	17.3	82.7	0.0	-	-	0.0	100.0	0.0	-	-	-
Total %	36.1	0.6	0.0	-	36.7	9.4	45.0	0.0	-	54.4	0.0	8.9	0.0	-	8.9	-
PHF	0.813	0.250	0.000	-	0.825	0.607	0.750	0.000	-	0.721	0.000	0.500	0.000	-	0.500	0.763
Motorcycles	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Motorcycles	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	-	0.0	-	-	0.0	0.0
Cars & Light Goods	63	1	0	-	64	16	76	0	-	92	0	16	0	-	16	172
% Cars & Light Goods	96.9	100.0	-	-	97.0	94.1	93.8	-	-	93.9	-	100.0	-	-	100.0	95.6
Buses	2	0	0	-	2	1	2	0	-	3	0	0	0	-	0	5
% Buses	3.1	0.0	-	-	3.0	5.9	2.5	-	-	3.1	-	0.0	-	-	0.0	2.8
Single-Unit Trucks	0	0	0	-	0	0	2	0	-	2	0	0	0	-	0	2
% Single-Unit Trucks	0.0	0.0	-	-	0.0	0.0	2.5	-	-	2.0	-	0.0	-	-	0.0	1.1
Articulated Trucks	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	-	0.0	-	-	0.0	0.0
Bicycles on Road	0	0	0	-	0	0	1	0	-	1	0	0	0	-	0	1
% Bicycles on Road	0.0	0.0	-	-	0.0	0.0	1.2	-	-	1.0	-	0.0	-	-	0.0	0.6
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Allendale Road & Riverbank Drive
Site Code: 230691 230692
Start Date: 12/07/2023

Peak Hour Data

12/07/2023 7:30 AM
Ending At
12/07/2023 8:30 AM

Motorcycles
Cars & Light Goods
Buses
Single-Unit Trucks
Other

Riverbank Drive [N]

Out	In	Total
0	0	0
17	16	33
1	0	1
0	0	0
0	0	0
18	**16**	**34**

T	L	U	P
0	0	0	0
16	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
16	**0**	**0**	**0**

Allendale Road [E]

Out	In	Total
0	0	0
76	64	140
2	2	4
2	0	2
1	0	1
81	**66**	**147**

R	L	U	P
0	0	0	0
1	63	0	0
0	2	0	0
0	0	0	0
0	0	0	0
1	**65**	**0**	**0**

Riverbank Drive [S]

U	T	R	P
0	0	0	0
0	16	76	0
0	1	2	0
0	0	2	0
0	0	1	0
0	**17**	**81**	**0**

Out	In	Total
0	0	0
79	92	171
2	3	5
0	2	2
0	1	1
81	**98**	**179**

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

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Allendale Road & Riverbank Drive
Site Code: 230691 230692
Start Date: 12/07/2023
Page No: 6

Turning Movement Peak Hour Data (12:00 PM)

Start Time	Allendale Road Westbound					Riverbank Drive Northbound					Riverbank Drive Southbound					
	Left	Right	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Int. Total
12:00 PM	7	1	0	0	8	4	18	0	0	22	1	7	0	0	8	38
12:15 PM	9	1	0	0	10	7	7	0	0	14	0	0	0	0	0	24
12:30 PM	5	0	0	0	5	3	13	0	0	16	1	0	0	0	1	22
12:45 PM	9	0	0	0	9	1	13	0	0	14	1	2	0	0	3	26
Total	30	2	0	0	32	15	51	0	0	66	3	9	0	0	12	110
Approach %	93.8	6.3	0.0	-	-	22.7	77.3	0.0	-	-	25.0	75.0	0.0	-	-	-
Total %	27.3	1.8	0.0	-	29.1	13.6	46.4	0.0	-	60.0	2.7	8.2	0.0	-	10.9	-
PHF	0.833	0.500	0.000	-	0.800	0.536	0.708	0.000	-	0.750	0.750	0.321	0.000	-	0.375	0.724
Motorcycles	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Motorcycles	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0
Cars & Light Goods	30	2	0	-	32	15	51	0	-	66	3	9	0	-	12	110
% Cars & Light Goods	100.0	100.0	-	-	100.0	100.0	100.0	-	-	100.0	100.0	100.0	-	-	100.0	100.0
Buses	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Buses	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0
Single-Unit Trucks	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Single-Unit Trucks	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0
Articulated Trucks	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Road	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Allendale Road & Riverbank Drive
Site Code: 230691 230692
Start Date: 12/07/2023
Page No: 7

Riverbank Drive [N]		
Out	In	Total
0	0	0
17	12	29
0	0	0
0	0	0
0	0	0
17	**12**	**29**

0	0	0	0
9	3	0	0
0	0	0	0
0	0	0	0
0	0	0	0
9	**3**	**0**	**0**
T	L	U	P

Peak Hour Data

12/07/2023 12:00 PM
Ending At
12/07/2023 1:00 PM

Motorcycles
Cars & Light Goods
Buses
Single-Unit Trucks
Other

R	L	U	P
0	0	0	0
2	30	0	0
0	0	0	0
0	0	0	0
0	0	0	0
2	**30**	**0**	**0**

Allendale Road [E]		
Out	In	Total
0	0	0
54	32	86
0	0	0
0	0	0
0	0	0
54	**32**	**86**

U	T	R	P
0	0	0	0
0	15	51	0
0	0	0	0
0	0	0	0
0	0	0	0
0	**15**	**51**	**0**

0	0	0
39	66	105
0	0	0
0	0	0
0	0	0
39	**66**	**105**
Out	In	Total
Riverbank Drive [S]		

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

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Allendale Road & Riverbank Drive
Site Code: 230691 230692
Start Date: 12/07/2023

Turning Movement Peak Hour Data (4:15 PM)

Start Time	Allendale Road					Riverbank Drive					Riverbank Drive					
	Westbound					Northbound					Southbound					
	Left	Right	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Int. Total
4:15 PM	66	3	0	0	69	5	22	0	0	27	0	3	0	0	3	99
4:30 PM	55	0	0	0	55	3	46	0	0	49	0	4	0	0	4	108
4:45 PM	62	0	0	0	62	3	35	0	0	38	0	2	0	0	2	102
5:00 PM	45	2	0	0	47	6	43	0	1	49	2	5	0	0	7	103
Total	228	5	0	0	233	17	146	0	1	163	2	14	0	0	16	412
Approach %	97.9	2.1	0.0	-	-	10.4	89.6	0.0	-	-	12.5	87.5	0.0	-	-	-
Total %	55.3	1.2	0.0	-	56.6	4.1	35.4	0.0	-	39.6	0.5	3.4	0.0	-	3.9	-
PHF	0.864	0.417	0.000	-	0.844	0.708	0.793	0.000	-	0.832	0.250	0.700	0.000	-	0.571	0.954
Motorcycles	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Motorcycles	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0
Cars & Light Goods	226	5	0	-	231	17	146	0	-	163	2	11	0	-	13	407
% Cars & Light Goods	99.1	100.0	-	-	99.1	100.0	100.0	-	-	100.0	100.0	78.6	-	-	81.3	98.8
Buses	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Buses	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0
Single-Unit Trucks	1	0	0	-	1	0	0	0	-	0	0	0	0	-	0	1
% Single-Unit Trucks	0.4	0.0	-	-	0.4	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.2
Articulated Trucks	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Road	1	0	0	-	1	0	0	0	-	0	0	3	0	-	3	4
% Bicycles on Road	0.4	0.0	-	-	0.4	0.0	0.0	-	-	0.0	0.0	21.4	-	-	18.8	1.0
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	-	-
Pedestrians	-	-	-	0	-	-	-	-	1	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Allendale Road & Riverbank Drive
Site Code: 230691 230692
Start Date: 12/07/2023

Riverbank Drive [N]		
Out	In	Total
0	0	0
22	13	35
0	0	0
0	0	0
0	3	3
22	**16**	**38**

0	0	0	0
11	2	0	0
0	0	0	0
0	0	0	0
3	0	0	0
14	**2**	**0**	**0**
T	L	U	P

Peak Hour Data

12/07/2023 4:15 PM
Ending At
12/07/2023 5:15 PM

Motorcycles
Cars & Light Goods
Buses
Single-Unit Trucks
Other

R	L	U	P
5	**228**	**0**	**0**
0	1	0	0
0	1	0	0
0	0	0	0
5	226	0	0
0	0	0	0

Allendale Road [E]		
Out	In	Total
0	0	0
148	231	379
0	0	0
0	1	1
0	1	1
148	**233**	**381**

U	T	R	P
0	0	0	0
0	17	146	0
0	0	0	0
0	0	0	0
0	0	0	1
0	**17**	**146**	**1**

0	0	0
237	163	400
0	0	0
1	0	1
4	0	4
242	**163**	**405**
Out	In	Total
Riverbank Drive [S]		

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

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Riverbank Drive & King Street E
Site Code: 230691
Start Date: 12/07/2023
Page No: 1

Turning Movement Data

Start Time	Riverbank Drive Westbound					King Street E Northbound					King Street E Southbound					
	Left	Right	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Int. Total
7:30 AM	9	19	0	0	28	51	6	0	0	57	14	96	0	0	110	195
7:45 AM	5	17	0	0	22	62	5	0	0	67	21	96	0	0	117	206
Hourly Total	14	36	0	0	50	113	11	0	0	124	35	192	0	0	227	401
8:00 AM	13	14	0	0	27	78	10	0	0	88	20	81	0	0	101	216
8:15 AM	6	18	0	0	24	49	5	0	0	54	12	83	0	0	95	173
8:30 AM	5	14	0	0	19	69	10	0	0	79	13	85	0	0	98	196
8:45 AM	10	15	0	0	25	59	3	0	0	62	14	82	0	0	96	183
Hourly Total	34	61	0	0	95	255	28	0	0	283	59	331	0	0	390	768
9:00 AM	3	3	0	0	6	63	5	0	0	68	11	104	0	0	115	189
9:15 AM	5	5	0	0	10	68	5	0	0	73	5	67	0	1	72	155
9:30 AM	4	12	0	0	16	86	0	0	0	86	8	84	0	0	92	194
9:45 AM	3	12	0	0	15	75	5	0	0	80	12	106	0	0	118	213
Hourly Total	15	32	0	0	47	292	15	0	0	307	36	361	0	1	397	751
10:00 AM	5	11	0	0	16	75	2	0	0	77	14	87	0	0	101	194
10:15 AM	3	10	0	0	13	75	5	0	0	80	8	79	0	0	87	180
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	8	21	0	0	29	150	7	0	0	157	22	166	0	0	188	374
12:00 PM	6	11	0	0	17	108	7	0	0	115	16	113	0	0	129	261
12:15 PM	2	7	0	0	9	97	6	0	0	103	8	118	0	0	126	238
12:30 PM	0	10	0	0	10	112	3	0	0	115	17	105	0	0	122	247
12:45 PM	3	7	0	0	10	121	3	0	0	124	11	105	0	0	116	250
Hourly Total	11	35	0	0	46	438	19	0	0	457	52	441	0	0	493	996
1:00 PM	2	14	0	0	16	109	6	0	0	115	7	121	0	0	128	259
1:15 PM	2	15	0	0	17	93	6	0	0	99	13	116	0	0	129	245
1:30 PM	2	13	0	0	15	104	4	0	0	108	11	106	0	0	117	240
1:45 PM	3	4	0	0	7	104	1	0	0	105	15	77	0	0	92	204
Hourly Total	9	46	0	0	55	410	17	0	0	427	46	420	0	0	466	948
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3:00 PM	6	25	0	0	31	98	9	0	0	107	14	100	0	0	114	252
3:15 PM	3	25	0	0	28	135	6	0	0	141	25	95	0	0	120	289
3:30 PM	6	23	0	0	29	109	10	0	0	119	13	125	0	0	138	286
3:45 PM	7	31	0	0	38	126	3	0	0	129	27	126	0	0	153	320
Hourly Total	22	104	0	0	126	468	28	0	0	496	79	446	0	0	525	1147
4:00 PM	10	48	0	0	58	118	7	0	0	125	28	120	0	0	148	331
4:15 PM	8	65	0	0	73	124	6	0	0	130	26	130	0	0	156	359
4:30 PM	9	46	0	0	55	135	13	0	0	148	32	103	0	0	135	338

