Smithville 3A Block Plan Area 9 Development

Transportation Impact Study

Final

August 19, 2024

Prepared for:
Lockbridge Development Inc.

Prepared by:
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Revision	Description	Author		Quality Check		Independent Review	
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Sign-off Sheet

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1.0 INTRODUCTION

Stantec has been retained by Lockbridge Development Inc. (the "Developer") to conduct a Transportation Impact Study (TIS) for Block Plan Area 9, located in the southeast part of the community of Smithville, Township of West Lincoln, Niagara Region, Ontario.

Block Plan Area 9 is the development area associated with Stage 3A of the *Smithville Master Community Plan (MCP)*. The Block Plan Area 9 (the "Block") encompasses approximately 61.07 hectares of land southeast of the intersection of Townline Road (Regional Road 14, or RR14) and Port Davidson Road, as shown in **Figure 1.1**. The proposed development by the Developer is specific to Phase 1 of the Block and encompasses approximately 11.75 hectares of land in the northeast part of the Block.

According to the *Comprehensive Block and MESP Guidelines* of the Township of West Lincoln, a single TIS is to be completed for each Block irrespective of the number of landowners/developers for each Block. The purpose of this TIS is to assess the potential transportation impacts of the proposed development of the entire Block, and assess the impacts of the proposed development specific to Phase 1 of the Block. The impacts on both the surrounding transportation network and site-specific transportation components were examined.

The assumptions and findings of the TIS is documented in this report, which consists of the following sections:

- **Section 1** introduces the report and covers the study scope including the study area, study scenarios, study horizon, utilized traffic count data, and applied traffic volume growth rate.
- **Section 2** discusses the existing transportation network (i.e. automobile, truck, pedestrian, transit, and cycling routes and infrastructure)
- **Section 3** discusses the background development information.
- **Section 4** details the methodology and presents the results of trip generation, trip distribution, and trip assignment forecasts for the subject site and background developments.
- **Section 5** details the methodology used for traffic operations analysis, and presents results for existing condition, future background, and future total scenarios.
- **Section 6** outlines transportation demand management measures.
- **Section 7** details the methodology and presents the results for the site access sightline analysis.
- **Section 8** provides a summary of the study and offers recommendations based on the preceding sections.

1.1 PROPOSED DEVELOPMENT

The proposed Block development, known as Block Plan Area 9, is situated in the southeast quadrant of the intersection of Townline Road (Regional Road 14) and Port Davidson Road in Smithville. The Block development is part of Stage 3A in the development staging plan of the *Smithville Master Community Plan (MCP)* of the Township of West Lincoln.

In this TIS, the proposed developments in Block Plan Area 9 are divided into two components – Phase 1 development, and Block area development outside of Phase 1. The land use concept map of the Block development (January 2024) is illustrated in **Figure 1.1** with Phase 1 shown in the dashed cyan line. A more updated detailed draft plan of the Phase 1 development (April 2024) is illustrated in **Figure 1.2**.The proposed Block Plan Area 9 development includes two access road connected to Townline Road – Street A and Street B – and three accesses connected to Port Davidson Road – the Street D, Street F, and a Unnamed Street South. The land use distribution information provided by the Client is summarized in **Table 1.1**.

Phase 1 development is composed of 196 residential units – of which 154 are single detached units, 12 are semi-detached units, and 30 are townhouse units.

The Block area outside of Phase 1 is assumed to comprise of 815 residential units – of which 547 are low density residential units, and 268 are medium density residential units. The distribution between the number of low and medium density units is estimated based on the distribution of development area by type.

As illustrated in **Table 1.1**, Block Plan Area 9 development was previously provided as 957 residential units – of which 498 are low density residential units, and 459 are medium density residential units. With the information provided in the updated draft plan of Phase 1 development (increase from 142 to 196 residential units), the total Block Plan Area 9 development is revised to 1,011 residential units. The revised land use distribution information is summarized in **Table 1.2**.

Table 1.1: Land Use Distribution provided by the Client

Land Use	Area (ha)	Area Distribution	# Units
Phase 1 Development (Concept Plan, January 2024)			142
Phase 1 Development (Draft Plan, April 2024)			
Single Detached Dwellings			154
Semi Detached Dwellings			12
Townhouse Dwellings			30
TOTAL			**196**
Block Plan Area 9 Development (Concept Plan, January 2024)			
Low Density Residential	25.15	67%	498
Medium Density Residential	12.38	33%	459
TOTAL	**37.53**	**100%**	**957**

Table 1.2: Revised Land Use Distribution

Land Use	Area (ha)	Area Distribution	# Units
Phase 1 Development (Draft Plan, April 2024)			
Single Detached Dwellings			154
Semi Detached Dwellings			12
Townhouse Dwellings			30
TOTAL			**196**
Block Plan Area 9 Development, minus Phase 1 (Draft Plan, April 2024)			
Low Density Residential		67%	547
Medium Density Residential		33%	268
TOTAL		**100%**	**815**
Updated Block Plan Area 9 Development			**1,011**

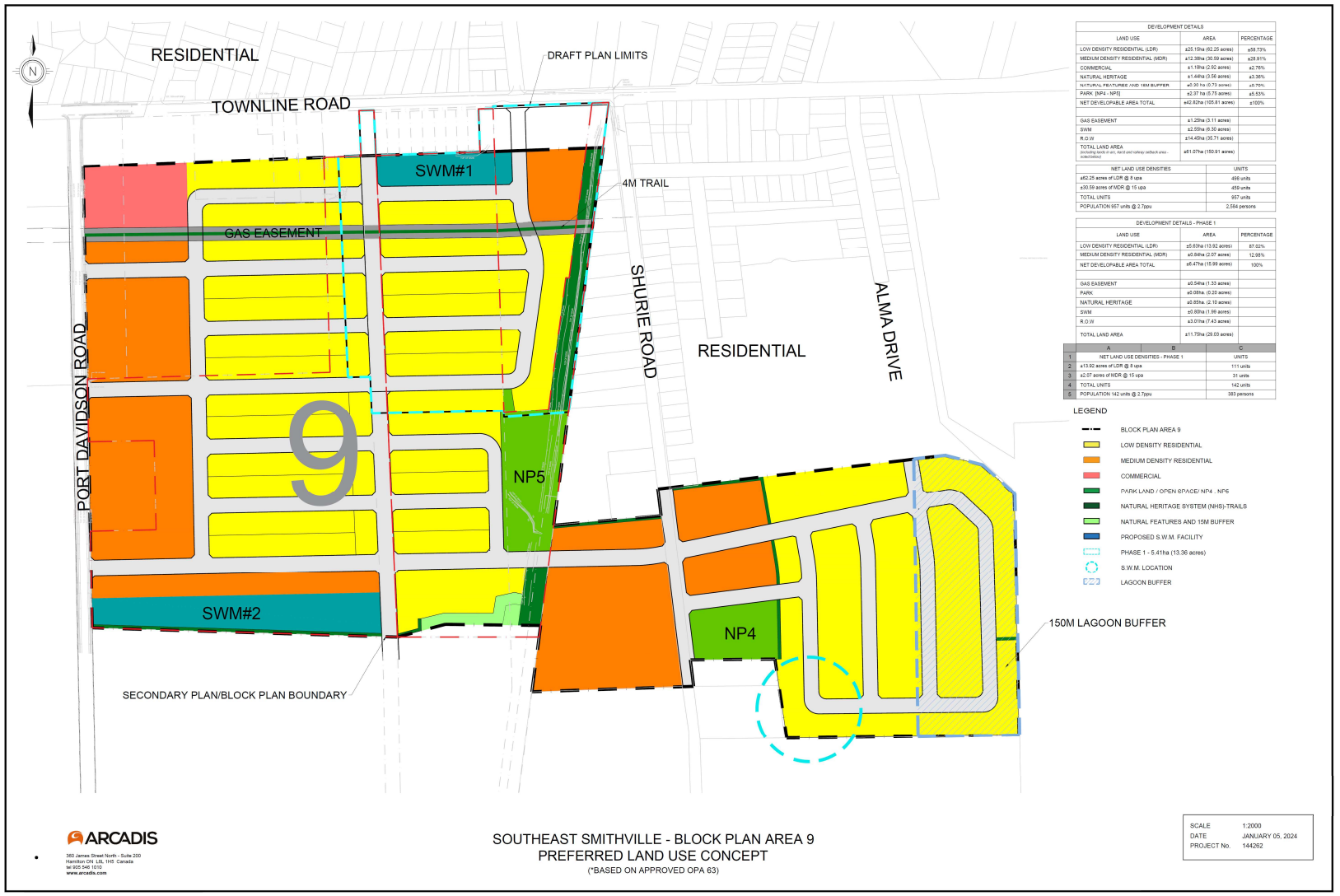


Figure 1.1: Block Plan Area 9 Land Use Concept Plan (Arcadis, January 2024)

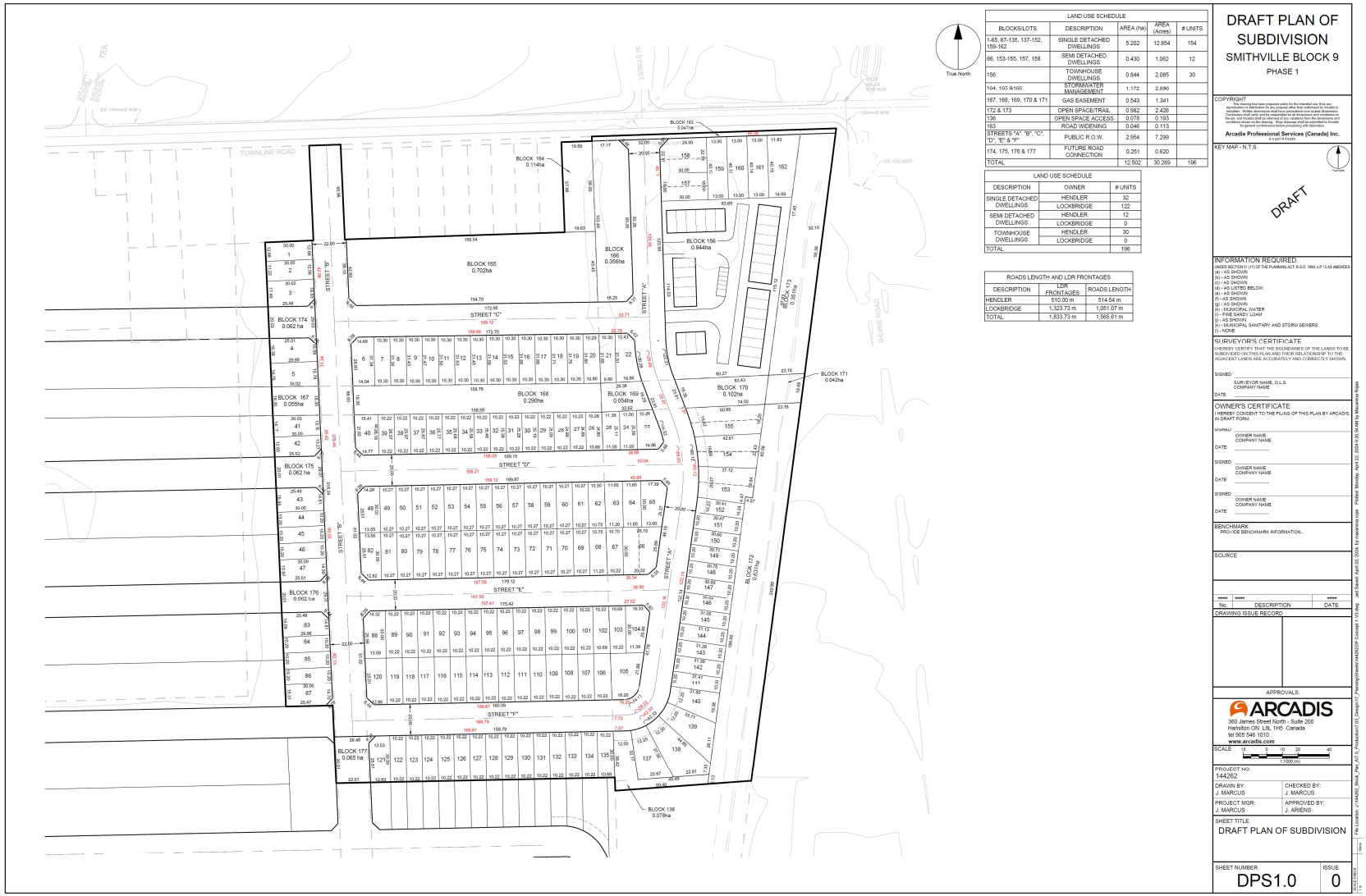


Figure 1.2: Proposed Draft Plan of Phase 1 Development (Arcadis, April 2024)

1.2 STUDY AREA

The study area is shown in **Figure 1.3** and includes the following intersections:

1. Townline Road and Port Davidson Road (unsignalized);
2. Townline Road and Canborough Street (unsignalized);
3. Townline Road and Shurie Road (unsignalized);
4. Townline Road and Alma Drive (unsignalized);
5. Townline Road and St Catharines Street (roundabout); and,
6. St Catharines Street and Industrial Park Road (unsignalized).

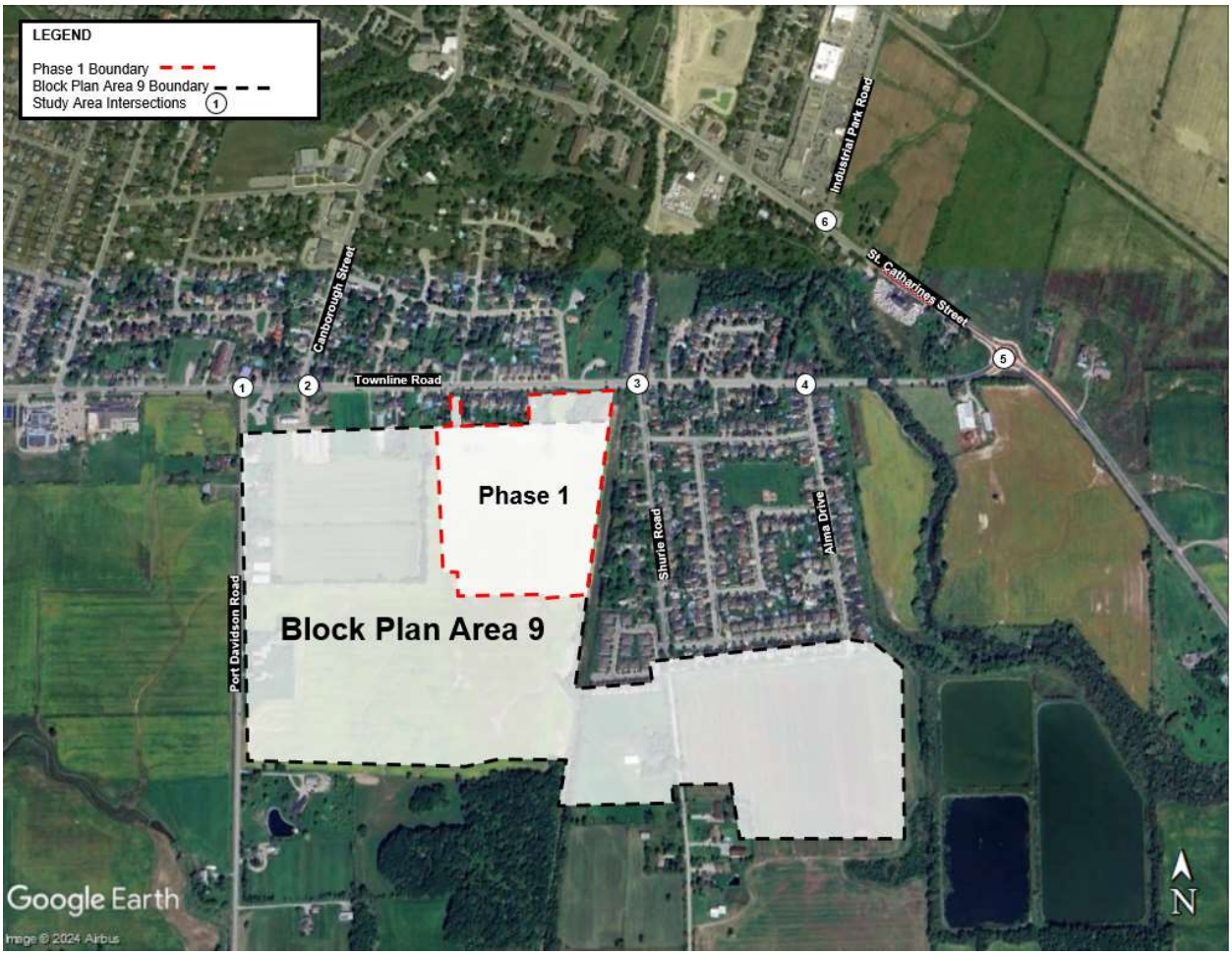


Figure 1.3: Proposed Site Location and Study Area Intersections

1.3 TRAFFIC COUNT DATA

Turning movement count (TMC) data were obtained from the Niagara Region for the intersection of St Catharines Street (Regional Road 20, or RR20) and Industrial Park Road. The TMC for the remaining intersections were collected by Traffic Survey Analysis Inc. A summary of TMC data is found in **Table 1.3**. Detailed TMC data are available in **Appendix A**.

Table 1.3: Turning Movement Count Details

Intersection No.	Intersection	Date Collected	Source
1	Townline Rd (RR14) and Port Davidson Rd	13-Jun-24	Traffic Survey Analysis Inc.
2	Townline Rd (RR14) and Canborough St	13-Jun-24	Traffic Survey Analysis Inc.
3	Townline Rd and Shurie Rd	13-Jun-24	Traffic Survey Analysis Inc.
4	Townline Rd and Alma Dr	13-Jun-24	Traffic Survey Analysis Inc.
5	St Catharines St (RR20) and Industrial Park Dr	13-Jun-24	Traffic Survey Analysis Inc.
6	Townline Rd and St Catharines St (RR20)	15-Jun-23	Niagara Region

1.4 HORIZONS, SCENARIOS, AND GROWTH RATES

Considering the scale and specifications of the development, the following scenarios were evaluated in this study:

- Existing conditions in 2024;
- Future background traffic without Phase 1 development in 2030;
- Future total traffic with Phase 1 development in 2030.

The future horizon of 2030 represents five years after the expected construction year of 2025.

For all selected scenarios, traffic volumes during the weekday AM and PM peak hours were utilized for the analyses.

As per correspondence with Region of Niagara Staff, provided in **Appendix B**, an annual growth rate of 3.0% was applied to the available and collected traffic count data to project traffic volumes for the existing year (2024) and the future horizon year (2030). This growth rate is relatively conservative, as according to the *Smithville Transportation Master Plan (2023)*, an annual growth rate of 2.5% is projected for internal-to-internal trips, and a linear annual growth rate of 2.0% is projected for all other trips to, from, or through Smithville.

2.0 EXISTING CONDITIONS

2.1 LAND USE

The proposed development site for Block Plan Area 9 is located at the southeast corner of the Townline Road (Regional Road 14) and Port Davidson Road intersection within the Township of West Lincoln.

Under the existing conditions, the subject site is mostly vacant. Several residential units currently occupy a small area north of the site, along Townline Road. These units will largely remain upon construction of the proposed development.

The subject site is surrounded by residential land uses as pictured in **Figure 2.1** below from the Township of West Lincoln's Community Map.

Figure 2.1: Existing Land Use (Source: *Township of West Lincoln Community Map*)

2.2 ROAD NETWORK

Figure 2.2 below depicts the road classification of the road network surrounding the study area, as outlined in the Niagara Region's Map of Regional Roads.

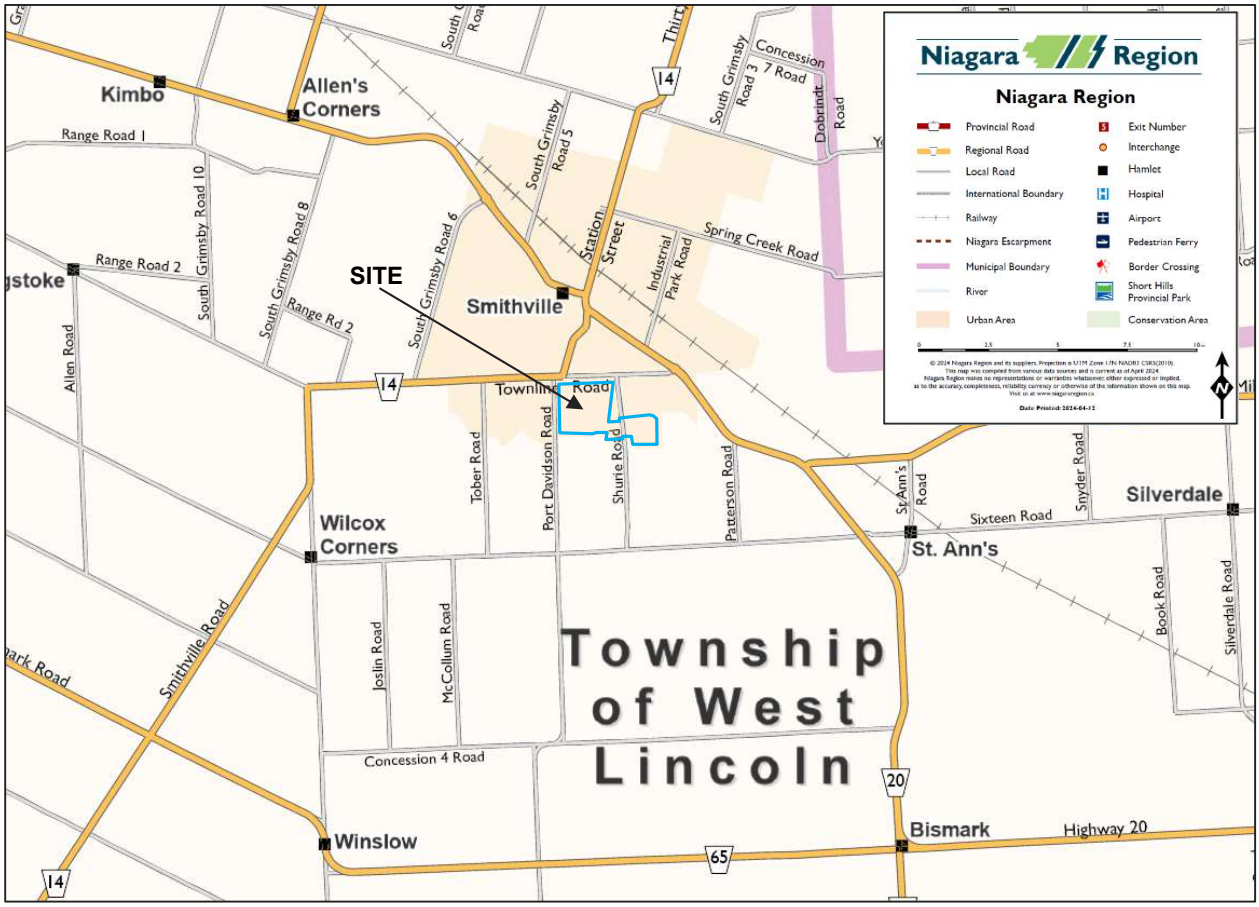


Figure 2.2: Study Area Road Classification (Source: *Niagara Region Map of Regional Roads*)

Townline Road is a two-lane east-west arterial road under the jurisdiction of the Niagara Region west of Canborough Street – known as Regional Road 14 – and a collector road under the jurisdiction of the Township of West Lincoln east of Canborough Street. Sidewalks are provided on both sides of the road. Through the study area, the posted speed limit is 50 km/h.

Port Davidson Road is a two-lane north-south township arterial road under the jurisdiction of the Township of West Lincoln. Sidewalks are not provided on either side of the road. Through the study area, the posted speed limit is 80 km/h.

Canborough Street is a two-lane north-south arterial road under the jurisdiction of the Niagara Region – known as Regional Road 14. Sidewalks are provided on both sides of the road. Through the study area, the posted speed limit is 50 km/h.

Shurie Street is a two-lane north-south local road under the jurisdiction of the Township of West Lincoln. Sidewalks are provided on the east side of the road. Through the study area, the posted speed limit is 50 km/h.

Alma Drive is a two-lane north-south local road under the jurisdiction of the Township of West Lincoln. Sidewalks are provided on the west side of the road. Through the study area, the assumed speed limit is 50 km/h.

St Catharines Street is a two-lane north-south arterial road under the jurisdiction of the Niagara Region – known as Regional Road 20. No sidewalk is provided south of Townline Road roundabout, and sidewalk is only provided on the west side of roadway north of Townline Road roundabout. Through the study area, the posted speed limit north of Townline Road and in the road segment between the roundabout intersection and approximately 200 metres south of that intersection are 50 km/hr. Further south of this location, the posted speed limit becomes 80 km/hr.

Industrial Park Road is a two-lane east-west collector road under the jurisdiction of the Township of West Lincoln. Sidewalks are not provided on the either side of the road. Through the study area, the posted speed limit is 50 km/h.

The existing roadway lane configurations and intersection control types are illustrated in **Figure 2.3.**

2.2.1 Transit Service

Within the study area, there is currently no regularly scheduled transit service provided. However, the Niagara Region Transit (NRT) offers OnDemand service which enable riders to travel to and from the municipalities within the Region. It is of note that internal OnDemand trips within the Township of West Lincoln are currently not available.

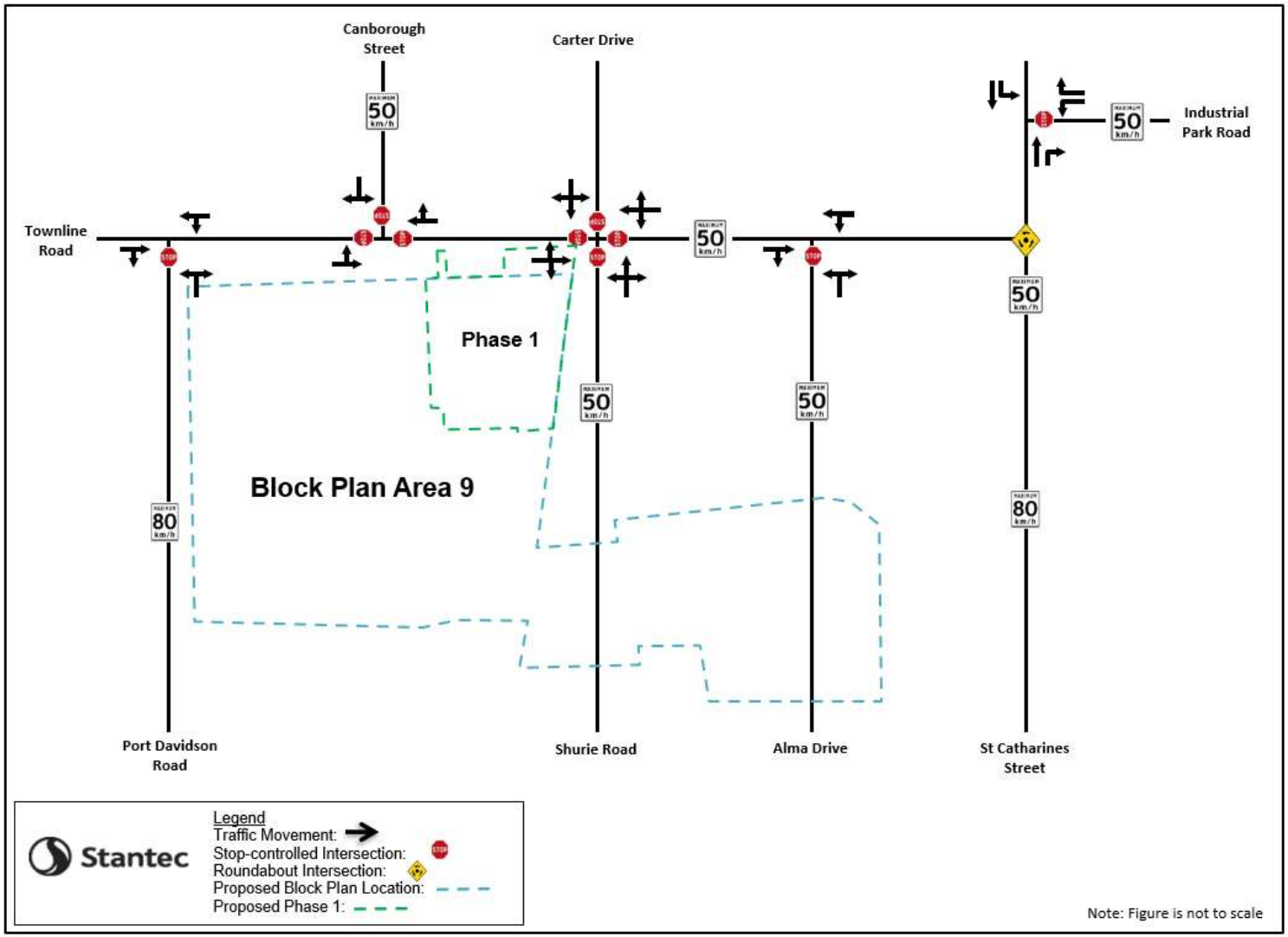


Figure 2.3: Existing Lane Configuration and Intersection Control

2.2.2 Cycling Routes

According to the *Smithville Transportation Master Plan*, existing on-street cycling facilities within the study area are as follows:

- Along St Catharines Street (Regional Road 20) on both sides of the road between Dufferin Street and Townline Road.
- Along Canborough Street (Regional Road 14) on both sides of the road between Smits Cove and Townline Road.

