



Charleston Developments Halton Hills, ON Transportation Impact Study

Paradigm Transportation Solutions Limited

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Executive Summary

Content

Paradigm Transportation Solutions Limited (Paradigm) was retained to conduct this Transportation Impact Study (TIS) for a proposed residential development, north of Bishop Court and east of Confederation Street/Ninth Line in the Town of Halton Hills.

The purpose of this study is to determine the impacts of the development traffic on the surrounding road network and to identify any improvements necessary to accommodate this traffic.

Conclusions

This study evaluated the impacts of background traffic growth and forecasts the impacts with the development of 28 single family residential units. Vehicular access is proposed through an extension of Bishop Court that will provide a connection to the development's internal roadway network. In addition, a new street connection (Street A) to Ninth Line located approximately 270 metres north of Bishop Court (centreline to centreline) will be provided.

Paradigm conducted a sight distance evaluation for the proposed roadway connection (Street A) in accordance with guidelines provided by TAC. The location of Street A provides sufficient decision sight distance and intersection sight distance to/from the north and south of the intersection. Based on this, the location of Street A is supportable from a sight distance perspective.

With Street A proposed to be located north of Bishop Court, adequate intersection spacing should be maintained. TAC recommends a minimum intersection separation of 60 metres between four-legged intersections and 40 metres is acceptable between three-legged intersections along a local roadway. As Street A is spaced 270 metres from Mountain Street, the location will not result in operational difficulties and will function acceptably as successive T-intersections.

Full-build out of the development is forecasted to generate approximately 25 new vehicle trips during the weekday AM peak hour and 30 new vehicle trips during the weekday PM peak hour.

The traffic analysis conducted as part of this assessment indicates that development volumes will result in minor increases to the surrounding study area intersection volumes under peak conditions which should not be perceptible. Capacity analyses were conducted at key intersections, indicating that the transportation infrastructure currently provided remains adequate for accommodating traffic associated with the proposed development program.



A left turn lane warrant analysis was conducted at the unsignalized intersections and determined that a southbound left-turn lane along Ninth Line at either Bishop Court or Street A is not warranted.

Recommendations

Based on the findings of this study, it is recommended that:

- ▶ To maintain a clear line of sight to the south, foliage and vegetation within the south-east quadrant of the proposed intersection of Ninth Line and Street A be trimmed back to not exceed a height greater than 50 cm.



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1 Introduction

1.1 Overview

Paradigm Transportation Solutions Limited (Paradigm) was retained to conduct this Transportation Impact Study (TIS) for a residential development on Confederation Street/Ninth Line north of Bishop Court in the Town of Halton Hills.

Figure 1.1 illustrates the location of the subject site.

1.2 Purpose and Scope

The purpose of this study is to determine the impacts of the development traffic on the surrounding road network and identify any improvements necessary to accommodate the increase in traffic generated by this development. The scope of this study, as confirmed with the Town, is to:

- ▶ Forecast traffic from the proposed development using trip generation rates developed and assignment to the surrounding road network;
- ▶ Assess the impact of existing and future traffic conditions with and without the proposed development for five years from the date of the study (2025); and
- ▶ Recommend any improvements required to alleviate any operational or safety concerns (if required).

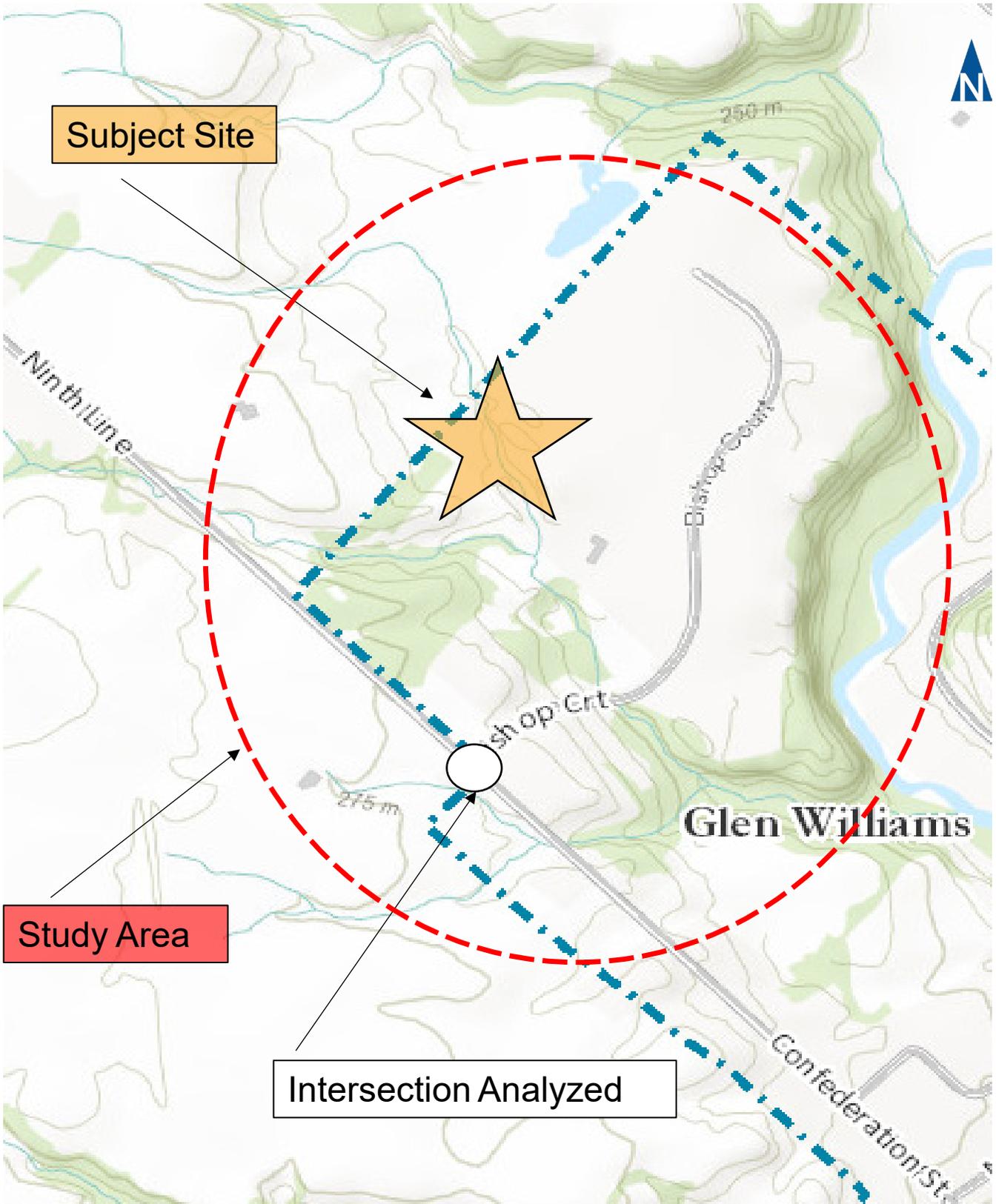
1.3 Study Area

Based on a review of the anticipated trip generation and trip distribution for the proposed development, a study area was established through consultation with the Town of Halton Hills in (November 2020). The project study area includes the following intersections:

- ▶ Confederation Street at Bishop Court (unsignalized);
- ▶ One (1) new street connection to Ninth Line (unsignalized).

Appendix A contains the terms of reference established for this study which has been carried out in general accordance with the Halton Region Traffic Impact Study Guideline (2015) document.





2 Existing Conditions

The existing conditions evaluation consisted of an inventory of the traffic control; roadway and intersection geometry in the study area and the collection of peak period traffic volumes.

2.1 Roadway Characteristics

The main roadways near the subject site considered in assessing the traffic impacts of the development include:

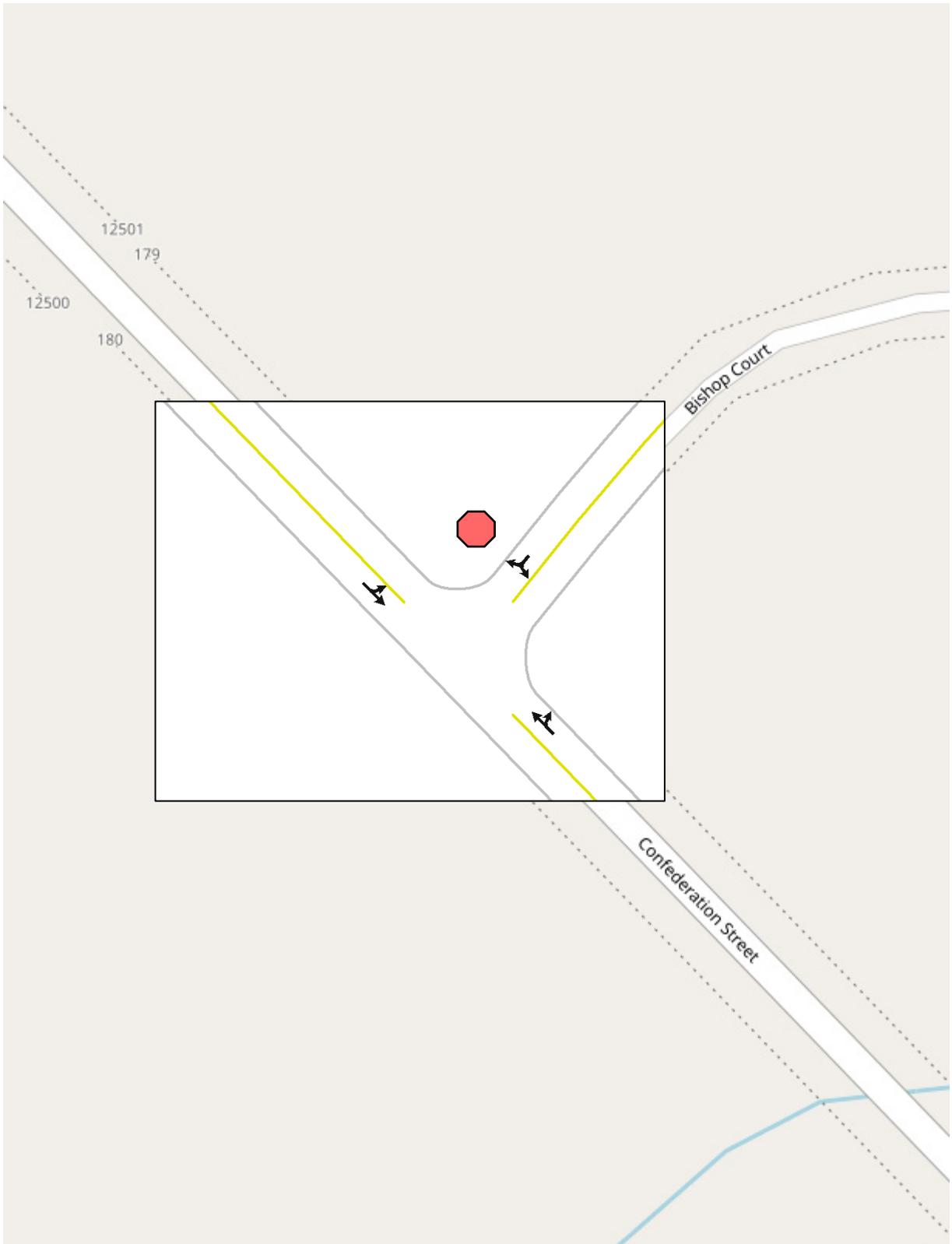
- ▶ **Confederation Street/Ninth Line** is a north-south local road under the jurisdiction of Town of Halton Hills with a two-lane rural cross-section. The posted speed limit in the study area is 50 kilometres per hour. Pedestrian and cycling facilities are not provided along this roadway within the study area.
- ▶ **Bishop Court** is an east-west local road under the jurisdiction of the Town of Halton Hills with a basic two-lane urban cross-section. This roadway has an assumed speed limit of 50 kilometers per hour within the study area. No cycling facilities or pedestrian facilities are provided within the study area.