4:45 PM	9	57	0	0	66	132	6	0	0	138	33	123	0	0	156	360
Hourly Total	36	216	0	0	252	509	32	0	0	541	119	476	0	0	595	1388
5:00 PM	8	47	0	0	55	141	8	0	0	149	42	123	0	0	165	369
5:15 PM	8	30	0	0	38	108	16	0	0	124	19	127	0	0	146	308
5:30 PM	3	19	0	0	22	105	6	0	0	111	13	84	0	0	97	230
5:45 PM	5	20	0	0	25	102	2	0	0	104	15	88	0	0	103	232
Hourly Total	24	116	0	0	140	456	32	0	0	488	89	422	0	0	511	1139
Grand Total	173	667	0	0	840	3091	189	0	0	3280	537	3255	0	1	3792	7912
Approach %	20.6	79.4	0.0	-	-	94.2	5.8	0.0	-	-	14.2	85.8	0.0	-	-	-
Total %	2.2	8.4	0.0	-	10.6	39.1	2.4	0.0	-	41.5	6.8	41.1	0.0	-	47.9	-
Motorcycles	0	1	0	-	1	0	0	0	-	0	0	0	0	-	0	1
% Motorcycles	0.0	0.1	-	-	0.1	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0
Cars & Light Goods	167	659	0	-	826	2995	183	0	-	3178	529	3159	0	-	3688	7692
% Cars & Light Goods	96.5	98.8	-	-	98.3	96.9	96.8	-	-	96.9	98.5	97.1	-	-	97.3	97.2
Buses	4	1	0	-	5	39	3	0	-	42	2	40	0	-	42	89
% Buses	2.3	0.1	-	-	0.6	1.3	1.6	-	-	1.3	0.4	1.2	-	-	1.1	1.1
Single-Unit Trucks	2	5	0	-	7	46	3	0	-	49	5	45	0	-	50	106
% Single-Unit Trucks	1.2	0.7	-	-	0.8	1.5	1.6	-	-	1.5	0.9	1.4	-	-	1.3	1.3
Articulated Trucks	0	0	0	-	0	7	0	0	-	7	1	10	0	-	11	18
% Articulated Trucks	0.0	0.0	-	-	0.0	0.2	0.0	-	-	0.2	0.2	0.3	-	-	0.3	0.2
Bicycles on Road	0	1	0	-	1	4	0	0	-	4	0	1	0	-	1	6
% Bicycles on Road	0.0	0.1	-	-	0.1	0.1	0.0	-	-	0.1	0.0	0.0	-	-	0.0	0.1
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	1	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Riverbank Drive & King Street E
Site Code: 230691
Start Date: 12/07/2023

King Street E [N]

Out	In	Total
1	0	1
3654	3688	7342
40	42	82
51	50	101
12	12	24
3758	**3792**	**7550**

T	L	U	P
0	0	0	0
3159	529	0	0
40	2	0	0
45	5	0	0
11	1	0	1
3255	**537**	**0**	**1**

Riverbank Drive [E]

Out	In	Total
0	1	1
712	826	1538
5	5	10
8	7	15
1	1	2
726	**840**	**1566**

R	L	U	P
1	0	0	0
659	167	0	0
1	4	0	0
5	2	0	0
1	0	0	0
667	**173**	**0**	**0**

12/07/2023 7:30 AM
Ending At
12/07/2023 6:00 PM

Motorcycles
Cars & Light Goods
Buses
Single-Unit Trucks
Other

U	T	R	P
0	0	0	0
0	2995	183	0
0	39	3	0
0	46	3	0
0	11	0	0
0	**3091**	**189**	**0**

Out	In	Total
0	0	0
3326	3178	6504
44	42	86
47	49	96
11	11	22
3428	**3280**	**6708**

King Street E [S]

Turning Movement Data Plot

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Riverbank Drive & King Street E
Site Code: 230691
Start Date: 12/07/2023

Turning Movement Peak Hour Data (7:45 AM)

Start Time	Riverbank Drive Westbound					King Street E Northbound					King Street E Southbound					
	Left	Right	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Int. Total
7:45 AM	5	17	0	0	22	62	5	0	0	67	21	96	0	0	117	206
8:00 AM	13	14	0	0	27	78	10	0	0	88	20	81	0	0	101	216
8:15 AM	6	18	0	0	24	49	5	0	0	54	12	83	0	0	95	173
8:30 AM	5	14	0	0	19	69	10	0	0	79	13	85	0	0	98	196
Total	29	63	0	0	92	258	30	0	0	288	66	345	0	0	411	791
Approach %	31.5	68.5	0.0	-	-	89.6	10.4	0.0	-	-	16.1	83.9	0.0	-	-	-
Total %	3.7	8.0	0.0	-	11.6	32.6	3.8	0.0	-	36.4	8.3	43.6	0.0	-	52.0	-
PHF	0.558	0.875	0.000	-	0.852	0.827	0.750	0.000	-	0.818	0.786	0.898	0.000	-	0.878	0.916
Motorcycles	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Motorcycles	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0
Cars & Light Goods	28	61	0	-	89	241	28	0	-	269	61	334	0	-	395	753
% Cars & Light Goods	96.6	96.8	-	-	96.7	93.4	93.3	-	-	93.4	92.4	96.8	-	-	96.1	95.2
Buses	1	1	0	-	2	6	2	0	-	8	2	5	0	-	7	17
% Buses	3.4	1.6	-	-	2.2	2.3	6.7	-	-	2.8	3.0	1.4	-	-	1.7	2.1
Single-Unit Trucks	0	1	0	-	1	8	0	0	-	8	2	4	0	-	6	15
% Single-Unit Trucks	0.0	1.6	-	-	1.1	3.1	0.0	-	-	2.8	3.0	1.2	-	-	1.5	1.9
Articulated Trucks	0	0	0	-	0	2	0	0	-	2	1	1	0	-	2	4
% Articulated Trucks	0.0	0.0	-	-	0.0	0.8	0.0	-	-	0.7	1.5	0.3	-	-	0.5	0.5
Bicycles on Road	0	0	0	-	0	1	0	0	-	1	0	1	0	-	1	2
% Bicycles on Road	0.0	0.0	-	-	0.0	0.4	0.0	-	-	0.3	0.0	0.3	-	-	0.2	0.3
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

paradigm

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Riverbank Drive & King Street E
Site Code: 230691
Start Date: 12/07/2023
Page No: 5

King Street E [N]		
Out	In	Total
0	0	0
302	395	697
7	7	14
9	6	15
3	3	6
321	**411**	**732**

T	L	U	P
0	0	0	0
334	61	0	0
5	2	0	0
4	2	0	0
2	1	0	0
345	**66**	**0**	**0**

Peak Hour Data

12/07/2023 7:45 AM
Ending At
12/07/2023 8:45 AM

Motorcycles
Cars & Light Goods
Buses
Single-Unit Trucks
Other

R	L	U	P
0	0	0	0
61	28	0	0
1	1	0	0
1	0	0	0
0	0	0	0
63	**29**	**0**	**0**

Riverbank Drive [E]		
Out	In	Total
0	0	0
89	89	178
4	2	6
2	1	3
1	0	1
96	**92**	**188**

U	T	R	P
0	0	0	0
0	241	28	0
0	6	2	0
0	8	0	0
0	3	0	0
0	**258**	**30**	**0**

0	0	0
362	269	631
6	8	14
4	8	12
2	3	5
374	**288**	**662**
Out	In	Total
King Street E [S]		

Turning Movement Peak Hour Data Plot (7:45 AM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Riverbank Drive & King Street E
Site Code: 230691
Start Date: 12/07/2023
Page No: 6

Turning Movement Peak Hour Data (12:30 PM)

Start Time	Riverbank Drive Westbound					King Street E Northbound					King Street E Southbound					
	Left	Right	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Int. Total
12:30 PM	0	10	0	0	10	112	3	0	0	115	17	105	0	0	122	247
12:45 PM	3	7	0	0	10	121	3	0	0	124	11	105	0	0	116	250
1:00 PM	2	14	0	0	16	109	6	0	0	115	7	121	0	0	128	259
1:15 PM	2	15	0	0	17	93	6	0	0	99	13	116	0	0	129	245
Total	7	46	0	0	53	435	18	0	0	453	48	447	0	0	495	1001
Approach %	13.2	86.8	0.0	-	-	96.0	4.0	0.0	-	-	9.7	90.3	0.0	-	-	-
Total %	0.7	4.6	0.0	-	5.3	43.5	1.8	0.0	-	45.3	4.8	44.7	0.0	-	49.5	-
PHF	0.583	0.767	0.000	-	0.779	0.899	0.750	0.000	-	0.913	0.706	0.924	0.000	-	0.959	0.966
Motorcycles	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Motorcycles	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0
Cars & Light Goods	6	46	0	-	52	424	17	0	-	441	48	430	0	-	478	971
% Cars & Light Goods	85.7	100.0	-	-	98.1	97.5	94.4	-	-	97.4	100.0	96.2	-	-	96.6	97.0
Buses	0	0	0	-	0	4	0	0	-	4	0	4	0	-	4	8
% Buses	0.0	0.0	-	-	0.0	0.9	0.0	-	-	0.9	0.0	0.9	-	-	0.8	0.8
Single-Unit Trucks	1	0	0	-	1	7	1	0	-	8	0	13	0	-	13	22
% Single-Unit Trucks	14.3	0.0	-	-	1.9	1.6	5.6	-	-	1.8	0.0	2.9	-	-	2.6	2.2
Articulated Trucks	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Road	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Riverbank Drive & King Street E
Site Code: 230691
Start Date: 12/07/2023

King Street E [N]

Out	In	Total
0	0	0
470	478	948
4	4	8
7	13	20
0	0	0
481	**495**	**976**

T	L	U	P
0	0	0	0
430	48	0	0
4	0	0	0
13	0	0	0
0	0	0	0
447	**48**	**0**	**0**

Peak Hour Data

12/07/2023 12:30 PM
Ending At
12/07/2023 1:30 PM

Motorcycles
Cars & Light Goods
Buses
Single-Unit Trucks
Other

Riverbank Drive [E]

	Out	In	Total
Motorcycles	0	0	0
Cars & Light Goods	65	52	117
Buses	0	0	0
Single-Unit Trucks	1	1	2
Other	0	0	0
Total	**66**	**53**	**119**

	R	L	U	P
Motorcycles	0	0	0	0
Cars & Light Goods	46	6	0	0
Buses	0	0	0	0
Single-Unit Trucks	0	1	0	0
Other	0	0	0	0
Total	**46**	**7**	**0**	**0**

U	T	R	P
0	0	0	0
0	424	17	0
0	4	0	0
0	7	1	0
0	0	0	0
0	**435**	**18**	**0**

Out	In	Total
0	0	0
436	441	877
4	4	8
14	8	22
0	0	0
454	**453**	**907**
Out	In	Total

King Street E [S]