These existing bike lanes are illustrated in **Figure 2.4.**

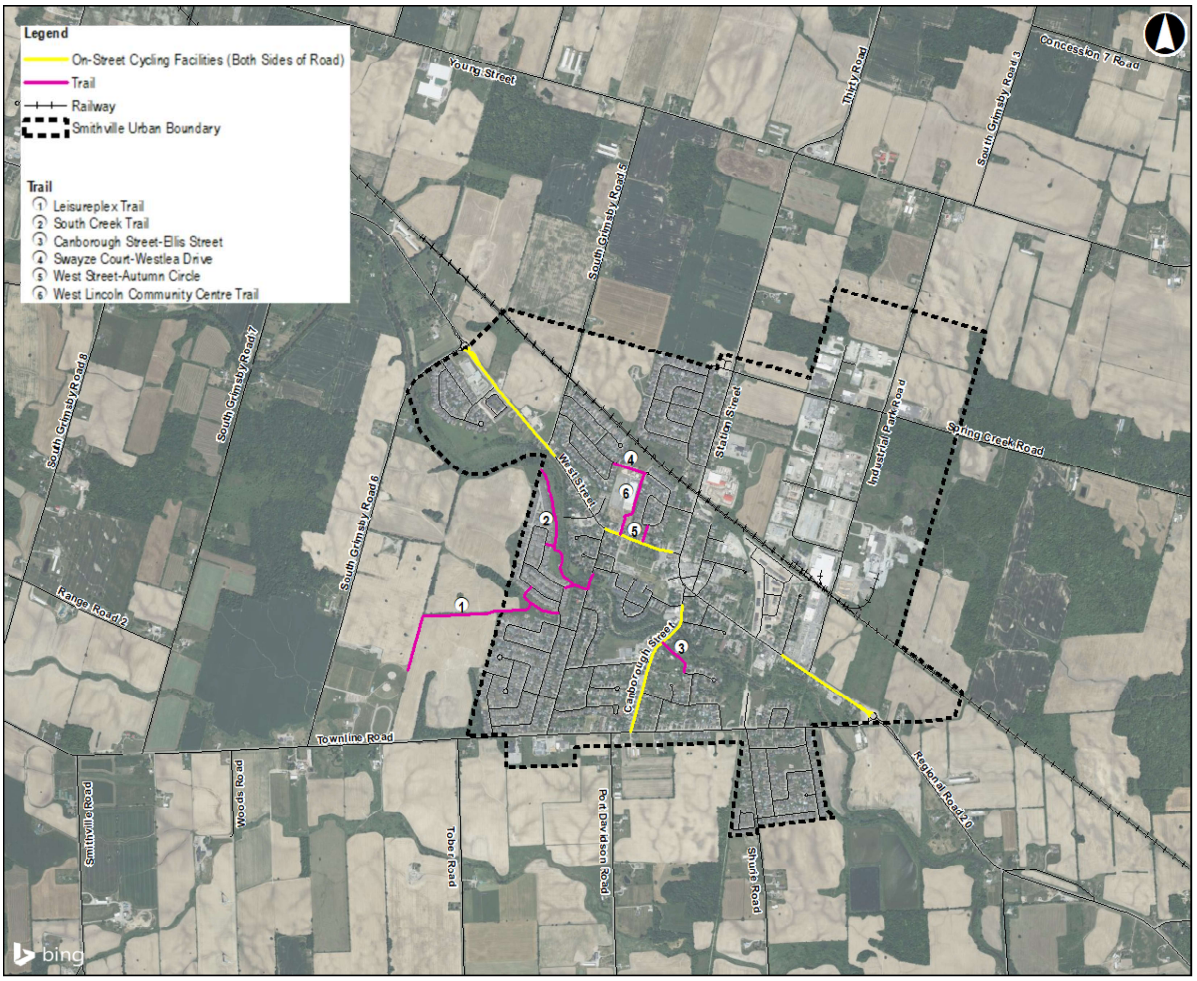


Figure 2.4: On-Street Cycling Facilities within the Study Area (Source: Smithville Transportation Master Plan, 2023)

3.0 BACKGROUND DEVELOPMENTS

The proposed developments of the East Smithville Secondary Plan Area – hereby known as Background Development #1 – and the Block Plan Area 9 outside of Phase 1 – hereby known as Background Development #2 – are included as part of the background traffic estimation in the future horizon.

During the Terms of Reference consultation process with the Township of West Lincoln and the Region of Niagara, the planned development in the East Smithville Secondary Plan Area was identified as a background development. The development is located south of the rail corridor – part of Canadian Pacific Kansas City Limited's Hamilton subdivision – and along St Catharines Street (Regional Road 20), between Industrial Park Road and Townline Road. Its land uses are illustrated in **Figure 3.1.** As per correspondence with Township Staff, provided in **Appendix B**, this development is planned to contain 725 residential units. No further development or traffic impact analysis information was available. Hence, assumption was made to distribute the planned units by residential density in the same proportion as the proposed Phase 1 development. The resulting distribution is illustrated in **Table 3.1**.

Table 3.1: Assumed Land Use Distribution for Planned East Smithville Secondary Plan Area Development

Land Use	# Units	% Total
Single Detached Dwellings	570	79%
Semi Detached Dwellings	44	6%
Townhouse Dwellings	111	15%
TOTAL	**725**	**100%**

In addition, for the purpose of traffic operations analysis, the Block Plan Area 9 development outside of Phase 1 was considered as a second background development. The assumed land use concept plan is shown in **Figure 1.1**.

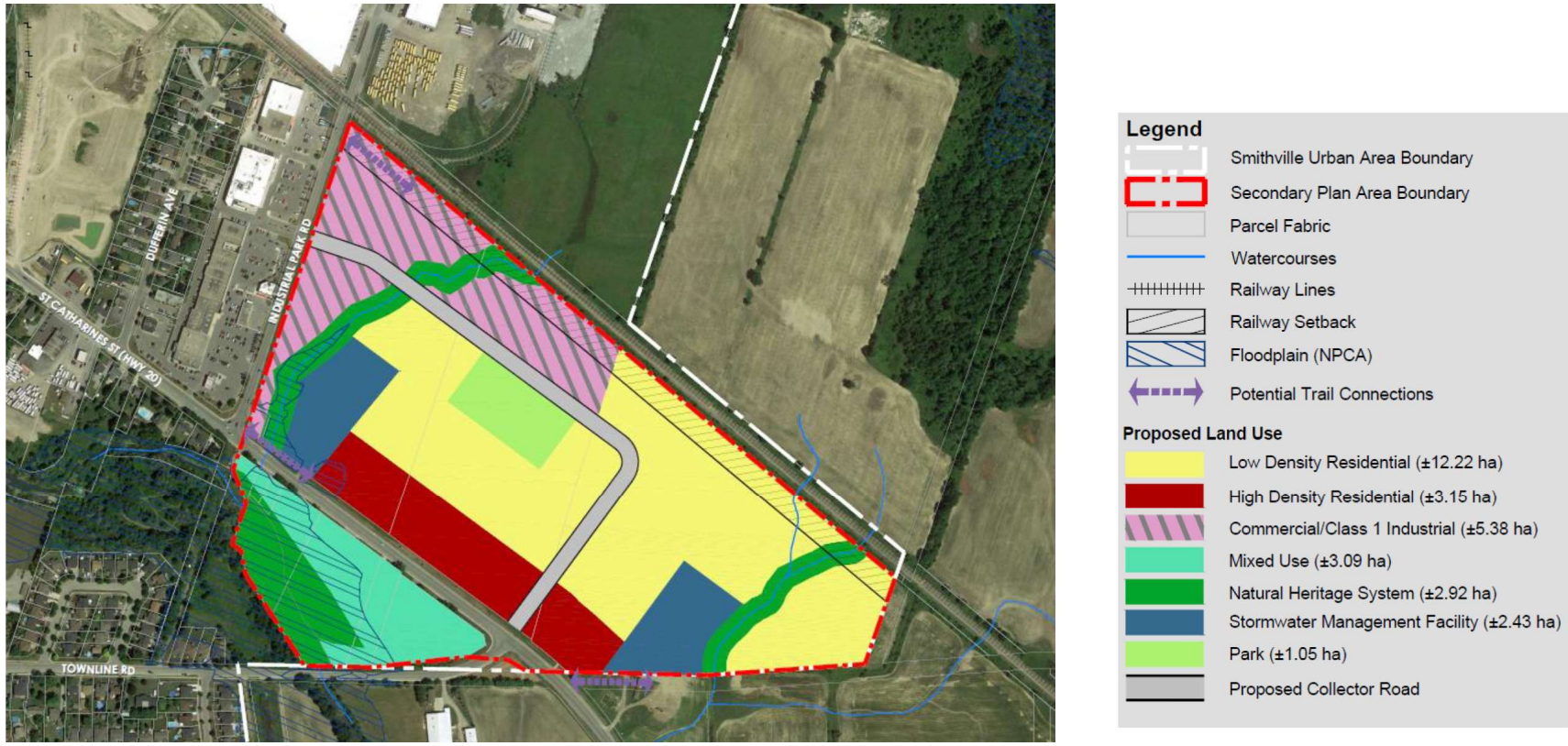


Figure 3.1: East Smithville Secondary Plan Area Land Use Option 1 (Source: East Smithville Secondary Plan Council Meeting, February 2021)

4.0 SITE TRIPS

4.1 TRIP GENERATION

Vehicular trip generation for the proposed land use in Block Plan Area 9, Phase 1 and without Phase 1, and East Smithville Secondary Plan Area were calculated using the Institute of Transportation Engineers' (ITE) *Trip Generation Manual, 11th Edition*. The vehicular trip generation calculation is based on ITE Land Use Code (LUC) 210 (Single Family Detached Housing) and 215 (Single Family Attached Housing). These two categories are used for the estimation of low density (single family detached dwellings) and medium density residential (semi-detached dwellings and townhouse dwellings) units, respectively. Both the Average Rate Method and the Fitted Curve Method were used to generate vehicle trips for each land use category. The method that generates the larger number of trips was applied.

The vehicular trip generation results for each of the aforementioned development are provided in **Table 4.1** and summarized as follows:

- Phase 1 Development: 33 inbound and 98 outbound trips are estimated in the AM peak hour, and 108 inbound and 65 outbound trips are estimated in the PM peak hour.
- East Smithville Secondary Plan development: 119 inbound and 355 outbound trips in the AM peak hour, and 391 inbound and 235 outbound trips in the PM peak hour.
- Block Plan Area 9 Development, without Phase 1: 129 inbound and 387 outbound trips in the AM peak hour, and 417 inbound and 254 outbound trips in the PM peak hour.

Table 4.1: Vehicular Trip Generation Results by Development

Land Use Code	Variable	Units	Trip Generation Rates	Total Trip Generation	IN		OUT	
					%	#	%	#
Phase 1 Development - Block Plan Area 9								
AM Peak Hour								
210	Dwelling Units	154	Ln(T) = 0.91 Ln(X) + 0.12	110	25%	28	75%	83
215	Dwelling Units	42	0.48 Trips Per Unit	20	25%	5	75%	15
			Total	**130**		**33**		**98**
PM Peak Hour								
210	Dwelling Units	154	Ln(T) = 0.94 Ln(X) + 0.27	149	63%	94	37%	55
215	Dwelling Units	42	0.57 Trips Per Unit	24	59%	14	41%	10
			Total	**173**		**108**		**65**
Background Development 1 - East Smithville Secondary Plan								
AM Peak Hour								
210	Dwelling Units	570	0.7 Trips Per Unit	399	25%	100	75%	299
215	Dwelling Units	155	T = 0.52(X) - 5.70	75	25%	19	75%	56
			Total	**474**		**119**		**355**
PM Peak Hour								
210	Dwelling Units	570	0.94 Trips Per Unit	536	63%	338	37%	198
215	Dwelling Units	155	T = 0.60(X) - 3.93	90	59%	53	41%	37
			Total	**625**		**391**		**235**
Background Development 2 - Block Plan Area 9, without Phase 1								
AM Peak Hour								
210	Dwelling Units	547	0.7 Trips Per Unit	383	25%	96	75%	287
215	Dwelling Units	268	T = 0.52(X) - 5.70	134	25%	33	75%	100
			Total	**517**		**129**		**387**
PM Peak Hour								
210	Dwelling Units	547	0.94 Trips Per Unit	514	63%	324	37%	190
215	Dwelling Units	268	T = 0.60(X) - 3.93	157	59%	93	41%	64
			Total	**671**		**417**		**254**

4.2 TRIP DISTRIBUTION AND ASSIGNMENT

The trips generated by the proposed developments were distributed based on the information extracted from the Township of West Lincoln's *Smithville Transportation Master Plan (TMP) Appendices*, including:

- Appendix A, Table 30: Contains the estimated number of trips under the 2051 Projected Background Traffic AM peak scenario, split into four categories:
    - Internal-to-internal (I-I) trips: 880 trips;
    - Internal-to-external (I-X) trips: 1,995 trips;
    - External-to-internal (X-I) trips: 1,340 trips; and,
    - External-to-external (X-X) trips: 1,578 trips.

  This implies that I-I trips (880 trips) represent 31% of total trips originated in Smithville (2,875 trips), and represent 40% of total trips destined in Smithville (2,220 trips).
- Appendix A, Table 26: Contains observed volumes at corridor limits of the Smithville model area, as shown in **Table 4.2**. The distribution of observed volumes is then calculated – field "Assumed Distribution" – and used to distribute external trips to the various external gateways that enter and exit the urban boundaries of Smithville.

Note that the *Smithville TMP* does not provide PM peak hour model results.

Based on this information, the following assumptions were applied to trips generated from the proposed Block Plan Development, Phase 1 and without Phase 1, and the East Smithville Secondary Plan Area Development:

- In the AM peak hour, 31% of trips generated by each development were assigned as internal trips to/from locations in Smithville (I-I), and 69% were assigned as external trips to/from locations outside of Smithville (I-X and X-I). This assumes that the proportion of I-X trips in the *Smithville TMP*'s 2051 Projected Background Traffic AM peak scenario represent both inbound (I-X) and outbound (X-I) external trips in the future horizon AM peak hour.
- In the PM peak hour, 40% of trips generated by each development were assigned as internal trips to/from locations in Smithville (I-I), and 60% were assigned as external trips to/from locations outside of Smithville (I-X and X-I). This assumes that the proportion of X-I trips in the *Smithville TMP*'s 2051 Projected Background Traffic AM peak scenario represent both inbound (I-X) and outbound (X-I) external trips in the future horizon PM peak hour.

- Internal trips are distributed as follows, based on existing relative development density in Smithville:
    - To/from Town Centre via Canborough Street: 45%
    - To/from Village Square and Industrial Park via Townline Road and St Catharines Street (Regional Road 20): 45%
    - To/from Townline Road West: 10%
- External trips are distributed to external gateways as illustrated in **Table 4.2**.

Table 4.2: Trip Distribution of External Trips by External Gate (Source: Smithville Transportation Master Plan, 2023)

Roadway	External Gate	Observed Volume (Weekday AM Peak Hour)	Assumed Distribution
Regional Rd 14 / Canborough Street	North Gate (North)	260	17%
Smithville Rd / Townline Rd	West Gate (West)	215	14%
Regional Rd 20	West Gate (Northwest)	458	29%
Regional Rd 20	East Gate (East)	517	33%
Port Davidson Rd	South Leg (South)	119*	8%*

*Note: South gate data is not available in the *Smithville TMP*. The observed volume and percentage were estimated by comparing the existing traffic count data at the south legs of Regional Rd 20/Townline Rd and the Port Davidson Rd/Townline Rd intersections, and applying the compared ratio (23%) to the observed trip value at the East Gate.

Based on the assumptions outlined above, the trip distribution of development trips are summarized in the **Table 4.3** below.

Table 4.3: Trip Distribution Summary for Block Plan Area 9 and Phase 1 Developments

Type	Distribution		Origin/Destination	Assumed Distribution
	AM Peak	PM Peak		
Internal-to-Internal	31%	40%	to/from Town Centre via Canborough St	45%
			to/from Village Square and Industrial Park via Townline Road and St Catharines St (RR20)	45%
			to/from Townline Road West	10%
Internal-to External (Out), External-to-Internal (In)	69%	60%	to/from North via Canborough St (North)	17%
			to/from North via Townline Road and St Catharines St (RR20) (North)	
			to/from Northwest via Canborough St to RR20 (Northwest)	29%
			to/from Northwest via Townline Road and St Catharines St (RR20) (Northwest)	
			to/from West via Townline Road West (West)	14%
			to/from East via Townline Road East to RR20 (East)	33%
			to/from South via Port Davidson Rd	8%

Table 4.4: Trip Distribution for East Smithville Secondary Plan Developments

Type	Distribution		Destination	Distribution
	AM Peak	PM Peak		
Internal-to-Internal	31%	40%	to/from Town Centre via RR20	45%
			to/from Village Square and Industrial Park via Townline Road and St Catharines St (RR20)	45%
			to/from Townline Road West	10%
Internal-to External (Outbound), External-to-Internal (In)	69%	60%	to/from North via Townline Road and St Catharines St (RR20) (North)	17%
			to/from Northwest via Canborough St to RR20 (Northwest)	29%
			to/from West via Townline Road West (West)	14%
			to/from East via RR20 (East)	33%
			to/from South via Townline Road West to Port Davidson Rd (South)	8%

The distributed trips are then further assigned to the study road network based on the following assumptions:

- Phase 1 Development:
  - Equal distribution between Street A and Street B for trips accessing Townline Road.
  - Equal distribution between Street C and Street F for trips accessing Port Davidson Road.
- East Smithville Secondary Plan Area Development (Background Development #1):
  - All trips to/from Village Square or Industrial Park will access via Industrial Park Road.
  - All trips to/from west part of the town, west gate, south gate, or east gate will access via the Townline Road/Regional Road 20 roundabout.
  - 70% of trips to/from Town Centre, north gate, or northwest gate will access via the Townline Road/Regional Road 20 roundabout, and the remaining 30% will access via Industrial Park Road.

- Block Plan Area 9 Development outside of Phase 1 (Background Development #2):
    - Equal distribution between Street A, Street B and Surie Road for trips accessing Townline Road.
    - Equal distribution between Street C, Street F and Unnamed Road South for trips accessing Port Davidson Road.

Figure 4.1, **Figure 4.2, Figure 4.3** and **Figure 4.4** show the AM and PM peak hour trip assignment percentage and assigned trips for Phase 1 Development, respectively.

Figure 4.5, **Figure 4.6**, **Figure 4.7** and **Figure 4.8** show the AM and PM peak hour trip assignment percentage and assigned trips for East Smithville Secondary Plan, respectively.

Figure 4.9, **Figure 4.10**, **Figure 4.11** and **Figure 4.12** show the AM and PM peak hour trip assignment percentage and assigned trips for Block Plan Area 9, without Phase 1, respectively.