Figure 2.1 illustrates the existing lane configurations and traffic control at the study area intersections.

2.2 Transit Network

Transit service is presently not provided within the Town of Halton Hills.





Existing Lane Configuration and Traffic Control

2.3 Traffic Volumes

To assess intersection operations, turning movement counts are used to quantify the movement of vehicles. Existing traffic data at an intersection or on a road section forms the foundation for analysis. The counts are usually taken during peak periods to complete level of service analysis.

Current turning movement volumes for the peak hours were conducted as the municipal agencies did not have recent traffic data for the study area intersections. **Table 2.1** outlines the counts used for the traffic analysis. **Appendix B** contains the traffic data.

TABLE 2.1: TRAFFIC DATA

Intersection	Data	Conducted By
Confederation Street/Ninth Line and Bishop Court	October, 2020	Paradigm

2.3.1 COVID-19

As COVID-19 restrictions were relaxed and business were granted the ability to open for business a review of mobility trends for the City of Toronto was reviewed as no data for the Town of Halton Hills or adjacent municipalities within Halton Region is available. The data is available through Apple¹ and indicates vehicle travel patterns have closely normalized to the baseline volumes prior to the pandemic outbreak as outlined in **Table 2.2**.

A further detailed review of the mobility trends indicates passenger vehicle traffic is 1% higher than the average volume observed prior to March 1, 2020. This has reason to assume that the COVID-19 pandemic has not altered the traffic volumes observed in October 2020.

It is recognized the public transportation is expected to be underrepresented within these volumes, however as there is no local public transit within the Town of Halton Hills, this would not impact the traffic volumes for the study area.

Figure 2.2 illustrates the base year turning movement traffic volumes.

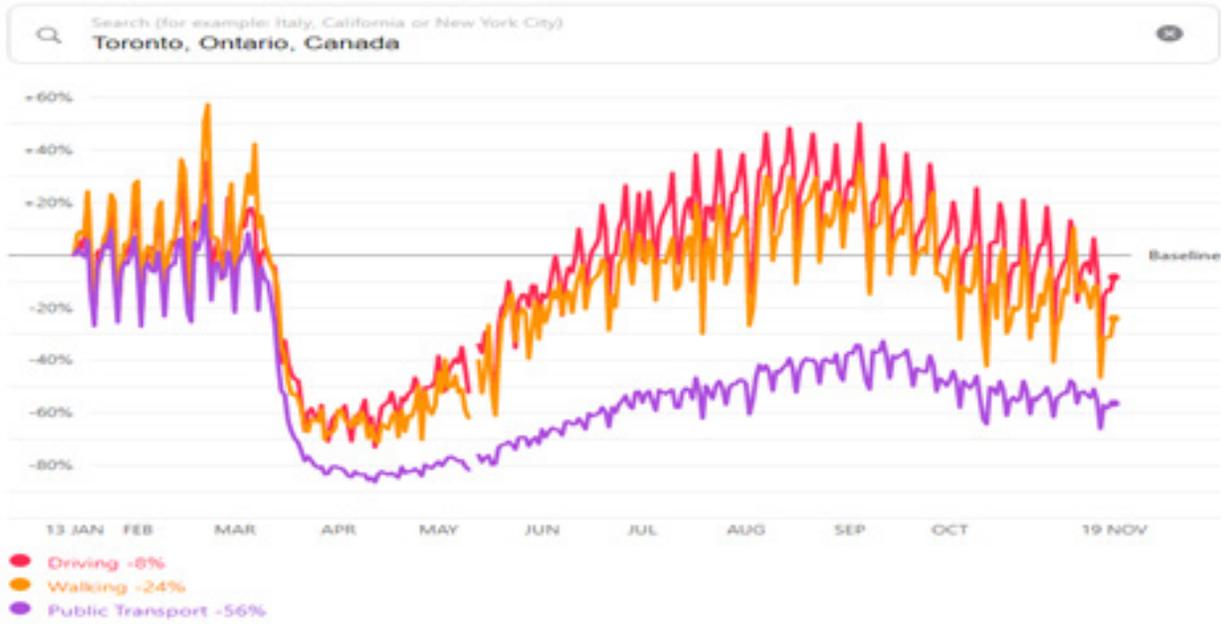
¹ Apple Inc. *COVID-19 Mobility Trends Reports*. Accessed 19 November 2020 from <https://covid19.apple.com/mobility>



TABLE 2.2: MOBILITY TRENDS (TORONTO)

Mobility Trends

Change in routing requests since 13 January 2020



2.4 Existing Operational Assessment

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

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

The operations of intersections in the study area were evaluated with the existing turning movement volumes using Synchro 10 with HCM 2000. The intersection analysis considered two separate measures of performance:

- ▶ The volume to capacity ratio for each intersection; and
- ▶ The LOS for each turning movement. LOS is based on the average control delay per vehicle.

The existing intersection operations are summarized in **Table 2.3** indicating the existing levels of service (LOS), volume to capacity ratios (V/C) and 95th percentile queues experienced within the study area, for the AM and PM peak hours. Detailed Synchro reports are provided in **Appendix C**. The following is noted:

- ▶ Individual movements at the three-legged stop-controlled intersection of Confederation Street/Ninth Line at Bishop Court presently operates at LOS A with a v/c ratio no greater than 0.03.



TABLE 2.3: EXISTING CONDITIONS – OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																Overall	
				Eastbound				Westbound				Northbound				Southbound					
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach		
AM Peak	102 Bishop Court and Confederation Street/Ninth Line	TCS	LOS	-	-	-		<	A	>	A	<	A	>	A	<	A	>	A	A	A
			Delay	-	-	-		<	9	>	0	<	0	>	0	<	0	>	0	0	0
			V/C	-	-	-		<	0.01	>		<	0.02	>		<	0.00	>		>	>
			Q	-	-	-		<	0	>		<	0	>		<	0	>		>	>
			Ex Avail.	-	-	-		<	-	>		<	-	>		<	-	>		>	>
PM Peak	102 Bishop Court and Confederation Street/Ninth Line	TCS	LOS	-	-	-		<	A	>	A	<	A	>	A	<	A	>	A	A	A
			Delay	-	-	-		<	9	>	0	<	0	>	0	<	0	>	0	0	0
			V/C	-	-	-		<	0.01	>		<	0.03	>		<	0.00	>		>	>
			Q	-	-	-		<	0	>		<	0	>		<	0	>		>	>
			Ex Avail.	-	-	-		<	-	>		<	-	>		<	-	>		>	>



3 Development Concept

3.1 Development Description

The 19.47-hectare site is to be comprised of a residential development with a total of 28 single detached units. Vehicular access is proposed through an extension of Bishop Court that will provide a connection to the development's internal roadway network. In addition, a new street connection (Street A) to Ninth Line located approximately 270 metres north of Bishop Court (centreline to centreline) will be provided.

Figure 3.1 illustrates the site concept plan.



3.2 Street A Review

Careful consideration to maintain the mobility in this area and accommodate development traffic is essential and is a vital element to the success of the project. Access management and corridor planning is largely a balancing act where safety and congestion issues must be addressed in the context of land use visions, economic development goals, environmental resource preservation, and funding constraints.

The proposed street connection (Street A) to Ninth Line has been assessed to determine whether there are design issues and/or safety-related concerns that may be affected by the location, and whether an alternative location should be considered from a design perspective. The key design issues to consider with respect to the driveway location are discussed in the sections below.

3.2.1 Sight Distance

The section of Confederation Straight is located on a flat elevation. For two-lane roadways, a design speed of 20 kilometres per hour over the posted and/or assumed speed is typically used.

Paradigm conducted a sight distance evaluation for the proposed roadway connections to Confederation Street in accordance with guidelines provided by the Transportation Association of Canada (TAC). Sight distance considerations for new municipal intersections are divided into; decision sight distance (DSD) and intersection sight distance (ISD).

- ▶ Decision Sight Distance (DSD) is the distance required for a vehicle approaching an intersection from either direction to perceive, react and select an appropriate speed and path, and initiate and complete the movement safely and efficiently to avoid the hazard. In this respect, DSD can be considered as the preferred visibility criterion for the safe operation of an unsignalized intersection.
- ▶ Intersection Sight Distance (ISD) is based on the time required for perception, reaction and completion of the desired critical exiting maneuver (typically, a left turn) once the driver on a minor street approach (or a driveway) decides to execute the maneuver. Calculations for ISD include the time to: (1) turn left and clear the near half of the intersection without conflicting with the vehicles approaching from the left; and (2) upon turning left, to accelerate to the operating speed on the roadway without causing approaching vehicles on the main road to unduly reduce their speed. In this context, ISD can be considered as a desirable visibility criterion for the safe operation of an unsignalized intersection.

Photographs of the sightline conditions are illustrated in **Appendix D**. The sightline calculations are provided in **Table 3.1**.



TABLE 3.1: SIGHT DISTANCE ASSESSMENT

Location	Direction	Sight Distance (m) 70km/h Design Speed			
		Decision Sight Distance		Intersection Sight Distance	
		TAC	Measured	TAC	Measured
Ninth Line at Street A	To/From North	200	235	150	205
	To/From South	200	212	130	180

	Meets or exceeds TAC Guideline
	Does not meet TAC Guideline

The sight distance at Ninth Line and Street A exceeds the intersection sight distance and the decision sight distance for both directions. Although to maintain the desired sight distance foliage and vegetation was observed along the south-east quadrant of the proposed intersection of Ninth Line and Street A. It is recommended that foliage and vegetation be trimmed back to not exceed a height greater than 50 cm to ensure a clear line of sight to the

The proposed intersection at Ninth Line and Street A presents no sight line concerns.

3.2.2 Corner Clearance

With Street A proposed to be located north of Bishop Court adequate intersection spacing should be maintained. The spacing of intersections along a road has a large impact on the operation, level of service, and capacity of the roadway. The Transportation Association of Canada (TAC) Geometric Design Guide² recommends a minimum intersection separation of 60 metres between four-legged intersections and 40 metres is acceptable between three-legged intersections along a local roadway.

As Street A is spaced 270 metres from Bishop Court, the location will not result in in operational difficulties and will function acceptably as a stop-controlled 3-way intersection.

² Geometric Design Guide for Canadian Roads, Transportation Association of Canada, 2017



3.3 Development Trip Generation

Trip generation information is used to forecast the anticipated level of traffic activity because of the development. Trip generation for each land use type were summed to establish total site trip generation for the respective peak hours.

The rate at which any development generates traffic is dependent upon several factors such as size, location, and concentration of surrounding developments. To estimate the volume of traffic generated by components of the development, traffic projections were based on trip generation data published in the Institute for Transportation Engineer’s (ITE) Trip Generation Manual, 10th Edition³. The following land uses (LUC) have been used:

- ▶ **LUC 210 – Single Family Detached** – Single-family detached housing includes all single-family detached homes on individual lots. A typical site surveyed is a suburban subdivision.

The estimated total trip generation for the proposed development is displayed in **Table 3.1**. A total of 25 to 30 new vehicle trips are forecast to be generated during the AM and PM peak hours, respectively.

TABLE 3.2: TRIP GENERATION

ITE Land Use	Units	AM Peak Hour				PM Peak Hour			
		Rate	In	Out	Total	Rate	In	Out	Total
210 - Single-Family Detached Housing	28	Eqn.	6	19	25	Eqn.	19	11	30

$FC1 - T = 0.71(X) + 4.80$ $FC2 - Ln(T) = 0.96 Ln(X) + 0.20$

³ Trip Generation Tenth Edition, Institute of Transportation Engineers, Washington D.C., 2017



3.4 Development Trip Distribution and Assignment

The directional distribution of traffic approaching and departing the development is a function of several variables: population densities, existing travel patterns, and the efficiency of the roadways leading to the site.

The trip distribution for the site was developed based on the 2016 Transportation Tomorrow Survey (TTS)⁴ data for Georgetown. Based on the distribution of population within the study area, arrival and departure patterns for site-related traffic were estimated and if appropriate, were adjusted based on known local factors.