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

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Riverbank Drive & King Street E
Site Code: 230691
Start Date: 12/07/2023

Turning Movement Peak Hour Data (4:15 PM)

Start Time	Riverbank Drive Westbound					King Street E Northbound					King Street E Southbound					
	Left	Right	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Int. Total
4:15 PM	8	65	0	0	73	124	6	0	0	130	26	130	0	0	156	359
4:30 PM	9	46	0	0	55	135	13	0	0	148	32	103	0	0	135	338
4:45 PM	9	57	0	0	66	132	6	0	0	138	33	123	0	0	156	360
5:00 PM	8	47	0	0	55	141	8	0	0	149	42	123	0	0	165	369
Total	34	215	0	0	249	532	33	0	0	565	133	479	0	0	612	1426
Approach %	13.7	86.3	0.0	-	-	94.2	5.8	0.0	-	-	21.7	78.3	0.0	-	-	-
Total %	2.4	15.1	0.0	-	17.5	37.3	2.3	0.0	-	39.6	9.3	33.6	0.0	-	42.9	-
PHF	0.944	0.827	0.000	-	0.853	0.943	0.635	0.000	-	0.948	0.792	0.921	0.000	-	0.927	0.966
Motorcycles	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Motorcycles	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0
Cars & Light Goods	34	212	0	-	246	523	33	0	-	556	133	470	0	-	603	1405
% Cars & Light Goods	100.0	98.6	-	-	98.8	98.3	100.0	-	-	98.4	100.0	98.1	-	-	98.5	98.5
Buses	0	0	0	-	0	5	0	0	-	5	0	6	0	-	6	11
% Buses	0.0	0.0	-	-	0.0	0.9	0.0	-	-	0.9	0.0	1.3	-	-	1.0	0.8
Single-Unit Trucks	0	2	0	-	2	2	0	0	-	2	0	2	0	-	2	6
% Single-Unit Trucks	0.0	0.9	-	-	0.8	0.4	0.0	-	-	0.4	0.0	0.4	-	-	0.3	0.4
Articulated Trucks	0	0	0	-	0	1	0	0	-	1	0	1	0	-	1	2
% Articulated Trucks	0.0	0.0	-	-	0.0	0.2	0.0	-	-	0.2	0.0	0.2	-	-	0.2	0.1
Bicycles on Road	0	1	0	-	1	1	0	0	-	1	0	0	0	-	0	2
% Bicycles on Road	0.0	0.5	-	-	0.4	0.2	0.0	-	-	0.2	0.0	0.0	-	-	0.0	0.1
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
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Count Name: Riverbank Drive & King Street E
Site Code: 230691
Start Date: 12/07/2023
Page No: 9

King Street E [N]

Out	In	Total
0	0	0
735	603	1338
5	6	11
4	2	6
3	1	4
747	**612**	**1359**

T	L	U	P
0	0	0	0
470	133	0	0
6	0	0	0
2	0	0	0
1	0	0	0
479	**133**	**0**	**0**

Peak Hour Data

12/07/2023 4:15 PM
Ending At
12/07/2023 5:15 PM

Motorcycles
Cars & Light Goods
Buses
Single-Unit Trucks
Other

Riverbank Drive [E]

Out	In	Total
0	0	0
166	246	412
0	0	0
0	2	2
0	1	1
166	**249**	**415**

R	L	U	P
0	0	0	0
212	34	0	0
0	0	0	0
2	0	0	0
1	0	0	0
215	**34**	**0**	**0**

U	T	R	P
0	0	0	0
0	523	33	0
0	5	0	0
0	2	0	0
0	2	0	0
0	**532**	**33**	**0**

Out	In	Total
0	0	0
504	556	1060
6	5	11
2	2	4
1	2	3
513	**565**	**1078**

King Street E [S]

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

Appendix C

Existing Traffic Operations Reports

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	29	63	258	30	66	245
Future Volume (vph)	29	63	258	30	66	245
Ideal Flow (vphpl)	1765	1765	1650	1650	1775	1900
Storage Length (m)	0.0	0.0		0.0	30.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	7.5				70.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.908		0.986			
Flt Protected	0.984				0.950	
Satd. Flow (prot)	1531	0	1520	0	1561	1827
Flt Permitted	0.984				0.950	
Satd. Flow (perm)	1531	0	1520	0	1561	1827
Link Speed (k/h)	50		60			60
Link Distance (m)	309.9		250.6			281.7
Travel Time (s)	22.3		15.0			16.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	3%	7%	7%	8%	4%
Adj. Flow (vph)	29	63	258	30	66	245
Shared Lane Traffic (%)						
Lane Group Flow (vph)	92	0	288	0	66	245
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.6			3.6
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	1.10	1.10	1.20	1.20	1.09	1.00
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized
Intersection Capacity Utilization 37.5% ICU Level of Service A
Analysis Period (min) 15

Intersection

Int Delay, s/veh 2.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	29	63	258	30	66	245
Future Vol, veh/h	29	63	258	30	66	245
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	30	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	3	3	7	7	8	4
Mvmt Flow	29	63	258	30	66	245

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	650	273	0	0	288	0
Stage 1	273	-	-	-	-	-
Stage 2	377	-	-	-	-	-
Critical Hdwy	6.43	6.23	-	-	4.18	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.327	-	-	2.272	-
Pot Cap-1 Maneuver	432	763	-	-	1240	-
Stage 1	771	-	-	-	-	-
Stage 2	691	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	409	763	-	-	1240	-
Mov Cap-2 Maneuver	409	-	-	-	-	-
Stage 1	771	-	-	-	-	-
Stage 2	654	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.1	0	1.7
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	599	1240	-
HCM Lane V/C Ratio	-	-	0.154	0.053	-
HCM Control Delay (s)	-	-	12.1	8.1	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	0.5	0.2	-

Lanes, Volumes, Timings
2: Riverbank Drive & Allendale Road

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	65	1	17	81	0	16
Future Volume (vph)	65	1	17	81	0	16
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.998		0.888			
Flt Protected	0.953					
Satd. Flow (prot)	1631	0	1382	0	0	1650
Flt Permitted	0.953					
Satd. Flow (perm)	1631	0	1382	0	0	1650
Link Speed (k/h)	70		50			50
Link Distance (m)	257.7		200.8			253.3
Travel Time (s)	13.3		14.5			18.2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	0%	6%	6%	0%	0%
Adj. Flow (vph)	65	1	17	81	0	16
Shared Lane Traffic (%)						
Lane Group Flow (vph)	66	0	98	0	0	16
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		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	1.10	1.10	1.20	1.20	1.20	1.20
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 17.4%	ICU Level of Service A
Analysis Period (min) 15	

HCM 6th TWSC
2: Riverbank Drive & Allendale Road

Intersection	
Int Delay, s/veh	3.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	65	1	17	81	0	16
Future Vol, veh/h	65	1	17	81	0	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	3	0	6	6	0	0
Mvmt Flow	65	1	17	81	0	16

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	74	58	0	0	98	0
Stage 1	58	-	-	-	-	-
Stage 2	16	-	-	-	-	-
Critical Hdwy	6.43	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	927	1014	-	-	1508	-
Stage 1	962	-	-	-	-	-
Stage 2	1004	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	927	1014	-	-	1508	-
Mov Cap-2 Maneuver	927	-	-	-	-	-
Stage 1	962	-	-	-	-	-
Stage 2	1004	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.2	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	928	1508	-
HCM Lane V/C Ratio	-	-	0.071	-	-
HCM Control Delay (s)	-	-	9.2	0	-
HCM Lane LOS	-	-	A	A	-
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	34	215	532	33	133	479
Future Volume (vph)	34	215	532	33	133	479
Ideal Flow (vphpl)	1765	1765	1650	1650	1775	1900
Storage Length (m)	0.0	0.0		0.0	30.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	7.5				70.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.883		0.992			
Flt Protected	0.993				0.950	
Satd. Flow (prot)	1534	0	1607	0	1686	1863
Flt Permitted	0.993				0.950	
Satd. Flow (perm)	1534	0	1607	0	1686	1863
Link Speed (k/h)	50		60			60
Link Distance (m)	309.9		250.6			281.7
Travel Time (s)	22.3		15.0			16.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	1%	2%	0%	0%	2%
Adj. Flow (vph)	34	215	532	33	133	479
Shared Lane Traffic (%)						
Lane Group Flow (vph)	249	0	565	0	133	479
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.6			3.6
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	1.10	1.10	1.20	1.20	1.09	1.00
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 68.8%	ICU Level of Service C
Analysis Period (min) 15	

Intersection	
Int Delay, s/veh	5.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	34	215	532	33	133	479
Future Vol, veh/h	34	215	532	33	133	479
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	30	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	1	2	0	0	2
Mvmt Flow	34	215	532	33	133	479

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1294	549	0	0	565	0
Stage 1	549	-	-	-	-	-
Stage 2	745	-	-	-	-	-
Critical Hdwy	6.4	6.21	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.309	-	-	2.2	-
Pot Cap-1 Maneuver	181	537	-	-	1017	-
Stage 1	583	-	-	-	-	-
Stage 2	473	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	157	537	-	-	1017	-
Mov Cap-2 Maneuver	157	-	-	-	-	-
Stage 1	583	-	-	-	-	-
Stage 2	411	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	27.2	0	2
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	404	1017	-
HCM Lane V/C Ratio	-	-	0.616	0.131	-
HCM Control Delay (s)	-	-	27.2	9.1	-
HCM Lane LOS	-	-	D	A	-
HCM 95th %tile Q(veh)	-	-	4	0.5	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	228	5	17	146	2	14
Future Volume (vph)	228	5	17	146	2	14
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.997		0.879			
Flt Protected	0.953					0.994
Satd. Flow (prot)	1661	0	1450	0	0	1386
Flt Permitted	0.953					0.994
Satd. Flow (perm)	1661	0	1450	0	0	1386
Link Speed (k/h)	70		50			50
Link Distance (m)	257.7		200.8			253.3
Travel Time (s)	13.3		14.5			18.2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	1%	0%	0%	0%	0%	21%
Adj. Flow (vph)	228	5	17	146	2	14
Shared Lane Traffic (%)						
Lane Group Flow (vph)	233	0	163	0	0	16
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		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	1.10	1.10	1.20	1.20	1.20	1.20
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 32.0%	ICU Level of Service A
Analysis Period (min) 15	

Intersection	
Int Delay, s/veh	5.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	228	5	17	146	2	14
Future Vol, veh/h	228	5	17	146	2	14
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	1	0	0	0	0	21
Mvmt Flow	228	5	17	146	2	14

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	108	90	0	0	163	0
Stage 1	90	-	-	-	-	-
Stage 2	18	-	-	-	-	-
Critical Hdwy	6.41	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.41	-	-	-	-	-
Critical Hdwy Stg 2	5.41	-	-	-	-	-
Follow-up Hdwy	3.509	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	892	973	-	-	1428	-
Stage 1	936	-	-	-	-	-
Stage 2	1007	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	891	973	-	-	1428	-
Mov Cap-2 Maneuver	891	-	-	-	-	-
Stage 1	936	-	-	-	-	-
Stage 2	1006	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.4	0	0.9
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	893	1428	-
HCM Lane V/C Ratio	-	-	0.261	0.001	-
HCM Control Delay (s)	-	-	10.4	7.5	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	1	0	-

Appendix D

ITE Trip Generation Manual Excerpts

Land Use: 215
Single-Family Attached Housing

Description

Single-family attached housing includes any single-family housing unit that shares a wall with an adjoining dwelling unit, whether the walls are for living space, a vehicle garage, or storage space.