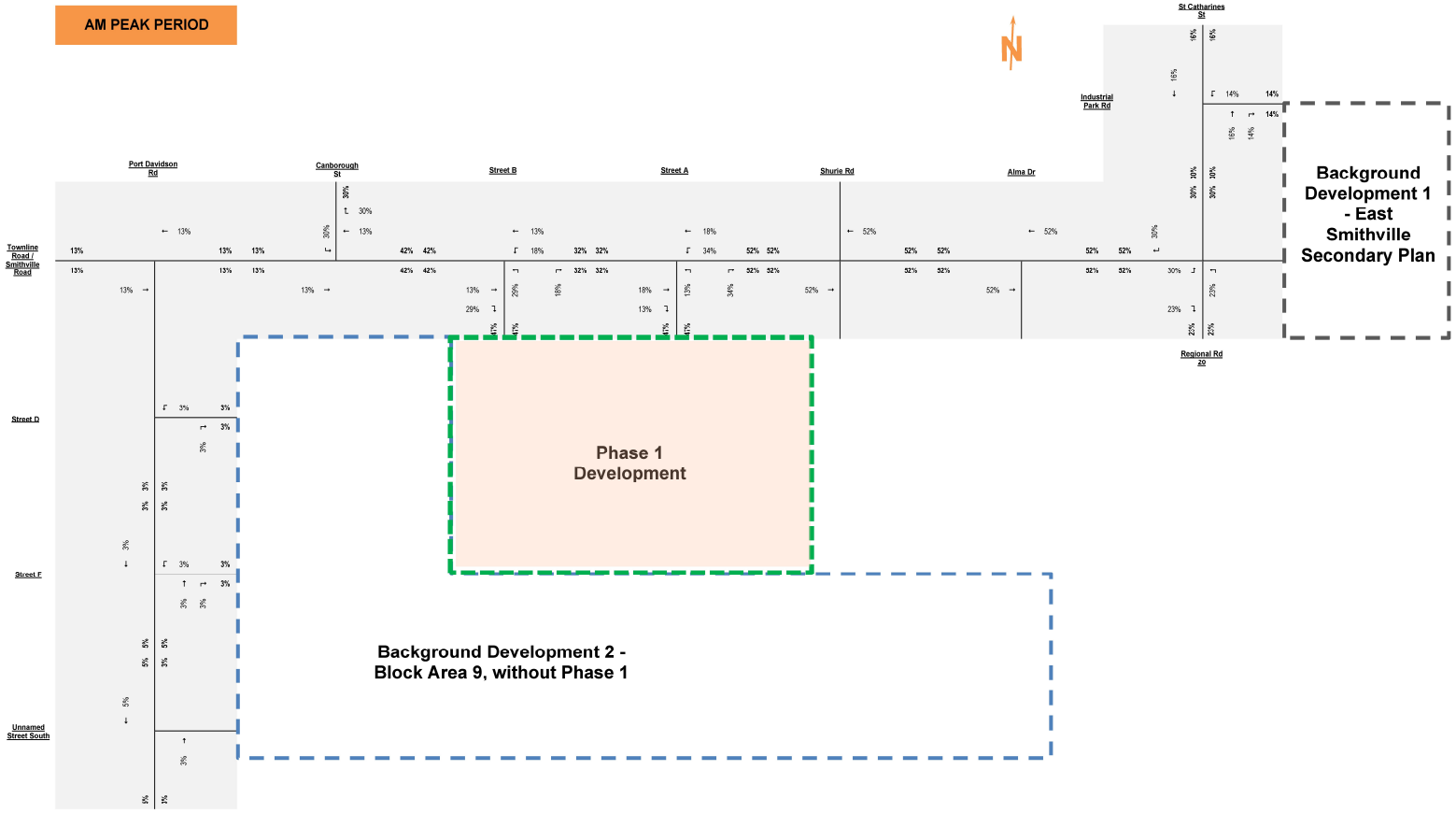


Figure 4.1: Phase 1 Development Trip Assignment Percentage - AM Peak Hour

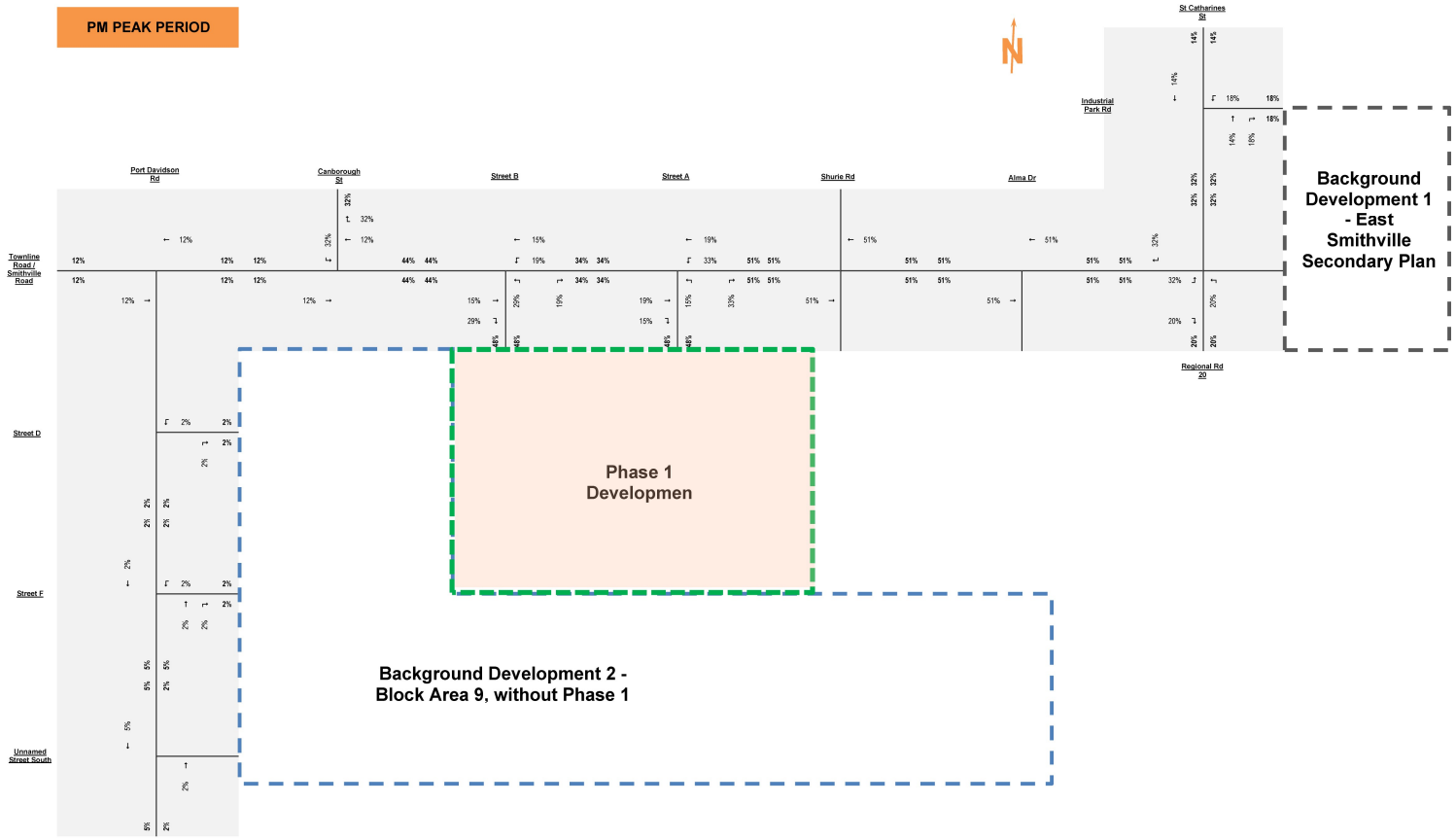


Figure 4.2: Phase 1 Development Trip Assignment Percentage - PM Peak Hour

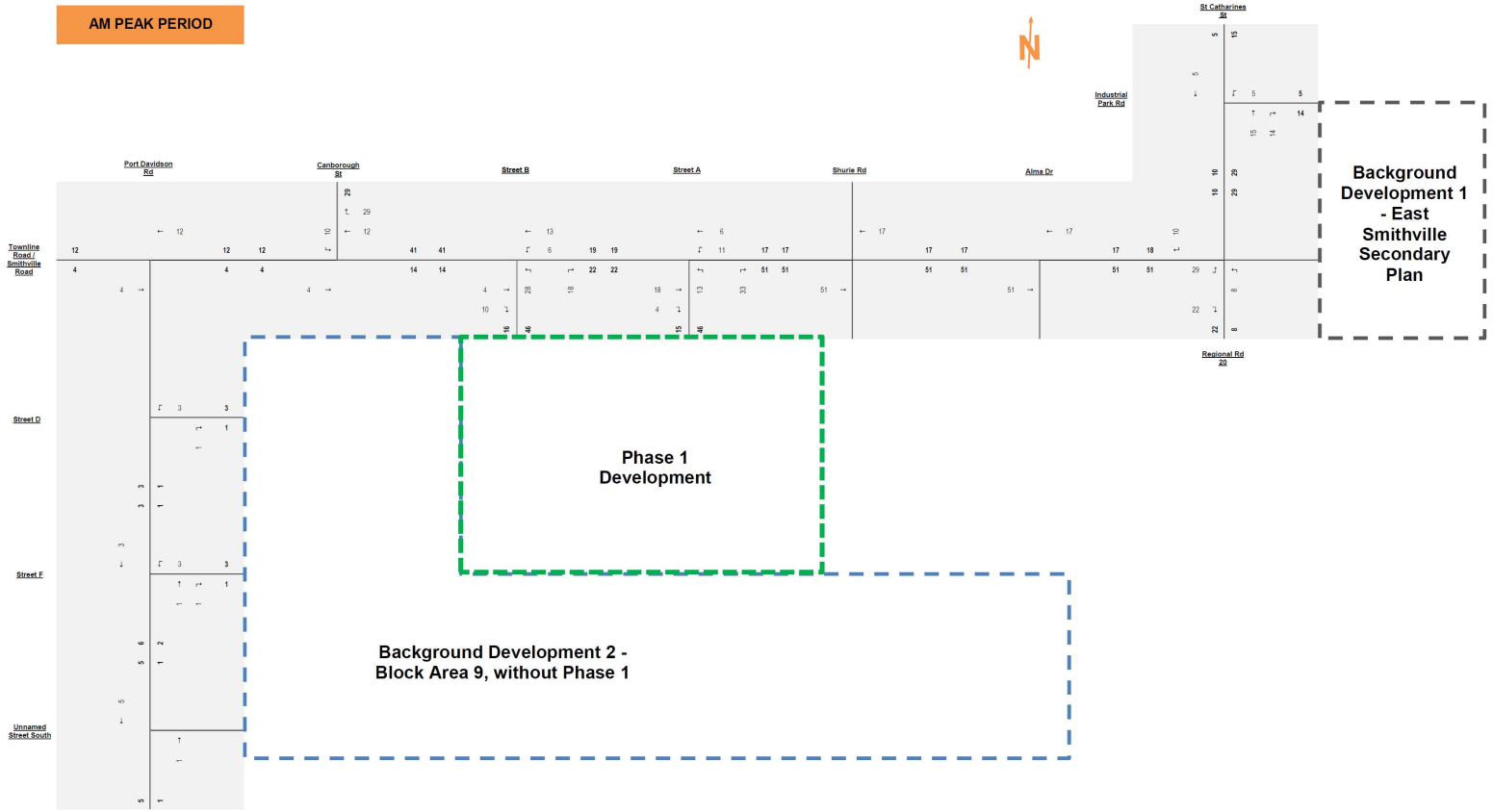


Figure 4.3: Phase 1 Development Site-generated Volume - AM Peak Hour

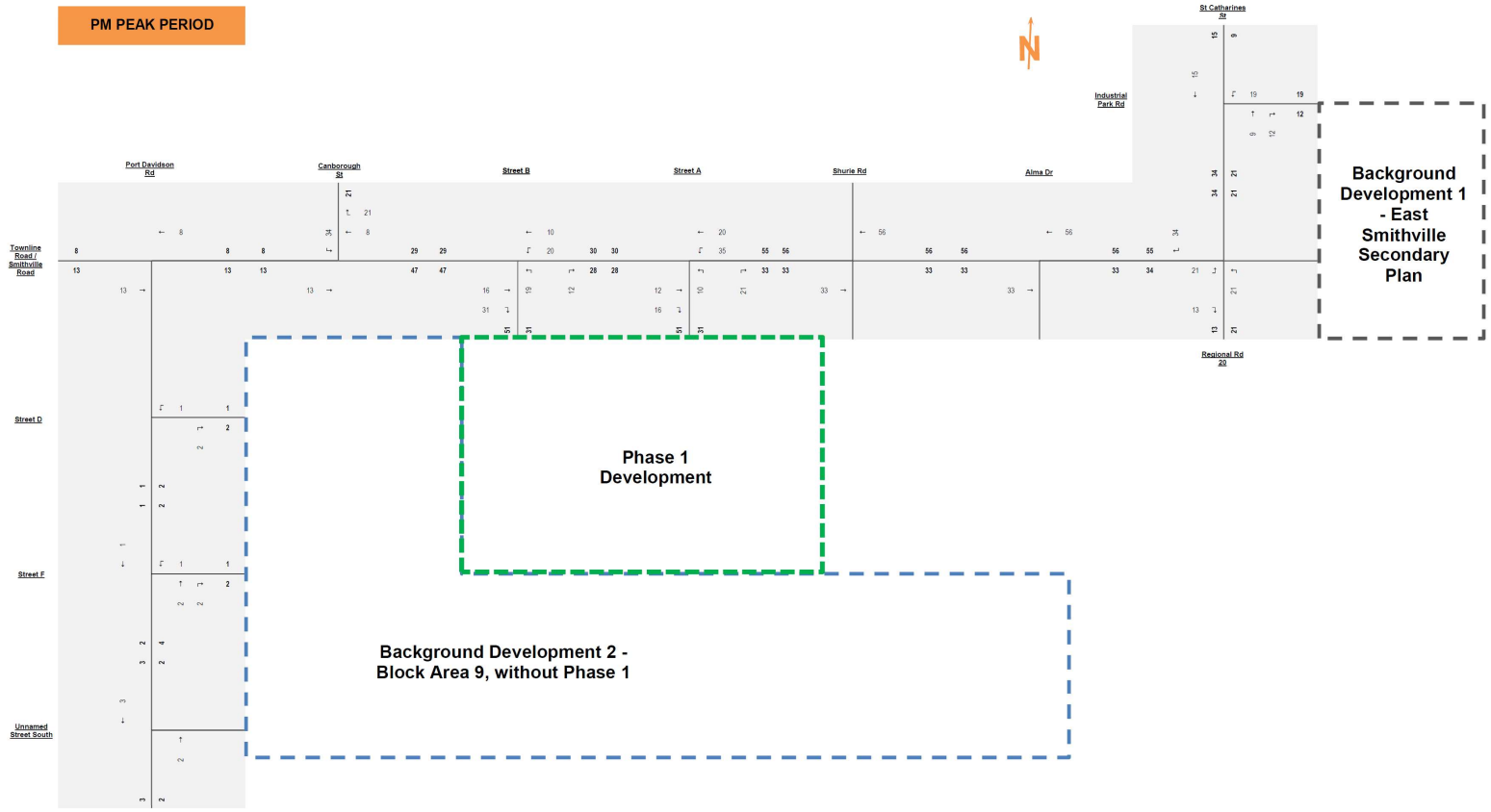


Figure 4.4: Phase 1 Development Site-generated Volume - PM Peak Hour

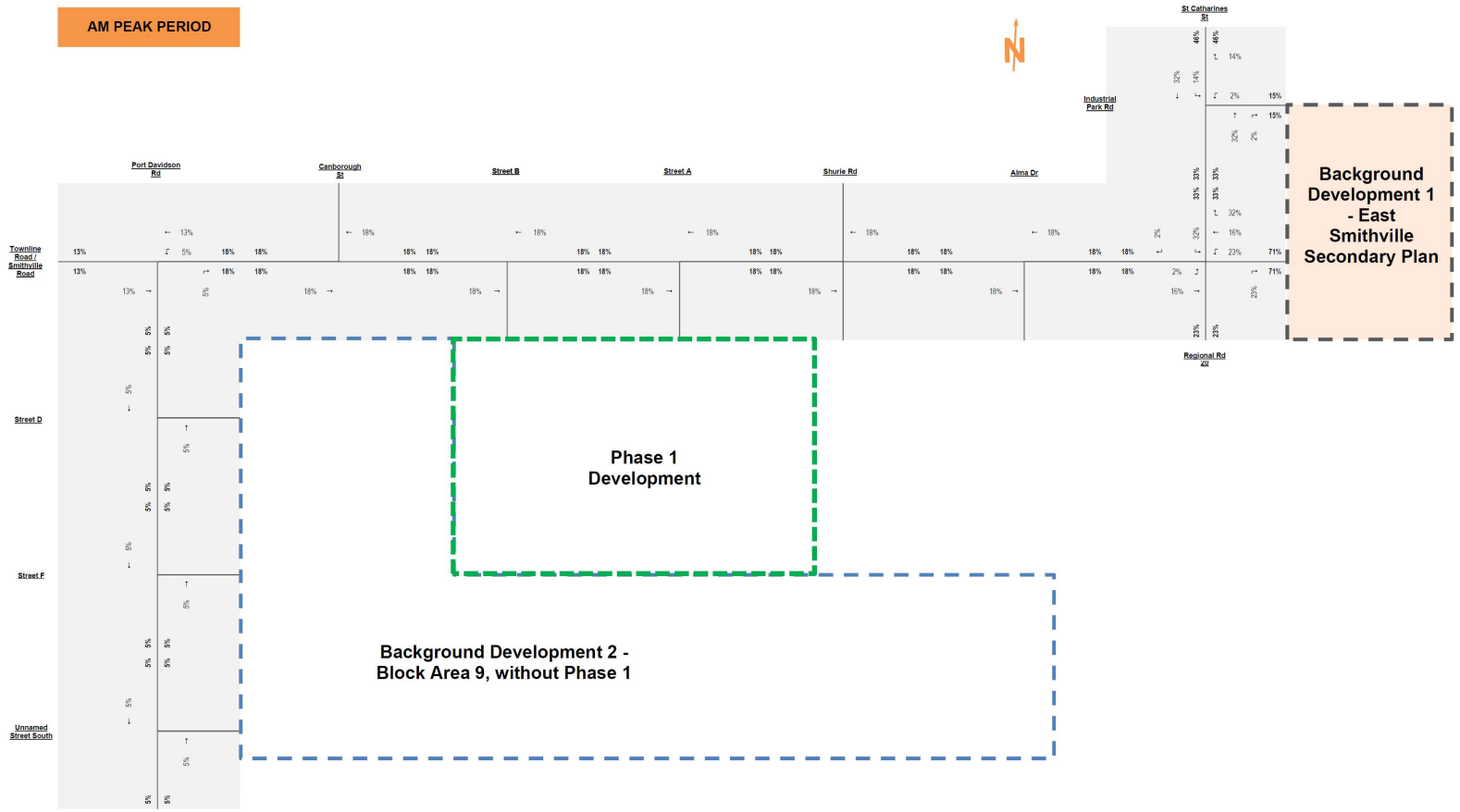


Figure 4.5: East Smithville Secondary Plan Trip Assignment Percentage - AM Peak Hour

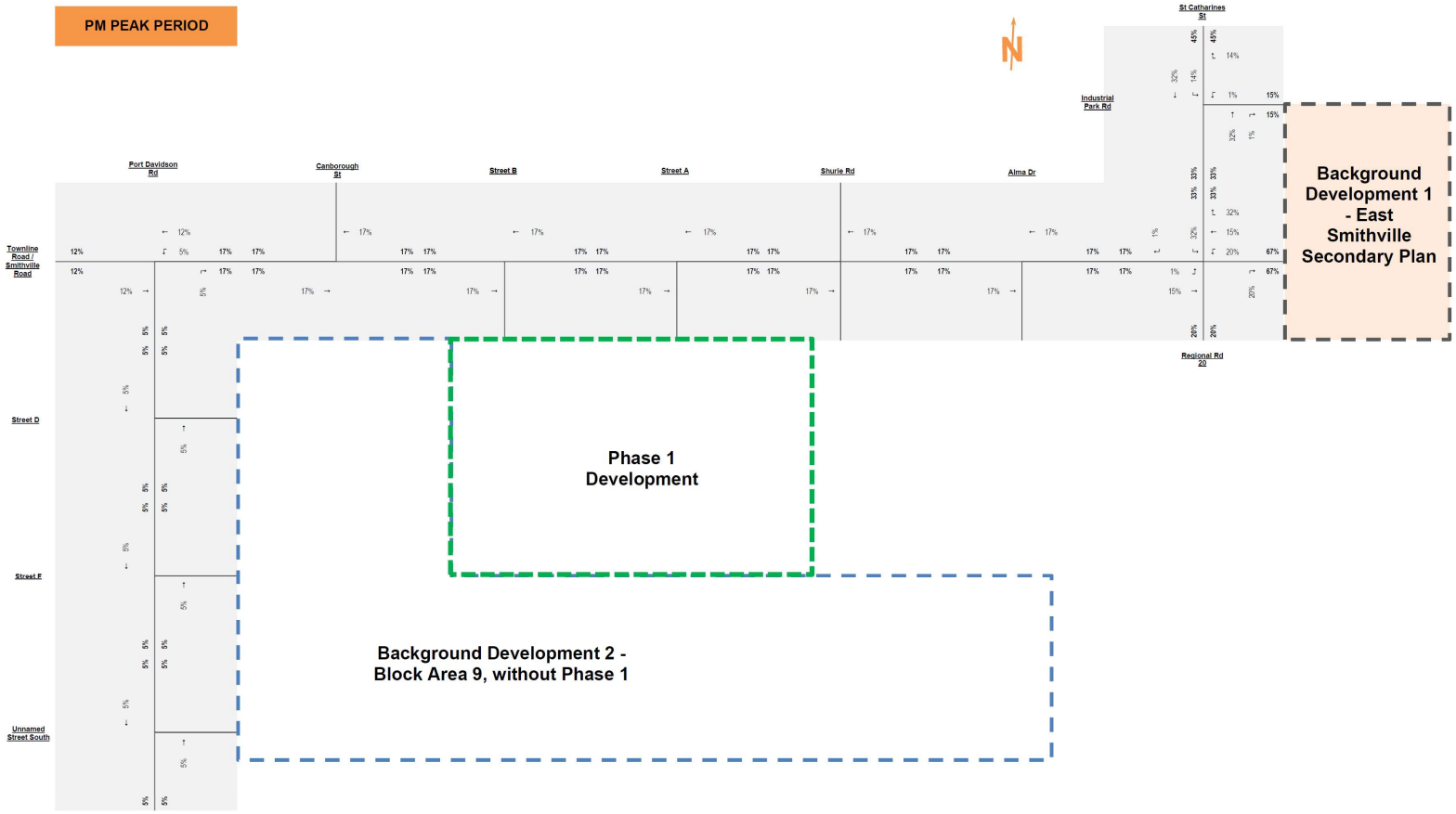


Figure 4.6: East Smithville Secondary Plan Trip Assignment Percentage - PM Peak Hour

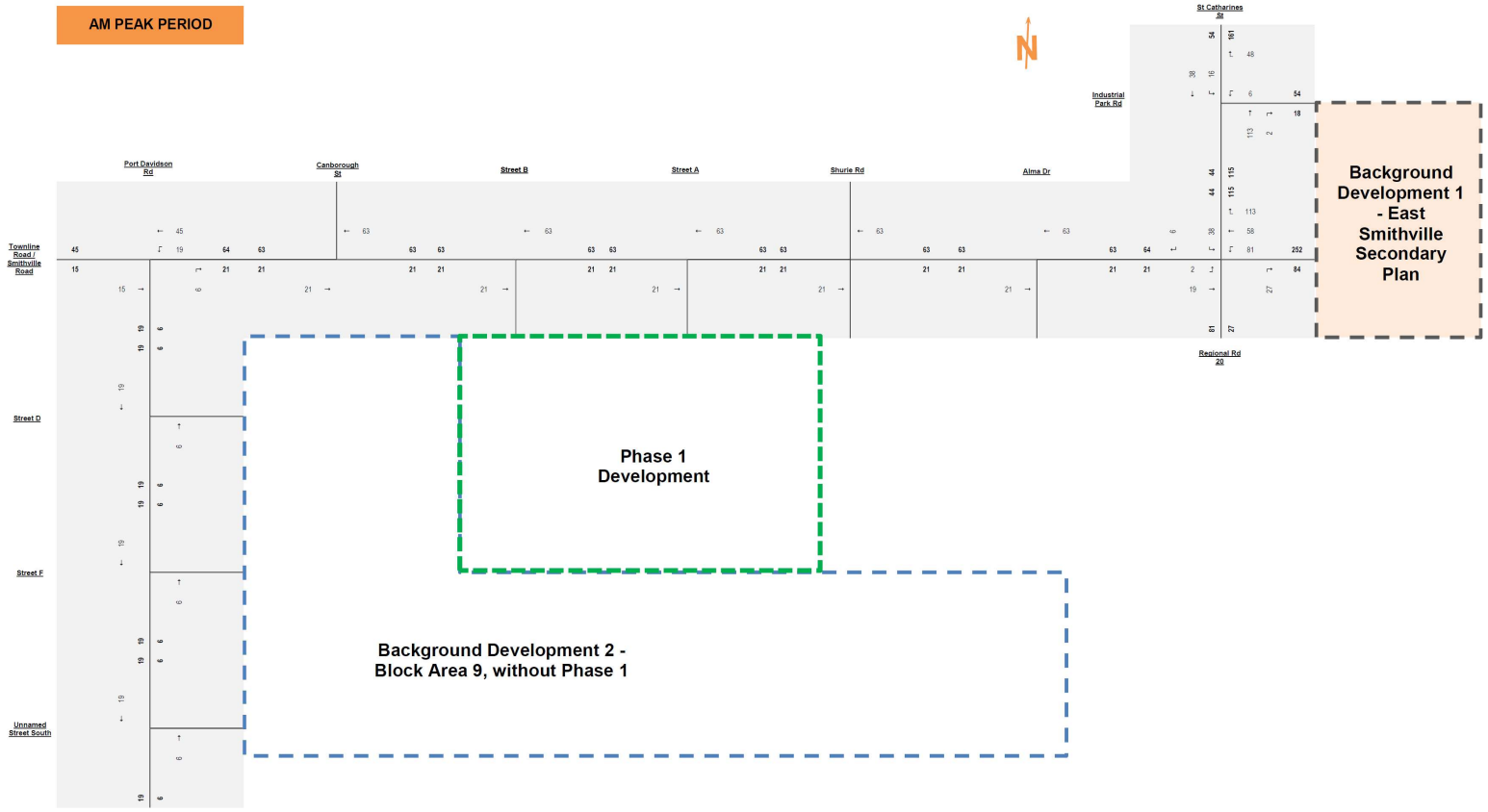


Figure 4.7: East Smithville Secondary Plan Site-generated Volume - AM Peak Hour

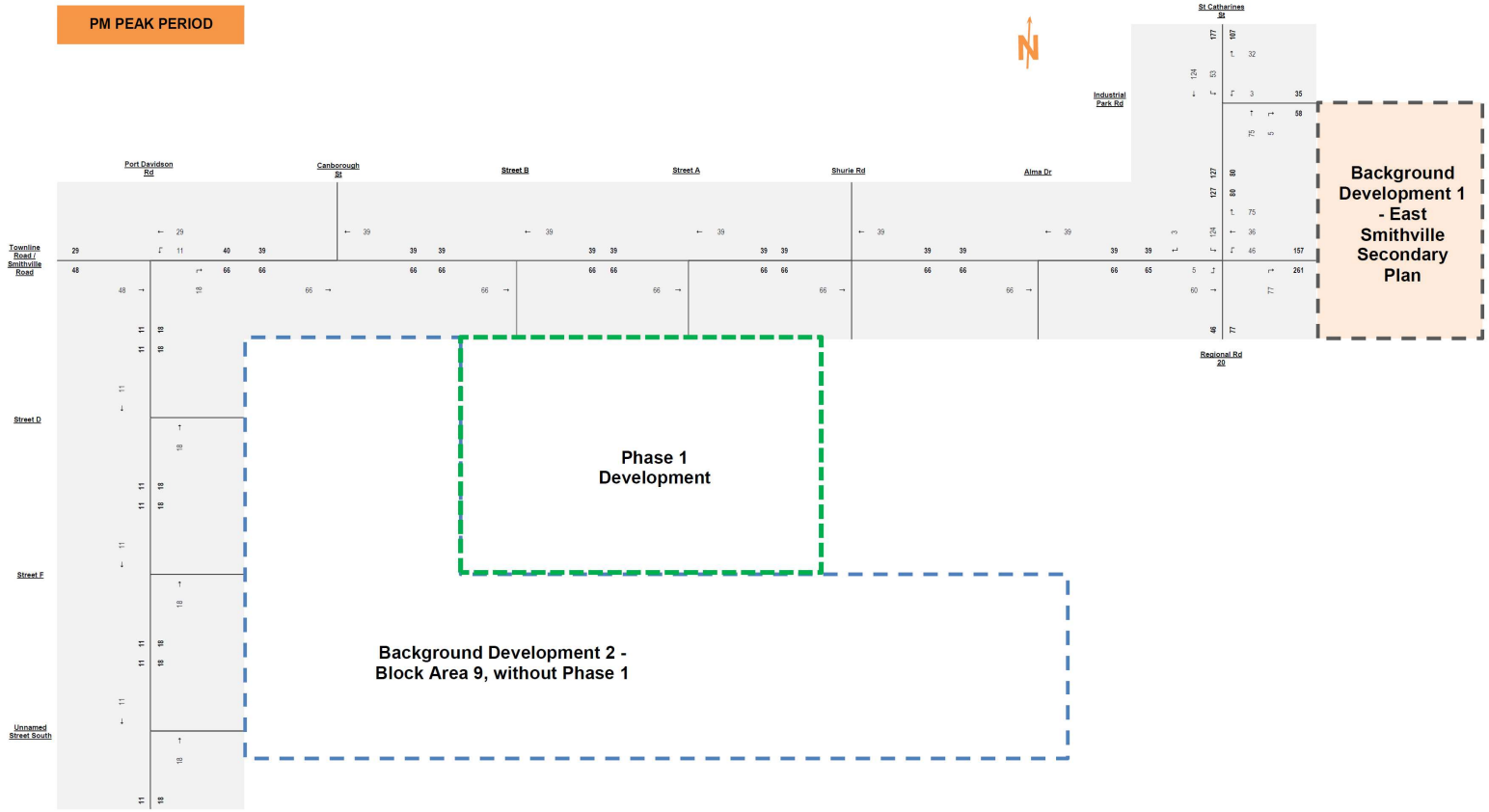


Figure 4.8: East Smithville Secondary Plan Site-generated Volume - PM Peak Hour

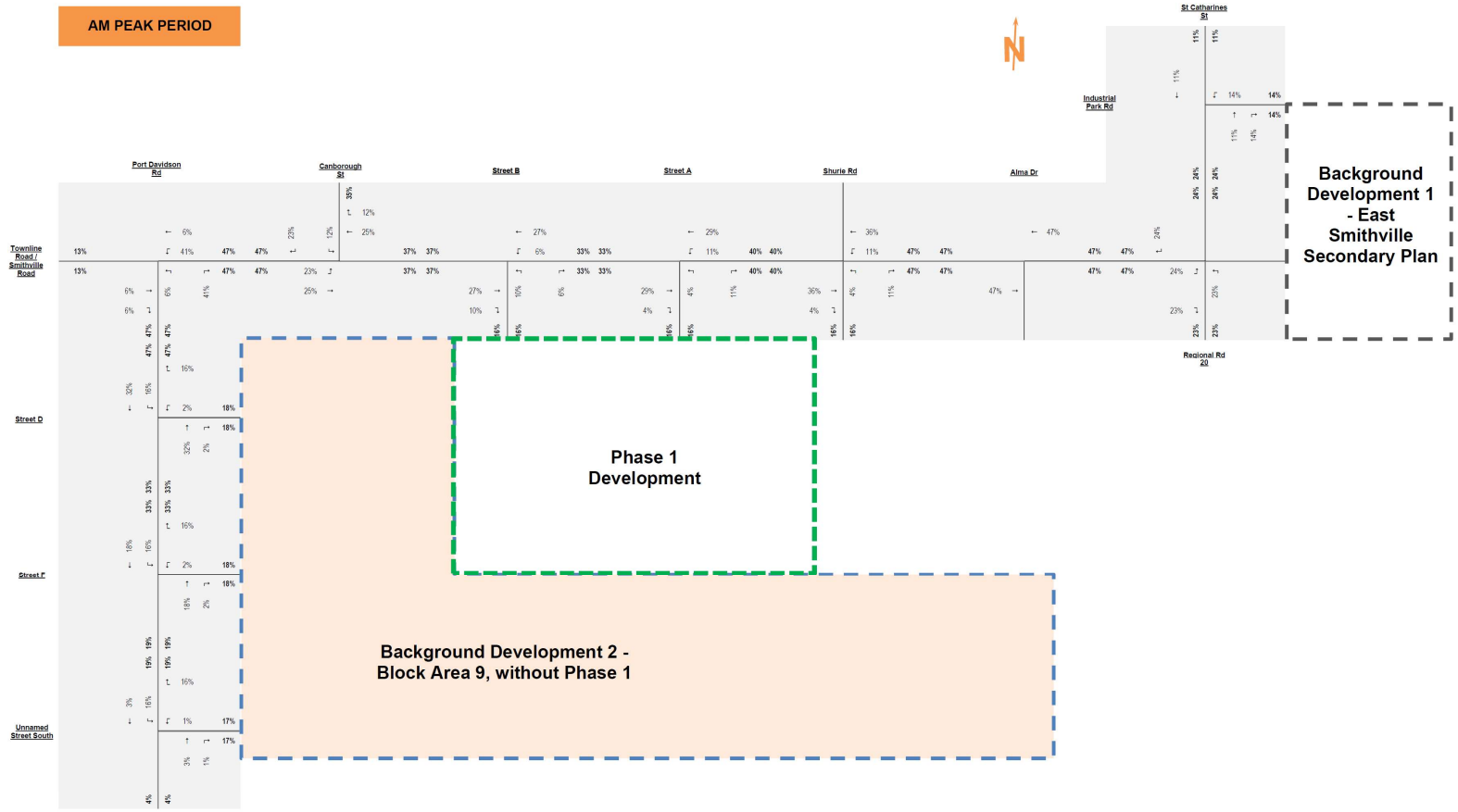


Figure 4.9: Block Plan Area 9, without Phase 1 Trip Assignment Percentage - AM Peak Hour

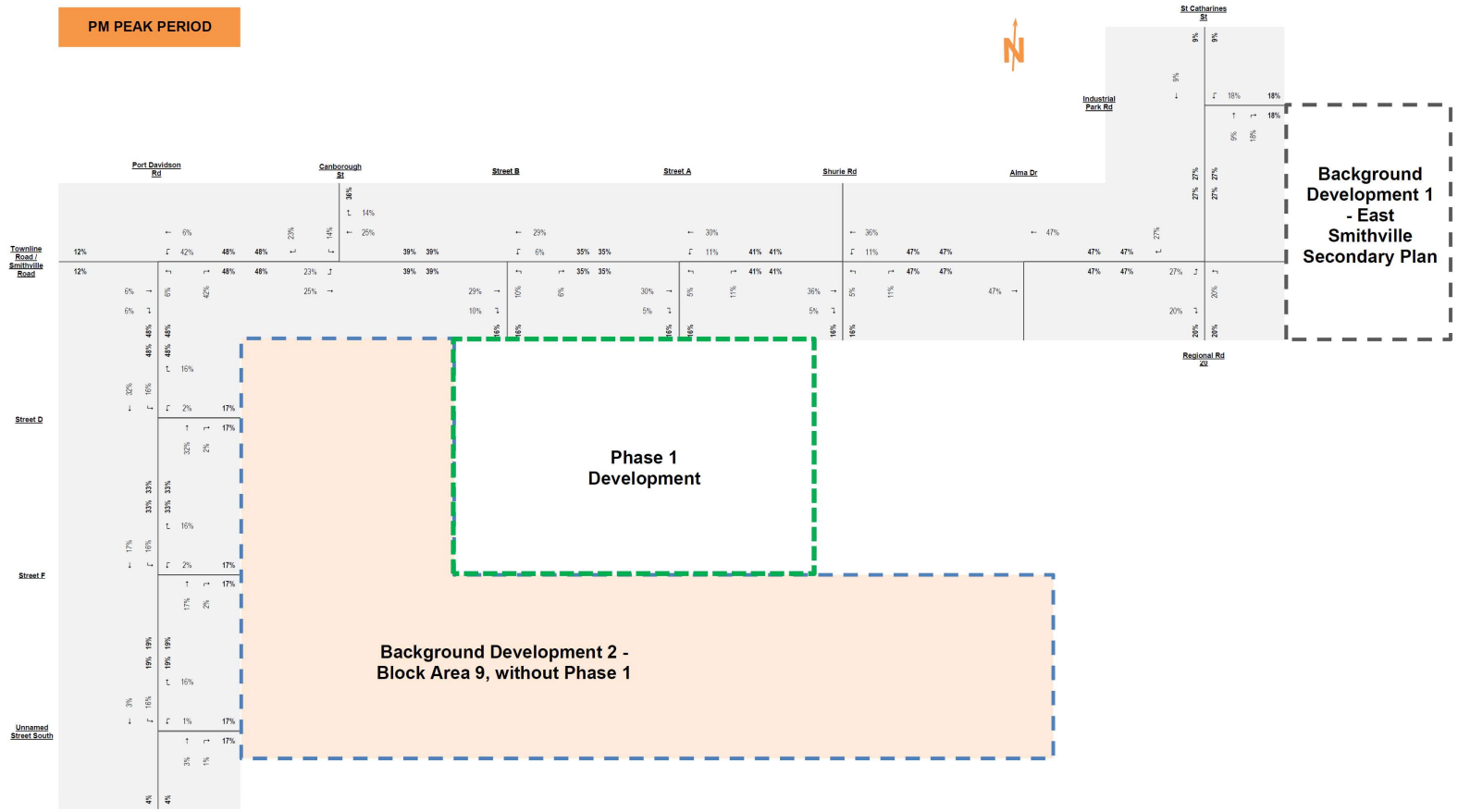


Figure 4.10: Block Plan Area 9, without Phase 1 Trip Assignment Percentage - PM Peak Hour