The trip distribution calculations are included in **Appendix E. Table 3.3** summarizes the estimated trip distribution for the development.

TABLE 3.3: TRIP DISTRIBUTION

Direction (To/From)	Travel Route	Percent to Route
North	Ninth Line	2%
South	Ninth Line	98%
Total		100%

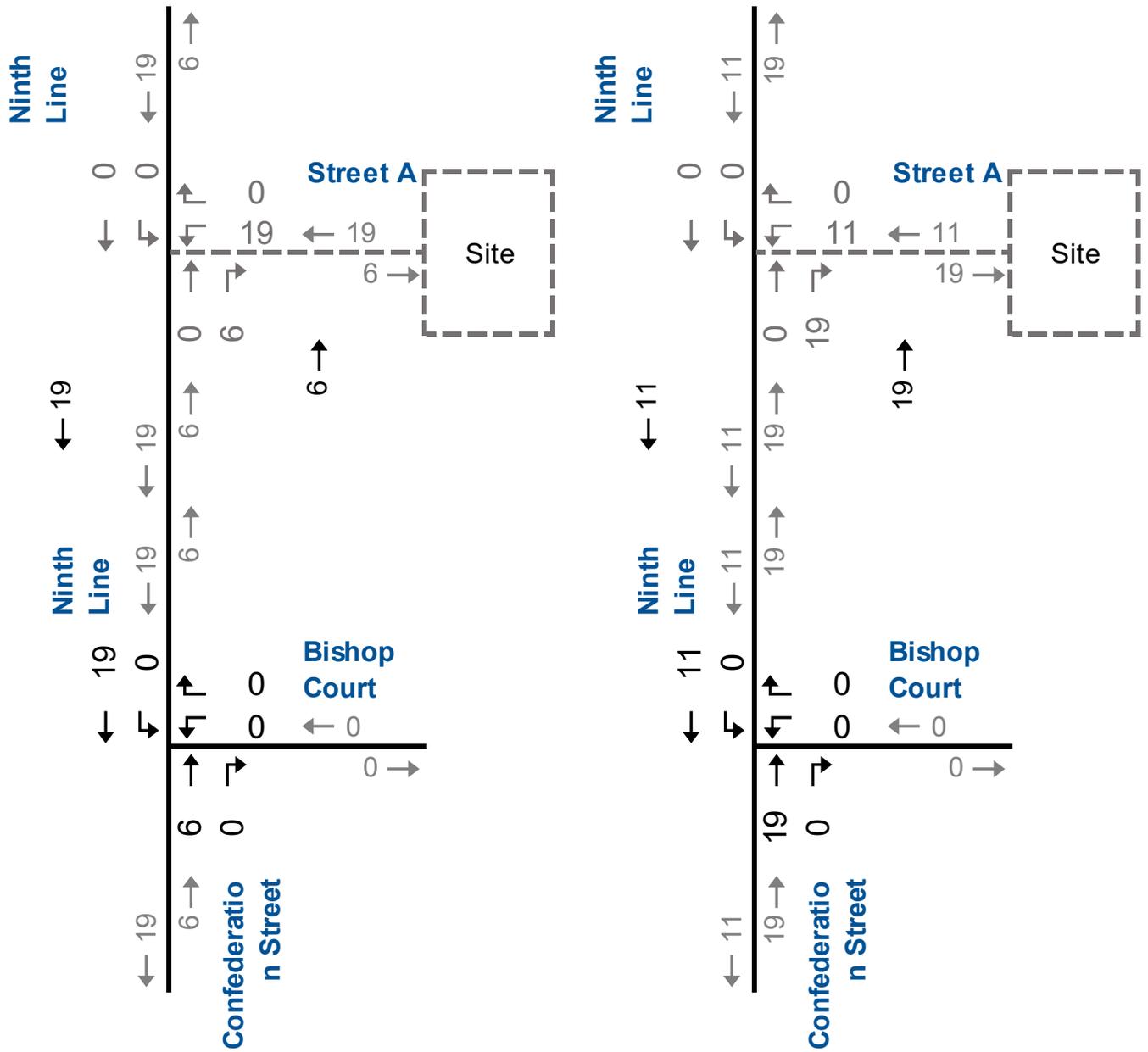
Using the trip generation data and the trip distribution the site traffic was assigned to the adjacent road network. **Figure 3.2** illustrates the projected site traffic.

⁴ Transportation Tomorrow Survey (TTS), 2016, Summary by Traffic Zones, Data Management Group, University of Toronto.



AM Peak Hour

PM Peak Hour



Site Generated Traffic Forecasts

Figure 3.2

4 Future Traffic Conditions

To be consistent with the terms of reference established with the Town of Halton Hills, a horizon year of 2025 (five years from the date of the study) has been used for traffic forecasting and analyses purposes.

4.1 Forecast Traffic Volumes

Traffic growth on area roadways is a function of the expected land development, economic activity, and changes in demographics. A frequently used procedure is to estimate an annual percentage increase and apply that increase to the study area traffic volumes. An alternative procedure is to identify estimated traffic generated by specific planned major developments that would be expected to affect the project study area roadways. For the purpose of this assessment, both methods have been used.

4.1.1 General Growth

According to the Statistics Canada 2016 Community Profile⁵, the Community of Georgetown grew by 4.82% from year 2011 to 2016, or an average annual growth rate of 0.95%. For the purposes of this study, a conservative traffic growth rate of 2% per annum was applied to existing counts to project general background growth for the study area roadways.

Paradigm is also aware of residential subdivision application proposed south of the study area off of Confederation Street (Glen Williams Estates⁶). Traffic associated with this development has been considered, however based on a review of the traffic projections, traffic from the Glen Williams Estates development is not projected to travel along this section of Confederation Street, north of Mountain Street.

⁵ <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=POPC&Code1=0314&Geo2=PR&Code2=35&SearchText=Georgetown&SearchType=Begins&SearchPR=01&B1=All&TABID=1&type=0>

⁶ 190618: Glen Williams Estates, Halton Hills, Transportation Impact Study, August 2020.



4.1.2 Background Traffic Growth

The non-site traffic increase (background traffic) represents generalized traffic growth in the Georgetown area. The background traffic projections for the 2025 horizon are illustrated in **Figure 4.1**.

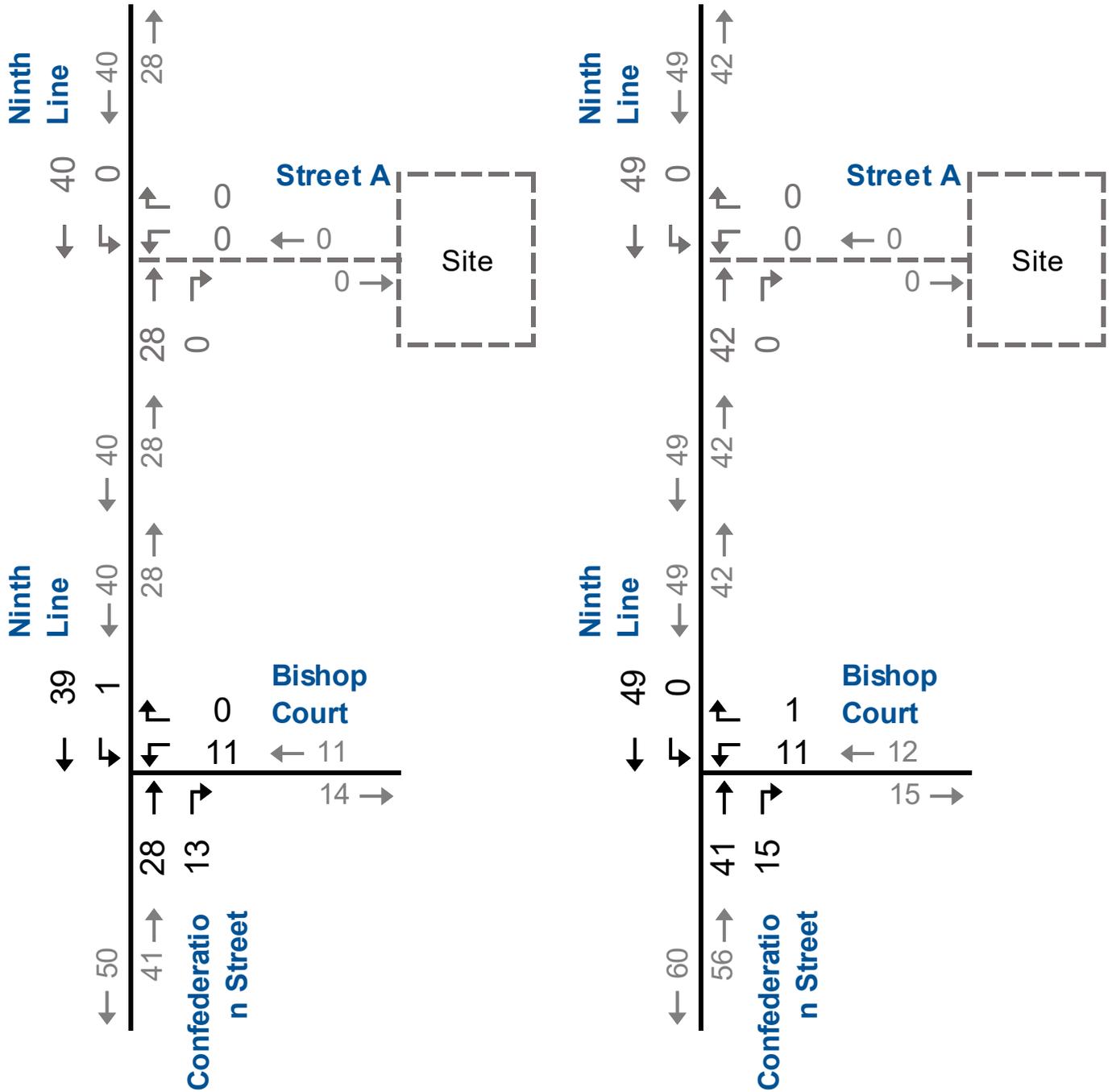
4.1.3 Total Traffic Growth

The projected site-generated traffic volumes were added to the background projections to develop the total traffic projections. The total traffic projections for the 2025 horizon are illustrated in **Figure 4.2**.