Additional Data

The database for this land use includes duplexes (defined as a single structure with two distinct dwelling units, typically joined side-by-side and each with at least one outside entrance) and townhouses/rowhouses (defined as a single structure with three or more distinct dwelling units, joined side-by-side in a row and each with an outside entrance).

The technical appendices provide supporting information on time-of-day distributions for this land use. The appendices can be accessed through either the ITETripGen web app or the trip generation resource page on the ITE website (https://www.ite.org/technical-resources/topics/trip-and-parking-generation/).

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in British Columbia (CAN), California, Georgia, Illinois, Maryland, Massachusetts, Minnesota, New Jersey, Ontario (CAN), Oregon, Pennsylvania, South Dakota, Utah, Virginia, and Wisconsin.

Source Numbers

168, 204, 211, 237, 305, 306, 319, 321, 357, 390, 418, 525, 571, 583, 638, 735, 868, 869, 870, 896, 912, 959, 1009, 1046, 1056, 1058, 1077

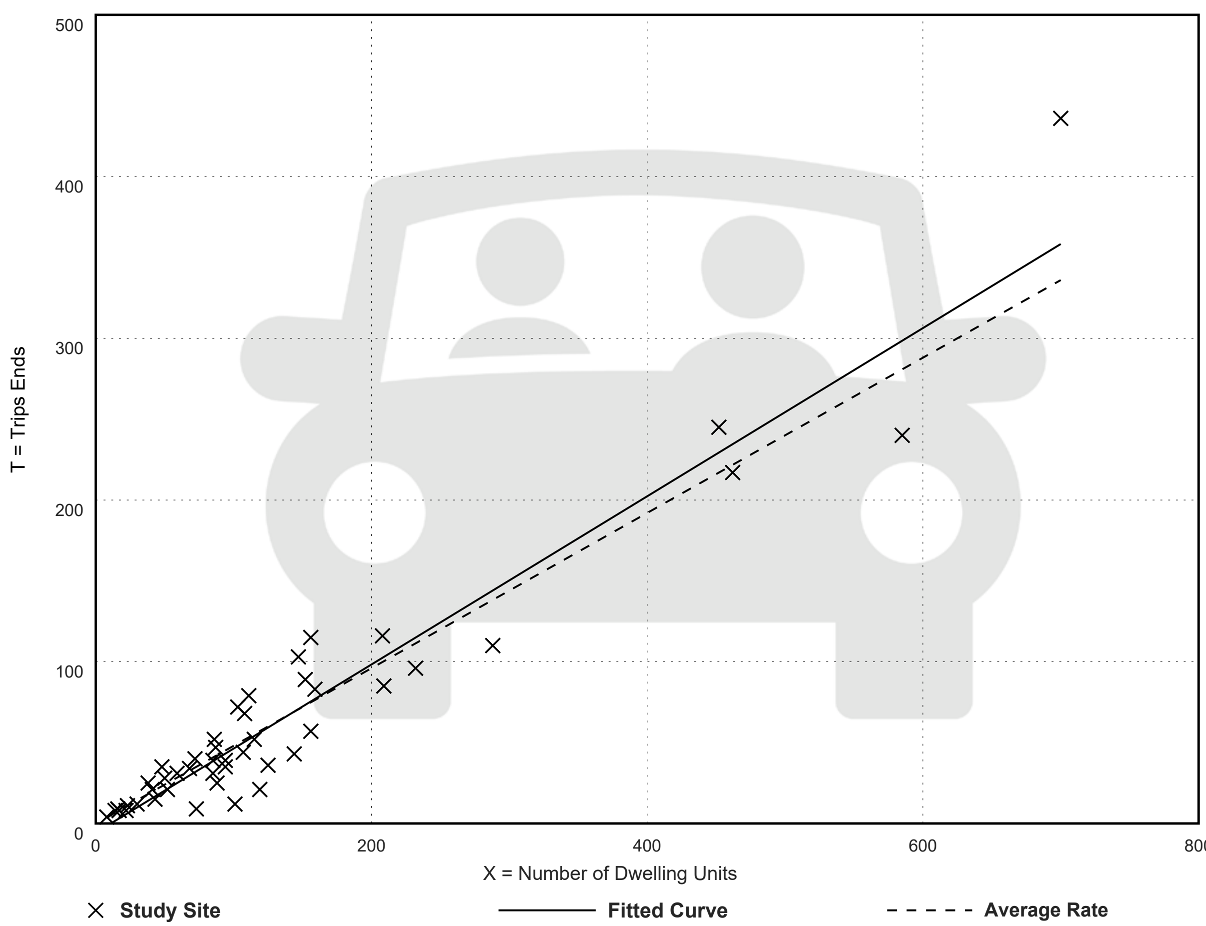
Single-Family Attached Housing
(215)

Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	46
Avg. Num. of Dwelling Units:	135
Directional Distribution:	31% entering, 69% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.48	0.12 - 0.74	0.14

Data Plot and Equation



Fitted Curve Equation: T = 0.52(X) - 5.70 **R^2= 0.92**

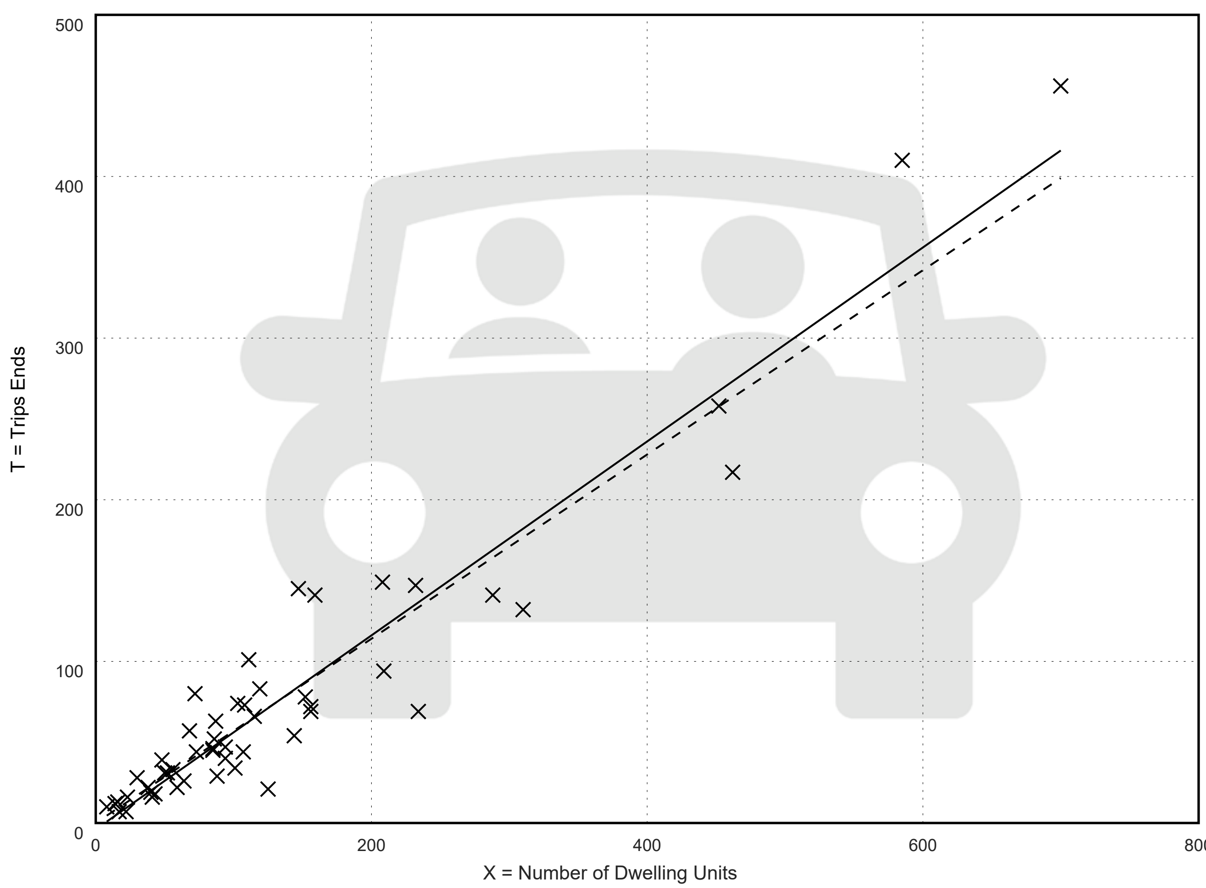
Single-Family Attached Housing (215)

Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	51
Avg. Num. of Dwelling Units:	136
Directional Distribution:	57% entering, 43% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.57	0.17 - 1.25	0.18

Data Plot and Equation



× **Study Site** — **Fitted Curve** - - - - - **Average Rate**

Fitted Curve Equation: T = 0.60(X) - 3.93 **R^2= 0.91**

Appendix E

2029 Background Traffic Operations Reports

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	16	71	392	17	74	790
Future Volume (vph)	16	71	392	17	74	790
Ideal Flow (vphpl)	1765	1765	1650	1650	1775	1900
Storage Length (m)	0.0	0.0		0.0	30.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	7.5				70.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.890		0.994			
Flt Protected	0.991				0.950	
Satd. Flow (prot)	1511	0	1533	0	1561	1827
Flt Permitted	0.991				0.950	
Satd. Flow (perm)	1511	0	1533	0	1561	1827
Link Speed (k/h)	50		60			60
Link Distance (m)	309.9		250.6			281.7
Travel Time (s)	22.3		15.0			16.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	3%	7%	7%	8%	4%
Adj. Flow (vph)	16	71	392	17	74	790
Shared Lane Traffic (%)						
Lane Group Flow (vph)	87	0	409	0	74	790
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.6			3.6
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	1.10	1.10	1.20	1.20	1.09	1.00
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized
Intersection Capacity Utilization 53.9% ICU Level of Service A
Analysis Period (min) 15

Intersection	
Int Delay, s/veh	1.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	16	71	392	17	74	790
Future Vol, veh/h	16	71	392	17	74	790
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	30	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	3	3	7	7	8	4
Mvmt Flow	16	71	392	17	74	790

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1339	401	0	0	409	0
Stage 1	401	-	-	-	-	-
Stage 2	938	-	-	-	-	-
Critical Hdwy	6.43	6.23	-	-	4.18	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.327	-	-	2.272	-
Pot Cap-1 Maneuver	168	647	-	-	1118	-
Stage 1	674	-	-	-	-	-
Stage 2	379	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	157	647	-	-	1118	-
Mov Cap-2 Maneuver	157	-	-	-	-	-
Stage 1	674	-	-	-	-	-
Stage 2	354	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.1	0	0.7
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	411	1118	-
HCM Lane V/C Ratio	-	-	0.212	0.066	-
HCM Control Delay (s)	-	-	16.1	8.4	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	0.8	0.2	-

Lanes, Volumes, Timings
2: Riverbank Drive & Allendale Road

2029 Background: AM Peak Hour

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	56	1	19	74	0	18
Future Volume (vph)	56	1	19	74	0	18
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.998		0.893			
Flt Protected	0.953					
Satd. Flow (prot)	1631	0	1390	0	0	1650
Flt Permitted	0.953					
Satd. Flow (perm)	1631	0	1390	0	0	1650
Link Speed (k/h)	70		50			50
Link Distance (m)	257.7		200.8			253.3
Travel Time (s)	13.3		14.5			18.2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	0%	6%	6%	0%	0%
Adj. Flow (vph)	56	1	19	74	0	18
Shared Lane Traffic (%)						
Lane Group Flow (vph)	57	0	93	0	0	18
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		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	1.10	1.10	1.20	1.20	1.20	1.20
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 16.5%	ICU Level of Service A
Analysis Period (min) 15	