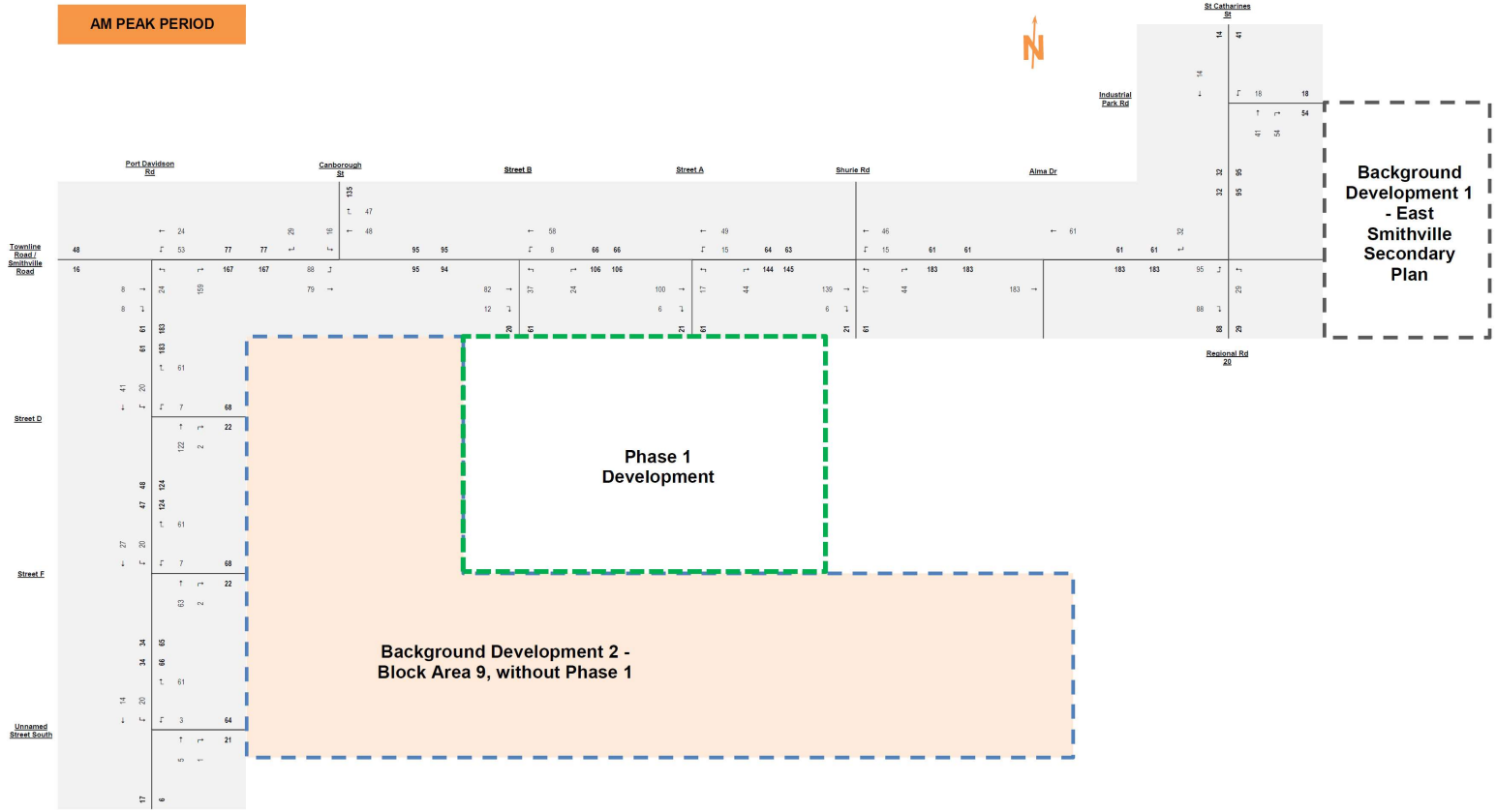


Figure 4.11: Block Plan Area 9, without Phase 1 Site-generated Volume - AM Peak Hour

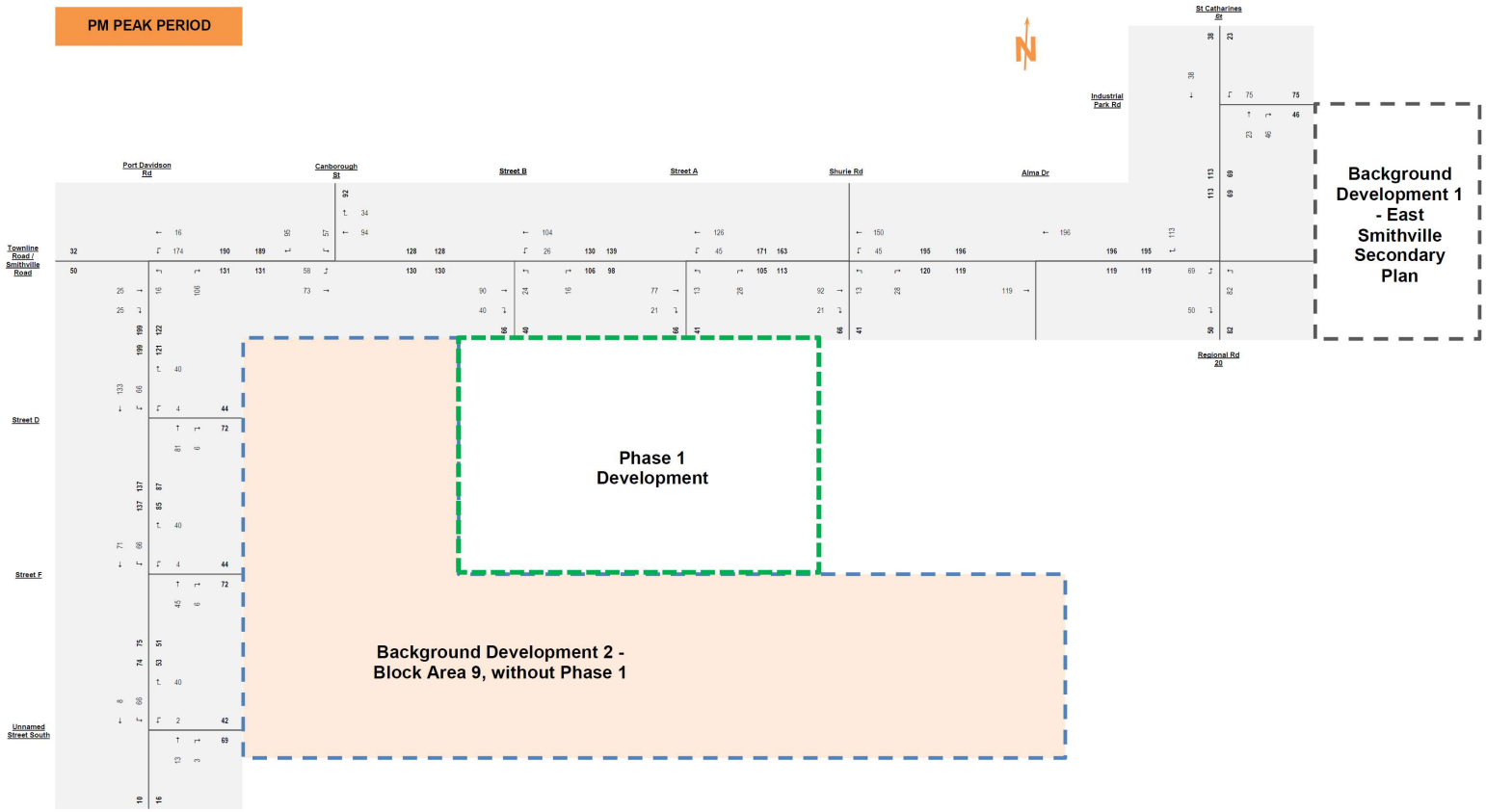


Figure 4.12: Block Plan Area 9, without Phase 1 Site-generated Volume - PM Peak Hour

5.0 TRAFFIC OPERATIONS ANALYSIS

5.1 METHODOLOGY

The traffic operations analyses for the study area intersections were conducted based on Niagara Region's *Transportation Impact Assessment (TIA) Guidelines (2023)*. As outlined in **Section 1.4**, the following scenarios were evaluated in this study:

- Existing conditions in 2024;
- Future background traffic without Phase 1 development in 2030;
- Future total traffic with Phase 1 development in 2030.

For all selected scenarios, traffic volumes during the weekday AM and PM peak hours were utilized for the analyses.

The operations of the study area intersections were evaluated in terms of level of service (LOS) and volume to capacity (v/c) as defined by the Highway Capacity Manual (HCM). The 95th percentile queue lengths at intersection movements were also evaluated as compared to the available turning lane storage capacity.

LOS was evaluated based on the average control delay per vehicle and includes deceleration delay, queue move-up time, stopped delay, and final acceleration delay. Capacity was evaluated in terms of ratio of demand flow to capacity with an at-capacity condition represented by a v/c ratio of 1.00 (i.e. volume demand equals capacity). The LOS criteria for unsignalized intersections are defined in **Table 5.1.**

Table 5.1: Level of Service Criteria, Unsignalized Intersections

LOS	Delay (seconds/veh)
A	≤10s
B	>10s and ≤15s
C	>15s and ≤25s
D	>25s and ≤35s
E	>35s and ≤50s
F	>50s

To assess the traffic conditions for study scenarios, LOS analyses were undertaken for the study area stop-controlled intersections using Trafficware's Synchro 11 platform and HCM 2000 methodology, and for the study area roundabout intersection using TRL Software's ARCADY 9 module and HCM 2010 methodology. The key parameters used in the analysis include:

- Existing lane configurations;
- Heavy vehicle (HV) percentages as derived from collected traffic count data;
- Peak hour factor (PHF) of 0.92 for all movements; and,
- Synchro and ARCADY default values for all other inputs.

Critical movements were identified if one or more of the following criteria is satisfied:

- Level of service (LOS) of "D" or worse at unsignalized intersections (based on the Niagara Region's *TIA Guidelines, 2023)*;
- 95th percentile queue length exceeds the storage lane capacity (based on the Niagara Region's *TIA Guidelines, 2023)*; or,
- Vehicle queuing negatively affects upstream or downstream intersections.

5.2 EXISTING CONDITIONS SCENARIO (2024)

As outlined in **Section 1.3**, the traffic count data at the five intersections were collected on June 13th, 2024, with the exception of Townline Road and St Catharines Street which was collected on June 15th 2023. A minor adjustment was made to the northbound traffic volumes at the Townline Road and Industrial Park Road intersection to balance its traffic volume with the upstream intersection at the Townline Road and St Catharines Street (Regional Road 20) intersection. There is no other significant traffic volume imbalances found in the network.

The full traffic count dataset is provided in **Appendix A**.

5.2.1 Traffic Volume

The traffic volume distribution for the weekday AM and PM peak hours in the existing conditions is illustrated in **Figure 5.1** and **Figure 5.2**.

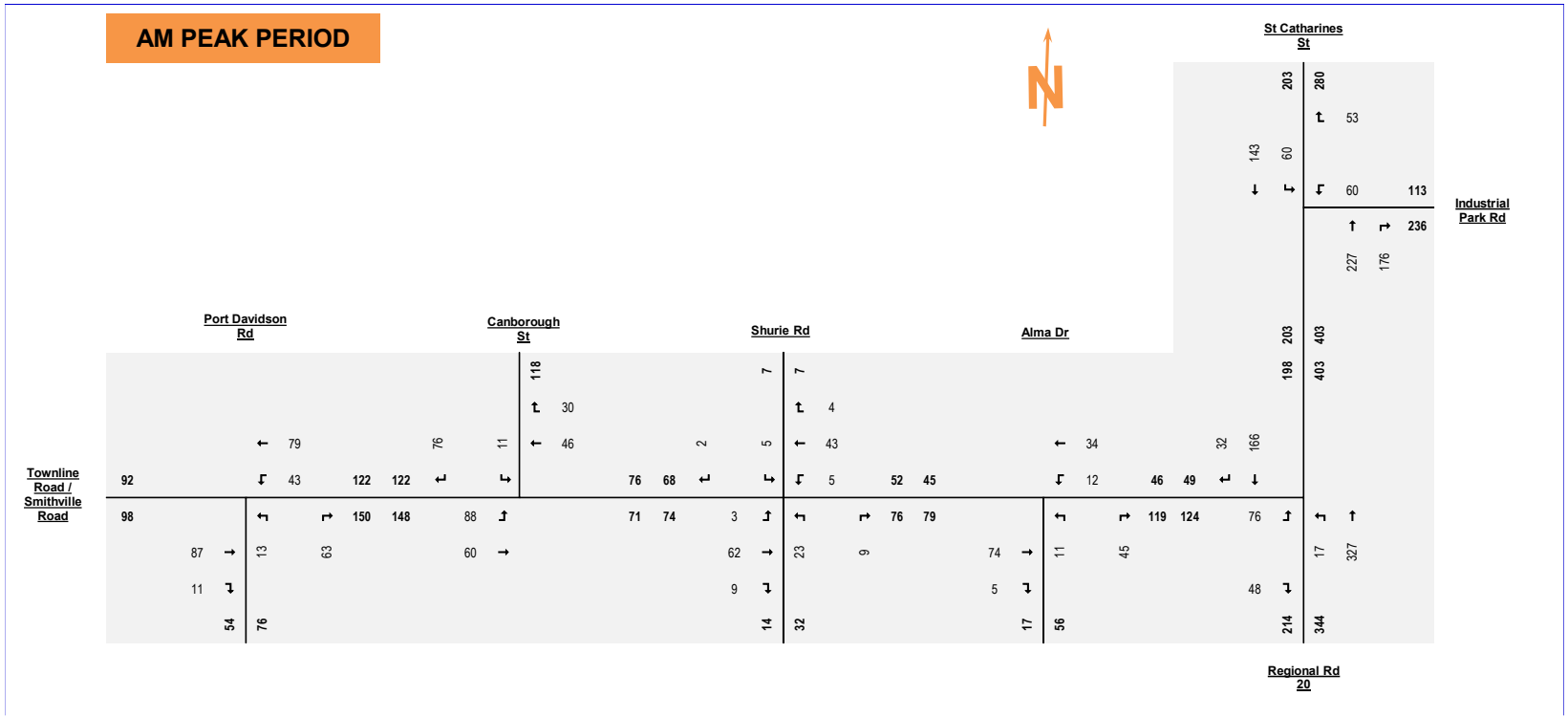


Figure 5.1: Existing Conditions Scenario (2024) – Weekday AM Peak Hour Traffic Volumes

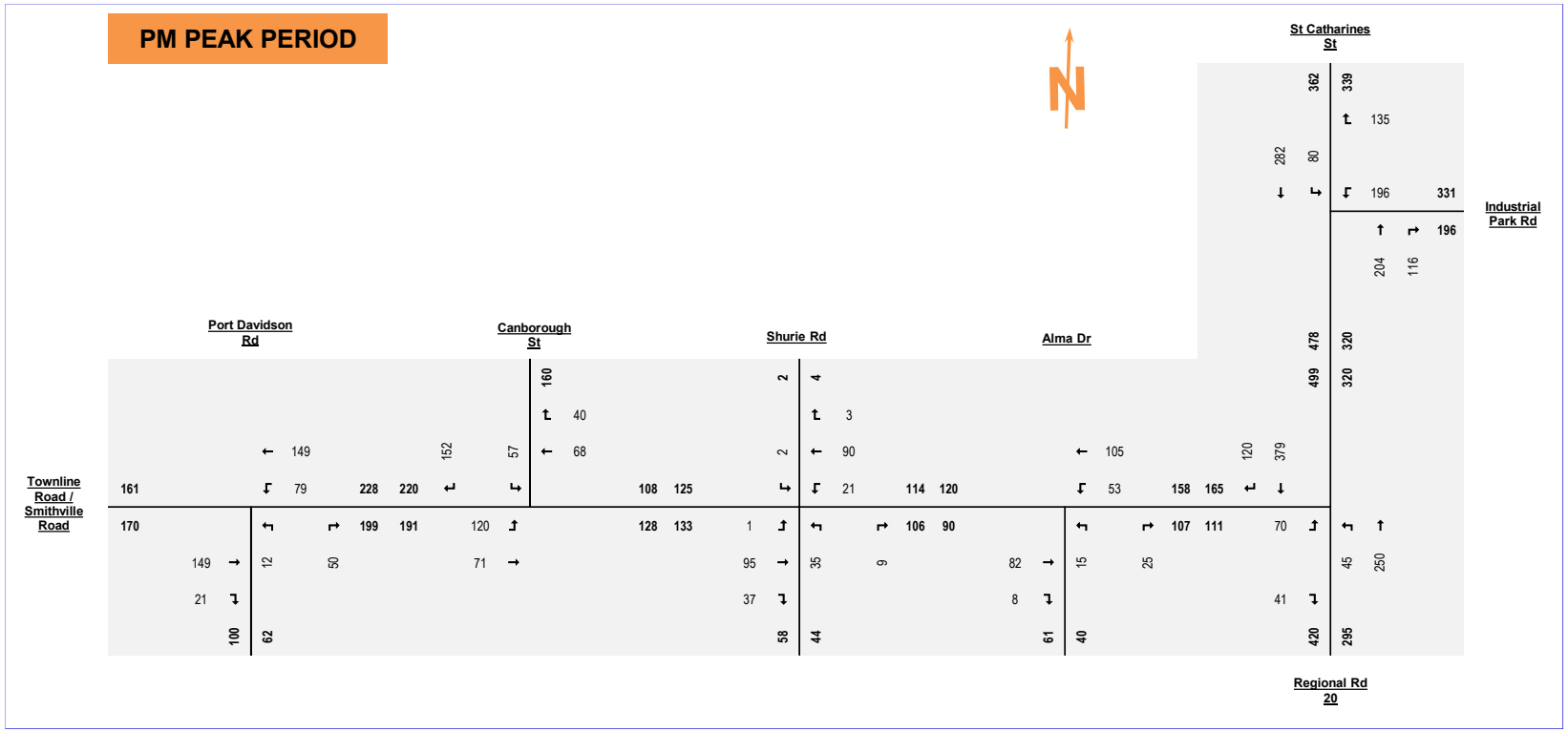


Figure 5.2: Existing Conditions Scenario (2024) – Weekday PM Peak Hour Traffic Volumes

5.2.2 Traffic Operations Analysis

The results of the HCM intersection capacity analysis (ICA) of the existing conditions scenario for the signalized study area intersection is presented in **Table 5.2** and **Table 5.3**. Synchro outputs for this scenario are included in **Appendix C**. ARCADY outputs for this scenario are included in **Appendix D**.

All existing intersections in the study area except for the St Catharines Street and Industrial Park Road intersection are anticipated to operate within capacity, with each movement performing at LOS B or better during both the AM and PM peak hours.

For the St Catharines Street and Industrial Park Road intersection, during the PM peak, the westbound left movement performs at LOS D, with a 95th percentile queue that exceeds the available storage by 6 metres. Upon further review, the intersection delay of 26.7 seconds, v/c ratio of 0.57, and 6-metres of storage deficit are considered acceptable for an urban intersection. Therefore, no further mitigation strategy is recommended.

Table 5.2: ICA Results (Existing Conditions Scenario, Stop-Controlled Intersections)

Intersection	Intersection Delay (s)	Traffic Operations Results by Movement					
		Movement	LOS	Movement	V/C Ratio	95th Percentile Queue (m)	Storage Capacity (m)
AM Peak Hour							
Port Davidson Rd & Townline Rd	3.6	WBTL	A	2.8	0.03	1	-
		NBLR	A	9.5	0.09	2	-
Townline Rd & Canborough St	8.1	EBLT	A	8.5	-	-	-
		WBTR	A	7.6	-	-	-
		SBLR	A	7.7	-	-	-
Shurie Rd & Townline Rd	7.5	EBLTR	A	7.5	-	-	-
		WBLTR	A	7.6	-	-	-
		NBLTR	A	7.4	-	-	-
		SBLTR	A	7.7	-	-	-
Alma Rd & Townline Rd	3.3	WBLT	A	2.0	0.01	0	-
		NBLR	A	9.1	0.07	2	-
St Catharines St & Industrial Park Rd	2.6	WBL	B	14.0	0.14	4	20
		WBR	B	10.2	0.08	2	-
		SBL	A	8.5	0.06	1	100
PM Peak Hour							
	2.9	WBTL	A	3.1	0.06	2	-

Intersection	Intersection Delay (s)	Traffic Operations Results by Movement					
		Movement	LOS	Movement	V/C Ratio	95th Percentile Queue (m)	Storage Capacity (m)
Port Davidson Rd & Townline Rd		NBLR	B	10.4	0.09	2	-
Townline Rd & Canborough St	9.0	EBLT	A	9.5	-	-	-
		WBTR	A	8.2	-	-	-
		SBLR	A	8.9	-	-	-
Shurie Rd & Townline Rd	7.9	EBLTR	A	7.9	-	-	-
		WBLTR	A	7.9	-	-	-
		NBLTR	A	7.9	-	-	-
		SBLTR	A	7.8	-	-	-
Alma Rd & Townline Rd	2.8	WBLT	A	2.7	0.04	1	-
		NBLR	A	9.6	0.05	1	-
St Catharines St & Industrial Park Rd	7.2	WBL	D	26.7	0.57	26	20
		WBR	B	10.3	0.18	5	-
		SBL	A	8.3	0.07	2	100

Table 5.3: ICA Results (Existing Conditions Scenario, Roundabout Intersection)

Intersection	Intersection LOS	Intersection Delay	Traffic Operations Results by Movement					
			Movement	LOS	Delay (s)	V/C Ratio	95th Percentile Queue (veh)	Storage Capacity (m)
AM Peak Hour								
Townline Road and St Catharines Street	A	5.3	SB	A	4.4	0.17	1	-
			EB	A	4.4	0.12	0	
			NB	A	6.1	0.32	1	-
PM Peak Hour								
Townline Road and St Catharines Street	A	6.2	SB	A	7.0	0.42	2	-
			EB	A	5.4	0.14	1	
			NB	A	5.2	0.26	1	-

5.3 FUTURE BACKGROUND SCENARIO (2030)

In the future background scenario, the trips generated by the background developments identified in **Section 2.3** are merged into the projected traffic volumes from the existing conditions scenario. As discussed in **Section 1.4**, a conservative annual growth rate of 3% was applied to the existing conditions traffic volumes to project the traffic volumes for the future background scenario in the horizon year of 2030.

All site accesses for Block Plan Area 9 were added to the roadway network for analysis. All site access intersections were assumed to operate with stop control at the site approach. The proposed road configuration and intersection control in the future background scenario is shown in **Figure 5.3**.

5.3.1 Traffic Volume

The traffic volume distribution for future background scenario is illustrated in **Figure 5.4** and **Figure 5.5** for the weekday AM and PM peak hours**.**

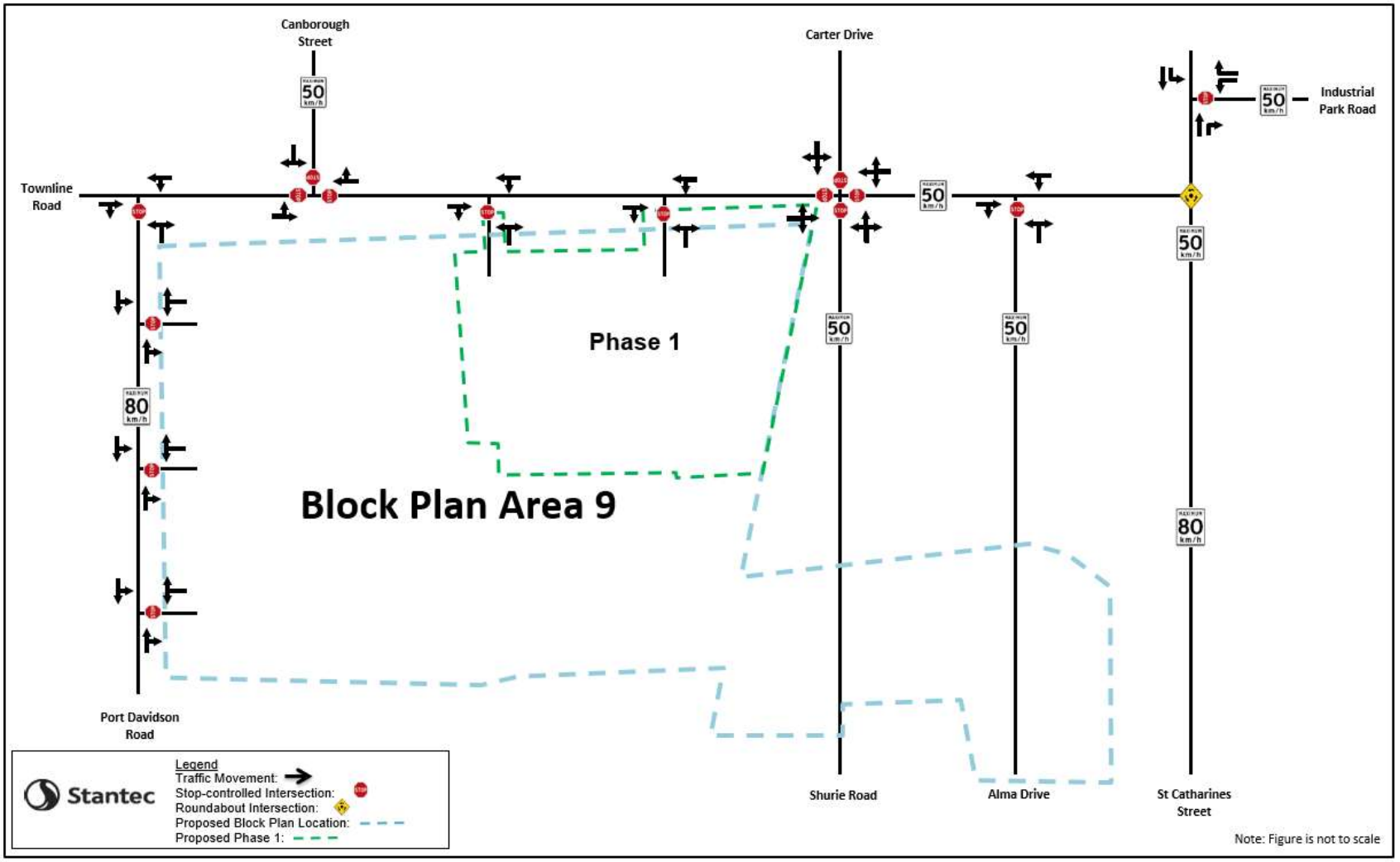


Figure 5.3: Future Lane Configuration and Intersection Control

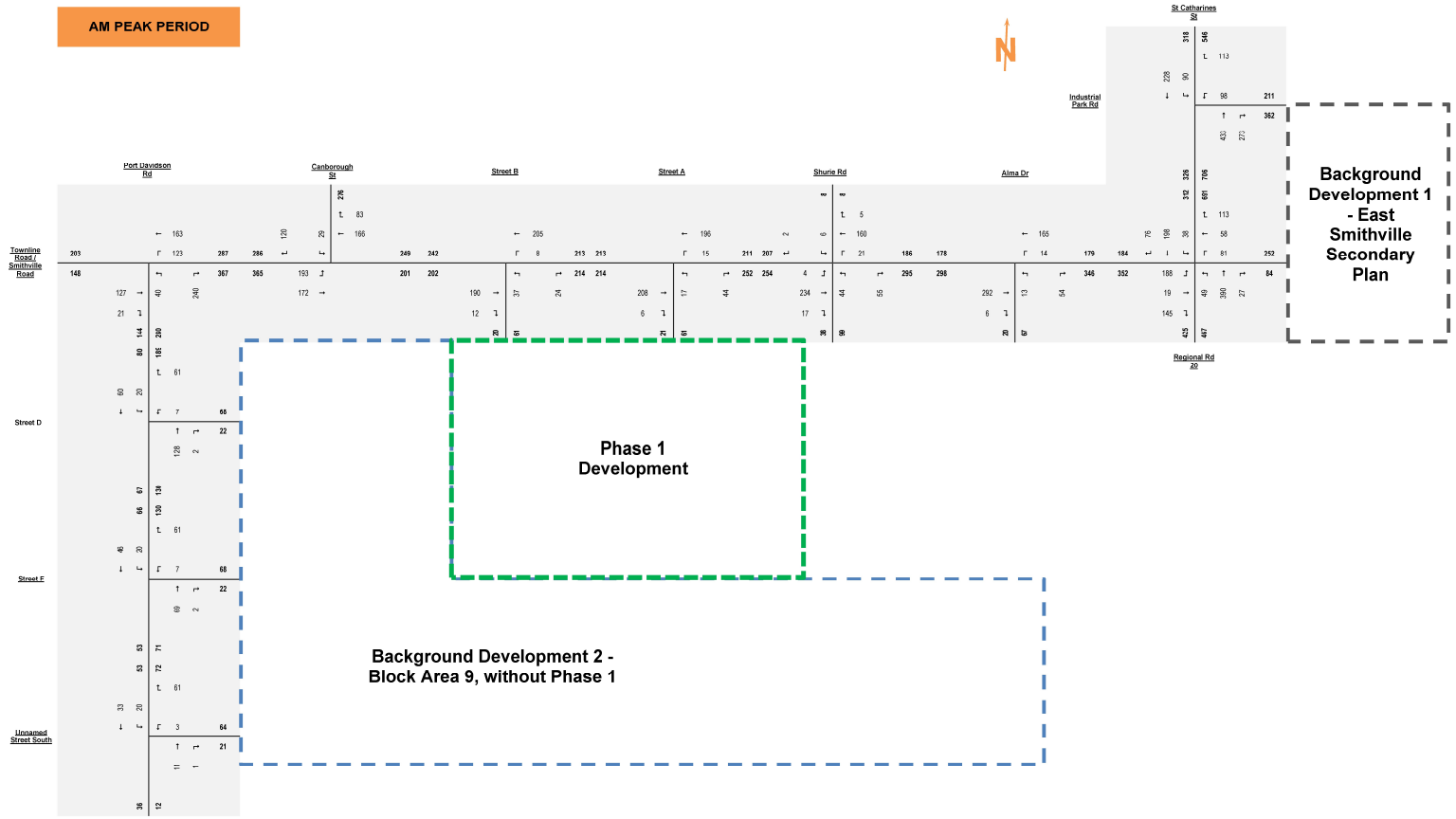


Figure 5.4: Future Background Scenario (2030) – Weekday AM Peak Hour Traffic Volumes

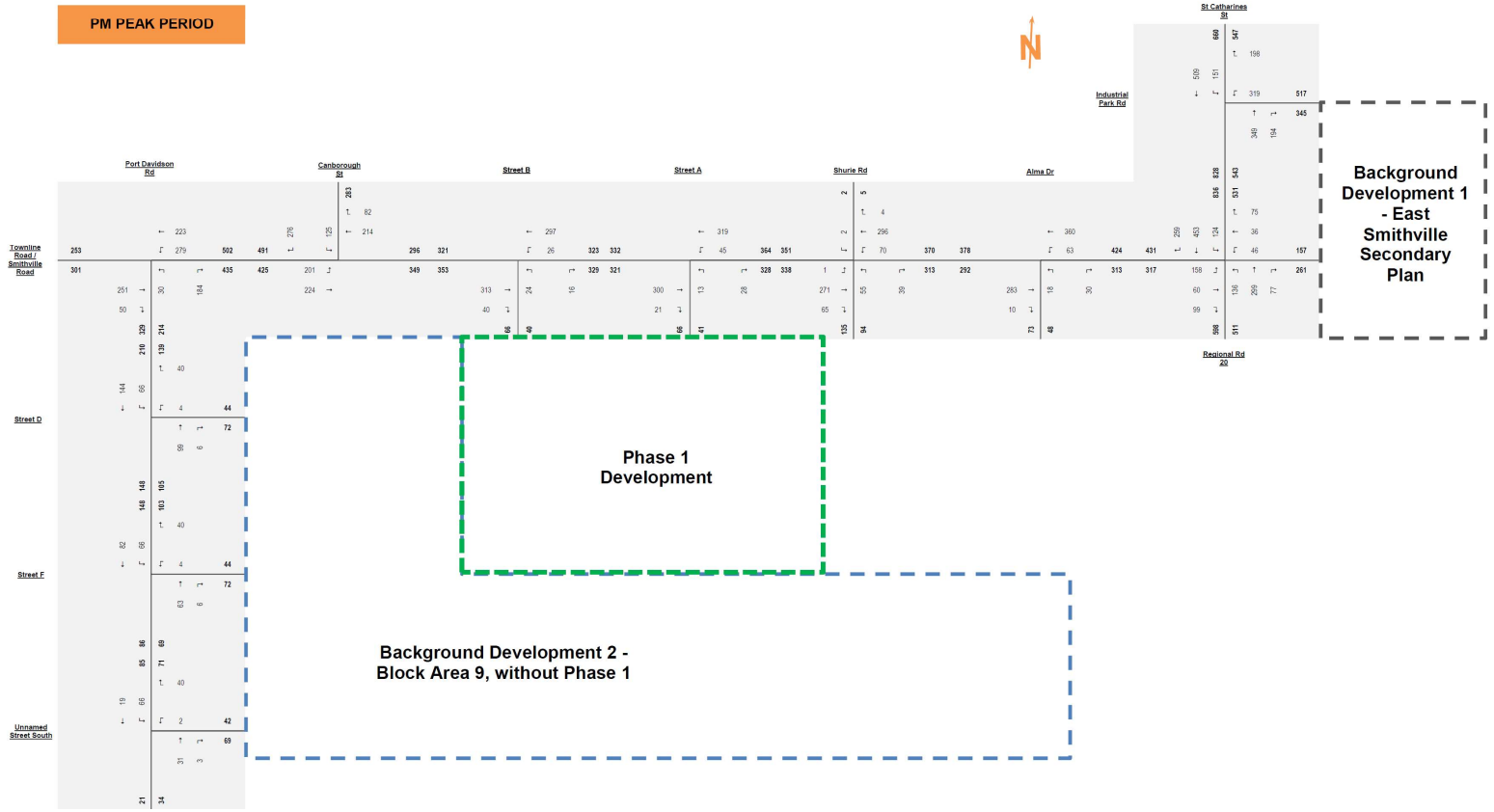


Figure 5.5: Future Background Scenario (2030) – Weekday PM Peak Hour Traffic Volumes

5.3.2 Traffic Operations Analysis

The results of the HCM intersection capacity analysis (ICA) of the future background scenario for the study area intersections are presented in **Table 5.4** and **Table 5.5**. Synchro outputs for this scenario are included in **Appendix E.** ARCADY outputs for this scenario are included in **Appendix F**.