AM Peak Hour

PM Peak Hour

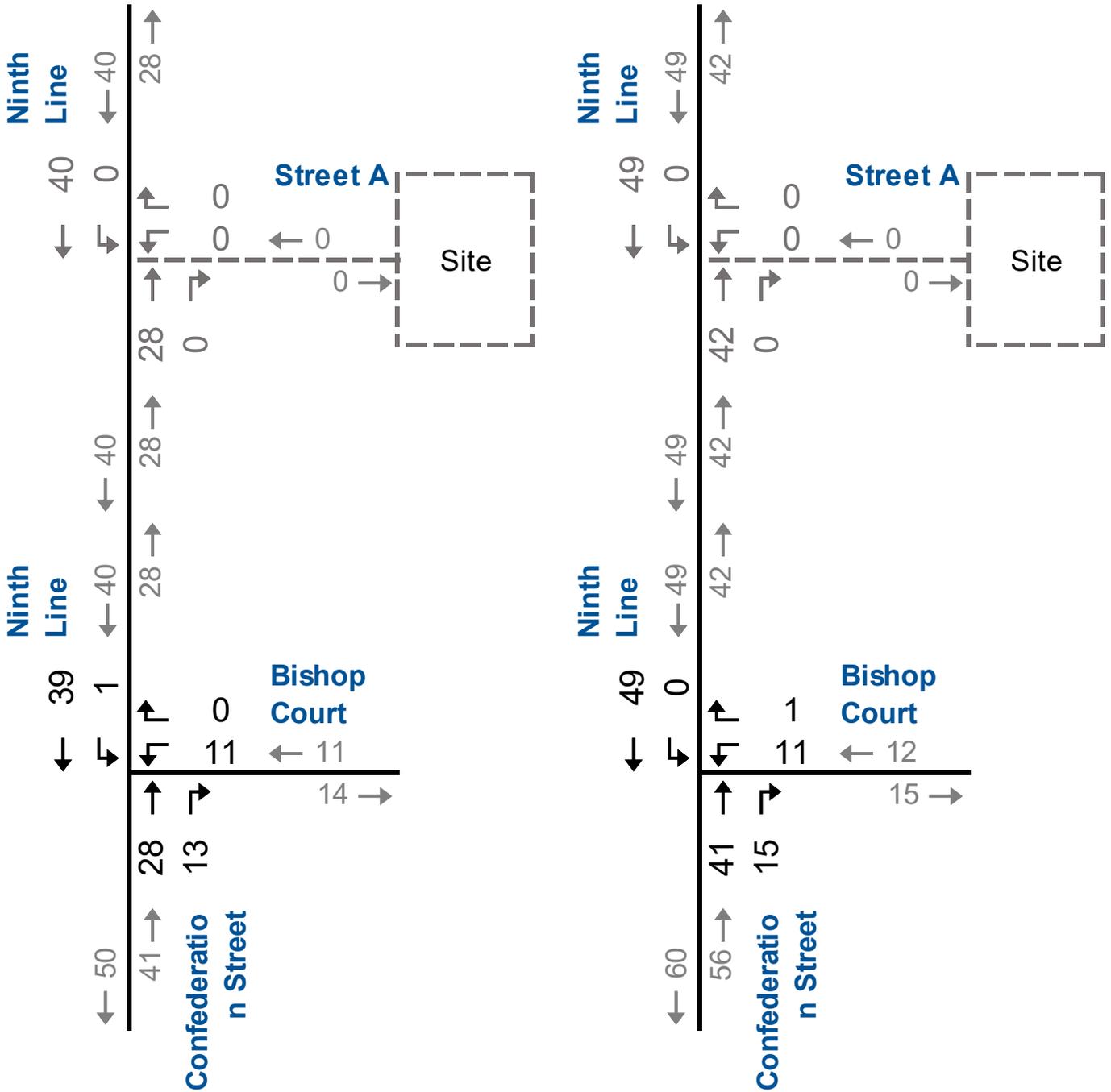


2025 Background Future Traffic Volumes

Figure 4.1

AM Peak Hour

PM Peak Hour



2025 Total Future Traffic Volumes

Figure 4.2

4.2 2025 Operational Assessment

Based on the forecasted 2025 traffic volumes, operational analyses have been conducted using Synchro 10 with HCM 2000 to determine the peak hour conditions for the intersections within the study area.

4.1.1 Background Traffic Operations

The 2027 background traffic operations are summarized in **Table 4.1. Appendix F** contain the Synchro reports. Based on the analysis, the following is noted:

- ▶ Individual movements at the three-legged stop-controlled intersection of Confederation Street/Ninth Line at Bishop Court are projected to operate at LOS A with a v/c ratio no greater than 0.04. The future operations are considered acceptable.

4.1.2 Total Traffic Operations

The 2025 total traffic operations are summarized in **Table 4.2. Appendix G** contain the Synchro reports. Based on the analysis, the following is noted:

- ▶ Individual movements at the three-legged stop-controlled intersection of Confederation Street/Ninth Line at Bishop Court are projected to operate at LOS A with a v/c ratio no greater than 0.05. The future operations are considered acceptable.
- ▶ As described previously, a single new roadway is proposed to be constructed to provide access to the development through Confederation Street. Under future conditions with the full-build out of the development, Street A is expected to operate at LOS A with a v/c ratio no greater than 0.04. The future operations are considered acceptable.



TABLE 4.1: 2025 BACKGROUND – OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																Overall				
				Eastbound				Westbound				Northbound				Southbound								
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach					
AM Peak	102 Bishop Court and Confederation Street/Ninth Line	TCS	LOS Delay	-	-	-		<	A	>	A	<	9	>	A	<	0	>	A	<	0	>	A	A
			V/C	-	-	-		<	0.01	>	0	<	0.03	>	0	<	0.00	>	0	<	0	>	0	1
			Q	-	-	-		<	0	>	0	<	0	>	0	<	0	>	0	<	0	>	0	
			Ex Avail.	-	-	-		<	-	>	-	<	-	>	-	<	-	>	-	<	-	>	-	
PM Peak	102 Bishop Court and Confederation Street/Ninth Line	TCS	LOS Delay	-	-	-		<	A	>	A	<	9	>	A	<	0	>	A	<	0	>	A	A
			V/C	-	-	-		<	0.02	>	0	<	0.04	>	0	<	0.00	>	0	<	0	>	0	1
			Q	-	-	-		<	0	>	0	<	0	>	0	<	0	>	0	<	0	>	0	
			Ex Avail.	-	-	-		<	-	>	-	<	-	>	-	<	-	>	-	<	-	>	-	

TABLE 4.2: 2025 TOTAL – OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																Overall				
				Eastbound				Westbound				Northbound				Southbound								
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach					
AM Peak	101 Ninth Line and Street A	TCS	LOS Delay	-	-	-		<	A	>	A	<	9	>	A	<	0	>	A	<	0	>	A	A
			V/C	-	-	-		<	0.02	>	0	<	0.02	>	0	<	0.00	>	0	<	0	>	0	2
			Q	-	-	-		<	1	>	0	<	0	>	0	<	0	>	0	<	0	>	0	
			Ex Avail.	-	-	-		<	-	>	-	<	-	>	-	<	-	>	-	<	-	>	-	
PM Peak	101 Ninth Line and Street A	TCS	LOS Delay	-	-	-		<	A	>	A	<	9	>	A	<	0	>	A	<	0	>	A	A
			V/C	-	-	-		<	0.01	>	0	<	0.04	>	0	<	0.00	>	0	<	0	>	0	1
			Q	-	-	-		<	0	>	0	<	0	>	0	<	0	>	0	<	0	>	0	
			Ex Avail.	-	-	-		<	-	>	-	<	-	>	-	<	-	>	-	<	-	>	-	
PM Peak	102 Bishop Court and Confederation Street/Ninth Line	TCS	LOS Delay	-	-	-		<	A	>	A	<	9	>	A	<	0	>	A	<	0	>	A	A
			V/C	-	-	-		<	0.02	>	0	<	0.05	>	0	<	0.00	>	0	<	0	>	0	1
			Q	-	-	-		<	0	>	0	<	0	>	0	<	0	>	0	<	0	>	0	
			Ex Avail.	-	-	-		<	-	>	-	<	-	>	-	<	-	>	-	<	-	>	-	



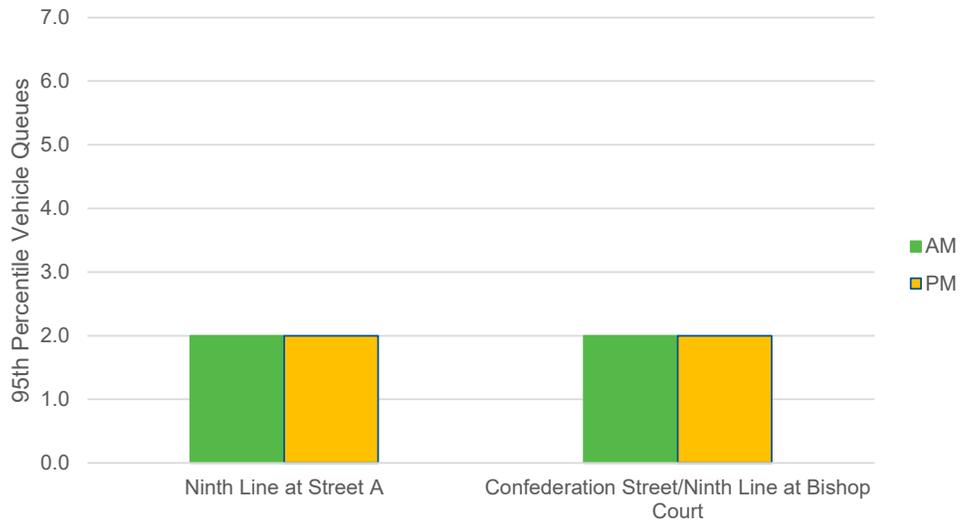
4.3 Queue Assessment

As part of this assessment, Paradigm completed a queue assessment of the unsignalized intersections within study area to determine the queue lengths for the stop-controlled movements. The queue estimates are an additional key metric to determine if improvements are necessary.

SimTraffic was used rather than Synchro in this assessment as microscopic models, such as Sim Traffic, individually track each vehicle in the traffic system through the model and collect comprehensive operational measures of effectiveness for every vehicle during each 0.1 second of the simulation. Unlike Synchro, SimTraffic measures the full impact of queuing and blocking. Synchro is best used to determine level of service and delay at the macro level but is not ideal for assessments simulating real-world conditions.

The analysis consisted of ten (10) iterations of sixty (60) minute simulations to forecast the delay per vehicle in seconds. **Appendix H** provides the SimTraffic results. **Chart 4.3** provides a summary of the queue analysis for the unsignalized intersections within the study area under Total traffic conditions. Based on the queue assessment, mitigation measures are not warranted.

CHART 4.3: QUEUE ASSESSMENT (95TH PERCENTILE)



4.4 Left-Turn Lanes

The unsignalized intersections were assessed to determine if the existing and future traffic volumes warrant installation of a left turn lane along the major roadway.

The warrants for left-turn lanes follow the requirements in the Ministry of Transportation's (MTO) Geometric Design Standards⁷. For two-lane roadways, a design speed of 20 kilometres per hour over the posted and/or assumed speed limit has been utilized. The percentages of left-turning vehicles in the approaching volume were rounded to the nearest 5 percent, as nomographs are only provided for 5 percent increments.

Table 4.4 summarizes the results of the left-turn lane warrant analyses. The following is noted:

- ▶ A southbound left turn lane along Confederation Street/Ninth Line at Bishop Court is not warranted under the 2025 total horizon.
- ▶ A southbound left turn lane along Ninth Line at Street A is not warranted under the 2025 total horizon.

TABLE 4.4: LEFT-TURN LANE ANALYSIS

Criteria	Confederation Street/Ninth Line at Bishop Court		Ninth Line at Street A	
Approach Direction	Southbound		Southbound	
Design Speed	70 km/h		70 km/h	
Horizon	2025 Total		2025 Total	
Peak Hour	AM	PM	AM	PM
Advancing Volumes	59	60	40	49
Opposing Volumes	47	75	34	61
Left Turning Traffic	1	0	0	0
% of Left Turning Traffic	2%	0%	0%	0%
Figure Used*	N/A (Less than 5%)		N/A (Less than 5%)	
Warranted	No	No	No	No
Storage Length Required	N/A	N/A	N/A	N/A

Based on MTO Design Supplement for TAC Geometric Design Guide for Canadian Road - June 2017

⁷ MTO Design Supplement for TAC Geometric Design Guide for Canadian Road, 2017



5 Conclusions

5.1 Conclusions

This study evaluated the impacts of background traffic growth and projects the impacts with the development of 28 single family residential units. Vehicular access is proposed through an extension of Bishop Court that will provide a connection to the development's internal roadway network. In addition, a new street connection (Street A) to Ninth Line located approximately 270 metres north of Bishop Court (centreline to centreline) will be provided.

Paradigm conducted a sight distance evaluation for the proposed roadway connection (Street A) in accordance with guidelines provided by TAC. The location of Street A provides sufficient decision sight distance and intersection sight distance to/from the north and south of the intersection. Based on this, the location of Street A is supportable from a sight distance perspective.

With Street A proposed to be located north of Bishop Court, adequate intersection spacing should be maintained. TAC recommends a minimum intersection separation of 60 metres between four-legged intersections and 40 metres is acceptable between three-legged intersections along a local roadway. As Street A is spaced 270 metres from Mountain Street, the location will not result in operational difficulties and will function acceptably as successive T intersections.