HCM 6th TWSC
2: Riverbank Drive & Allendale Road

2029 Background: AM Peak Hour

Intersection	
Int Delay, s/veh	3.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	56	1	19	74	0	18
Future Vol, veh/h	56	1	19	74	0	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	3	0	6	6	0	0
Mvmt Flow	56	1	19	74	0	18

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	74	56	0	0	93	0
Stage 1	56	-	-	-	-	-
Stage 2	18	-	-	-	-	-
Critical Hdwy	6.43	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	927	1016	-	-	1514	-
Stage 1	964	-	-	-	-	-
Stage 2	1002	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	927	1016	-	-	1514	-
Mov Cap-2 Maneuver	927	-	-	-	-	-
Stage 1	964	-	-	-	-	-
Stage 2	1002	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.1	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	928	1514	-
HCM Lane V/C Ratio	-	-	0.061	-	-
HCM Control Delay (s)	-	-	9.1	0	-
HCM Lane LOS	-	-	A	A	-
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	19	242	1058	18	150	651
Future Volume (vph)	19	242	1058	18	150	651
Ideal Flow (vphpl)	1765	1765	1650	1650	1775	1900
Storage Length (m)	0.0	0.0		0.0	30.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	7.5				70.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.875		0.998			
Flt Protected	0.996				0.950	
Satd. Flow (prot)	1524	0	1615	0	1686	1863
Flt Permitted	0.996				0.950	
Satd. Flow (perm)	1524	0	1615	0	1686	1863
Link Speed (k/h)	50		60			60
Link Distance (m)	309.9		250.6			281.7
Travel Time (s)	22.3		15.0			16.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	1%	2%	0%	0%	2%
Adj. Flow (vph)	19	242	1058	18	150	651
Shared Lane Traffic (%)						
Lane Group Flow (vph)	261	0	1076	0	150	651
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.6			3.6
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	1.10	1.10	1.20	1.20	1.09	1.00
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 101.5%	ICU Level of Service G
Analysis Period (min) 15	

Intersection	
Int Delay, s/veh	25.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	19	242	1058	18	150	651
Future Vol, veh/h	19	242	1058	18	150	651
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	30	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	1	2	0	0	2
Mvmt Flow	19	242	1058	18	150	651

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2018	1067	0	0	1076	0
Stage 1	1067	-	-	-	-	-
Stage 2	951	-	-	-	-	-
Critical Hdwy	6.4	6.21	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.309	-	-	2.2	-
Pot Cap-1 Maneuver	65	271	-	-	656	-
Stage 1	334	-	-	-	-	-
Stage 2	379	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	50	271	-	-	656	-
Mov Cap-2 Maneuver	50	-	-	-	-	-
Stage 1	334	-	-	-	-	-
Stage 2	292	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	201.7	0	2.3
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	205	656	-
HCM Lane V/C Ratio	-	-	1.273	0.229	-
HCM Control Delay (s)	-	-	201.7	12.1	-
HCM Lane LOS	-	-	F	B	-
HCM 95th %tile Q(veh)	-	-	14	0.9	-

Lanes, Volumes, Timings
2: Riverbank Drive & Allendale Road

2029 Background: PM Peak Hour

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	238	6	19	145	2	16
Future Volume (vph)	238	6	19	145	2	16
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.997		0.881			
Flt Protected	0.953					0.994
Satd. Flow (prot)	1661	0	1454	0	0	1382
Flt Permitted	0.953					0.994
Satd. Flow (perm)	1661	0	1454	0	0	1382
Link Speed (k/h)	70		50			50
Link Distance (m)	257.7		200.8			253.3
Travel Time (s)	13.3		14.5			18.2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	1%	0%	0%	0%	0%	21%
Adj. Flow (vph)	238	6	19	145	2	16
Shared Lane Traffic (%)						
Lane Group Flow (vph)	244	0	164	0	0	18
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		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	1.10	1.10	1.20	1.20	1.20	1.20
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 32.7%		ICU Level of Service A
Analysis Period (min) 15		

HCM 6th TWSC
2: Riverbank Drive & Allendale Road

2029 Background: PM Peak Hour

Intersection	
Int Delay, s/veh	6.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	238	6	19	145	2	16
Future Vol, veh/h	238	6	19	145	2	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	1	0	0	0	0	21
Mvmt Flow	238	6	19	145	2	16

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	112	92	0	0	164	0
Stage 1	92	-	-	-	-	-
Stage 2	20	-	-	-	-	-
Critical Hdwy	6.41	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.41	-	-	-	-	-
Critical Hdwy Stg 2	5.41	-	-	-	-	-
Follow-up Hdwy	3.509	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	887	971	-	-	1427	-
Stage 1	934	-	-	-	-	-
Stage 2	1005	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	886	971	-	-	1427	-
Mov Cap-2 Maneuver	886	-	-	-	-	-
Stage 1	934	-	-	-	-	-
Stage 2	1004	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.6	0	0.8
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	888	1427	-
HCM Lane V/C Ratio	-	-	0.275	0.001	-
HCM Control Delay (s)	-	-	10.6	7.5	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	1.1	0	-

Appendix F

2029 Total Traffic Operations Reports

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	21	83	392	19	80	790
Future Volume (vph)	21	83	392	19	80	790
Ideal Flow (vphpl)	1765	1765	1650	1650	1775	1900
Storage Length (m)	0.0	0.0		0.0	30.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	7.5				70.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.892		0.994			
Flt Protected	0.990				0.950	
Satd. Flow (prot)	1513	0	1533	0	1561	1827
Flt Permitted	0.990				0.950	
Satd. Flow (perm)	1513	0	1533	0	1561	1827
Link Speed (k/h)	50		60			60
Link Distance (m)	309.9		250.6			281.7
Travel Time (s)	22.3		15.0			16.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	3%	7%	7%	8%	4%
Adj. Flow (vph)	21	83	392	19	80	790
Shared Lane Traffic (%)						
Lane Group Flow (vph)	104	0	411	0	80	790
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.6			3.6
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	1.10	1.10	1.20	1.20	1.09	1.00
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 55.0%	ICU Level of Service B
Analysis Period (min) 15	

Intersection	
Int Delay, s/veh	1.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	21	83	392	19	80	790
Future Vol, veh/h	21	83	392	19	80	790
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	30	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	3	3	7	7	8	4
Mvmt Flow	21	83	392	19	80	790

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1352	402	0	0	411	0
Stage 1	402	-	-	-	-	-
Stage 2	950	-	-	-	-	-
Critical Hdwy	6.43	6.23	-	-	4.18	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.327	-	-	2.272	-
Pot Cap-1 Maneuver	165	646	-	-	1116	-
Stage 1	673	-	-	-	-	-
Stage 2	374	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	153	646	-	-	1116	-
Mov Cap-2 Maneuver	153	-	-	-	-	-
Stage 1	673	-	-	-	-	-
Stage 2	347	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	17.5	0	0.8
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	391	1116	-
HCM Lane V/C Ratio	-	-	0.266	0.072	-
HCM Control Delay (s)	-	-	17.5	8.5	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	1.1	0.2	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	62	1	23	88	0	20
Future Volume (vph)	62	1	23	88	0	20
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.998		0.893			
Flt Protected	0.953					
Satd. Flow (prot)	1631	0	1390	0	0	1650
Flt Permitted	0.953					
Satd. Flow (perm)	1631	0	1390	0	0	1650
Link Speed (k/h)	70		50			50
Link Distance (m)	257.7		200.8			253.3
Travel Time (s)	13.3		14.5			18.2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	0%	6%	6%	0%	0%
Adj. Flow (vph)	62	1	23	88	0	20
Shared Lane Traffic (%)						
Lane Group Flow (vph)	63	0	111	0	0	20
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		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	1.10	1.10	1.20	1.20	1.20	1.20
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized
Intersection Capacity Utilization 18.1% ICU Level of Service A
Analysis Period (min) 15

Intersection	
Int Delay, s/veh	3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	62	1	23	88	0	20
Future Vol, veh/h	62	1	23	88	0	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	3	0	6	6	0	0
Mvmt Flow	62	1	23	88	0	20

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	87	67	0	0	111	0
Stage 1	67	-	-	-	-	-
Stage 2	20	-	-	-	-	-
Critical Hdwy	6.43	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	912	1002	-	-	1492	-
Stage 1	953	-	-	-	-	-
Stage 2	1000	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	912	1002	-	-	1492	-
Mov Cap-2 Maneuver	912	-	-	-	-	-
Stage 1	953	-	-	-	-	-
Stage 2	1000	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.2	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	913	1492	-
HCM Lane V/C Ratio	-	-	0.069	-	-
HCM Control Delay (s)	-	-	9.2	0	-
HCM Lane LOS	-	-	A	A	-
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	91	8	8	74	17	18
Future Volume (vph)	91	8	8	74	17	18
Ideal Flow (vphpl)	1650	1650	1650	1650	1765	1765
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.989				0.931	
Flt Protected				0.995	0.976	
Satd. Flow (prot)	1533	0	0	1613	1604	0
Flt Permitted				0.995	0.976	
Satd. Flow (perm)	1533	0	0	1613	1604	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	93.9			79.9	113.6	
Travel Time (s)	6.8			5.8	8.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	7%	0%	0%	2%	0%	0%
Adj. Flow (vph)	91	8	8	74	17	18
Shared Lane Traffic (%)						
Lane Group Flow (vph)	99	0	0	82	35	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.6	
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	1.20	1.20	1.20	1.20	1.10	1.10
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 21.7%	ICU Level of Service A
Analysis Period (min) 15	

Intersection	
Int Delay, s/veh	1.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	91	8	8	74	17	18
Future Vol, veh/h	91	8	8	74	17	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	7	0	0	2	0	0
Mvmt Flow	91	8	8	74	17	18

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	99	0	185	95
Stage 1	-	-	-	-	95	-
Stage 2	-	-	-	-	90	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1507	-	809	967
Stage 1	-	-	-	-	934	-
Stage 2	-	-	-	-	939	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1507	-	804	967
Mov Cap-2 Maneuver	-	-	-	-	804	-
Stage 1	-	-	-	-	934	-
Stage 2	-	-	-	-	933	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.7	9.3
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	880	-	-	1507	-
HCM Lane V/C Ratio	0.04	-	-	0.005	-
HCM Control Delay (s)	9.3	-	-	7.4	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	22	256	1058	21	161	651
Future Volume (vph)	22	256	1058	21	161	651
Ideal Flow (vphpl)	1765	1765	1650	1650	1775	1900
Storage Length (m)	0.0	0.0		0.0	30.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	7.5				70.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.876		0.997			
Flt Protected	0.996				0.950	
Satd. Flow (prot)	1526	0	1613	0	1686	1863
Flt Permitted	0.996				0.950	
Satd. Flow (perm)	1526	0	1613	0	1686	1863
Link Speed (k/h)	50		60			60
Link Distance (m)	309.9		250.6			281.7
Travel Time (s)	22.3		15.0			16.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	1%	2%	0%	0%	2%
Adj. Flow (vph)	22	256	1058	21	161	651
Shared Lane Traffic (%)						
Lane Group Flow (vph)	278	0	1079	0	161	651
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.6			3.6
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	1.10	1.10	1.20	1.20	1.09	1.00
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized
Intersection Capacity Utilization 103.5% ICU Level of Service G
Analysis Period (min) 15

Intersection	
Int Delay, s/veh	33.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	22	256	1058	21	161	651
Future Vol, veh/h	22	256	1058	21	161	651
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	30	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	1	2	0	0	2
Mvmt Flow	22	256	1058	21	161	651