All intersections in the study area, except for the Townline Road and Canborough Street, St Catharines Street and Townline Road, and St Catharines Street and Industrial Park Road intersections, are anticipated to operate within capacity with each movement performing at LOS C or better during both the AM and PM peak hours.

Townline Road and Canborough Street: In this scenario, it is noted that the eastbound movement at the Townline Road and Canborough Street intersection performs at LOS D during the PM peak hour. However, no mitigation strategy is recommended to this intersection based on the following factors:

- Intersection delay and capacity calculations in Synchro are based on conservative assumptions on driver behavior, e.g. strict gap acceptance and uniformly-distributed vehicle arrival for unsignalized intersections.
- Intersection delay of 26 seconds is considered acceptable in an urban intersection.

It is recommended that traffic conditions at this intersection be monitored.

St Catharines Street and Townline Road: In this scenario, it is noted that the southbound movement at the Townline Road and Canborough Street roundabout performs at LOS D during the PM peak hour. However, no mitigation strategy is recommended to this intersection based on the following factors:

- Intersection delay of 25 seconds and 95th percentile queue of 12 vehicles are considered acceptable in an urban intersection, and does not interfere with upstream operations of the roadway.
- Majority of the increased traffic demand through this intersection is due to the assumed background development from the East Smithville Secondary Plan Area, as indicated in **Figure 4.7** and **Figure 4.8**. However, the available traffic information for the East Smithville Secondary Plan Area is limited, and the scale of development and the distribution of these trips are based on high-level assumptions. These assumptions are expected to be modified with future development plans.

It is recommended that further traffic analysis be conducted as part of the proposed development applications in the area to assess the potential traffic impacts at this roundabout.

St Catharines Street and Industrial Park Road: In this scenario, it is noted that the westbound left movement at the St Catharines Street and Industrial Park Road intersection performs at LOS D during the AM peak hour and LOS F during the PM peak hour. The 95th percentile queue of the westbound left movement also exceeds the storage length of the movement in the PM peak hour. In addition, projected traffic volumes in the future background scenario meets traffic signal warrant thresholds, as indicated in **Appendix G**.

As a result, based on the available information, traffic signal is recommended at this intersection to mitigate the anticipated critical operations. The storage length of the westbound left movement is also recommended to be extended to 60 metres.

The ICA results of the mitigation scenario and pre-mitigation scenario at this intersection are presented in **Table 5.6**.

Similar to the estimated impacts at the St. Catharines Street and Townline Road roundabout, the majority of the increased traffic demand through this intersection is due to the assumed background development from the East Smithville Secondary Plan Area. Given that the available traffic information for the East Smithville Secondary Plan Area is limited, and that the scale of development and the distribution of these trips are based on high-level assumptions, the current assumptions are expected to be further studied in future development plans. Therefore, it is recommended that further traffic analysis be conducted as part of the proposed development applications in the area to assess the potential traffic impacts and review the need for traffic signalization at this intersection.

Table 5.4: ICA Results (Future Background Scenario, Stop-Controlled Intersections)

Intersection	Intersection Delay (s)	Traffic Operations Results by Movements					
		Movement	LOS	Delay (s)	V/C Ratio	95th Percentile Queue (m)	Storage Capacity (m)
AM Peak Hour							
Port Davidson Rd & Townline Rd	6.6	WBTL	A	3.9	0.10	2	-
		NBLR	B	12.9	0.40	15	-
Townline Rd & Canborough St	11.8	EBLT	B	13.5	-	-	-
		WBTR	B	10.4	-	-	-
		SBLR	A	9.9	-	-	-
Shurie Rd & Townline Rd	9.5	EBLTR	A	9.9	-	-	-
		WBLTR	A	9.4	-	-	-

Intersection	Intersection Delay (s)	Traffic Operations Results by Movements					
		Movement	LOS	Delay (s)	V/C Ratio	95th Percentile Queue (m)	Storage Capacity (m)
		NBLTR	A	8.6	-	-	-
		SBLTR	A	8.8	-	-	-
Alma Rd & Townline Rd	1.6	WBLT	A	0.7	0.01	0	-
		NBLR	B	11.1	0.11	3	-
St Catharines St & Industrial Park Rd	4.2	WBL	D	28.5	0.41	15	20
		WBR	B	13.2	0.22	6	-
		SBL	A	10.0	0.12	3	100
Street B & Townline Rd	1.6	WBL	A	0.4	0.01	0	-
		NBLR	B	11.3	0.10	3	-
Street A & Townline Rd	1.6	WBL	A	0.6	0.01	0	-
		NBLR	B	10.6	0.09	2	-
Port Davidson Rd & Street D	2.9	WBLR	A	9.4	0.08	2	-
		SBL	A	2.0	0.02	0	-
Port Davidson Rd & Street F	3.8	WBLR	A	9.1	0.08	2	-
		SBL	A	2.3	0.01	0	-
Port Davidson Rd & Unnamed Rd South	5.4	WBLR	A	8.6	0.07	2	-
		SBL	A	2.8	0.01	0	-
PM Peak Hour							
Port Davidson Rd & Townline Rd	7.2	WBTL	A	6.2	0.25	8	-
		NBLR	C	19.7	0.49	20	-
Townline Rd & Canborough St	21.5	EBLT	D	25.9	-	-	-
		WBTR	C	15.6	-	-	-
		SBLR	C	21.3	-	-	-
Shurie Rd & Townline Rd	12	EBLTR	B	11.8	-	-	-
		WBLTR	B	12.8	-	-	-
		NBLTR	A	9.7	-	-	-
		SBLTR	A	9.1	-	-	-
Alma Rd & Townline Rd	1.8	WBLT	A	1.7	0.05	1	-
		NBLR	B	13.2	0.11	3	-
St Catharines St & Industrial Park Rd	117.6	WBL	F	620.9	2.23	217	20
		WBR	B	12.9	0.32	11	-
		SBL	A	9.5	0.17	5	100
Street B & Townline Rd	1.2	WBL	A	0.9	0.02	1	-
		NBLR	B	13.7	0.09	2	-
Street A & Townline Rd	1.4	WBL	A	1.4	0.04	1	-
		NBLR	B	12.4	0.08	2	-
	2.7	WBLR	A	9.3	0.05	1	-

Intersection	Intersection Delay (s)	Traffic Operations Results by Movements					
		Movement	LOS	Delay (s)	V/C Ratio	95th Percentile Queue (m)	Storage Capacity (m)
Port Davidson Rd & Street D		SBL	A	2.7	0.05	1	-
Port Davidson Rd & Street F	3.5	WBLR	A	9.0	0.05	1	-
		SBL	A	3.6	0.05	1	-
Port Davidson Rd & Unnamed Rd South	5.3	WBLR	A	8.7	0.04	1	-
		SBL	A	5.8	0.05	1	-

Table 5.5: ICA Results (Future Background Scenario, Roundabout Intersection)

Intersection	Intersection LOS	Intersection Delay	Traffic Operations Results by Movements					
			Movement	LOS	Delay (s)	V/C Ratio	95th Percentile Queue (veh)	Storage Capacity (m)
AM Peak Hour								
Townline Road and St Catharines Street	A	9.5	WB	B	11.9	0.63	2	-
			SB	A	7.0	0.33	2	
			EB	A	8.9	0.42	2	
			NB	B	10.5	0.53	3	-
PM Peak Hour								
Townline Road and St Catharines Street	B	18.2	WB	A	8.4	0.25	1	-
			SB	D	25.1	0.87	12	
			EB	B	13.7	0.52	3	
			NB	B	12.9	0.61	4	-

Table 5.6: ICA Results (Future Background Scenario, Mitigated Intersection)

Intersection	Intersection LOS	Intersection Delay	Traffic Operations Results by Movements					
			Movement	LOS	Delay (s)	V/C Ratio	95th Percentile Queue (m)	Storage Capacity (m)
AM Peak Hour								
Before Mitigation								
St Catherines St & Industrial Park Rd	-	4.2	WBL	D	28.5	0.41	15	20
			WBR	B	13.2	0.22	6	-
			SBL	A	10	0.12	3	100
After Mitigation								
St Catharines St & Industrial Park Rd	A	9.5	WBL	B	12	0.18	14.4	60
			WBR	A	3.9	0.21	7.7	
			NBT	B	14	0.6	52	
			NBR	A	2.6	0.35	9.5	
			SBL	B	11.9	0.31	13.6	100
			SBT	A	9.9	0.31	24.6	
PM Peak Hour								
Before Mitigation								
St Catherines St & Industrial Park Rd	-	117.6	WBL	F	620.9	2.23	217	20
			WBR	B	12.9	0.32	11	-
			SBL	A	9.5	0.17	5	100
After Mitigation								
St Catharines St & Industrial Park Rd	B	11.7	WBL	B	16.7	0.54	43.4	60
			WBR	A	3.4	0.3	10	
			NBT	B	11.3	0.45	38.1	
			NBR	A	2.5	0.27	8.1	
			SBL	B	13	0.41	21.3	100
			SBT	B	15.1	0.66	62.2	

5.4 FUTURE TOTAL TRAFFIC SCENARIO (2030)

In the future total traffic scenario, both the estimated future background traffic volumes in **Section 5.3** and the trips generated by the Phase 1 development in **Section 4.1** are considered.

No adjustment to the future background road configuration and intersection control is applied in this scenario.

5.4.1 Traffic Volume

The traffic volume distribution for the future total scenario was generated for the AM and PM peak hours in the 2030 study horizon year. The forecasted traffic volume is illustrated in **Figure 5.6** and **Figure 5.7** for the weekday AM and PM peak hours**.**

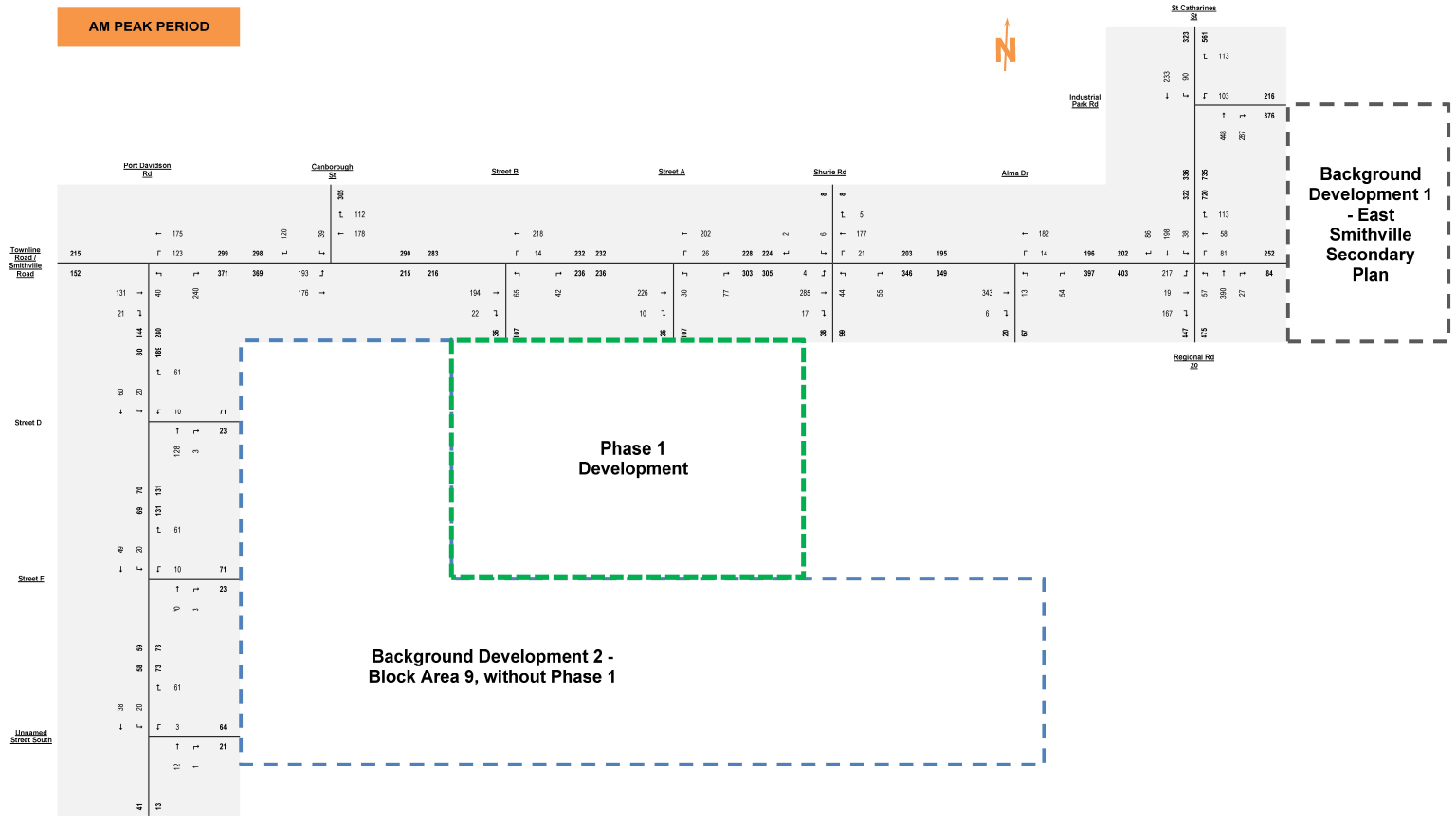


Figure 5.6: Future Total Scenario (2030) – Weekday AM Peak Hour Traffic Volumes

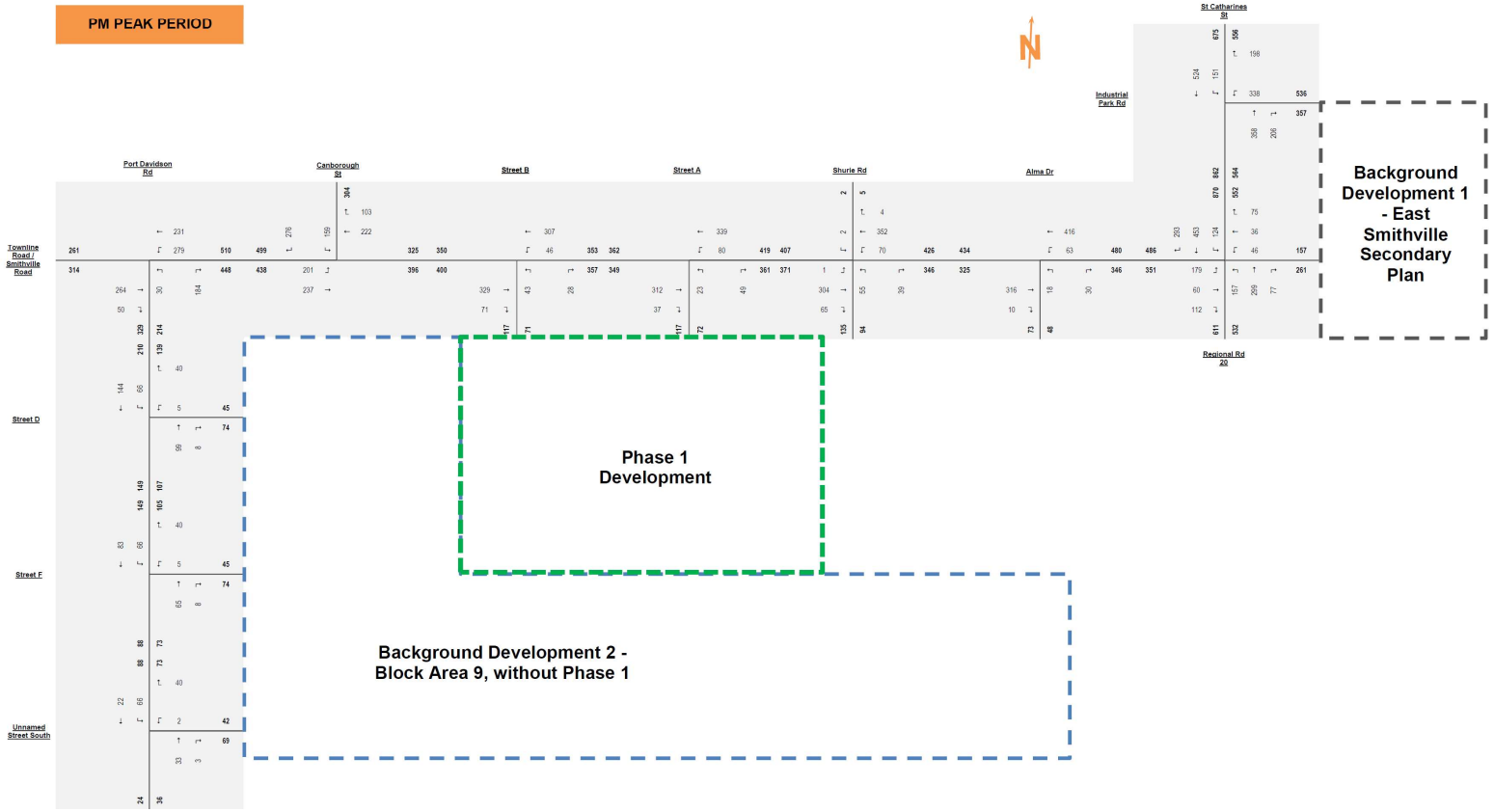


Figure 5.7: Future Total Scenario (2030) – Weekday PM Peak Hour Traffic Volumes

5.4.2 Traffic Operations Analysis

The results of the HCM intersection capacity analysis (ICA) of the future total scenario for the study area intersections are presented in **Table 5.7** and **Table 5.8.** Synchro outputs for this scenario are included in **Appendix H.** ARCADY outputs for this scenario are included in **Appendix F.**

All intersections in the study area, except for the Townline Road and Canborough Street, St Catharines Street and Townline Road, and St Catharines Street and Industrial Park Road intersections, are anticipated to operate within capacity with each movement performing at LOS C or better during both the AM and PM peak hours.

Townline Road and Canborough Street: In this scenario, it is noted that the eastbound movement at the Townline Road and Canborough Street intersection performs at LOS E during the PM peak hour. However, no mitigation strategy is recommended to this intersection based on the following factors:

- Intersection delay and capacity calculations in Synchro are based on conservative assumptions on driver behavior, e.g. strict gap acceptance and uniformly-distributed vehicle arrival for unsignalized intersections.
- Intersection delay of 37 seconds is considered acceptable in an urban intersection.

It is recommended that traffic conditions at this intersection be monitored.

St Catharines Street and Townline Road: In this scenario, it is noted that the southbound movement at the Townline Road and Canborough Street roundabout performs at LOS D during the PM peak hour. However, similar to the future background scenario, no mitigation strategy is recommended to this intersection based on the following factors:

- Intersection delay of 33 seconds and 95th percentile queue of 15 vehicles are considered acceptable in an urban intersection, and does not interfere with upstream operations of the roadway.
- Majority of the increased traffic demand through this intersection is due to the assumed background development from the East Smithville Secondary Plan Area, as indicated in **Figure 4.7** and **Figure 4.8**. However, the available traffic information for the East Smithville Secondary Plan Area is limited, and the scale of development and the distribution of these trips are based on high-level assumptions. These assumptions are expected to be modified with future development plans.

It is recommended that further traffic analysis to be conducted as part of the proposed development applications in the area to better assess the potential traffic impacts at this roundabout.

St Catharines Street and Industrial Park Road: In this scenario, it is noted that the westbound left movement at the St Catharines Street and Industrial Park Road intersection performs at LOS D during the AM peak hour and LOS F during the PM peak hour. The 95th percentile queue of the westbound left movement also exceeds the storage length of the movement in the PM peak hour. In addition, projected traffic volumes in the future total scenario meets traffic signal warrant thresholds, as indicated in **Appendix I**.

Similar to the future background scenario, based on the available information, traffic signal is recommended at the St Catharines Street and Industrial Park Road intersection to mitigate the critical operations. The storage length of the westbound left movement is also recommended to be extended to 60 metres.

The ICA results of the mitigation scenario and pre-mitigation scenario at this intersection are presented in **Table 5.9.**

As noted under the future background scenario, the majority of the increased traffic demand through this intersection is due to the assumed background development from the East Smithville Secondary Plan Area. Given that the available traffic information for the East Smithville Secondary Plan Area is limited, and that the scale of development and the distribution of these trips are based on high-level assumptions, the current assumptions are recommended to be further studies as part of the future development applications. Therefore, it is recommended that further traffic analysis be conducted by proposed development applications in the area to better assess the potential traffic impacts and review the need for traffic signalization at this intersection.

Table 5.7: ICA Results (Future Total Traffic Scenario, Stop-Controlled Intersections)

Intersection	Intersection Delay (s)	Traffic Operations Results by Movements					
		Movement	LOS	Delay (s)	V/C Ratio	95th Percentile Queue (m)	Storage Capacity (m)
AM Peak Hour							
Port Davidson Rd & Townline Rd	6.5	WBTL	A	3.8	0.10	2	-
		NBLR	B	13.0	0.41	15	-
Townline Rd & Canborough St	12.4	EBLT	B	14.1	-	-	-
		WBTR	B	11.2	-	-	-

Intersection	Intersection Delay (s)	Traffic Operations Results by Movements					
		Movement	LOS	Delay (s)	V/C Ratio	95th Percentile Queue (m)	Storage Capacity (m)
		SBLR	B	10.3	-	-	-
Shurie Rd & Townline Rd	10.1	EBLTR	B	10.8	0.35-		
		WBLTR	A	9.8	0.27		
		NBLTR	A	8.9	0.14		
		SBLTR	A	8.9	0.01-		
Alma Rd & Townline Rd	1.5	WBLT	A	0.7	0.01	0	-
		NBLR	B	11.7	0.12	3	-
St Catherines St & Industrial Park Rd	4.4	WBL	D	30.6	0.45	17	20
		WBR	B	13.4	0.22	6	-
		SBL	B	10.1	0.12	3	100
Street B & Townline Rd	2.6	WBL	A	0.6	0.01	0	-
		NBLR	B	12.2	0.19	5	-
Street A & Townline Rd	2.6	WBL	A	1.1	0.02	1	-
		NBLR	B	11.4	0.17	5	-
Port Davidson Rd & Street D	3.0	WBLR	A	9.5	0.09	2	-
		SBL	A	2.0	0.02	0	-
Port Davidson Rd & Street F	3.8	WBLR	A	9.1	0.08	2	-
		SBL	A	2.3	0.01	0	-
Port Davidson Rd & Unnamed Rd South	5.2	WBLR	A	8.6	0.07	2	-
		SBL	A	2.6	0.01	0	-
PM Peak Hour							
Port Davidson Rd & Townline Rd	7.3	WBTL	A	6.2	0.25	8	-
		NBLR	C	20.5	0.51	21	-
Townline Rd & Canborough St	31.2	EBLT	E	37.1	-	-	-
		WBTR	C	20.1	-	-	-
		SBLR	D	33.6	-	-	-
Shurie Rd & Townline Rd	14.4	EBLTR	B	13.4	-	-	
		WBLTR	C	16.3	-	-	
		NBLTR	A	10.0	-	-	
		SBLTR	A	9.8	-	-	
Alma Rd & Townline Rd	1.7	WBLT	A	1.6	0.06	1	-
		NBLR	B	14.2	0.12	3	-
	148.1	WBL	F	766.1	2.55	244	20

Intersection	Intersection Delay (s)	Traffic Operations Results by Movements					
		Movement	LOS	Delay (s)	V/C Ratio	95th Percentile Queue (m)	Storage Capacity (m)
St Catherines St & Industrial Park Rd		WBR	B	13.7	0.34	12	-
		SBL	A	9.6	0.17	5	100
Street B & Townline Rd	2.0	WBL	A	1.5	0.04	1	-
		NBLR	C	16.0	0.19	5	-
Street A & Townline Rd	2.3	WBL	A	2.2	0.07	2	-
		NBLR	B	14.1	0.16	4	-
Port Davidson Rd & Street D	2.7	WBLR	A	9.3	0.05	1	-
		SBL	A	2.7	0.05	1	-
Port Davidson Rd & Street F	3.5	WBLR	A	9.1	0.05	1	-
		SBL	A	3.5	0.05	1	-
Port Davidson Rd & Unnamed Rd South	5.2	WBLR	A	8.7	0.04	1	-
		SBL	A	5.6	0.05	1	-

Table 5.8: ICA Results (Future Total Traffic Scenario, Roundabout Intersection)

Intersection	Intersection LOS	Intersection Delay	Traffic Operations Results by Movements					
			Movement	Lane LOS	Lane Delay (s)	V/C Ratio	Lane 95th Percentile Queue (m)	Storage Capacity (m)
AM Peak Hour								
Townline Road and St Catharines Street	B	10.3	WB	B	12.8	0.45	2	-
			SB	A	7.2	0.35	2	
			EB	A	9.9	0.48	3	
			NB	B	11.5	0.56	4	-
PM Peak Hour								
Townline Road and St Catharines Street	B	22.6	WB	A	8.9	0.26	1	-
			SB	D	33.0	0.92	15	
			EB	C	15.4	0.58	4	
			NB	B	14.4	0.65	5	-

Table 5.9: ICA Results (Future Total Scenario, Mitigated Intersection)

Intersection	Intersection LOS	Intersection Delay	Traffic Operations Results by Movements					
			Movement	LOS	Delay (s)	V/C Ratio	95th Percentile Queue (m)	Storage Capacity (m)
AM Peak Hour								
Before Mitigation								
St Catherines St & Industrial Park Rd	-	4.4	WBL	D	30.6	0.45	17	20
			WBR	B	13.4	0.22	6	-
			SBL	B	10.1	0.12	3	100
After Mitigation								
St Catharines St & Industrial Park Rd	A	9.7	WBL	B	12.1	0.19	15	60
			WBR	A	3.9	0.21	7.7	
			NBT	B	14.4	0.62	54.5	
			NBR	A	2.7	0.37	9.8	
			SBL	B	12.3	0.32	13.8	100
			SBT	A	9.9	0.32	25.2	
PM Peak Hour								
Before Mitigation								
St Catherines St & Industrial Park Rd	-	148.1	WBL	F	766.1	2.55	244	20
			WBR	B	13.7	0.34	12	-
			SBL	A	9.6	0.17	5	100
After Mitigation								
St Catharines St & Industrial Park Rd	B	12.9	WBL	B	16.7	0.65	58.2	60
			WBR	A	3.4	0.35	11.6	
			NBT	B	11.3	0.45	43.1	
			NBR	A	2.5	0.26	8.3	
			SBL	B	13	0.38	22.4	100
			SBT	B	15.1	0.64	71.2	

6.0 TRANSPORTATION DEMAND MANAGEMENT

Some potential TDM strategies and measures could be deployed to reduce site generated single-occupant vehicle trips, which will mitigate the roadway/intersection capacity issues in the future. A summary of the TDM-supportive side design elements, infrastructure, and recommendations is shown below:

- TDM Education:
  - Providing program incentives and initiatives to promote TDM such as sharing TDM options and raising TDM awareness, TDM website and brochures.
- Carpooling:
  - Promoting the Niagara Rideshare carpool matching tool to future residents.
- Active Transportation:
  - Providing cycling infrastructure such as bike lanes and shared-use paths on local and regional roads throughout the site.
  - Providing pedestrian facilities such as sidewalks and shared-use paths on both sides of all roads throughout the site.
  - Providing bike parking/repairing facilities in the area.
  - Supporting school-based programs with options for active transportation to school.
- Travel Planning:
  - Promoting the Niagara Region Map App and cycling maps to site residents.