Full-build out of the development is projected to generate approximately 25 new vehicle trips during the weekday AM peak hour and 30 new vehicle trips during the weekday PM peak hour.

The traffic analysis conducted as part of this assessment indicates that development volumes will result in minor increases to the surrounding study area intersection volumes under peak conditions which should not be perceptible. Capacity analyses were conducted at key intersections, indicating that the transportation infrastructure currently provided remains adequate for accommodating traffic associated with the proposed development program.

A left turn lane warrant analysis was conducted at the unsignalized intersections and determined that a southbound left-turn lane along Ninth Line at either Bishop Court or Street A is not warranted.



5.2 Recommendations

Based on the findings of this study, it is recommended that:

- ▶ To maintain a clear line of sight to the south, foliage and vegetation within the south-east quadrant of the proposed intersection of Ninth Line and Street A be trimmed back to not exceed a height greater than 50 cm.



Appendix A

Terms of Reference



From: [Ivan Drewnitski](#)
To: [Adam Makarewicz](#)
Cc: [Creighton Chartier](#); [Maureen Van Ravens](#); [Jeff Markowiak](#)
Subject: RE: 200479: Charleston Homes Subdivision (Glen Williams) TIA Scope of Work
Date: 11-Nov-20 4:09:20 PM
Attachments: [image001.png](#)

Good Afternoon Adam,

Thank you for circulating the Terms of Reference (TOR) for our review and comments. We have reviewed the proposed TOR, and are generally in agreement. However, we have the following comments:

- The Town does not currently have approved Transportation Impact Study Guidelines; therefore your study must comply with the Region's Transportation Impact Study Guidelines;
- A thorough review of the proposed site access to Confederation Road will be required. Ensure that all TAC standards are adhered to including, but not limited to, sightlines, intersection spacing, corner clearances, road alignments, etc.
- We agree with the methodology for trip generation, distribution and the proposed study hours. However, query results obtained from the TTS data shall be appended to the report for our reference and review.
- Please provide the synchro analysis electronically as part of the submission.

Regards,

Ivan Drewnitski

Traffic Analyst

Transportation & Public Works

Town of Halton Hills

T: 905-873-2601 ext. 2328

idrewnitski@haltonhills.ca

From: Adam Makarewicz [mailto:amakarewicz@ptsl.com]
Sent: Tuesday, October 6, 2020 1:50 PM
To: Ivan Drewnitski
Cc: Creighton Chartier
Subject: 200479: Charleston Homes Subdivision (Glen Williams) TIA Scope of Work

Good Afternoon Ivan,

This email provides our scope of work for a Transportation Impact Assessment (TIA) for a proposed residential development located east of Confederation Street and north of Bishop Court in the Town of Halton Hills. The property owner is proposing to develop the site with 28 single detached units/lots with a new local street access providing separate individual access to each residential lot. This new local street will connect to the existing Bishop Court at the east end of the development and will also connect to Ninth Line at a new intersection. I've attached the development plan.

The TIA will examine the proposed development's anticipated impact on the study area's traffic operations and identify any necessary road improvements required to accommodate the generated traffic. The proposed scope of work, as outlined below is based on the Region of Halton's TIS Guidelines.

Scope of Work

1. **Development Study Area:** We will comment on existing transportation facilities within 250 metres of the subject site. Existing key roadways, major intersections, transit services, and pedestrian facilities will be discussed, as appropriate.

2. **Analysis Time Periods and Intersections:** Based on the proposed development's land use, size, and proximity, we plan to analyze the following intersections during the weekday AM/PM peak hours:
 - Confederation Street at Bishop Court

 - Confederation Street at New Roadway

3. **2020 Existing Conditions:** Traffic counts at the study area intersection will be obtained through the Town of Halton or conducted by Paradigm if recent counts are not available. The 2020 existing traffic operations at the aforementioned intersections will be analyzed using the software program Synchro (version 10) for the weekday AM/PM peak hours.

4. **2025 Future Background Traffic Conditions:** The background traffic volumes will be determined for the study area intersections, five years from the date of the study. We will identify an applicable background traffic growth rate and other area developments that may introduce traffic into the study area. Based on our previous assumptions and discussions with the Town, specific assumptions are noted:
 - General Background Growth will be developed based on 2% per annum.

 - Glen Williams Estates development to be included (located west of Confederation Street and south of Mountain Street)

Planned road improvements will be taken into consideration. The 2025 background traffic operations will be analyzed for the weekday AM/PM peak hours.

5. **Site Traffic Generation and Trip Distribution:** The size and nature of the proposed subject site will be documented based on the received site drawings

and statistics, and will be used to estimate the number of automobile trips likely to be produced during the weekday AM/PM peak hours. The estimation will be based on information from the Institute of Transportation Engineers (ITE) publication, Trip Generation, 10th Edition. The trip distribution for the proposed site will be based on a review of the 2016 Transportation Tomorrow Survey (TTS). The forecast site traffic for the development will be added to the road network based on the trip distribution and assigned to the network based on existing travel patterns, logical travel routes, and available traffic capacity.

6. **2025 Future Total Traffic Conditions:** The estimated site traffic volumes will be combined with the future background traffic volumes to determine the 2025 total traffic volumes for the study area intersections. Intersection operations analysis will be undertaken for the weekday AM/PM peak hours. Any necessary road improvements required to accommodate total traffic volumes will be identified if necessary, such as additional turning lanes, storage length modifications, intersection reconfigurations and, signal installation.

7. **Traffic Signal Warrant Analysis:** Ontario Traffic Manual (OTM) Book 12 will be referenced with regards to signal warrant guidelines to determine if the installation of a traffic signal at the unsignalized intersections that experience operational issues.

8. **Road Improvements (Left Turn Storage Lane):** Left turn storage lane assessment will be conducted to determine if site traffic volumes will be high enough to warrant a left turn lane provision upon full buildout of the subject site at the unsignalized intersections. The assessment will be based on the methodology outlined in the Transportation Association of Canada (TAC) Geometric Design Guide.

If we could receive a response back by **October 14, 2020** that we can proceed with our scope of work, it would be greatly appreciated.

Regards,

Adam J. Makarewicz
Senior Project Manager



Paradigm Transportation Solutions Limited

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

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

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Appendix B

Traffic Data





Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@pts1.com

Count Name: Confederation Street & Bishop
Court
Site Code: 200479
Start Date: 10/08/2020
Page No: 1

Turning Movement Data

Start Time	Eastbound Approach Eastbound						Bishop Court Westbound						Confederation Street Northbound						Confederation Street Southbound						Int. Total	
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total		
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4	0	3	0	0	0	3	7
7:15 AM	0	0	0	0	0	0	1	0	0	0	0	1	0	2	0	0	0	0	2	0	5	0	0	1	5	8
7:30 AM	0	0	0	0	0	0	2	0	0	0	0	2	0	4	0	0	1	4	0	10	0	0	0	10	16	
7:45 AM	0	0	0	0	0	0	1	0	1	0	0	2	0	3	0	0	0	3	0	12	0	0	1	12	17	
Hourly Total	0	0	0	0	0	0	4	0	1	0	0	5	0	13	0	0	1	13	0	30	0	0	2	30	48	
8:00 AM	0	0	1	0	1	1	7	0	0	0	0	7	0	5	1	0	0	6	0	8	0	0	0	8	22	
8:15 AM	0	0	0	0	1	0	1	0	0	0	4	1	0	6	4	0	0	10	0	6	0	0	0	6	17	
8:30 AM	0	0	0	0	0	0	5	0	0	0	1	5	0	8	3	0	2	11	0	11	0	0	0	11	27	
8:45 AM	0	0	0	0	0	0	3	0	0	0	0	3	0	4	3	0	0	7	0	7	0	0	0	7	17	
Hourly Total	0	0	1	0	2	1	16	0	0	0	5	16	0	23	11	0	2	34	0	32	0	0	0	32	83	
9:00 AM	0	0	1	0	0	1	1	0	0	0	0	1	1	7	2	0	0	10	1	11	0	0	0	12	24	
9:15 AM	0	0	0	0	0	0	2	0	0	0	0	2	0	2	0	0	0	2	0	5	0	0	0	5	9	
9:30 AM	0	0	1	0	0	1	0	0	0	0	0	0	0	3	0	0	0	3	0	6	0	0	0	6	10	
9:45 AM	0	0	0	0	0	0	6	0	0	0	0	6	0	2	0	0	0	2	0	6	0	0	0	6	14	
Hourly Total	0	0	2	0	0	2	9	0	0	0	0	9	1	14	2	0	0	17	1	28	0	0	0	29	57	
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
11:00 AM	0	0	0	0	0	0	2	0	1	0	0	3	0	7	3	0	0	10	1	7	0	0	0	8	21	
11:15 AM	0	0	0	0	0	0	2	0	0	0	0	2	0	4	5	0	0	9	0	2	0	0	0	2	13	
11:30 AM	0	0	0	0	0	0	2	0	1	0	0	3	0	2	4	0	0	6	0	5	0	0	0	5	14	
11:45 AM	0	0	0	0	0	0	2	0	0	0	0	2	0	8	3	0	0	11	0	7	0	0	0	7	20	
Hourly Total	0	0	0	0	0	0	8	0	2	0	0	10	0	21	15	0	0	36	1	21	0	0	0	22	68	
12:00 PM	0	0	0	0	0	0	2	0	0	0	0	2	0	9	1	0	0	10	1	4	0	0	0	5	17	
12:15 PM	0	0	0	0	0	0	4	0	1	0	0	5	0	10	2	0	0	12	1	11	0	0	0	12	29	
12:30 PM	0	0	0	0	0	0	1	0	0	0	1	1	0	6	1	0	0	7	0	8	0	0	0	8	16	
12:45 PM	0	0	0	0	0	0	8	0	0	0	0	8	0	10	1	0	0	11	0	6	0	0	0	6	25	
Hourly Total	0	0	0	0	0	0	15	0	1	0	1	16	0	35	5	0	0	40	2	29	0	0	0	31	87	
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3:00 PM	0	0	0	0	0	0	2	0	0	0	0	2	0	13	0	0	0	13	0	11	0	0	0	11	26	
3:15 PM	0	0	0	0	0	0	2	0	0	0	0	2	0	15	3	0	0	18	0	6	0	0	0	6	26	
3:30 PM	0	0	1	0	0	1	3	0	0	0	0	3	0	12	2	0	0	14	1	1	0	0	0	2	20	
3:45 PM	0	0	0	0	0	0	2	0	0	0	0	2	0	11	4	0	0	15	0	7	1	0	0	8	25	
Hourly Total	0	0	1	0	0	1	9	0	0	0	0	9	0	51	9	0	0	60	1	25	1	0	0	27	97	
4:00 PM	0	0	0	0	1	0	0	0	0	1	0	0	0	12	2	0	0	14	1	7	0	0	0	8	22	
4:15 PM	0	0	0	0	0	0	2	0	1	0	0	3	0	11	4	0	0	15	0	17	0	0	0	17	35	
4:30 PM	0	0	0	0	0	0	4	0	0	0	1	4	0	7	2	0	0	9	0	6	0	0	0	6	19	