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2042	1069	0	0	1079	0
Stage 1	1069	-	-	-	-	-
Stage 2	973	-	-	-	-	-
Critical Hdwy	6.4	6.21	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.309	-	-	2.2	-
Pot Cap-1 Maneuver	63	270	-	-	654	-
Stage 1	333	-	-	-	-	-
Stage 2	370	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	48	270	-	-	654	-
Mov Cap-2 Maneuver	48	-	-	-	-	-
Stage 1	333	-	-	-	-	-
Stage 2	279	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	254.6	0	2.4
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	198	654	-
HCM Lane V/C Ratio	-	-	1.404	0.246	-
HCM Control Delay (s)	-	-	254.6	12.3	-
HCM Lane LOS	-	-	F	B	-
HCM 95th %tile Q(veh)	-	-	16.4	1	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	257	6	20	154	2	18
Future Volume (vph)	257	6	20	154	2	18
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.997		0.881			
Flt Protected	0.953					0.995
Satd. Flow (prot)	1661	0	1454	0	0	1381
Flt Permitted	0.953					0.995
Satd. Flow (perm)	1661	0	1454	0	0	1381
Link Speed (k/h)	70		50			50
Link Distance (m)	257.7		200.8			253.3
Travel Time (s)	13.3		14.5			18.2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	1%	0%	0%	0%	0%	21%
Adj. Flow (vph)	257	6	20	154	2	18
Shared Lane Traffic (%)						
Lane Group Flow (vph)	263	0	174	0	0	20
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		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	1.10	1.10	1.20	1.20	1.20	1.20
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized
Intersection Capacity Utilization 34.5% ICU Level of Service A
Analysis Period (min) 15

Intersection	
Int Delay, s/veh	6.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	257	6	20	154	2	18
Future Vol, veh/h	257	6	20	154	2	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	1	0	0	0	0	21
Mvmt Flow	257	6	20	154	2	18

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	119	97	0	0	174	0
Stage 1	97	-	-	-	-	-
Stage 2	22	-	-	-	-	-
Critical Hdwy	6.41	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.41	-	-	-	-	-
Critical Hdwy Stg 2	5.41	-	-	-	-	-
Follow-up Hdwy	3.509	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	879	965	-	-	1415	-
Stage 1	929	-	-	-	-	-
Stage 2	1003	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	878	965	-	-	1415	-
Mov Cap-2 Maneuver	878	-	-	-	-	-
Stage 1	929	-	-	-	-	-
Stage 2	1002	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.8	0	0.8
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	880	1415	-
HCM Lane V/C Ratio	-	-	0.299	0.001	-
HCM Control Delay (s)	-	-	10.8	7.5	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	1.3	0	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	168	14	21	253	17	10
Future Volume (vph)	168	14	21	253	17	10
Ideal Flow (vphpl)	1650	1650	1650	1650	1765	1765
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.990				0.950	
Flt Protected				0.996	0.969	
Satd. Flow (prot)	1634	0	0	1614	1625	0
Flt Permitted				0.996	0.969	
Satd. Flow (perm)	1634	0	0	1614	1625	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	93.9			79.9	113.6	
Travel Time (s)	6.8			5.8	8.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	2%	0%	0%
Adj. Flow (vph)	168	14	21	253	17	10
Shared Lane Traffic (%)						
Lane Group Flow (vph)	182	0	0	274	27	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.6	
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	1.20	1.20	1.20	1.20	1.10	1.10
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 41.2% ICU Level of Service A

Analysis Period (min) 15

Intersection	
Int Delay, s/veh	0.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	168	14	21	253	17	10
Future Vol, veh/h	168	14	21	253	17	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	0	2	0	0
Mvmt Flow	168	14	21	253	17	10

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	182	0	470	175
Stage 1	-	-	-	-	175	-
Stage 2	-	-	-	-	295	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1405	-	556	874
Stage 1	-	-	-	-	860	-
Stage 2	-	-	-	-	760	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1405	-	547	874
Mov Cap-2 Maneuver	-	-	-	-	547	-
Stage 1	-	-	-	-	860	-
Stage 2	-	-	-	-	747	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	10.9
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	635	-	-	1405	-
HCM Lane V/C Ratio	0.043	-	-	0.015	-
HCM Control Delay (s)	10.9	-	-	7.6	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Appendix G

2029 Total Traffic Operations Reports (without Background Developments)

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	21	83	291	19	80	276
Future Volume (vph)	21	83	291	19	80	276
Ideal Flow (vphpl)	1765	1765	1650	1650	1775	1900
Storage Length (m)	0.0	0.0		0.0	30.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	7.5				70.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.892		0.992			
Flt Protected	0.990				0.950	
Satd. Flow (prot)	1513	0	1530	0	1561	1827
Flt Permitted	0.990				0.950	
Satd. Flow (perm)	1513	0	1530	0	1561	1827
Link Speed (k/h)	50		60			60
Link Distance (m)	309.9		250.6			281.7
Travel Time (s)	22.3		15.0			16.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	3%	7%	7%	8%	4%
Adj. Flow (vph)	21	83	291	19	80	276
Shared Lane Traffic (%)						
Lane Group Flow (vph)	104	0	310	0	80	276
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.6			3.6
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	1.10	1.10	1.20	1.20	1.09	1.00
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 40.5% ICU Level of Service A

Analysis Period (min) 15

Intersection	
Int Delay, s/veh	2.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	21	83	291	19	80	276
Future Vol, veh/h	21	83	291	19	80	276
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	30	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	3	3	7	7	8	4
Mvmt Flow	21	83	291	19	80	276

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	737	301	0	0	310	0
Stage 1	301	-	-	-	-	-
Stage 2	436	-	-	-	-	-
Critical Hdwy	6.43	6.23	-	-	4.18	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.327	-	-	2.272	-
Pot Cap-1 Maneuver	384	736	-	-	1217	-
Stage 1	748	-	-	-	-	-
Stage 2	650	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	359	736	-	-	1217	-
Mov Cap-2 Maneuver	359	-	-	-	-	-
Stage 1	748	-	-	-	-	-
Stage 2	607	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.2	0	1.8
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	607	1217	-
HCM Lane V/C Ratio	-	-	0.171	0.066	-
HCM Control Delay (s)	-	-	12.2	8.2	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	0.6	0.2	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	62	1	23	88	0	20
Future Volume (vph)	62	1	23	88	0	20
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.998		0.893			
Flt Protected	0.953					
Satd. Flow (prot)	1631	0	1390	0	0	1650
Flt Permitted	0.953					
Satd. Flow (perm)	1631	0	1390	0	0	1650
Link Speed (k/h)	70		50			50
Link Distance (m)	257.7		200.8			253.3
Travel Time (s)	13.3		14.5			18.2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	0%	6%	6%	0%	0%
Adj. Flow (vph)	62	1	23	88	0	20
Shared Lane Traffic (%)						
Lane Group Flow (vph)	63	0	111	0	0	20
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		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	1.10	1.10	1.20	1.20	1.20	1.20
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 18.1%	ICU Level of Service A
Analysis Period (min) 15	

Intersection	
Int Delay, s/veh	3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	62	1	23	88	0	20
Future Vol, veh/h	62	1	23	88	0	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	3	0	6	6	0	0
Mvmt Flow	62	1	23	88	0	20

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	87	67	0	0	111	0
Stage 1	67	-	-	-	-	-
Stage 2	20	-	-	-	-	-
Critical Hdwy	6.43	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	912	1002	-	-	1492	-
Stage 1	953	-	-	-	-	-
Stage 2	1000	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	912	1002	-	-	1492	-
Mov Cap-2 Maneuver	912	-	-	-	-	-
Stage 1	953	-	-	-	-	-
Stage 2	1000	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.2	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	913	1492	-
HCM Lane V/C Ratio	-	-	0.069	-	-
HCM Control Delay (s)	-	-	9.2	0	-
HCM Lane LOS	-	-	A	A	-
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	91	8	8	74	17	18
Future Volume (vph)	91	8	8	74	17	18
Ideal Flow (vphpl)	1650	1650	1650	1650	1765	1765
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.989				0.931	
Flt Protected				0.995	0.976	
Satd. Flow (prot)	1533	0	0	1613	1604	0
Flt Permitted				0.995	0.976	
Satd. Flow (perm)	1533	0	0	1613	1604	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	93.9			79.9	113.6	
Travel Time (s)	6.8			5.8	8.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	7%	0%	0%	2%	0%	0%
Adj. Flow (vph)	91	8	8	74	17	18
Shared Lane Traffic (%)						
Lane Group Flow (vph)	99	0	0	82	35	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.6	
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	1.20	1.20	1.20	1.20	1.10	1.10
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 21.7%	ICU Level of Service A
Analysis Period (min) 15	

Intersection	
Int Delay, s/veh	1.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	91	8	8	74	17	18
Future Vol, veh/h	91	8	8	74	17	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	7	0	0	2	0	0
Mvmt Flow	91	8	8	74	17	18

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	99	0	185	95
Stage 1	-	-	-	-	95	-
Stage 2	-	-	-	-	90	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1507	-	809	967
Stage 1	-	-	-	-	934	-
Stage 2	-	-	-	-	939	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1507	-	804	967
Mov Cap-2 Maneuver	-	-	-	-	804	-
Stage 1	-	-	-	-	934	-
Stage 2	-	-	-	-	933	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.7	9.3
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	880	-	-	1507	-
HCM Lane V/C Ratio	0.04	-	-	0.005	-
HCM Control Delay (s)	9.3	-	-	7.4	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Lanes, Volumes, Timings
1: King Street E & Riverbank Drive

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	22	256	599	21	161	539
Future Volume (vph)	22	256	599	21	161	539
Ideal Flow (vphpl)	1765	1765	1650	1650	1775	1900
Storage Length (m)	0.0	0.0		0.0	30.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	7.5				70.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.876		0.995			
Flt Protected	0.996				0.950	
Satd. Flow (prot)	1526	0	1611	0	1686	1863
Flt Permitted	0.996				0.950	
Satd. Flow (perm)	1526	0	1611	0	1686	1863
Link Speed (k/h)	50		60			60
Link Distance (m)	309.9		250.6			281.7
Travel Time (s)	22.3		15.0			16.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	1%	2%	0%	0%	2%
Adj. Flow (vph)	22	256	599	21	161	539
Shared Lane Traffic (%)						
Lane Group Flow (vph)	278	0	620	0	161	539
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.6			3.6
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	1.10	1.10	1.20	1.20	1.09	1.00
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 75.7% ICU Level of Service D

Analysis Period (min) 15

HCM 6th TWSC
1: King Street E & Riverbank Drive

Intersection	
Int Delay, s/veh	6.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	22	256	599	21	161	539
Future Vol, veh/h	22	256	599	21	161	539
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	30	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	1	2	0	0	2
Mvmt Flow	22	256	599	21	161	539