7.0 SITE ACCESS SIGHTLINE REVIEW

A desktop review was performed by utilizing Google's aerial and street view imagery to identify sightline deficiencies in the vicinity of the proposed site access locations. **Figure 7.1** shows the seven proposed site accesses. It is of note that the accesses numbered 6 and 7 will not be evaluated in this section as they are not intersections.

Using equation **9.9.1** of the Transportation Association of Canada's (TAC) *Geometric Design Guide for Canadian Roads, Chapter 9 – Intersections*, the following was used to calculate intersection sight distance (ISD):

$$ISD = 0.278\, V_{Major} t_g$$

Where:

ISD is the required intersection sight distance in metres;

V_{Major} is the major roadway's design speed in km/h; and

t_g is the minor roadway time gap in seconds.

The intersection sight distance was calculated using the following parameters:

- 60 km/h design speed for Townline Road and 90km/h[1] for Port Davidson Road;
- A time gap of 9.5 seconds for left turns from a stop and 8.5 seconds for right turns from a stop was utilized to represent a single-unit truck (e.g. garbage truck, fire truck) attempting to perform a turning maneuver from the site access; and,
- A time gap of 6.5 seconds for left turns from Townline Road and Port Davidson Road into the site access.

The calculations results are summarized in **Table 7.1**. Based on TAC Geometric Design Guide for Canadian Roads ("TAC") Section 9.9.2.3, the applicable cases are as follows:

- Case B1 – left turn movement from the minor road
- Case B2 – right turn movement from the minor road
- Case F – left turn movement from the major road

[1] Posted speed limit for Port Davidson Road is expected to be reduced to 50 km/h when the Block Plan fully built out. For a conservative analysis, a design speed of 90 km/h (posted speed of 80 km/h, plus 10 km/h) is used.

In addition to intersection sight distance requirements, stopping sight distances (SSD) were also evaluated to determine whether approaching vehicles along the major roadways have sufficient sight distance to perceive a conflict and decelerate to a stop in order to avoid a collision. Stopping sight distance is the sum of the distance travelled during the perception and reaction time, and the braking distance. To determine the minimum stopping sight distance relative to the design speed, *TAC* **Table 2.5.2** is used.

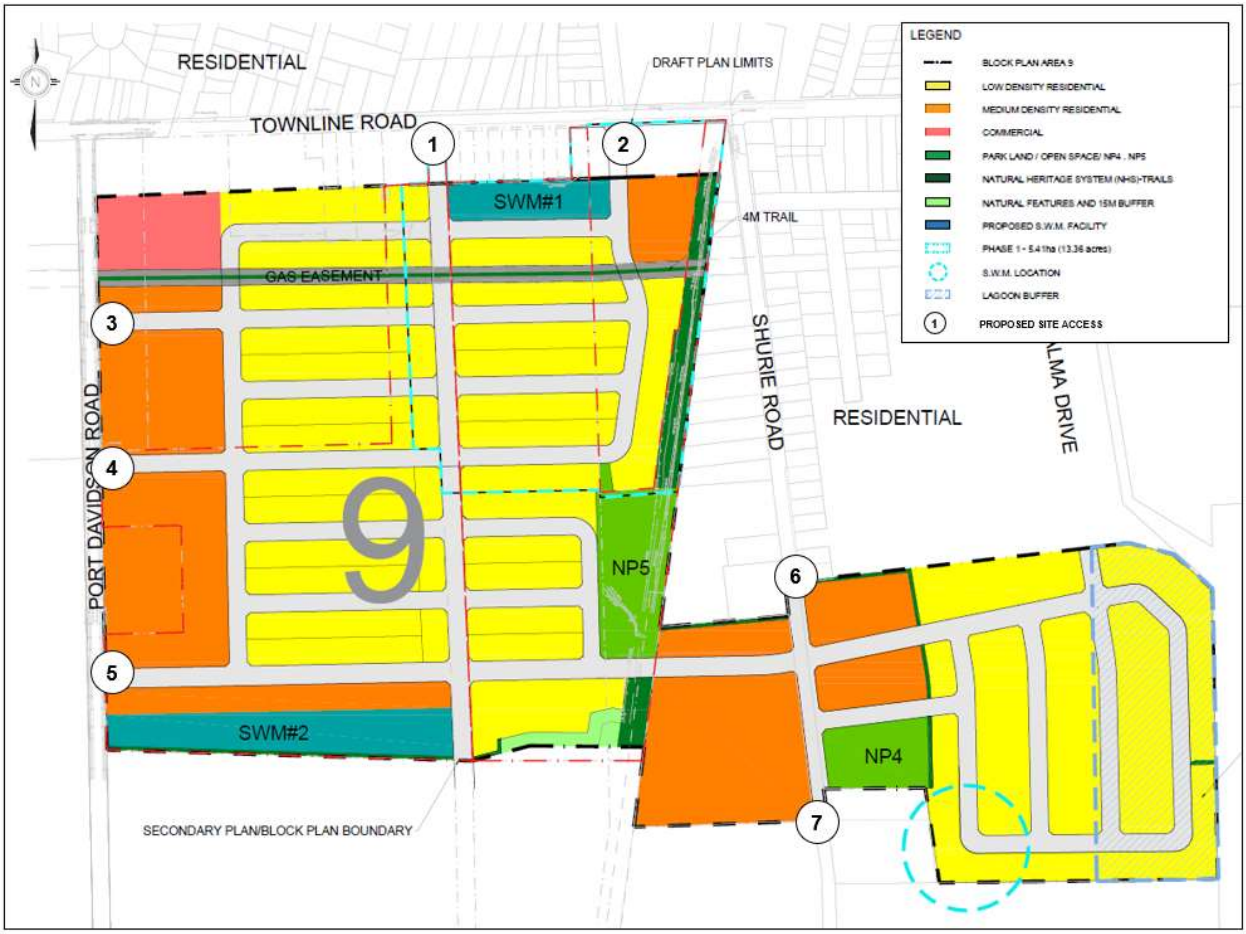


Figure 7.1: Proposed Site Access Locations

Table 7.1: ISD calculation results for combination trucks

Access Number	Intersection	Case	Design Speed (km/h)	Stopping Sight Distance (m)	Required Intersection Sight Distance (m)	Available Sight Distance (m)
1	Townline Road and Street B (stop sign on the minor road)	B1	60	85	160	>200
		B2	60	85	140	>200
		F	60	85	110	>200
2	Townline Road and Street A (stop sign on the minor road)	B1	60	85	160	>200
		B2	60	85	140	>200
		F	60	85	110	>200
3	Port Davidson Road and Street D (stop sign on the minor road)	B1	90	130	240	190
		B2	90	130	215	>250
		F	90	130	160	>200
4	Port Davidson Road and Street F (stop sign on the minor road)	B1	90	130	240	>250
		B2	90	130	215	>250
		F	90	130	160	>200
5	Port Davidson Road and Unnamed Street South (stop sign on the minor road)	B1	90	130	240	>250
		B2	90	130	215	>250
		F	90	130	160	>200

Figure 7.2 to **Figure 7.6** shows the required ISDs per case for each proposed access.

According to the existing aerial map, the sight distances in the north and south directions from the proposed accesses at Port Davidson Road, and the sight distances in the east and west directions from the proposed accesses at Townline Road are expected to exceed the required distances, except for the Case B1 (left-turn movement from a minor road) of Access 3 along Port Davidson Road.

The available sight distance for Case B1 (left-turn movement from a minor road) of Access 3 along Port Davidson Road is 190 metres, which is less than the required calculated ISD of 240 metres. It should be noted however, that vehicles travelling southbound along Port Davidson Road are accelerating from a left or right turn from Townline Road and are therefore anticipated to travel well below the roadway's design speed of 90 km/hr just south of Townline Road. Given this condition, there will be sufficient sight distance for the left-turning vehicles to complete their turn out of Access 3.

In addition, no vertical profile sight constraint was observed at the proposed site accesses. Therefore, the proposed site accesses are expected to have adequate sight distance.

Figure 7.2: Intersection Sight Distance Requirements for Proposed Access 1

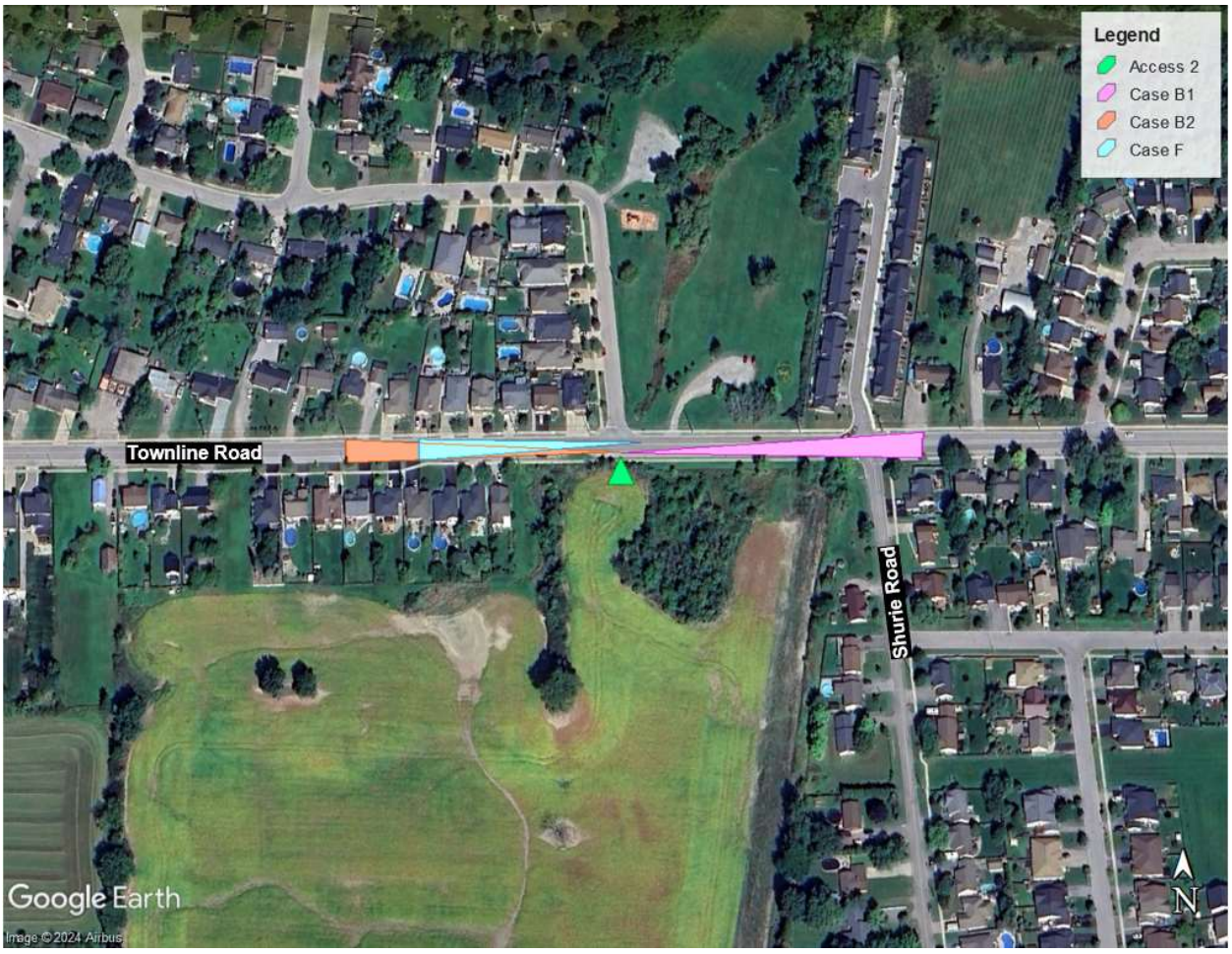


Figure 7.3: Intersection Sight Distance Requirements for Proposed Access 2

Figure 7.4: Intersection Sight Distance Requirements for Proposed Access 3

Figure 7.5: Intersection Sight Distance Requirements for Proposed Access 4

Figure 7.6: Intersection Sight Distance Requirements for Proposed Access 5

8.0 CONCLUSIONS & RECOMMENDATIONS

This traffic impact study for the proposed Block Plan Area 9 development concludes:

- 33 inbound and 98 outbound trips in the AM peak hour, and 108 inbound and 65 outbound trips in the PM peak hour are expected to be generated by the proposed Phase 1 Development based on the *ITE Trip Generation Manual, 11th Edition*;
- 119 inbound and 355 outbound trips in the AM peak hour, and 391 inbound and 235 outbound trips in the PM peak hour are expected to be generated by the proposed East Smithville Secondary Plan development; 129 inbound and 387 outbound trips in the AM peak hour, and 417 inbound and 254 outbound trips in the PM peak hour are expected to be generated by the proposed Block Plan Area 9 without Phase 1 development. The trips from these two developments are added to the 2030 background traffic.
- The study area intersections are currently performing with LOS B or better under the 2024 existing condition except for the westbound left-turn movement at the St Catharines Street and Industrial Park Road intersection which performs LOS D during PM peak hour. However, this is considered acceptable after reviewing the intersection delay and v/c ratio. No further mitigation strategy is required.
- Most study area intersection movements are expected to perform with LOS C or better under the 2030 Background Development and 2030 Total Development scenarios, with the following exceptions:
    - Eastbound movement at the Townline Road and Canborough Street intersection, which performs at LOS D in the 2030 Background Development scenario and LOS E in the 2030 Total Development scenario during the PM peak hour, respectively.
    - Southbound movement at the St Catharines Street and Townline Road intersection, which performs at LOS D during the PM peak hour.
    - Westbound left-turn movement at the St Catharines Street and Industrial Park Road intersection, which performs at LOS D and LOS F during the AM and PM peak hours, respectively. Traffic signalization and extension of westbound left turn storage length to 60 metres are recommended as mitigations for both 2030 Background Development and 2030 Total Development scenarios.
- When considering potential mitigation strategy, a few factors were considered, including limited information available for the East Smithville Secondary Plan

development, signal timing warrant results, and the conservative assumptions used in the analysis methodology. The following are recommended:

  - For the Townline Road and Canborough Street, and St Catharines Street and Townline Road intersections, it is recommended that future traffic volumes and impacts be monitored for potential need for intersection improvements.
  - For the St Catharines Street and Industrial Park Road intersection, traffic signalization and extension of westbound left turn storage length to 60 metres are recommended as mitigations for both the 2030 Background Development and 2030 Total Development scenarios.
  - For the St Catharines Street and Townline Road, and the St Catharines Street and Industrial Park Road intersections, it is recommended that further traffic analysis be conducted by proposed development applications in the area.

- Transportation demand management (TDM) measures are recommended to help mitigate roadway capacity issues and encourage the use of sustainable transportation modes.
- The sightlines for the five proposed site accesses are adequate according to the *TAC* intersection sight distance and stopping sight distance guidelines.
- Per Township of West Lincoln's *Official Plan Amendment (OPA) No. 63, Schedule 'L'*, and the *Smithville TMP*, the Township proposed a future realignment of Port Davidson Road to align with the Canborough Street in its intersection with Townline Road to support development of the Urban Boundary Expansion Lands. At this time and per the conclusions noted above, it is found that the existing intersection configuration is sufficient for the projected demand of Block Plan Area 9 and a realignment is not needed to accommodate this projected demand. The needs and timing of a possible realignment at this intersection is to be reviewed by the Township as development progresses.

Appendix A TRAFFIC COUNT DATA

Townline Road & St Catharines Street

Morning Peak Diagram

Specified Period
From: 6:30:00
To: 10:30:00

One Hour Peak
From: 7:00:00
To: 8:00:00

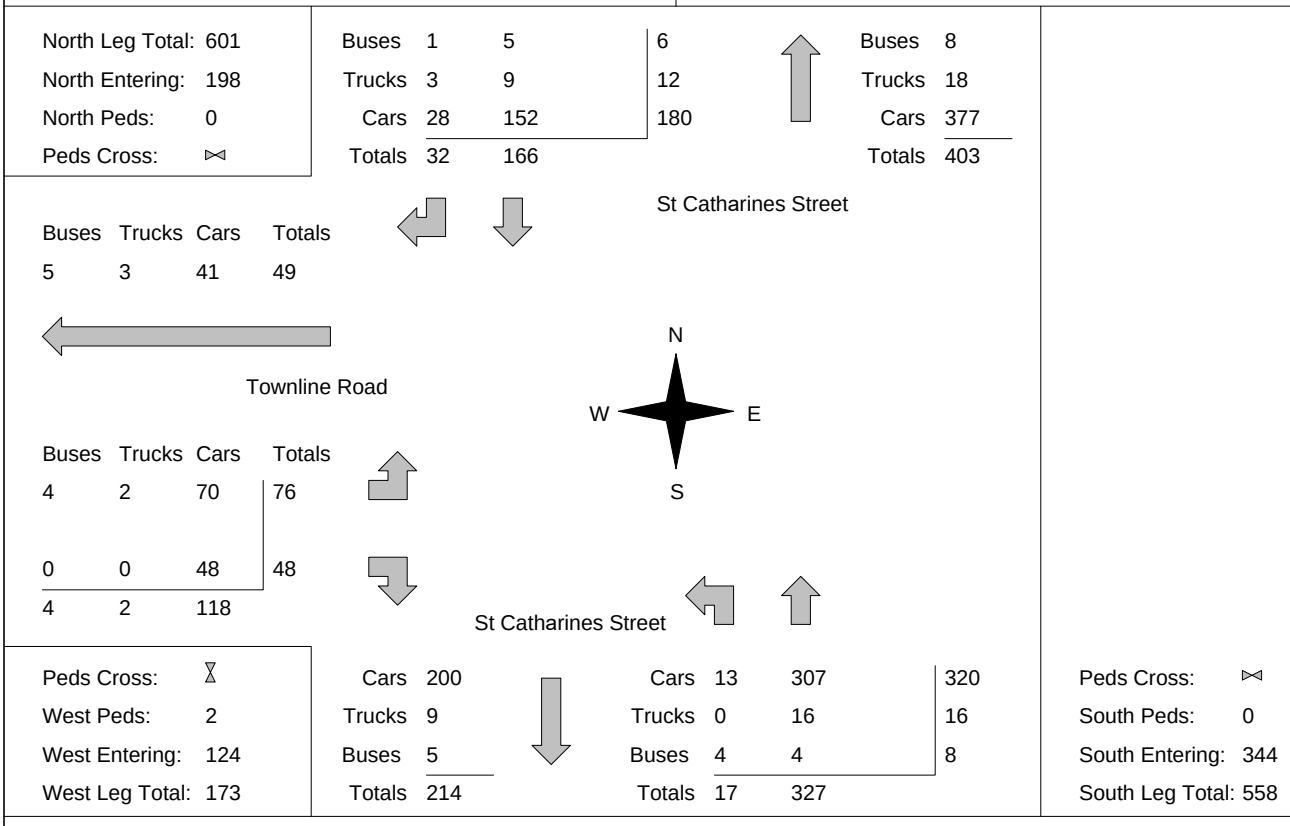
Municipality: Smithville
Site #: 0000002301
Intersection: St Catharines Street & Townline Ro
TFR File #: 1
Count date: 13-Jun-2024

Weather conditions:
Clear

Person(s) who counted:

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

Major Road: St Catharines Street runs N/S



Comments

ROUNDABOUT

Townline Road & St Catharines Street

Afternoon Peak Diagram

Specified Period
From: 14:30:00
To: 18:30:00

One Hour Peak
From: 16:30:00
To: 17:30:00

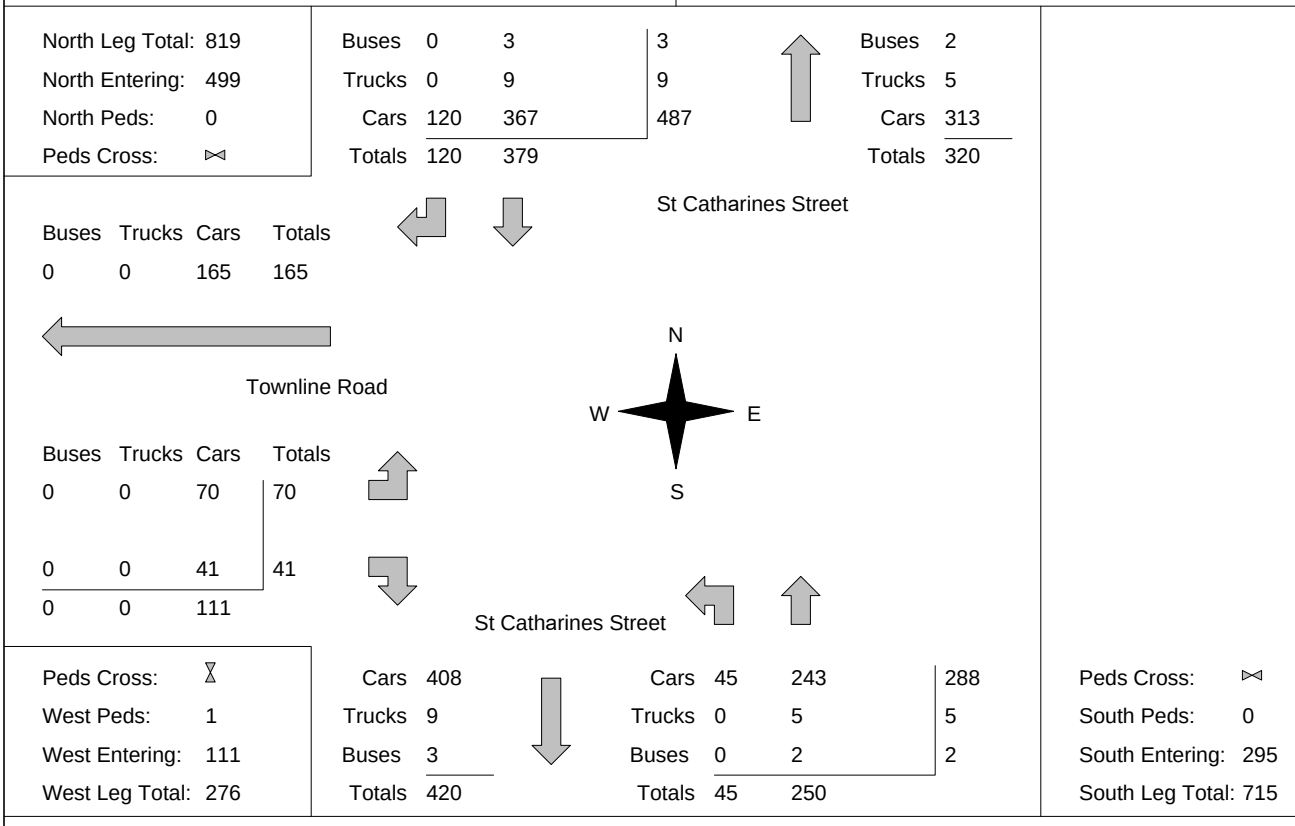
Municipality: Smithville
Site #: 0000002301
Intersection: St Catharines Street & Townline Ro
TFR File #: 1
Count date: 13-Jun-2024

Weather conditions:
Clear

Person(s) who counted:

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

Major Road: St Catharines Street runs N/S



Comments

ROUNDABOUT

Townline Road & St Catharines Street

Total Count Diagram

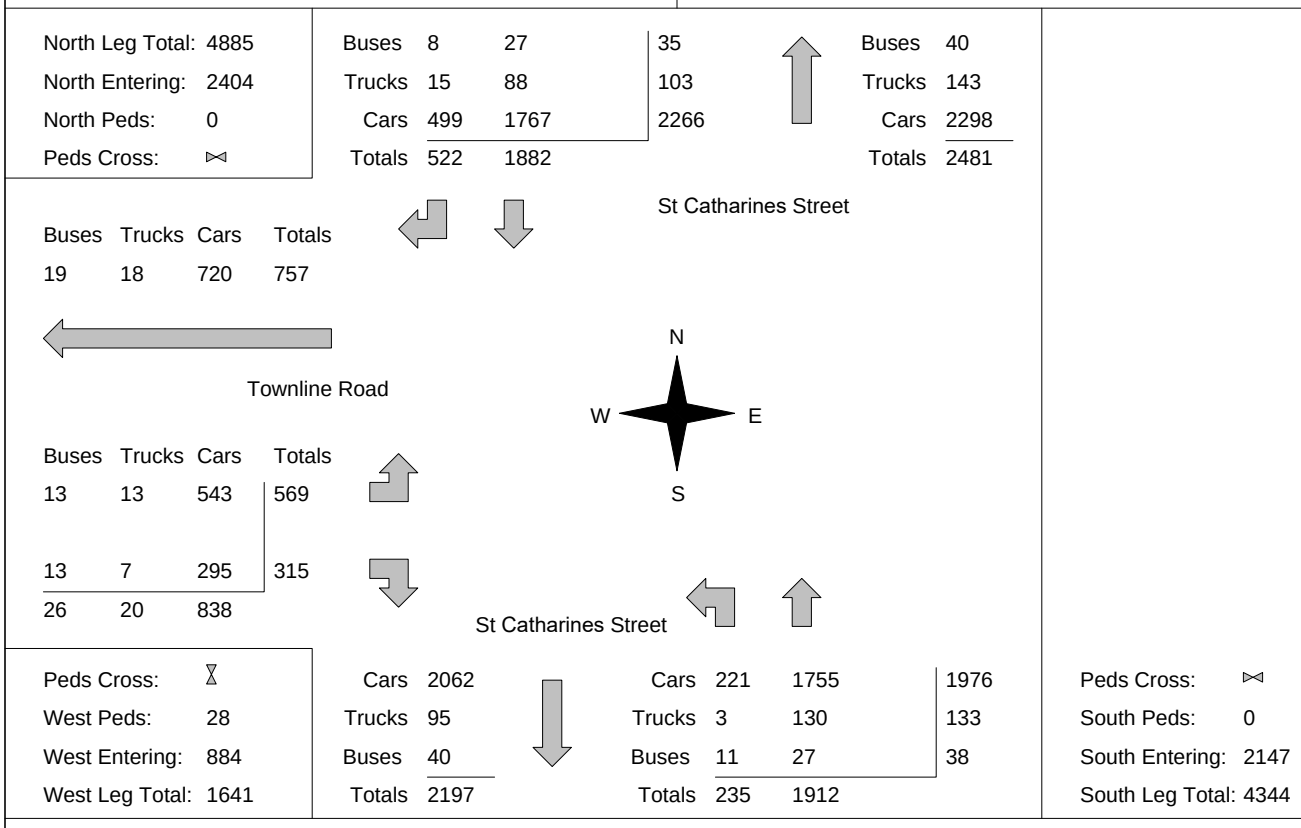
Municipality: Smithville
Site #: 0000002301
Intersection: St Catharines Street & Townline Ro
TFR File #: 1
Count date: 13-Jun-2024

Weather conditions:
Clear

Person(s) who counted:

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

Major Road: St Catharines Street runs N/S



Comments

ROUNDABOUT

Townline Road & St Catharines Street
Traffic Count Summary

Intersection: St Catharines Street & Townline Ro | **Count Date:** 13-Jun-2024 | **Municipality:** Smithville

North Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds	North/South Total Approaches
7:00:00	0	58	16	74	0	226
8:00:00	0	166	32	198	0	542
9:00:00	0	160	44	204	0	476
10:00:00	0	167	38	205	0	460
15:00:00	0	215	60	275	0	513
16:00:00	0	308	88	396	0	641
17:00:00	0	383	118	501	0	776
18:00:00	0	316	83	399	0	676
Totals:	0	1773	479	2252	0	4310

South Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds
7:00:00	2	150	0	152	0
8:00:00	17	327	0	344	0
9:00:00	40	232	0	272	0
10:00:00	20	235	0	255	0
15:00:00	24	214	0	238	0
16:00:00	35	210	0	245	0
17:00:00	41	234	0	275	0
18:00:00	47	230	0	277	0
Totals:	226	1832	0	2058	0

East Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds	East/West Total Approaches
7:00:00	0	0	0	0	0	59
8:00:00	0	0	0	0	0	124
9:00:00	0	0	0	0	0	129
10:00:00	0	0	0	0	0	91
15:00:00	0	0	0	0	0	87
16:00:00	0	0	0	0	0	124
17:00:00	0	0	0	0	0	115
18:00:00	0	0	0	0	0	107
Totals:	0	0	0	0	0	836

West Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds
7:00:00	43	0	16	59	3
8:00:00	76	0	48	124	2
9:00:00	87	0	42	129	3
10:00:00	60	0	31	91	8
15:00:00	57	0	30	87	3
16:00:00	75	0	49	124	2
17:00:00	76	0	39	115	1
18:00:00	66	0	41	107	3
Totals:	540	0	296	836	25

Calculated Values for Traffic Crossing Major Street

Hours Ending:	7:00	8:00	9:00	10:00	15:00	16:00	17:00	18:00
Crossing Values:	43	76	87	60	57	75	76	66

Townline Road & Canborough Street

Morning Peak Diagram

Specified Period
From: 6:30:00
To: 10:30:00

One Hour Peak
From: 8:00:00
To: 9:00:00

Municipality: Smithville
Site #: 0000002302
Intersection: Townline Road & Canborough Stree
TFR File #: 1
Count date: 13-Jun-2024

Weather conditions:
Clear

Person(s) who counted:

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

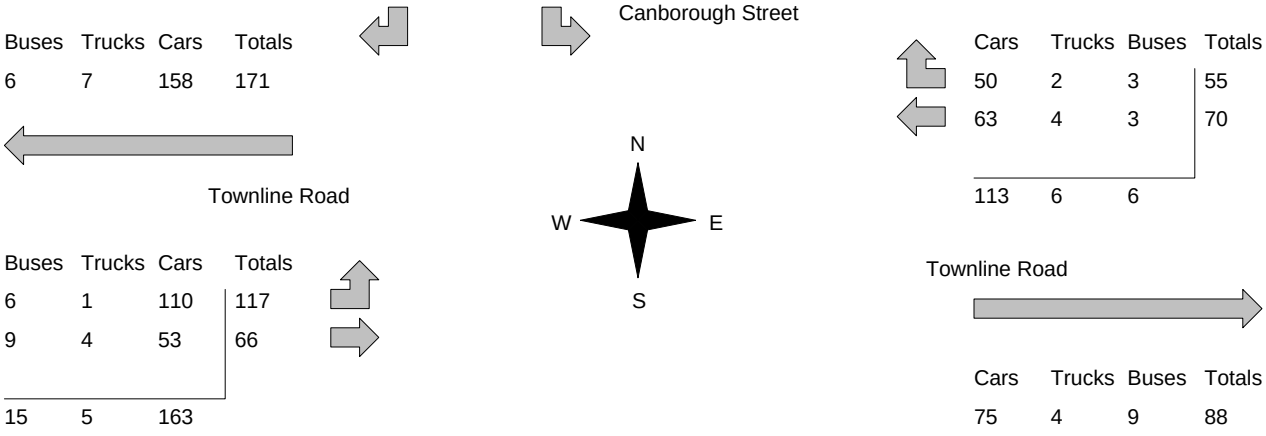
Major Road: Townline Road runs W/E

North Leg Total: 295
North Entering: 123
North Peds: 0
Peds Cross: ⋈

Buses	3	0	3
Trucks	3	0	3
Cars	95	22	117
Totals	101	22	

Buses	9
Trucks	3
Cars	160
Totals	172

East Leg Total: 213
East Entering: 125
East Peds: 6
Peds Cross: ⧖



Buses	Trucks	Cars	Totals
6	7	158	171

Cars	Trucks	Buses	Totals
50	2	3	55
63	4	3	70
113	6	6	

Buses	Trucks	Cars	Totals
6	1	110	117
9	4	53	66
15	5	163	

Cars	Trucks	Buses	Totals
75	4	9	88

Peds Cross: ⧖
West Peds: 0
West Entering: 183
West Leg Total: 354

Comments

Townline Road & Canborough Street

Afternoon Peak Diagram

Specified Period
From: 14:30:00
To: 18:30:00

One Hour Peak
From: 16:30:00
To: 17:30:00

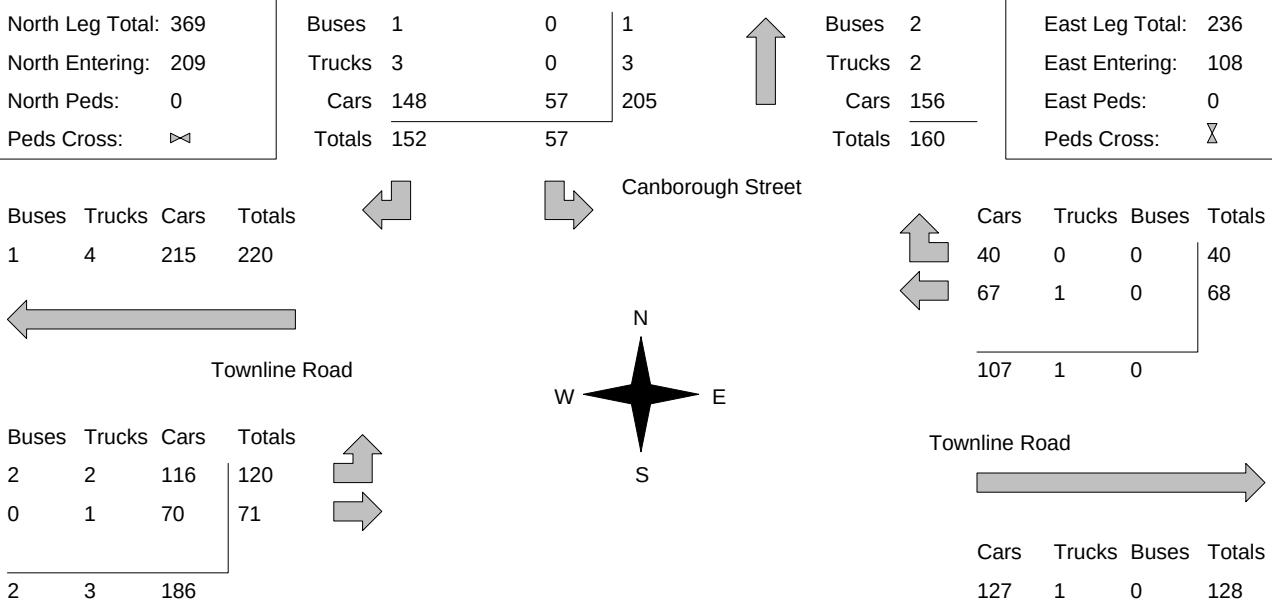
Municipality: Smithville
Site #: 0000002302
Intersection: Townline Road & Canborough Stree
TFR File #: 1
Count date: 13-Jun-2024

Weather conditions:
Clear

Person(s) who counted:

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

Major Road: Townline Road runs W/E



Peds Cross:
West Peds: 2
West Entering: 191
West Leg Total: 411

Comments

Townline Road & Canborough Street

Total Count Diagram

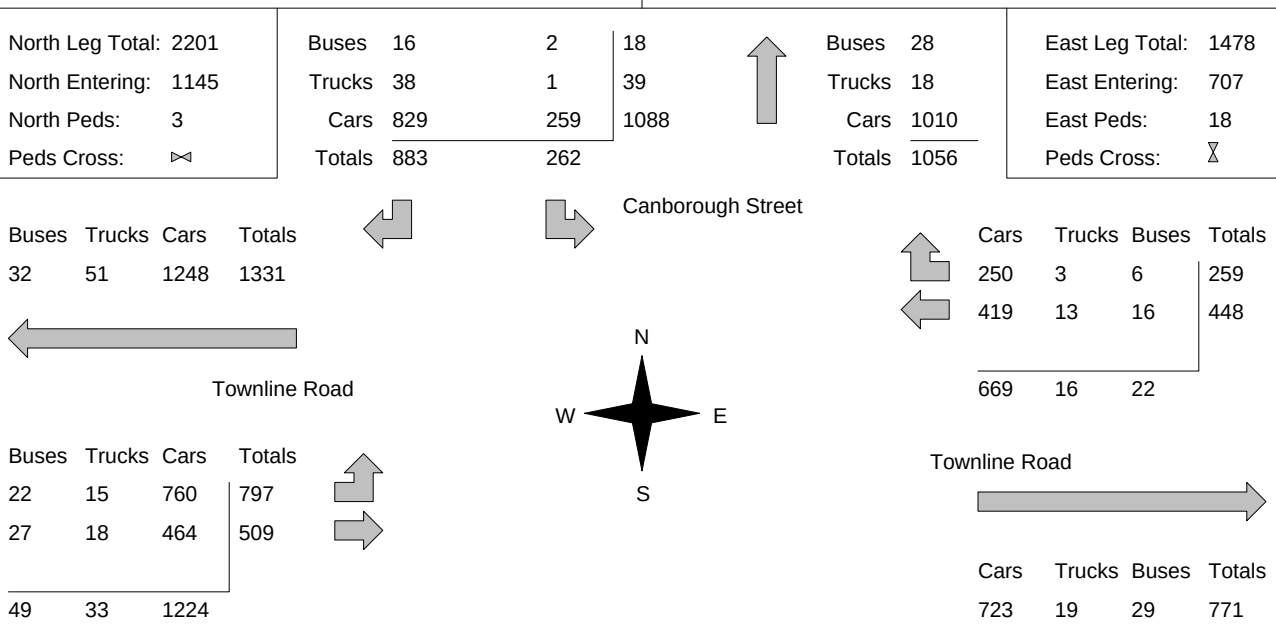
Municipality: Smithville
Site #: 0000002302
Intersection: Townline Road & Canborough Stree
TFR File #: 1
Count date: 13-Jun-2024

Weather conditions:
Clear

Person(s) who counted:

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

Major Road: Townline Road runs W/E



Comments

Townline Road & Canborough Street
Traffic Count Summary

Intersection: Townline Road & Canborough Stre | **Count Date:** 13-Jun-2024 | **Municipality:** Smithville

North Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds	North/South Total Approaches
7:00:00	6	0	29	35	0	35
8:00:00	11	0	76	87	0	87
9:00:00	22	0	101	123	0	123
10:00:00	17	0	97	114	0	114
15:00:00	29	0	120	149	0	149
16:00:00	44	0	141	185	0	185
17:00:00	63	0	137	200	0	200
18:00:00	41	0	138	179	3	179
Totals:	233	0	839	1072	3	1072

South Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds
7:00:00	0	0	0	0	0
8:00:00	0	0	0	0	0
9:00:00	0	0	0	0	0
10:00:00	0	0	0	0	0
15:00:00	0	0	0	0	0
16:00:00	0	0	0	0	0
17:00:00	0	0	0	0	0
18:00:00	0	0	0	0	0
Totals:	0	0	0	0	0

East Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds	East/West Total Approaches
7:00:00	0	24	8	32	3	90
8:00:00	0	46	30	76	2	224
9:00:00	0	70	55	125	6	308
10:00:00	0	35	27	62	3	192
15:00:00	0	59	24	83	2	225
16:00:00	0	70	25	95	1	306
17:00:00	0	69	41	110	0	291
18:00:00	0	57	35	92	1	276
Totals:	0	430	245	675	18	1912

West Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds
7:00:00	39	19	0	58	0
8:00:00	88	60	0	148	0
9:00:00	117	66	0	183	0
10:00:00	80	50	0	130	1
15:00:00	85	57	0	142	1
16:00:00	122	89	0	211	0
17:00:00	106	75	0	181	0
18:00:00	121	63	0	184	3
Totals:	758	479	0	1237	5

Calculated Values for Traffic Crossing Major Street

Hours Ending:	7:00	8:00	9:00	10:00	15:00	16:00	17:00	18:00
Crossing Values:	9	13	28	21	32	45	63	45

Townline Road & Port Davidson Road

Morning Peak Diagram

Specified Period
From: 6:30:00
To: 10:30:00

One Hour Peak
From: 8:00:00
To: 9:00:00

Municipality: Smithville
Site #: 0000002303
Intersection: Townline Road & Port Davidson Ro
TFR File #: 1
Count date: 13-Jun-2024

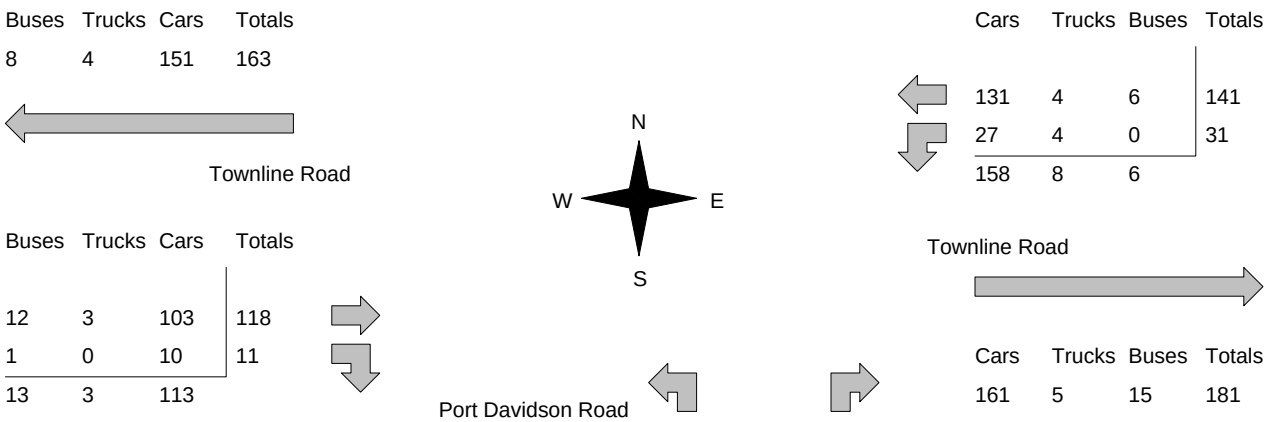
Weather conditions:
Clear

Person(s) who counted:

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

Major Road: Townline Road runs W/E

East Leg Total: 353
East Entering: 172
East Peds: 0
Peds Cross: ⧖



Peds Cross: ⧖
West Peds: 2
West Entering: 129
West Leg Total: 292

Cars 37
Trucks 4
Buses 1
Totals 42

Cars 20 58 78
Trucks 0 2 2
Buses 2 3 5
Totals 22 63

Peds Cross: ⋈
South Peds: 8
South Entering: 85
South Leg Total: 127

Comments

Townline Road & Port Davidson Road

Afternoon Peak Diagram

Specified Period
From: 14:30:00
To: 18:30:00

One Hour Peak
From: 14:30:00
To: 15:30:00

Municipality: Smithville
Site #: 0000002303
Intersection: Townline Road & Port Davidson Ro
TFR File #: 1
Count date: 13-Jun-2024

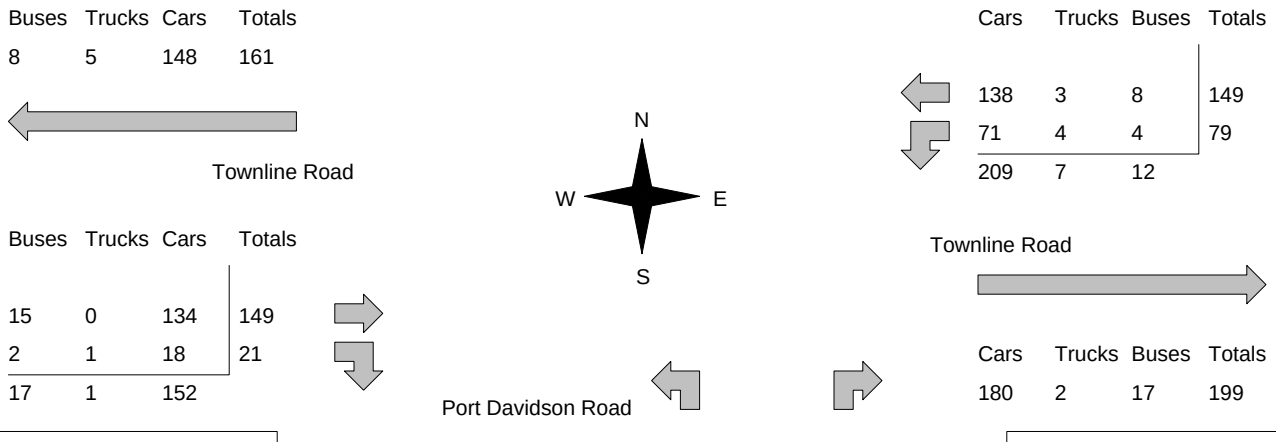
Weather conditions:
Clear

Person(s) who counted:

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

Major Road: Townline Road runs W/E

East Leg Total: 427
East Entering: 228
East Peds: 0
Peds Cross: ⧖



Peds Cross: ⧖
West Peds: 0
West Entering: 170
West Leg Total: 331

Cars 89
Trucks 5
Buses 6
Totals 100

Cars 10 46 56
Trucks 2 2 4
Buses 0 2 2
Totals 12 50

Peds Cross: ⋈
South Peds: 5
South Entering: 62
South Leg Total: 162

Comments

Townline Road & Port Davidson Road

Total Count Diagram

Municipality: Smithville
Site #: 0000002303
Intersection: Townline Road & Port Davidson Ro
TFR File #: 1
Count date: 13-Jun-2024

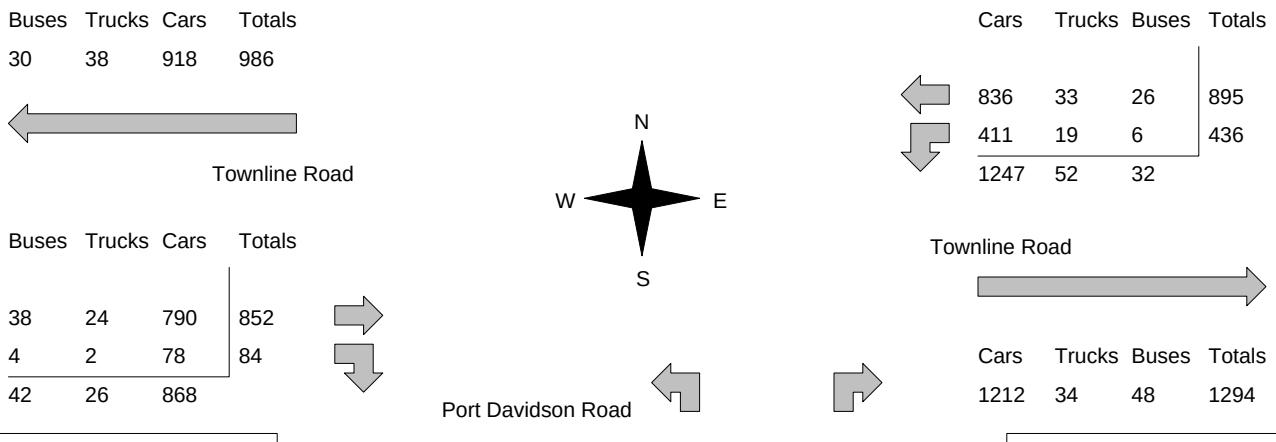
Weather conditions:
Clear

Person(s) who counted:

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

Major Road: Townline Road runs W/E

East Leg Total: 2625
East Entering: 1331
East Peds: 0
Peds Cross: ⧖



Peds Cross: ⧖
West Peds: 3
West Entering: 936
West Leg Total: 1922

Cars 489
Trucks 21
Buses 10
Totals 520

Cars 82 422 504
Trucks 5 10 15
Buses 4 10 14
Totals 91 442

Peds Cross: ⋈
South Peds: 34
South Entering: 533
South Leg Total: 1053

Comments

Townline Road & Port Davidson Road
Traffic Count Summary

Intersection: Townline Road & Port Davidson Rd | **Count Date:** 13-Jun-2024 | **Municipality:** Smithville

North Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds	North/South Total Approaches
7:00:00	0	0	0	0	0	37
8:00:00	0	0	0	0	0	76
9:00:00	0	0	0	0	0	85
10:00:00	0	0	0	0	0	58
15:00:00	0	0	0	0	0	66
16:00:00	0	0	0	0	0	47
17:00:00	0	0	0	0	0	68
18:00:00	0	0	0	0	0	66
Totals:	0	0	0	0	0	503

South Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds
7:00:00	2	0	35	37	3
8:00:00	13	0	63	76	4
9:00:00	22	0	63	85	8
10:00:00	8	0	50	58	5
15:00:00	9	0	57	66	4
16:00:00	8	0	39	47	7
17:00:00	10	0	58	68	0
18:00:00	9	0	57	66	3
Totals:	81	0	422	503	34

East Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds	East/West Total Approaches
7:00:00	17	36	0	53	0	82
8:00:00	43	79	0	122	0	220
9:00:00	31	141	0	172	0	301
10:00:00	38	94	0	132	0	216
15:00:00	58	118	0	176	0	265
16:00:00	68	146	0	214	0	407
17:00:00	92	109	0	201	0	331
18:00:00	68	134	0	202	0	333
Totals:	415	857	0	1272	0	2155

West Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds
7:00:00	0	27	2	29	0
8:00:00	0	87	11	98	0
9:00:00	0	118	11	129	2
10:00:00	0	80	4	84	0
15:00:00	0	81	8	89	0
16:00:00	0	170	23	193	0
17:00:00	0	121	9	130	0
18:00:00	0	121	10	131	1
Totals:	0	805	78	883	3

Calculated Values for Traffic Crossing Major Street

Hours Ending:	7:00	8:00	9:00	10:00	15:00	16:00	17:00	18:00
Crossing Values:	2	13	24	8	9	8	10	10

Townline Road & Shurie Road

Morning Peak Diagram

Specified Period
From: 6:30:00
To: 10:30:00

One Hour Peak
From: 8:00:00
To: 9:00:00

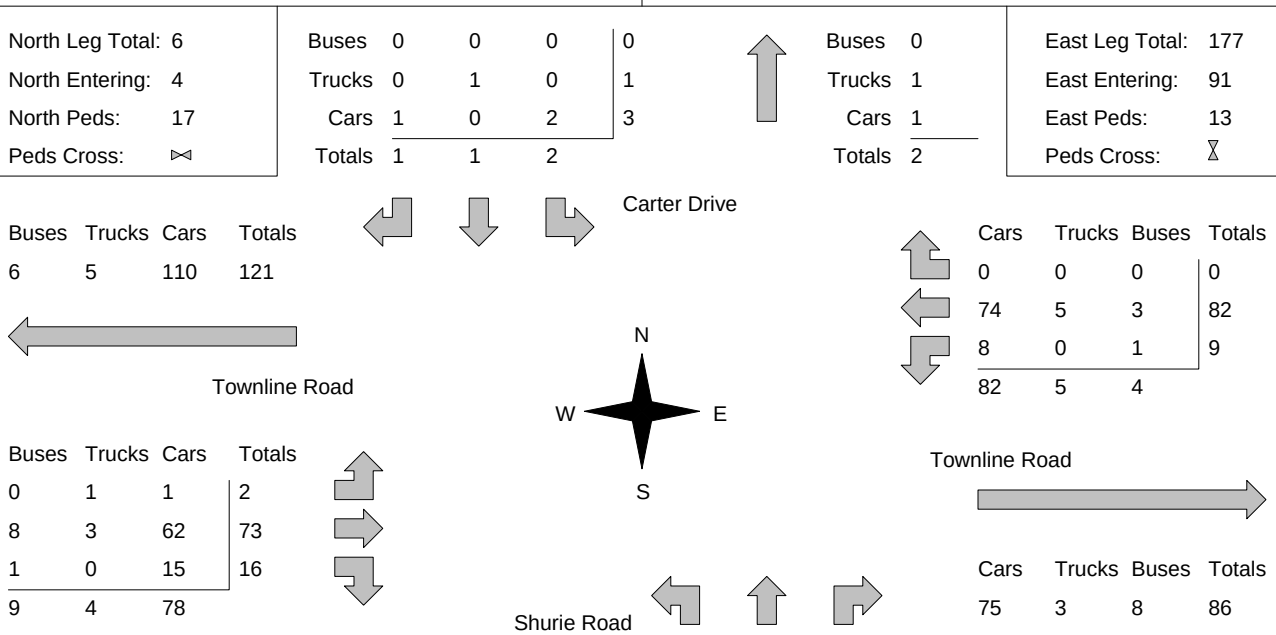
Municipality: Smithville
Site #: 0000002304
Intersection: Townline Road & Shurie Road
TFR File #: 1
Count date: 13-Jun-2024

Weather conditions:
Clear

Person(s) who counted:

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

Major Road: Townline Road runs W/E



Comments

Townline Road & Shurie Road

Afternoon Peak Diagram

Specified Period
From: 14:30:00
To: 18:30:00

One Hour Peak
From: 16:00:00
To: 17:00:00

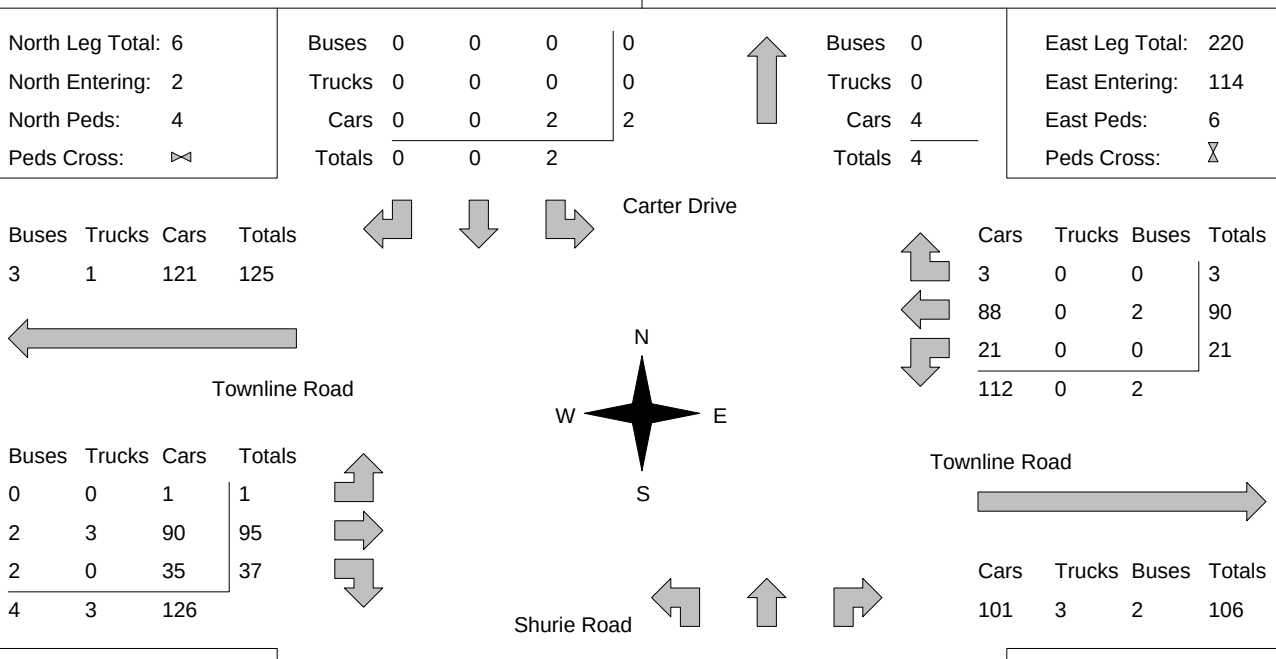
Municipality: Smithville
Site #: 0000002304
Intersection: Townline Road & Shurie Road
TFR File #: 1
Count date: 13-Jun-2024

Weather conditions:
Clear

Person(s) who counted:

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

Major Road: Townline Road runs W/E



Comments

Townline Road & Shurie Road

Total Count Diagram

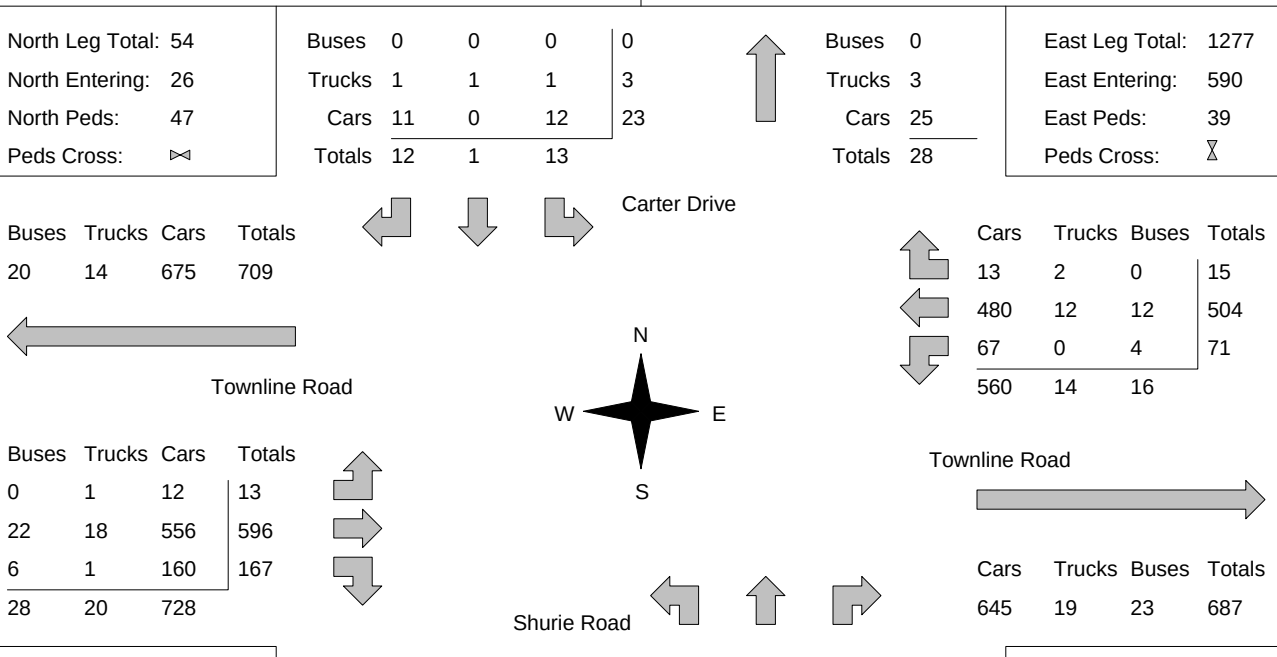
Municipality: Smithville
Site #: 0000002304
Intersection: Townline Road & Shurie Road
TFR File #: 1
Count date: 13-Jun-2024