4:45 PM	0	0	0	0	0	0	1	0	0	0	0	1	0	8	0	0	0	8	0	9	0	0	0	9	18
Hourly Total	0	0	0	0	1	0	7	0	1	0	2	8	0	38	8	0	0	46	1	39	0	0	0	40	94
5:00 PM	0	0	0	0	1	0	3	0	0	0	0	3	0	11	8	0	0	19	0	12	0	0	0	12	34
5:15 PM	0	0	0	0	0	0	4	0	0	0	0	4	0	18	3	0	0	21	0	7	0	0	0	7	32
5:30 PM	0	0	0	0	0	0	1	0	0	0	0	1	0	12	3	0	0	15	0	3	0	0	0	3	19
5:45 PM	0	0	0	0	1	0	0	0	0	0	0	0	0	10	0	0	0	10	0	8	0	0	0	8	18
Hourly Total	0	0	0	0	2	0	8	0	0	0	0	8	0	51	14	0	0	65	0	30	0	0	0	30	103
Grand Total	0	0	4	0	5	4	76	0	5	0	8	81	1	246	64	0	3	311	6	234	1	0	2	241	637
Approach %	0.0	0.0	100.0	0.0	-	-	93.8	0.0	6.2	0.0	-	-	0.3	79.1	20.6	0.0	-	-	2.5	97.1	0.4	0.0	-	-	-
Total %	0.0	0.0	0.6	0.0	-	0.6	11.9	0.0	0.8	0.0	-	12.7	0.2	38.6	10.0	0.0	-	48.8	0.9	36.7	0.2	0.0	-	37.8	-
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	0	2	0	0	-	2	0	3	0	0	-	3	5
% Motorcycles	-	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.0	0.8	0.0	-	-	0.6	0.0	1.3	0.0	-	-	1.2	0.8
Cars & Light Goods	0	0	4	0	-	4	71	0	5	0	-	76	0	233	60	0	-	293	5	208	1	0	-	214	587
% Cars & Light Goods	-	-	100.0	-	-	100.0	93.4	-	100.0	-	-	93.8	0.0	94.7	93.8	-	-	94.2	83.3	88.9	100.0	-	-	88.8	92.2
Buses	0	0	0	0	-	0	0	0	0	0	-	0	0	5	0	0	-	5	0	14	0	0	-	14	19
% Buses	-	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.0	2.0	0.0	-	-	1.6	0.0	6.0	0.0	-	-	5.8	3.0
Single-Unit Trucks	0	0	0	0	-	0	4	0	0	0	-	4	1	2	4	0	-	7	1	7	0	0	-	8	19
% Single-Unit Trucks	-	-	0.0	-	-	0.0	5.3	-	0.0	-	-	4.9	100.0	0.8	6.3	-	-	2.3	16.7	3.0	0.0	-	-	3.3	3.0
Articulated Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	2	0	0	-	2	0	1	0	0	-	1	3
% Articulated Trucks	-	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.0	0.8	0.0	-	-	0.6	0.0	0.4	0.0	-	-	0.4	0.5
Bicycles on Road	0	0	0	0	-	0	1	0	0	0	-	1	0	2	0	0	-	2	0	1	0	0	-	1	4
% Bicycles on Road	-	-	0.0	-	-	0.0	1.3	-	0.0	-	-	1.2	0.0	0.8	0.0	-	-	0.6	0.0	0.4	0.0	-	-	0.4	0.6
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	0	-	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	0.0	-	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	5	-	-	-	-	8	-	-	-	-	-	-	3	-	-	-	-	-	2	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	100.0	-	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Confederation Street & Bishop
Court
Site Code: 200479
Start Date: 10/08/2020
Page No: 4

Turning Movement Peak Hour Data (8:15 AM)

Start Time	Eastbound Approach Eastbound						Bishop Court Westbound						Confederation Street Northbound						Confederation Street Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
8:15 AM	0	0	0	0	1	0	1	0	0	0	4	1	0	6	4	0	0	10	0	6	0	0	0	6	17
8:30 AM	0	0	0	0	0	0	5	0	0	0	1	5	0	8	3	0	2	11	0	11	0	0	0	11	27
8:45 AM	0	0	0	0	0	0	3	0	0	0	0	3	0	4	3	0	0	7	0	7	0	0	0	7	17
9:00 AM	0	0	1	0	0	1	1	0	0	0	0	1	1	7	2	0	0	10	1	11	0	0	0	12	24
Total	0	0	1	0	1	1	10	0	0	0	5	10	1	25	12	0	2	38	1	35	0	0	0	36	85
Approach %	0.0	0.0	100.0	0.0	-	-	100.0	0.0	0.0	0.0	-	-	2.6	65.8	31.6	0.0	-	-	2.8	97.2	0.0	0.0	-	-	-
Total %	0.0	0.0	1.2	0.0	-	1.2	11.8	0.0	0.0	0.0	-	11.8	1.2	29.4	14.1	0.0	-	44.7	1.2	41.2	0.0	0.0	-	42.4	-
PHF	0.000	0.000	0.250	0.000	-	0.250	0.500	0.000	0.000	0.000	-	0.500	0.250	0.781	0.750	0.000	-	0.864	0.250	0.795	0.000	0.000	-	0.750	0.787
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	1	0	0	-	1	1
% Motorcycles	-	-	0.0	-	-	0.0	0.0	-	-	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	2.9	-	-	-	2.8	1.2
Cars & Light Goods	0	0	1	0	-	1	8	0	0	0	-	8	0	20	10	0	-	30	0	27	0	0	-	27	66
% Cars & Light Goods	-	-	100.0	-	-	100.0	80.0	-	-	-	-	80.0	0.0	80.0	83.3	-	-	78.9	0.0	77.1	-	-	-	75.0	77.6
Buses	0	0	0	0	-	0	0	0	0	0	-	0	0	2	0	0	-	2	0	4	0	0	-	4	6
% Buses	-	-	0.0	-	-	0.0	0.0	-	-	-	-	0.0	0.0	8.0	0.0	-	-	5.3	0.0	11.4	-	-	-	11.1	7.1
Single-Unit Trucks	0	0	0	0	-	0	2	0	0	0	-	2	1	1	2	0	-	4	1	2	0	0	-	3	9
% Single-Unit Trucks	-	-	0.0	-	-	0.0	20.0	-	-	-	-	20.0	100.0	4.0	16.7	-	-	10.5	100.0	5.7	-	-	-	8.3	10.6
Articulated Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	2	0	0	-	2	0	1	0	0	-	1	3
% Articulated Trucks	-	-	0.0	-	-	0.0	0.0	-	-	-	-	0.0	0.0	8.0	0.0	-	-	5.3	0.0	2.9	-	-	-	2.8	3.5
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	-	-	0.0	-	-	0.0	0.0	-	-	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	-	1	-	-	-	-	-	5	-	-	-	-	-	2	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-



Paradigm Transportation Solutions Limited
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Count Name: Confederation Street & Bishop
Court
Site Code: 200479
Start Date: 10/08/2020
Page No: 6

Turning Movement Peak Hour Data (12:00 PM)

Start Time	Eastbound Approach Eastbound						Bishop Court Westbound						Confederation Street Northbound						Confederation Street Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
12:00 PM	0	0	0	0	0	0	2	0	0	0	0	2	0	9	1	0	0	10	1	4	0	0	0	5	17
12:15 PM	0	0	0	0	0	0	4	0	1	0	0	5	0	10	2	0	0	12	1	11	0	0	0	12	29
12:30 PM	0	0	0	0	0	0	1	0	0	0	1	1	0	6	1	0	0	7	0	8	0	0	0	8	16
12:45 PM	0	0	0	0	0	0	8	0	0	0	0	8	0	10	1	0	0	11	0	6	0	0	0	6	25
Total	0	0	0	0	0	0	15	0	1	0	1	16	0	35	5	0	0	40	2	29	0	0	0	31	87
Approach %	0.0	0.0	0.0	0.0	-	-	93.8	0.0	6.3	0.0	-	-	0.0	87.5	12.5	0.0	-	-	6.5	93.5	0.0	0.0	-	-	-
Total %	0.0	0.0	0.0	0.0	-	0.0	17.2	0.0	1.1	0.0	-	18.4	0.0	40.2	5.7	0.0	-	46.0	2.3	33.3	0.0	0.0	-	35.6	-
PHF	0.000	0.000	0.000	0.000	-	0.000	0.469	0.000	0.250	0.000	-	0.500	0.000	0.875	0.625	0.000	-	0.833	0.500	0.659	0.000	0.000	-	0.646	0.750
Motorcycles	0	0	0	0	-	0	0	0	0	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	0	0	0	0	-	0	15	0	1	0	-	16	0	35	5	0	-	40	2	27	0	0	-	29	85
% Cars & Light Goods	-	-	-	-	-	-	100.0	-	100.0	-	-	100.0	-	100.0	100.0	-	-	100.0	100.0	93.1	-	-	-	93.5	97.7
Buses	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	2	0	0	-	2	2
% Buses	-	-	-	-	-	-	0.0	-	0.0	-	-	0.0	-	0.0	0.0	-	-	0.0	0.0	6.9	-	-	-	6.5	2.3
Single-Unit Trucks	0	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	0.0	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	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	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	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-



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Count Name: Confederation Street & Bishop
Court
Site Code: 200479
Start Date: 10/08/2020
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Turning Movement Peak Hour Data (4:15 PM)

Start Time	Eastbound Approach Eastbound						Bishop Court Westbound						Confederation Street Northbound						Confederation Street Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
4:15 PM	0	0	0	0	0	0	2	0	1	0	0	3	0	11	4	0	0	15	0	17	0	0	0	17	35
4:30 PM	0	0	0	0	0	0	4	0	0	0	1	4	0	7	2	0	0	9	0	6	0	0	0	6	19
4:45 PM	0	0	0	0	0	0	1	0	0	0	0	1	0	8	0	0	0	8	0	9	0	0	0	9	18
5:00 PM	0	0	0	0	1	0	3	0	0	0	0	3	0	11	8	0	0	19	0	12	0	0	0	12	34
Total	0	0	0	0	1	0	10	0	1	0	1	11	0	37	14	0	0	51	0	44	0	0	0	44	106
Approach %	0.0	0.0	0.0	0.0	-	-	90.9	0.0	9.1	0.0	-	-	0.0	72.5	27.5	0.0	-	-	0.0	100.0	0.0	0.0	-	-	-
Total %	0.0	0.0	0.0	0.0	-	0.0	9.4	0.0	0.9	0.0	-	10.4	0.0	34.9	13.2	0.0	-	48.1	0.0	41.5	0.0	0.0	-	41.5	-
PHF	0.000	0.000	0.000	0.000	-	0.000	0.625	0.000	0.250	0.000	-	0.688	0.000	0.841	0.438	0.000	-	0.671	0.000	0.647	0.000	0.000	-	0.647	0.757
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	0	1	0	0	-	1	0	0	0	0	-	0	1
% Motorcycles	-	-	-	-	-	-	0.0	-	0.0	-	-	0.0	-	2.7	0.0	-	-	2.0	-	0.0	-	-	-	0.0	0.9
Cars & Light Goods	0	0	0	0	-	0	8	0	1	0	-	9	0	33	13	0	-	46	0	39	0	0	-	39	94
% Cars & Light Goods	-	-	-	-	-	-	80.0	-	100.0	-	-	81.8	-	89.2	92.9	-	-	90.2	-	88.6	-	-	-	88.6	88.7
Buses	0	0	0	0	-	0	0	0	0	0	-	0	0	3	0	0	-	3	0	4	0	0	-	4	7
% Buses	-	-	-	-	-	-	0.0	-	0.0	-	-	0.0	-	8.1	0.0	-	-	5.9	-	9.1	-	-	-	9.1	6.6
Single-Unit Trucks	0	0	0	0	-	0	1	0	0	0	-	1	0	0	1	0	-	1	0	1	0	0	-	1	3
% Single-Unit Trucks	-	-	-	-	-	-	10.0	-	0.0	-	-	9.1	-	0.0	7.1	-	-	2.0	-	2.3	-	-	-	2.3	2.8
Articulated Trucks	0	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	-	0.0	-	-	-	0.0	0.0
Bicycles on Road	0	0	0	0	-	0	1	0	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	1
% Bicycles on Road	-	-	-	-	-	-	10.0	-	0.0	-	-	9.1	-	0.0	0.0	-	-	0.0	-	0.0	-	-	-	0.0	0.9
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-



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Count Name: Confederation Street & Bishop
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Appendix C

Base Year Synchro Reports



HCM Unsignalized Intersection Capacity Analysis
101: Ninth Line & Street A

AM Peak - BG 2020
(200479)