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1471	610	0	0	620	0
Stage 1	610	-	-	-	-	-
Stage 2	861	-	-	-	-	-
Critical Hdwy	6.4	6.21	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.309	-	-	2.2	-
Pot Cap-1 Maneuver	141	496	-	-	970	-
Stage 1	546	-	-	-	-	-
Stage 2	417	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	118	496	-	-	970	-
Mov Cap-2 Maneuver	118	-	-	-	-	-
Stage 1	546	-	-	-	-	-
Stage 2	348	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	32.9	0	2.2
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	396	970	-
HCM Lane V/C Ratio	-	-	0.702	0.166	-
HCM Control Delay (s)	-	-	32.9	9.4	-
HCM Lane LOS	-	-	D	A	-
HCM 95th %tile Q(veh)	-	-	5.2	0.6	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	257	6	20	154	2	18
Future Volume (vph)	257	6	20	154	2	18
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.997		0.881			
Flt Protected	0.953					0.995
Satd. Flow (prot)	1661	0	1454	0	0	1381
Flt Permitted	0.953					0.995
Satd. Flow (perm)	1661	0	1454	0	0	1381
Link Speed (k/h)	70		50			50
Link Distance (m)	257.7		200.8			253.3
Travel Time (s)	13.3		14.5			18.2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	1%	0%	0%	0%	0%	21%
Adj. Flow (vph)	257	6	20	154	2	18
Shared Lane Traffic (%)						
Lane Group Flow (vph)	263	0	174	0	0	20
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		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	1.10	1.10	1.20	1.20	1.20	1.20
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized
Intersection Capacity Utilization 34.5% ICU Level of Service A
Analysis Period (min) 15

Intersection	
Int Delay, s/veh	6.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	257	6	20	154	2	18
Future Vol, veh/h	257	6	20	154	2	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	1	0	0	0	0	21
Mvmt Flow	257	6	20	154	2	18

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	119	97	0	0	174	0
Stage 1	97	-	-	-	-	-
Stage 2	22	-	-	-	-	-
Critical Hdwy	6.41	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.41	-	-	-	-	-
Critical Hdwy Stg 2	5.41	-	-	-	-	-
Follow-up Hdwy	3.509	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	879	965	-	-	1415	-
Stage 1	929	-	-	-	-	-
Stage 2	1003	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	878	965	-	-	1415	-
Mov Cap-2 Maneuver	878	-	-	-	-	-
Stage 1	929	-	-	-	-	-
Stage 2	1002	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.8	0	0.8
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	880	1415	-
HCM Lane V/C Ratio	-	-	0.299	0.001	-
HCM Control Delay (s)	-	-	10.8	7.5	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	1.3	0	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	168	14	21	253	17	10
Future Volume (vph)	168	14	21	253	17	10
Ideal Flow (vphpl)	1650	1650	1650	1650	1765	1765
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.990				0.950	
Flt Protected				0.996	0.969	
Satd. Flow (prot)	1634	0	0	1614	1625	0
Flt Permitted				0.996	0.969	
Satd. Flow (perm)	1634	0	0	1614	1625	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	93.9			79.9	113.6	
Travel Time (s)	6.8			5.8	8.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	2%	0%	0%
Adj. Flow (vph)	168	14	21	253	17	10
Shared Lane Traffic (%)						
Lane Group Flow (vph)	182	0	0	274	27	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.6	
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	1.20	1.20	1.20	1.20	1.10	1.10
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 41.2%	ICU Level of Service A
Analysis Period (min) 15	

Intersection	
Int Delay, s/veh	0.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	168	14	21	253	17	10
Future Vol, veh/h	168	14	21	253	17	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	0	2	0	0
Mvmt Flow	168	14	21	253	17	10

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	182	0	470	175
Stage 1	-	-	-	-	175	-
Stage 2	-	-	-	-	295	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1405	-	556	874
Stage 1	-	-	-	-	860	-
Stage 2	-	-	-	-	760	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1405	-	547	874
Mov Cap-2 Maneuver	-	-	-	-	547	-
Stage 1	-	-	-	-	860	-
Stage 2	-	-	-	-	747	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	10.9
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	635	-	-	1405	-
HCM Lane V/C Ratio	0.043	-	-	0.015	-
HCM Control Delay (s)	10.9	-	-	7.6	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Appendix H

2029 Total Traffic Operations Reports (with Allendale Road Closure)

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	28	33	441	15	17	853
Future Volume (vph)	28	33	441	15	17	853
Ideal Flow (vphpl)	1765	1765	1650	1650	1775	1900
Storage Length (m)	0.0	0.0		0.0	30.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	7.5				70.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.927		0.996			
Flt Protected	0.978				0.950	
Satd. Flow (prot)	1554	0	1536	0	1561	1827
Flt Permitted	0.978				0.950	
Satd. Flow (perm)	1554	0	1536	0	1561	1827
Link Speed (k/h)	50		60			60
Link Distance (m)	309.9		250.6			281.7
Travel Time (s)	22.3		15.0			16.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	3%	7%	7%	8%	4%
Adj. Flow (vph)	28	33	441	15	17	853
Shared Lane Traffic (%)						
Lane Group Flow (vph)	61	0	456	0	17	853
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.6			3.6
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	1.10	1.10	1.20	1.20	1.09	1.00
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary
Area Type: Other
Control Type: Unsignalized
Intersection Capacity Utilization 55.4% ICU Level of Service B
Analysis Period (min) 15

Intersection
Int Delay, s/veh 1.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	28	33	441	15	17	853
Future Vol, veh/h	28	33	441	15	17	853
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	30	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	3	3	7	7	8	4
Mvmt Flow	28	33	441	15	17	853

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1336	449	0	0	456	0
Stage 1	449	-	-	-	-	-
Stage 2	887	-	-	-	-	-
Critical Hdwy	6.43	6.23	-	-	4.18	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.327	-	-	2.272	-
Pot Cap-1 Maneuver	168	608	-	-	1074	-
Stage 1	641	-	-	-	-	-
Stage 2	401	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	165	608	-	-	1074	-
Mov Cap-2 Maneuver	165	-	-	-	-	-
Stage 1	641	-	-	-	-	-
Stage 2	395	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	22	0	0.2
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	272	1074	-
HCM Lane V/C Ratio	-	-	0.224	0.016	-
HCM Control Delay (s)	-	-	22	8.4	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	0.8	0	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	0	0	24	0	0	20
Future Volume (vph)	0	0	24	0	0	20
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	1714	0	1557	0	0	1650
Flt Permitted						
Satd. Flow (perm)	1714	0	1557	0	0	1650
Link Speed (k/h)	70		50			50
Link Distance (m)	257.7		200.8			253.3
Travel Time (s)	13.3		14.5			18.2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	0%	6%	6%	0%	0%
Adj. Flow (vph)	0	0	24	0	0	20
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	24	0	0	20
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		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	1.10	1.10	1.20	1.20	1.20	1.20
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized
Intersection Capacity Utilization 6.7% ICU Level of Service A
Analysis Period (min) 15

Intersection	
Int Delay, s/veh	0

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	0	24	0	0	20
Future Vol, veh/h	0	0	24	0	0	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	3	0	6	6	0	0
Mvmt Flow	0	0	24	0	0	20

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	44	24	0	0	24	0
Stage 1	24	-	-	-	-	-
Stage 2	20	-	-	-	-	-
Critical Hdwy	6.43	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	964	1058	-	-	1604	-
Stage 1	996	-	-	-	-	-
Stage 2	1000	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	964	1058	-	-	1604	-
Mov Cap-2 Maneuver	964	-	-	-	-	-
Stage 1	996	-	-	-	-	-
Stage 2	1000	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	-	1604	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	-	-	0	0	-
HCM Lane LOS	-	-	A	A	-
HCM 95th %tile Q(veh)	-	-	-	0	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	18	14	2	18	31	4
Future Volume (vph)	18	14	2	18	31	4
Ideal Flow (vphpl)	1650	1650	1650	1650	1765	1765
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.941				0.985	
Flt Protected				0.995	0.958	
Satd. Flow (prot)	1494	0	0	1613	1666	0
Flt Permitted				0.995	0.958	
Satd. Flow (perm)	1494	0	0	1613	1666	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	93.9			79.9	113.6	
Travel Time (s)	6.8			5.8	8.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	7%	0%	0%	2%	0%	0%
Adj. Flow (vph)	18	14	2	18	31	4
Shared Lane Traffic (%)						
Lane Group Flow (vph)	32	0	0	20	35	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.6	
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	1.20	1.20	1.20	1.20	1.10	1.10
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

Intersection	
Int Delay, s/veh	3.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	18	14	2	18	31	4
Future Vol, veh/h	18	14	2	18	31	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	7	0	0	2	0	0
Mvmt Flow	18	14	2	18	31	4

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	32	0	47	25
Stage 1	-	-	-	-	25	-
Stage 2	-	-	-	-	22	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1593	-	968	1057
Stage 1	-	-	-	-	1003	-
Stage 2	-	-	-	-	1006	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1593	-	967	1057
Mov Cap-2 Maneuver	-	-	-	-	967	-
Stage 1	-	-	-	-	1003	-
Stage 2	-	-	-	-	1005	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.7	8.8
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	977	-	-	1593	-
HCM Lane V/C Ratio	0.036	-	-	0.001	-
HCM Control Delay (s)	8.8	-	-	7.3	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	15	34	1280	29	32	780
Future Volume (vph)	15	34	1280	29	32	780
Ideal Flow (vphpl)	1765	1765	1650	1650	1775	1900
Storage Length (m)	0.0	0.0		0.0	30.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	7.5				70.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.906		0.997			
Flt Protected	0.985				0.950	
Satd. Flow (prot)	1564	0	1613	0	1686	1863
Flt Permitted	0.985				0.950	
Satd. Flow (perm)	1564	0	1613	0	1686	1863
Link Speed (k/h)	50		60			60
Link Distance (m)	309.9		250.6			281.7
Travel Time (s)	22.3		15.0			16.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	1%	2%	0%	0%	2%
Adj. Flow (vph)	15	34	1280	29	32	780
Shared Lane Traffic (%)						
Lane Group Flow (vph)	49	0	1309	0	32	780
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.6			3.6
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	1.10	1.10	1.20	1.20	1.09	1.00
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized
Intersection Capacity Utilization 89.6% ICU Level of Service E
Analysis Period (min) 15

Intersection	
Int Delay, s/veh	1.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	15	34	1280	29	32	780
Future Vol, veh/h	15	34	1280	29	32	780
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	30	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	1	2	0	0	2
Mvmt Flow	15	34	1280	29	32	780

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2139	1295	0	0	1309	0
Stage 1	1295	-	-	-	-	-
Stage 2	844	-	-	-	-	-
Critical Hdwy	6.4	6.21	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.309	-	-	2.2	-
Pot Cap-1 Maneuver	55	199	-	-	535	-
Stage 1	259	-	-	-	-	-
Stage 2	425	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	52	199	-	-	535	-
Mov Cap-2 Maneuver	52	-	-	-	-	-
Stage 1	259	-	-	-	-	-
Stage 2	400	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	64.4	0	0.5
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	107	535	-
HCM Lane V/C Ratio	-	-	0.458	0.06	-
HCM Control Delay (s)	-	-	64.4	12.2	-
HCM Lane LOS	-	-	F	B	-
HCM 95th %tile Q(veh)	-	-	2	0.2	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	0	0	26	0	0	18
Future Volume (vph)	0	0	26	0	0	18
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	1748	0	1650	0	0	1364
Flt Permitted						
Satd. Flow (perm)	1748	0	1650	0	0	1364
Link Speed (k/h)	70		50			50
Link Distance (m)	257.7		200.8			253.3
Travel Time (s)	13.3		14.5			18.2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	1%	0%	0%	0%	0%	21%
Adj. Flow (vph)	0	0	26	0	0	18
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	26	0	0	18
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		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	1.10	1.10	1.20	1.20	1.20	1.20
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary
Area Type: Other
Control Type: Unsignalized
Intersection Capacity Utilization 6.7% ICU Level of Service A
Analysis Period (min) 15

Intersection	
Int Delay, s/veh	0

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	0	26	0	0	18
Future Vol, veh/h	0	0	26	0	0	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	1	0	0	0	0	21
Mvmt Flow	0	0	26	0	0	18

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	44	26	0	0	26	0
Stage 1	26	-	-	-	-	-
Stage 2	18	-	-	-	-	-
Critical Hdwy	6.41	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.41	-	-	-	-	-
Critical Hdwy Stg 2	5.41	-	-	-	-	-
Follow-up Hdwy	3.509	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	969	1056	-	-	1601	-
Stage 1	999	-	-	-	-	-
Stage 2	1007	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	969	1056	-	-	1601	-
Mov Cap-2 Maneuver	969	-	-	-	-	-
Stage 1	999	-	-	-	-	-
Stage 2	1007	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	-	1601	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	-	-	0	0	-
HCM Lane LOS	-	-	A	A	-
HCM 95th %tile Q(veh)	-	-	-	0	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	28	33	2	16	26	1
Future Volume (vph)	28	33	2	16	26	1
Ideal Flow (vphpl)	1650	1650	1650	1650	1765	1765
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.927				0.995	
Flt Protected				0.994	0.954	
Satd. Flow (prot)	1530	0	0	1611	1675	0
Flt Permitted				0.994	0.954	
Satd. Flow (perm)	1530	0	0	1611	1675	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	93.9			79.9	113.6	
Travel Time (s)	6.8			5.8	8.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	2%	0%	0%
Adj. Flow (vph)	28	33	2	16	26	1
Shared Lane Traffic (%)						
Lane Group Flow (vph)	61	0	0	18	27	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.6	
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	1.20	1.20	1.20	1.20	1.10	1.10
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 14.0%	ICU Level of Service A
Analysis Period (min) 15	

Intersection	
Int Delay, s/veh	2.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	28	33	2	16	26	1
Future Vol, veh/h	28	33	2	16	26	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	0	2	0	0
Mvmt Flow	28	33	2	16	26	1

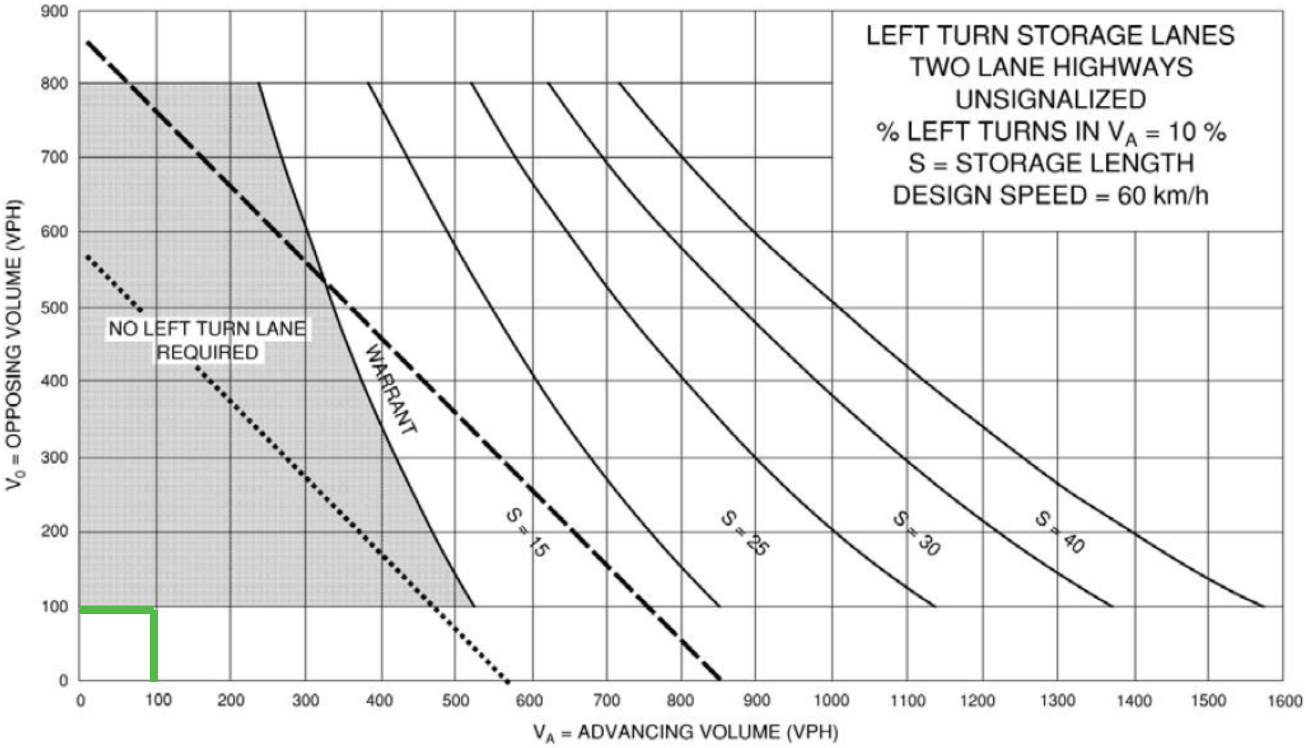
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	61	0	65	45
Stage 1	-	-	-	-	45	-
Stage 2	-	-	-	-	20	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1555	-	946	1031
Stage 1	-	-	-	-	983	-
Stage 2	-	-	-	-	1008	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1555	-	945	1031
Mov Cap-2 Maneuver	-	-	-	-	945	-
Stage 1	-	-	-	-	983	-
Stage 2	-	-	-	-	1007	-

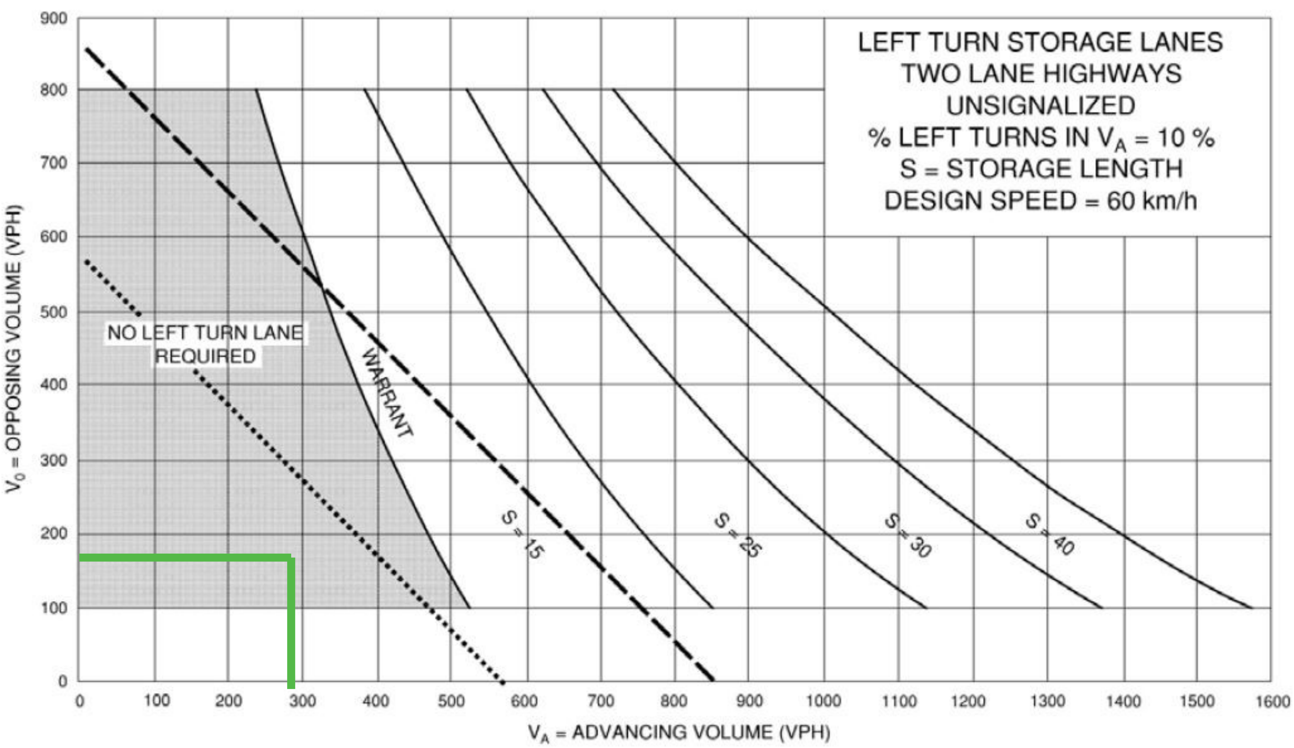
Approach	EB	WB	NB
HCM Control Delay, s	0	0.8	8.9
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	948	-	-	1555	-
HCM Lane V/C Ratio	0.028	-	-	0.001	-
HCM Control Delay (s)	8.9	-	-	7.3	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Appendix I

Left-Turn Lane Warrants





paradigm TRANSPORTATION SOLUTIONS LIMITED

Westbound Left-Turn Lane Warrant
Riverbank Drive at Site Driveway
2029 Future Total

Appendix J

Traffic Control Signal Warrants

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

Horizon Year: 2029 Future Total (without Allendale Road closure)
Region/City/Township: Cambridge, Region of Waterloo

Major Street: King Street East North/South?: Y
Minor Street: Riverbank Drive

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

PM Forecast Only?: N

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

	Major Street						Minor Street						
	King Street East						Riverbank Drive						
	Northbound			Southbound			Eastbound			Westbound			Peds
Time Period	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	Crossing
AM Peak Hour	0	392	19	80	790	0	0	0	0	21	0	83	
PM Peak Hour	0	1058	21	161	651	0	0	0	0	22	0	256	
verage Hourly Volun	0	363	10	60	360	0	0	0	0	11	0	85	0

Warrant	AHV
1A - All	889
1B - Minor	96
2A - Major	793
2B - Cross	11

Warrant 1 - Minimum Vehicular Volume

1A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
			X			
	All Approaches	480	720	600	900	889
					% Fulfilled	123.4%

1B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
			X			
	Minor Street Approaches	180	255	180	255	96
					% Fulfilled	37.5%

Warrant 2 - Delay To Cross Traffic

2A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
			X			
	Major Street Approaches	480	720	600	900	793
					% Fulfilled	110.1%

2B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
			X			
	Traffic Crossing Major Street	50	75	120	170	11
					% Fulfilled	14.3%

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

Horizon Year: 2029 Future Total (with Allendale Road closure)
Region/City/Township: Cambridge, Region of Waterloo

Major Street: King Street East
Minor Street: Riverbank Drive
North/South?: Y

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

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

PM Forecast Only? N

	Major Street						Minor Street						
	King Street East						Riverbank Drive						
	Northbound			Southbound			Eastbound			Westbound			Peds
Time Period	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	Crossing
AM Peak Hour	0	441	15	17	853	0	0	0	0	28	0	33	
PM Peak Hour	0	1280	29	32	780	0	0	0	0	15	0	34	
verage Hourly Volun	0	430	11	12	408	0	0	0	0	11	0	17	0

Warrant	AHV
1A - All	889
1B - Minor	28
2A - Major	862
2B - Cross	11

Warrant 1 - Minimum Vehicular Volume

1A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
			X			
	All Approaches	480	720	600	900	889
					% Fulfilled	123.5%

1B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
			X			
	Minor Street Approaches	180	255	180	255	28
					% Fulfilled	10.8%

Warrant 2 - Delay To Cross Traffic

2A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
			X			
	Major Street Approaches	480	720	600	900	862
					% Fulfilled	119.7%

2B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
			X			
	Traffic Crossing Major Street	50	75	120	170	11
					% Fulfilled	14.3%