	↙ ↘		↑		↗ ↖		↓
Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations	↔		↔		↔	↔	
Traffic Volume (veh/h)	0	0	25	0	0	36	
Future Volume (Veh/h)	0	0	25	0	0	36	
Sign Control	Stop		Free		Free		
Grade	0%		0%		0%		
Peak Hour Factor	0.50	0.25	0.78	0.75	0.25	0.80	
Hourly flow rate (vph)	0	0	32	0	0	45	
Pedestrians							
Lane Width (m)							
Walking Speed (m/s)							
Percent Blockage							
Right turn flare (veh)							
Median type	None			None			
Median storage (veh)							
Upstream signal (m)							
pX, platoon unblocked							
vC, conflicting volume	77	32			32		
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	77	32			32		
tC, single (s)	6.4	6.2			4.1		
tC, 2 stage (s)							
tF (s)	3.5	3.3			2.2		
p0 queue free %	100	100			100		
cM capacity (veh/h)	926	1042			1580		
Direction, Lane #	WB 1	NB 1	SB 1				
Volume Total	0	32	45				
Volume Left	0	0	0				
Volume Right	0	0	0				
cSH	1700	1700	1580				
Volume to Capacity	0.00	0.02	0.00				
Queue Length 95th (m)	0.0	0.0	0.0				
Control Delay (s)	0.0	0.0	0.0				
Lane LOS	A						
Approach Delay (s)	0.0	0.0	0.0				
Approach LOS	A						
Intersection Summary							
Average Delay			0.0				
Intersection Capacity Utilization			6.7%		ICU Level of Service	A	
Analysis Period (min)			15				

HCM Unsignalized Intersection Capacity Analysis
102: Confederation Street/Ninth Line & Bishop Court

AM Peak - BG 2020
(200479)

	↙ ↘		↑		↗ ↖		↓
Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations	↔		↔		↔	↔	
Traffic Volume (veh/h)	10	0	25	12	1	35	
Future Volume (Veh/h)	10	0	25	12	1	35	
Sign Control	Stop		Free		Free		
Grade	0%		0%		0%		
Peak Hour Factor	0.50	0.25	0.78	0.75	0.25	0.80	
Hourly flow rate (vph)	20	0	32	16	4	44	
Pedestrians	2		5		1		
Lane Width (m)	3.6		3.6		3.6		
Walking Speed (m/s)	1.2		1.2		1.2		
Percent Blockage	0		0		0		
Right turn flare (veh)							
Median type	None			None			
Median storage (veh)							
Upstream signal (m)							
pX, platoon unblocked							
vC, conflicting volume	99	43			50		
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	99	43			50		
tC, single (s)	6.6	6.2			4.6		
tC, 2 stage (s)							
tF (s)	3.7	3.3			2.7		
p0 queue free %	98	100			100		
cM capacity (veh/h)	850	1025			1296		
Direction, Lane #	WB 1	NB 1	SB 1				
Volume Total	20	48	48				
Volume Left	20	0	4				
Volume Right	0	16	0				
cSH	850	1700	1296				
Volume to Capacity	0.02	0.03	0.00				
Queue Length 95th (m)	0.6	0.0	0.1				
Control Delay (s)	9.3	0.0	0.7				
Lane LOS	A		A				
Approach Delay (s)	9.3	0.0	0.7				
Approach LOS	A						
Intersection Summary							
Average Delay			1.9				
Intersection Capacity Utilization			14.3%		ICU Level of Service	A	
Analysis Period (min)			15				

HCM Unsignalized Intersection Capacity Analysis
101: Ninth Line & Street A

PM Peak - BG 2020
(200479)

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	0	38	0	0	44
Future Volume (Veh/h)	0	0	38	0	0	44
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.63	0.25	0.84	0.44	0.25	0.65
Hourly flow rate (vph)	0	0	45	0	0	68
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	113	45			45	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	113	45			45	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	884	1025			1563	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	0	45	68			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1700	1700	1563			
Volume to Capacity	0.00	0.03	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			6.7%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
102: Confederation Street/Ninth Line & Bishop Court

PM Peak - BG 2020
(200479)

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	10	1	37	14	0	44
Future Volume (Veh/h)	10	1	37	14	0	44
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.63	0.25	0.84	0.44	0.25	0.65
Hourly flow rate (vph)	16	4	44	32	0	68
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	129	61			76	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	129	61			76	
tC, single (s)	6.6	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.7	3.3			2.2	
p0 queue free %	98	100			100	
cM capacity (veh/h)	824	1009			1536	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	20	76	68			
Volume Left	16	0	0			
Volume Right	4	32	0			
cSH	855	1700	1536			
Volume to Capacity	0.02	0.04	0.00			
Queue Length 95th (m)	0.6	0.0	0.0			
Control Delay (s)	9.3	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	9.3	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			1.1			
Intersection Capacity Utilization			13.7%	ICU Level of Service	A	
Analysis Period (min)			15			

Appendix D

Sightline Field Sheets

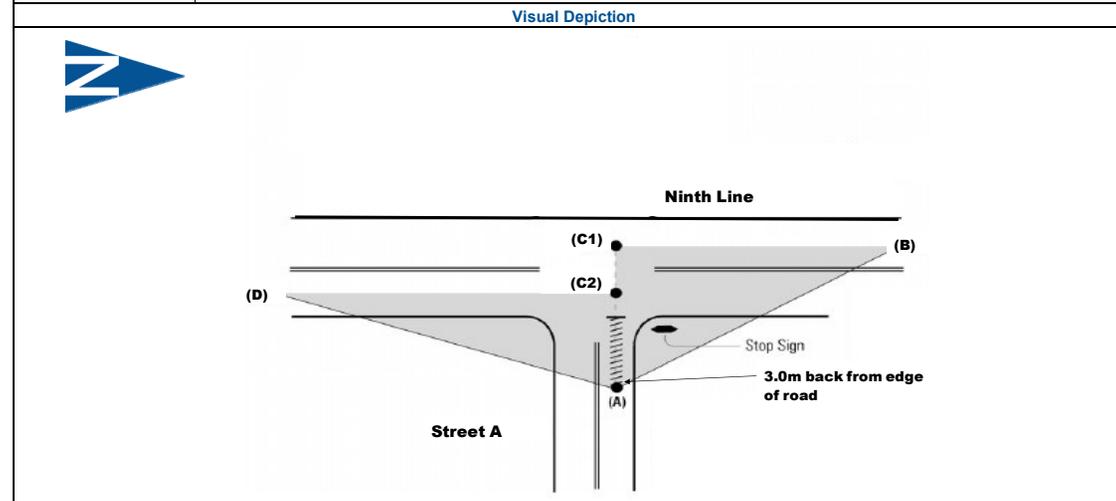


Sight Distance Field Form



General Information	
Project: Chareleston Homes Subdivision	
Project Number: 200479	
Jurisdiction: Halton Hills	
Date: 2021-01-08	Notes:
Time: 2:00 PM	
Weather: Sunny	
Intersection: Street A & Ninth Line	
Roadway Information	
Posted Speed (Major Road) (km/h):	50
Design Speed (Major Road) (km/h):	70
85th Percentile Speed (Major Road) (km/h):	-
Horizontal Curve (Yes or No):	No
Vertical Curve (Yes or No):	No
Major Road Pavement Width (m):	3
No. of Lanes (Major Road):	2
Minor Road Pavement Width (m):	4.5
No. of Lanes (Minor Road):	2
STOP Block Setback Distance (d) (m):	3.0 TAC

Sight Distance Information		
Intersection Sight Distance Information: A (Driver's Eye) to D (Object Height)		
Driver Eye Height (m)	1.08	
Object Height (m)	1.30	
Recommended ISD (m):	150	
Field Measured (m):	180	
Notes:		
Intersection Sight Distance Information: A (Driver's Eye) to B (Object Height)		
Driver Eye Height (m)	1.08	
Object Height (m)	1.30	
Recommended ISD (m):	150	
Field Measured (m):	205	
Notes:		
Decision Sight Distance Information: B (Driver's Eye) to C1 (Object Height)		
Driver Eye Height (m)	1.08	
Object Height (m)	0.60	
Recommended DSD (m):	200	
Field Measured (m):	235	
Notes:		
Decision Sight Distance Information: D (Driver's Eye) to C2 (Object Height)		
Driver Eye Height (m)	1.08	
Object Height (m)	0.60	
Recommended DSD (m):	200	
Field Measured (m):	212	
Notes: Vegetation on south-east quadrant is overgrown		



Appendix E

Trip Distribution Calculations



Direction (To/From)	Travel Route	Percent to Route
North	Ninth Line	2%
South	Ninth Line	98%
Total		100%

Appendix F

Background Synchro Reports



HCM Unsignalized Intersection Capacity Analysis
101: Ninth Line & Street A

AM Peak - BG 2025
(200479)

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↕	↱	↰	↱
Traffic Volume (veh/h)	0	0	28	0	0	40
Future Volume (Veh/h)	0	0	28	0	0	40
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.50	0.25	0.78	0.75	0.25	0.80
Hourly flow rate (vph)	0	0	36	0	0	50
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	86	36			36	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	86	36			36	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	915	1037			1575	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	0	36	50			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1700	1700	1575			
Volume to Capacity	0.00	0.02	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay		0.0				
Intersection Capacity Utilization		6.7%	ICU Level of Service	A		
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis
102: Confederation Street/Ninth Line & Bishop Court

AM Peak - BG 2025
(200479)

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↕	↱	↰	↱
Traffic Volume (veh/h)	11	0	28	13	1	39
Future Volume (Veh/h)	11	0	28	13	1	39
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.50	0.25	0.78	0.75	0.25	0.80
Hourly flow rate (vph)	22	0	36	17	4	49
Pedestrians	2		5			1
Lane Width (m)	3.6		3.6			3.6
Walking Speed (m/s)	1.2		1.2			1.2
Percent Blockage	0		0			0
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	108	48			55	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	108	48			55	
tC, single (s)	6.6	6.2			4.6	
tC, 2 stage (s)						
tF (s)	3.7	3.3			2.7	
p0 queue free %	97	100			100	
cM capacity (veh/h)	840	1019			1290	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	22	53	53			
Volume Left	22	0	4			
Volume Right	0	17	0			
cSH	840	1700	1290			
Volume to Capacity	0.03	0.03	0.00			
Queue Length 95th (m)	0.6	0.0	0.1			
Control Delay (s)	9.4	0.0	0.6			
Lane LOS	A		A			
Approach Delay (s)	9.4	0.0	0.6			
Approach LOS	A					
Intersection Summary						
Average Delay		1.9				
Intersection Capacity Utilization		14.3%	ICU Level of Service	A		
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis
101: Ninth Line & Street A

PM Peak - BG 2025
(200479)

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	0	42	0	0	49
Future Volume (Veh/h)	0	0	42	0	0	49
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.63	0.25	0.84	0.44	0.25	0.65
Hourly flow rate (vph)	0	0	50	0	0	75
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	125	50			50	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	125	50			50	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	870	1018			1557	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	0	50	75			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1700	1700	1557			
Volume to Capacity	0.00	0.03	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay		0.0				
Intersection Capacity Utilization		6.7%	ICU Level of Service	A		
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis
102: Confederation Street/Ninth Line & Bishop Court

PM Peak - BG 2025
(200479)

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	11	1	41	15	0	49
Future Volume (Veh/h)	11	1	41	15	0	49
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.63	0.25	0.84	0.44	0.25	0.65
Hourly flow rate (vph)	17	4	49	34	0	75
Pedestrians			1			1
Lane Width (m)			3.6			3.6
Walking Speed (m/s)			1.2			1.2
Percent Blockage			0			0
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	142	67			83	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	142	67			83	
tC, single (s)	6.6	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.7	3.3			2.2	
p0 queue free %	98	100			100	
cM capacity (veh/h)	809	1001			1527	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	21	83	75			
Volume Left	17	0	0			
Volume Right	4	34	0			
cSH	840	1700	1527			
Volume to Capacity	0.02	0.05	0.00			
Queue Length 95th (m)	0.6	0.0	0.0			
Control Delay (s)	9.4	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	9.4	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay		1.1				
Intersection Capacity Utilization		13.7%	ICU Level of Service	A		
Analysis Period (min)		15				

Appendix G

Total Synchro Reports



HCM Unsignalized Intersection Capacity Analysis
101: Ninth Line & Street A

AM Peak - Total 2025
(200479)

	↙		↑		↘	
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔		↔		↔	↔
Traffic Volume (veh/h)	19	0	28	6	0	40
Future Volume (Veh/h)	19	0	28	6	0	40
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.50	0.25	0.78	0.75	0.25	0.80
Hourly flow rate (vph)	38	0	36	8	0	50
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	90	40	44			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	90	40	44			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	100	100			
cM capacity (veh/h)	910	1031	1564			
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	38	44	50			
Volume Left	38	0	0			
Volume Right	0	8	0			
cSH	910	1700	1564			
Volume to Capacity	0.04	0.03	0.00			
Queue Length 95th (m)	1.0	0.0	0.0			
Control Delay (s)	9.1	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	9.1	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			2.6			
Intersection Capacity Utilization			13.3%		ICU Level of Service A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
102: Confederation Street/Ninth Line & Bishop Court

AM Peak - Total 2025
(200479)

	↙		↑		↘	
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔		↔		↔	↔
Traffic Volume (veh/h)	11	0	34	13	1	58
Future Volume (Veh/h)	11	0	34	13	1	58
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.50	0.25	0.78	0.75	0.25	0.80
Hourly flow rate (vph)	22	0	44	17	4	73
Pedestrians	2		5		1	
Lane Width (m)	3.6		3.6		3.6	
Walking Speed (m/s)	1.2		1.2		1.2	
Percent Blockage	0		0		0	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	140	56	63			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	140	56	63			
tC, single (s)	6.6	6.2	4.6			
tC, 2 stage (s)						
tF (s)	3.7	3.3	2.7			
p0 queue free %	97	100	100			
cM capacity (veh/h)	804	1009	1281			
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	22	61	77			
Volume Left	22	0	4			
Volume Right	0	17	0			
cSH	804	1700	1281			
Volume to Capacity	0.03	0.04	0.00			
Queue Length 95th (m)	0.7	0.0	0.1			
Control Delay (s)	9.6	0.0	0.4			
Lane LOS	A					
Approach Delay (s)	9.6	0.0	0.4			
Approach LOS	A					
Intersection Summary						
Average Delay			1.5			
Intersection Capacity Utilization			14.3%		ICU Level of Service A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
101: Ninth Line & Street A

PM Peak - Total 2025
(200479)

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	T		T			T
Traffic Volume (veh/h)	11	0	42	19	0	49
Future Volume (Veh/h)	11	0	42	19	0	49
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.63	0.25	0.84	0.44	0.25	0.65
Hourly flow rate (vph)	17	0	50	43	0	75
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	146	72			93	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	146	72			93	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	100			100	
cM capacity (veh/h)	846	991			1501	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	17	93	75			
Volume Left	17	0	0			
Volume Right	0	43	0			
cSH	846	1700	1501			
Volume to Capacity	0.02	0.05	0.00			
Queue Length 95th (m)	0.5	0.0	0.0			
Control Delay (s)	9.3	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	9.3	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay		0.9				
Intersection Capacity Utilization		13.4%	ICU Level of Service	A		
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis
102: Confederation Street/Ninth Line & Bishop Court

PM Peak - Total 2025
(200479)

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	T		T			T
Traffic Volume (veh/h)	11	1	60	15	0	60
Future Volume (Veh/h)	11	1	60	15	0	60
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.63	0.25	0.84	0.44	0.25	0.65
Hourly flow rate (vph)	17	4	71	34	0	92
Pedestrians			1			1
Lane Width (m)			3.6			3.6
Walking Speed (m/s)			1.2			1.2
Percent Blockage			0			0
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	181	89			105	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	181	89			105	
tC, single (s)	6.6	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.7	3.3			2.2	
p0 queue free %	98	100			100	
cM capacity (veh/h)	768	974			1499	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	21	105	92			
Volume Left	17	0	0			
Volume Right	4	34	0			
cSH	800	1700	1499			
Volume to Capacity	0.03	0.06	0.00			
Queue Length 95th (m)	0.6	0.0	0.0			
Control Delay (s)	9.6	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	9.6	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay		0.9				
Intersection Capacity Utilization		14.4%	ICU Level of Service	A		
Analysis Period (min)		15				

Appendix H

SimTraffic Simulation



SimTraffic Simulation Summary
AM Peak - Total 2025

01-18-2021

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	6:57	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:12	8:12	8:12	8:12	8:12	8:12	8:12
Total Time (min)	75	75	75	75	75	75	75
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	130	118	113	127	130	134	127
Vehs Exited	132	117	108	128	133	133	125
Starting Vehs	4	1	0	5	4	3	3
Ending Vehs	2	2	5	4	1	4	5
Travel Distance (km)	133	120	114	133	141	141	132
Travel Time (hr)	2.8	2.4	2.4	2.8	3.0	3.0	2.7
Total Delay (hr)	0.1	0.0	0.0	0.1	0.1	0.1	0.0
Total Stops	27	14	23	30	40	28	26
Fuel Used (l)	9.7	8.2	7.8	9.3	9.9	10.0	9.5

Summary of All Intervals

Run Number	7	1	SynchroAM	AM Total 2025	Avg
Start Time	6:57	6:57	6:57	6:57	6:57
End Time	8:12	8:12	8:12	8:12	8:12
Total Time (min)	75	75	75	75	75
Time Recorded (min)	60	60	60	60	60
# of Intervals	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1
Vehs Entered	128	127	119	144	127
Vehs Exited	133	129	118	144	127
Starting Vehs	6	3	4	3	2
Ending Vehs	1	1	5	3	2
Travel Distance (km)	129	127	125	151	132
Travel Time (hr)	2.7	2.7	2.6	3.2	2.8
Total Delay (hr)	0.1	0.1	0.1	0.1	0.1
Total Stops	27	26	27	33	27
Fuel Used (l)	9.2	9.2	8.5	10.4	9.2

Interval #0 Information Seeding

Start Time	6:57
End Time	7:12
Total Time (min)	15
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

SimTraffic Simulation Summary
AM Peak - Total 2025

01-18-2021

Interval #1 Information Recording

Start Time	7:12						
End Time	8:12						
Total Time (min)	60						
Volumes adjusted by Growth Factors.							
Run Number	1	10	2	3	4	5	6
Vehs Entered	130	118	113	127	130	134	127
Vehs Exited	132	117	108	128	133	133	125
Starting Vehs	4	1	0	5	4	3	3
Ending Vehs	2	2	5	4	1	4	5
Travel Distance (km)	133	120	114	133	141	141	132
Travel Time (hr)	2.8	2.4	2.4	2.8	3.0	3.0	2.7
Total Delay (hr)	0.1	0.0	0.0	0.1	0.1	0.1	0.0
Total Stops	27	14	23	30	40	28	26
Fuel Used (l)	9.7	8.2	7.8	9.3	9.9	10.0	9.5

Interval #1 Information Recording

Start Time	7:12				
End Time	8:12				
Total Time (min)	60				
Volumes adjusted by Growth Factors.					
Run Number	7	1	SynchroAM	AM Total 2025	Avg
Vehs Entered	128	127	119	144	127
Vehs Exited	133	129	118	144	127
Starting Vehs	6	3	4	3	2
Ending Vehs	1	1	5	3	2
Travel Distance (km)	129	127	125	151	132
Travel Time (hr)	2.7	2.7	2.6	3.2	2.8
Total Delay (hr)	0.1	0.1	0.1	0.1	0.1
Total Stops	27	26	27	33	27
Fuel Used (l)	9.2	9.2	8.5	10.4	9.2

Queuing and Blocking Report
AM Peak - Total 2025

01-18-2021

Intersection: 101: Ninth Line & Street A

Movement	WB
Directions Served	LR
Maximum Queue (m)	9.7
Average Queue (m)	4.0
95th Queue (m)	11.4
Link Distance (m)	265.3
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 102: Confederation Street/Ninth Line & Bishop Court

Movement	WB
Directions Served	LR
Maximum Queue (m)	14.1
Average Queue (m)	2.7
95th Queue (m)	10.5
Link Distance (m)	419.2
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 0

SimTraffic Simulation Summary
PM Peak - Total 2025

01-18-2021

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	6:57	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:12	8:12	8:12	8:12	8:12	8:12	8:12
Total Time (min)	75	75	75	75	75	75	75
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	129	160	157	177	171	146	143
Vehs Exited	129	153	162	172	171	150	143
Starting Vehs	4	1	8	1	3	5	2
Ending Vehs	4	8	3	6	3	1	2
Travel Distance (km)	145	174	178	195	189	164	159
Travel Time (hr)	3.0	3.6	3.7	4.1	4.0	3.4	3.3
Total Delay (hr)	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Total Stops	17	14	24	27	27	22	21
Fuel Used (l)	10.1	12.0	12.6	13.5	13.4	11.4	11.1

Summary of All Intervals

Run Number	7	10	Synchro	PM	PM	Total 2025	Avg
Start Time	6:57	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:12	8:12	8:12	8:12	8:12	8:12	8:12
Total Time (min)	75	75	75	75	75	75	75
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	162	154	135	152	152	152	152
Vehs Exited	162	148	136	152	153	153	153
Starting Vehs	4	1	2	4	3	3	3
Ending Vehs	4	7	1	4	3	3	3
Travel Distance (km)	190	170	154	174	172	172	172
Travel Time (hr)	4.0	3.5	3.2	3.6	3.6	3.6	3.6
Total Delay (hr)	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total Stops	30	26	12	36	23	23	23
Fuel Used (l)	13.0	12.0	10.8	12.1	12.0	12.0	12.0

Interval #0 Information Seeding

Start Time	6:57
End Time	7:12
Total Time (min)	15
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

SimTraffic Simulation Summary
PM Peak - Total 2025

01-18-2021

Interval #1 Information Recording

Start Time	7:12						
End Time	8:12						
Total Time (min)	60						
Volumes adjusted by Growth Factors.							
Run Number	1	10	2	3	4	5	6
Vehs Entered	129	160	157	177	171	146	143
Vehs Exited	129	153	162	172	171	150	143
Starting Vehs	4	1	8	1	3	5	2
Ending Vehs	4	8	3	6	3	1	2
Travel Distance (km)	145	174	178	195	189	164	159
Travel Time (hr)	3.0	3.6	3.7	4.1	4.0	3.4	3.3
Total Delay (hr)	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Total Stops	17	14	24	27	27	22	21
Fuel Used (l)	10.1	12.0	12.6	13.5	13.4	11.4	11.1

Interval #1 Information Recording

Start Time	7:12						
End Time	8:12						
Total Time (min)	60						
Volumes adjusted by Growth Factors.							
Run Number	7	10	Synchro	PM	PM	Total 2025	Avg
Vehs Entered	162	154	135	152	152	152	152
Vehs Exited	162	148	136	152	153	153	153
Starting Vehs	4	1	2	4	3	3	3
Ending Vehs	4	7	1	4	3	3	3
Travel Distance (km)	190	170	154	174	172	172	172
Travel Time (hr)	4.0	3.5	3.2	3.6	3.6	3.6	3.6
Total Delay (hr)	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total Stops	30	26	12	36	23	23	23
Fuel Used (l)	13.0	12.0	10.8	12.1	12.0	12.0	12.0

Queuing and Blocking Report
PM Peak - Total 2025

01-18-2021

Intersection: 101: Ninth Line & Street A

Movement	WB
Directions Served	LR
Maximum Queue (m)	9.8
Average Queue (m)	2.7
95th Queue (m)	9.6
Link Distance (m)	265.3
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 102: Confederation Street/Ninth Line & Bishop Court

Movement	WB
Directions Served	LR
Maximum Queue (m)	17.2
Average Queue (m)	3.7
95th Queue (m)	12.5
Link Distance (m)	419.2
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 0