Weather conditions:
Clear

Person(s) who counted:

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

Major Road: Townline Road runs W/E



Comments

Townline Road & Shurie Road
Traffic Count Summary

Intersection: Townline Road & Shurie Road | **Count Date:** 13-Jun-2024 | **Municipality:** Smithville

North Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds	North/South Total Approaches
7:00:00	0	0	0	0	0	16
8:00:00	5	0	2	7	1	39
9:00:00	2	1	1	4	17	53
10:00:00	2	0	3	5	2	31
15:00:00	1	0	1	2	6	32
16:00:00	1	0	0	1	12	31
17:00:00	2	0	0	2	4	46
18:00:00	0	0	5	5	3	36
Totals:	13	1	12	26	45	284

South Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds
7:00:00	13	0	3	16	8
8:00:00	23	0	9	32	1
9:00:00	38	0	11	49	6
10:00:00	14	0	12	26	7
15:00:00	19	0	11	30	5
16:00:00	20	0	10	30	1
17:00:00	35	0	9	44	0
18:00:00	21	0	10	31	1
Totals:	183	0	75	258	29

East Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds	East/West Total Approaches
7:00:00	1	14	0	15	0	50
8:00:00	5	43	4	52	2	126
9:00:00	9	82	0	91	13	182
10:00:00	3	37	1	41	0	105
15:00:00	9	60	1	70	5	157
16:00:00	12	76	4	92	11	227
17:00:00	21	90	3	114	6	247
18:00:00	7	77	1	85	1	186
Totals:	67	479	14	560	38	1280

West Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds
7:00:00	0	30	5	35	0
8:00:00	3	62	9	74	0
9:00:00	2	73	16	91	4
10:00:00	0	59	5	64	1
15:00:00	1	62	24	87	0
16:00:00	3	99	33	135	0
17:00:00	1	95	37	133	0
18:00:00	0	74	27	101	3
Totals:	10	554	156	720	8

Calculated Values for Traffic Crossing Major Street

Hours Ending:	7:00	8:00	9:00	10:00	15:00	16:00	17:00	18:00
Crossing Values:	13	30	58	17	25	32	43	25

Townline Road & Alma Drive

Morning Peak Diagram

Specified Period
From: 6:30:00
To: 10:30:00

One Hour Peak
From: 8:00:00
To: 9:00:00

Municipality: Smithville
Site #: 0000002305
Intersection: Townline Road & Alma Drive
TFR File #: 1
Count date: 13-Jun-2024

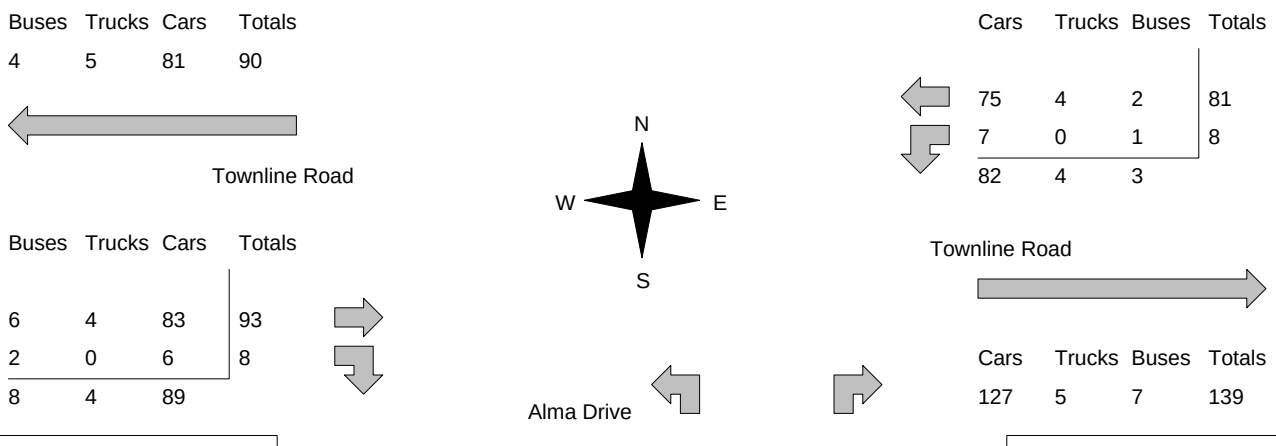
Weather conditions:
Clear

Person(s) who counted:

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

Major Road: Townline Road runs W/E

East Leg Total: 228
East Entering: 89
East Peds: 0
Peds Cross: ⧖



Peds Cross: ⧖
West Peds: 0
West Entering: 101
West Leg Total: 191

Cars 13
Trucks 0
Buses 3
Totals 16

Cars 6 44 50
Trucks 1 1 2
Buses 2 1 3
Totals 9 46

Peds Cross: ⋈
South Peds: 3
South Entering: 55
South Leg Total: 71

Comments

Townline Road & Alma Drive

Afternoon Peak Diagram

Specified Period
From: 14:30:00
To: 18:30:00

One Hour Peak
From: 16:30:00
To: 17:30:00

Municipality: Smithville
Site #: 0000002305
Intersection: Townline Road & Alma Drive
TFR File #: 1
Count date: 13-Jun-2024

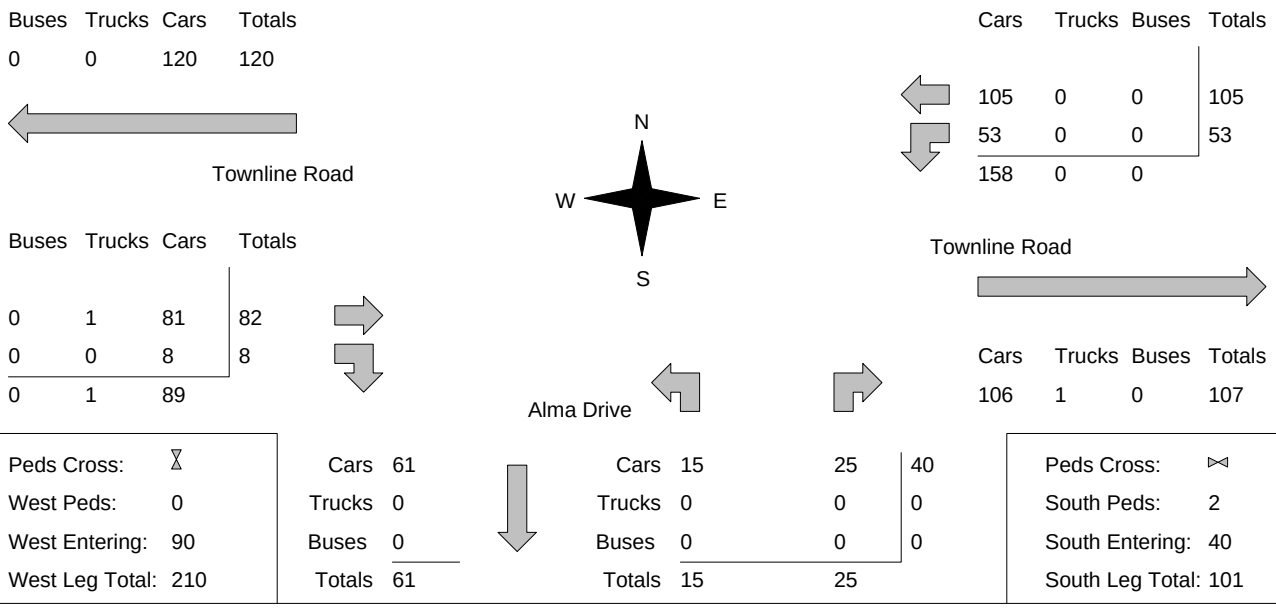
Weather conditions:
Clear

Person(s) who counted:

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

Major Road: Townline Road runs W/E

East Leg Total: 265
East Entering: 158
East Peds: 0
Peds Cross:



Peds Cross:
West Peds: 0
West Entering: 90
West Leg Total: 210

Cars 61
Trucks 0
Buses 0
Totals 61

Cars 15 25 40
Trucks 0 0 0
Buses 0 0 0
Totals 15 25

Peds Cross:
South Peds: 2
South Entering: 40
South Leg Total: 101

Comments

Townline Road & Alma Drive

Total Count Diagram

Municipality: Smithville
Site #: 0000002305
Intersection: Townline Road & Alma Drive
TFR File #: 1
Count date: 13-Jun-2024

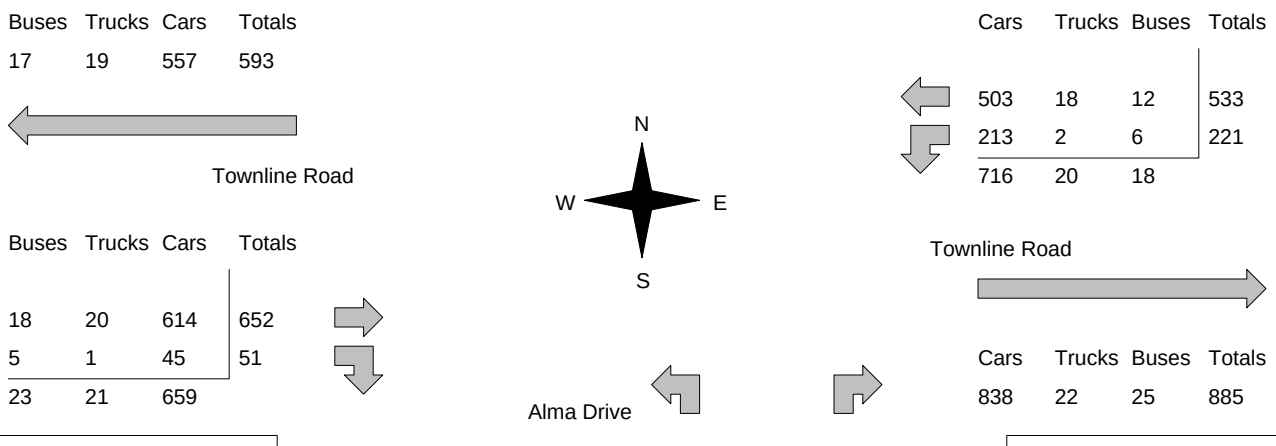
Weather conditions:
Clear

Person(s) who counted:

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

Major Road: Townline Road runs W/E

East Leg Total: 1639
East Entering: 754
East Peds: 0
Peds Cross: ⧖



Peds Cross: ⧖
West Peds: 0
West Entering: 703
West Leg Total: 1296

Cars 258
Trucks 3
Buses 11
Totals 272

Cars 54 224 278
Trucks 1 2 3
Buses 5 7 12
Totals 60 233

Peds Cross: ⋈
South Peds: 28
South Entering: 293
South Leg Total: 565

Comments

Townline Road & Alma Drive
Traffic Count Summary

Intersection: Townline Road & Alma Drive | **Count Date:** 13-Jun-2024 | **Municipality:** Smithville

North Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds	North/South Total Approaches
7:00:00	0	0	0	0	0	22
8:00:00	0	0	0	0	0	56
9:00:00	0	0	0	0	0	55
10:00:00	0	0	0	0	0	20
15:00:00	0	0	0	0	0	24
16:00:00	0	0	0	0	0	32
17:00:00	0	0	0	0	0	31
18:00:00	0	0	0	0	0	42
Totals:	0	0	0	0	0	282

South Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds
7:00:00	5	0	17	22	3
8:00:00	11	0	45	56	2
9:00:00	9	0	46	55	3
10:00:00	2	0	18	20	7
15:00:00	3	0	21	24	3
16:00:00	8	0	24	32	1
17:00:00	10	0	21	31	1
18:00:00	9	0	33	42	5
Totals:	57	0	225	282	25

East Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds	East/West Total Approaches
7:00:00	6	12	0	18	0	61
8:00:00	12	34	0	46	0	125
9:00:00	8	81	0	89	0	190
10:00:00	20	34	0	54	0	129
15:00:00	22	67	0	89	0	159
16:00:00	35	87	0	122	0	233
17:00:00	47	105	0	152	0	249
18:00:00	46	86	0	132	0	215
Totals:	196	506	0	702	0	1361

West Approach Totals

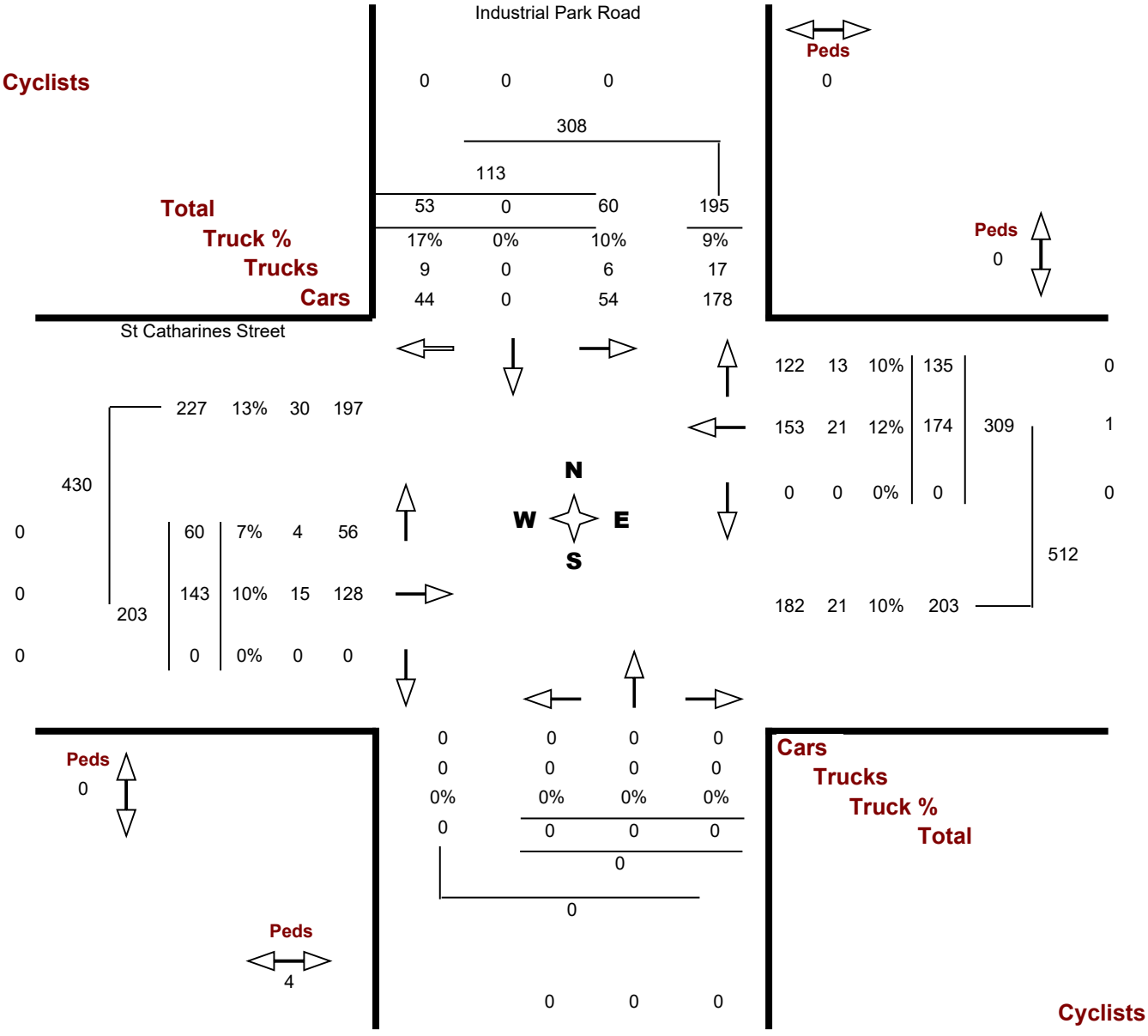
Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds
7:00:00	0	42	1	43	0
8:00:00	0	74	5	79	0
9:00:00	0	93	8	101	0
10:00:00	0	72	3	75	0
15:00:00	0	66	4	70	0
16:00:00	0	102	9	111	0
17:00:00	0	91	6	97	0
18:00:00	0	72	11	83	0
Totals:	0	612	47	659	0

Calculated Values for Traffic Crossing Major Street

Hours Ending:	7:00	8:00	9:00	10:00	15:00	16:00	17:00	18:00
Crossing Values:	5	11	9	2	3	8	10	9

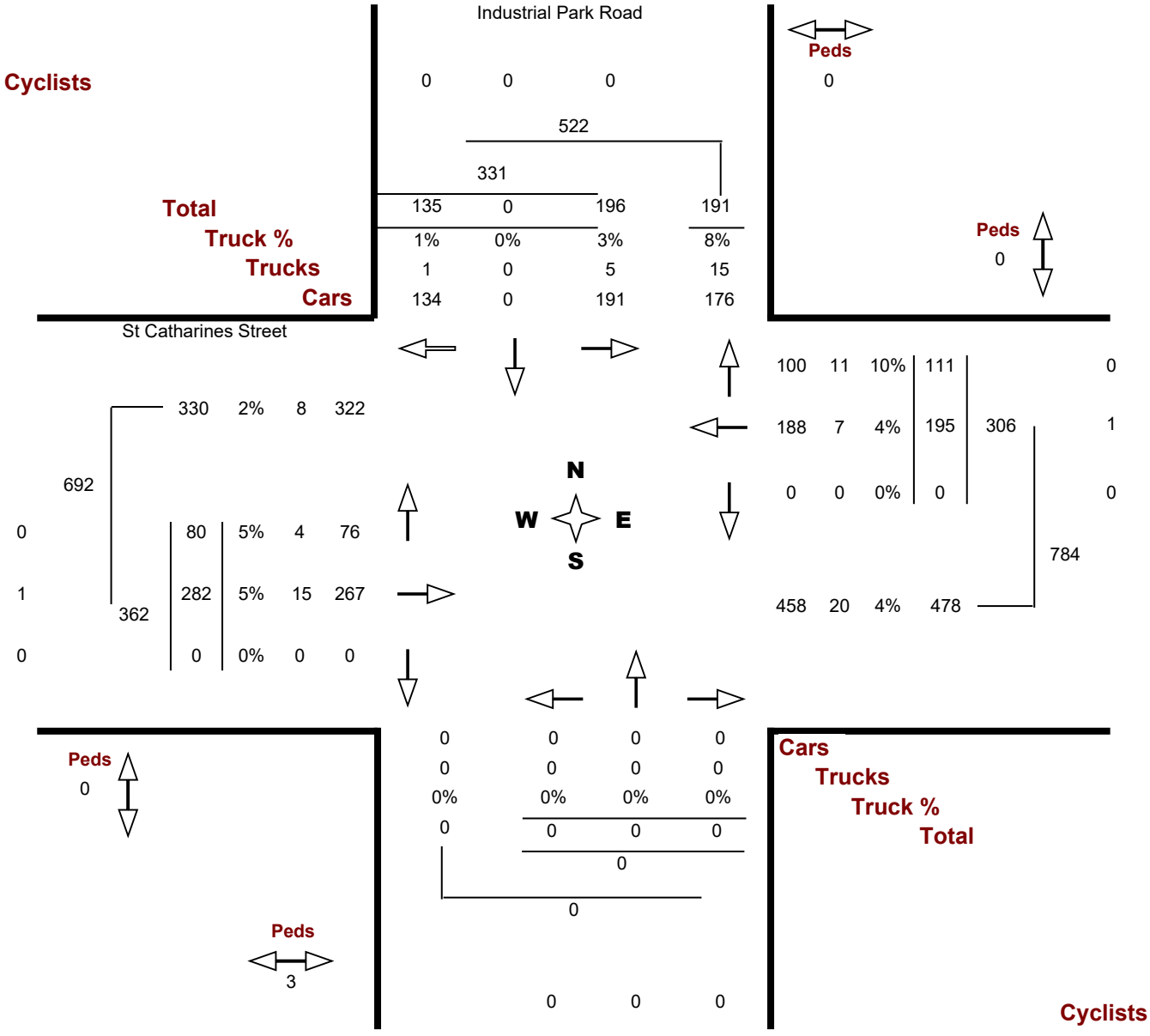
Turning Movements Report - AM Period

Location.....	Industrial Park Road @ St Catharines Street	**GeoID.....**	00085
Municipality.	WEST LINCOLN	**Count Date.**	Thursday, 15 June, 2023
Traffic Cont.		**Count Time.**	07:00 AM — 09:00 AM
Major Dir.....	East west	**Peak Hour..**	08:00 AM — 09:00 AM



Turning Movements Report - PM Period

Location..... Industrial Park Road @ St Catharines Street
GeoID..... 00085
Municipality. WEST LINCOLN
Count Date. Thursday, 15 June, 2023
Traffic Cont.
Count Time. 03:00 PM — 06:00 PM
Major Dir..... East west
Peak Hour.. 04:30 PM — 05:30 PM



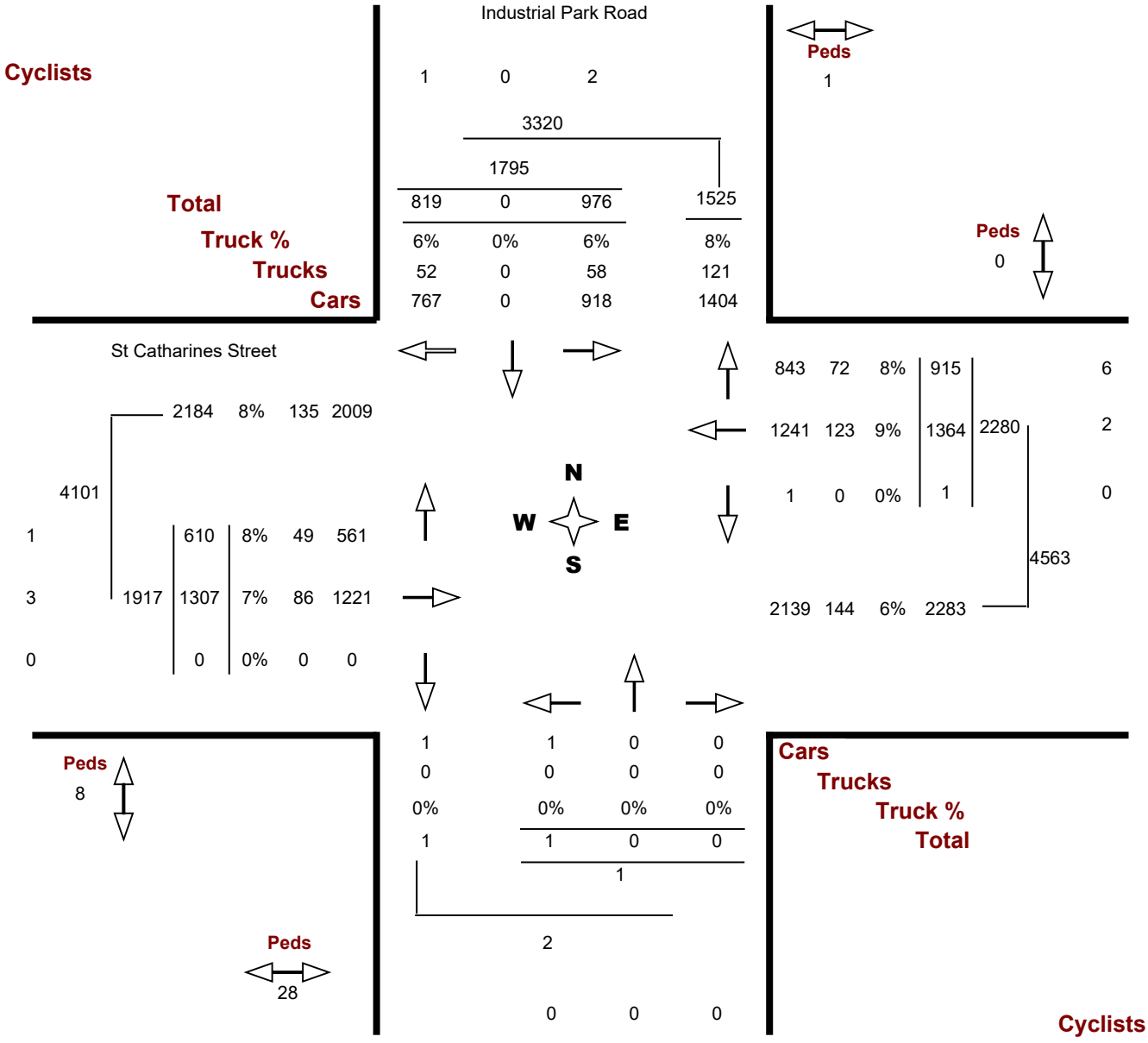
Turning Movement Count Report
Full Study

Location..... Industrial Park Road @ St Catharines Street

Municipality..... WEST LINCOLN

GeoID..... 00085

Count Date..... Thursday, 15 June, 2023



Turning Movement Count - Details Report (15 min)

Location..... Industrial Park Road @ St Catharines Street

Municipality..... WEST LINCOLN

Count Date..... Thursday, June 15, 2023

		Industrial Park Road										St Catharines Street									
		North Approach					South Approach					East Approach					West Approach				
Time Period		LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT
07:00	07:15	30	0	15	0	45	0	0	0	0	0	0	45	27	0	72	6	20	0	0	26
07:15	07:30	13	0	14	0	27	0	0	0	0	0	0	60	34	0	94	10	35	0	0	45
07:30	07:45	11	0	8	0	19	0	0	0	0	0	0	50	46	0	96	18	17	0	0	35
07:45	08:00	10	0	4	0	14	0	0	0	0	0	0	48	37	0	85	16	39	0	0	55
Hourly Total		64	0	41	0	105	0	0	0	0	0	0	203	144	0	347	50	111	0	0	161
08:00	08:15	12	0	12	0	24	0	0	0	0	0	0	40	29	0	69	8	41	0	0	49
08:15	08:30	18	0	11	0	29	0	0	0	0	0	0	43	30	0	73	15	30	0	0	45
08:30	08:45	15	0	9	0	24	0	0	0	0	0	0	42	39	0	81	21	33	0	0	54
08:45	09:00	15	0	21	0	36	0	0	0	0	0	0	49	37	0	86	16	39	0	0	55
Hourly Total		60	0	53	0	113	0	0	0	0	0	0	174	135	0	309	60	143	0	0	203
11:00	11:15	28	0	19	0	47	0	0	0	0	0	0	26	19	0	45	27	34	0	0	61
11:15	11:30	18	0	25	0	43	0	0	0	0	0	0	32	25	0	57	21	28	0	0	49
11:30	11:45	20	0	18	0	38	1	0	0	0	1	0	40	27	0	67	20	41	0	0	61
11:45	12:00	25	0	25	0	50	0	0	0	0	0	0	45	36	0	81	16	29	0	0	45
Hourly Total		91	0	87	0	178	1	0	0	0	1	0	143	107	0	250	84	132	0	0	216
12:00	12:15	38	0	25	0	63	0	0	0	0	0	0	40	15	0	55	22	35	0	0	57
12:15	12:30	27	0	29	0	56	0	0	0	0	0	0	36	34	0	70	28	29	0	0	57
12:30	12:45	27	0	29	0	56	0	0	0	0	0	0	36	26	0	62	24	26	0	0	50
12:45	13:00	23	0	33	0	56	0	0	0	0	0	0	29	23	0	52	22	33	0	0	55
Hourly Total		115	0	116	0	231	0	0	0	0	0	0	141	98	0	239	96	123	0	0	219
13:00	13:15	27	0	33	0	60	0	0	0	0	0	0	43	25	0	68	28	34	0	0	62
13:15	13:30	28	0	29	0	57	0	0	0	0	0	0	35	27	0	62	26	37	0	0	63
13:30	13:45	26	0	20	0	46	0	0	0	0	0	0	36	25	0	61	29	29	0	0	58
13:45	14:00	29	0	28	0	57	0	0	0	0	0	0	36	27	0	63	17	35	0	0	52
Hourly Total		110	0	110	0	220	0	0	0	0	0	0	150	104	0	254	100	135	0	0	235
15:00	15:15	63	0	49	0	112	0	0	0	0	0	0	34	24	0	58	21	54	0	0	75
15:15	15:30	49	0	28	0	77	0	0	0	0	0	0	40	27	0	67	19	42	0	0	61
15:30	15:45	44	0	33	0	77	0	0	0	0	0	0	38	26	0	64	21	48	0	0	69
15:45	16:00	42	0	40	0	82	0	0	0	0	0	0	50	19	0	69	18	43	0	0	61
Hourly Total		198	0	150	0	348	0	0	0	0	0	0	162	96	0	258	79	187	0	0	266
16:00	16:15	37	0	34	0	71	0	0	0	0	0	0	44	26	0	70	13	46	0	0	59

		Industrial Park Road										St Catharines Street									
		North Approach					South Approach					East Approach					West Approach				
Time Period		LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT
16:15	16:30	47	0	36	0	83	0	0	0	0	0	0	52	28	0	80	18	50	0	0	68
16:30	16:45	52	0	36	0	88	0	0	0	0	0	0	42	32	0	74	16	88	0	0	104
16:45	17:00	34	0	26	0	60	0	0	0	0	0	0	46	20	0	66	22	54	0	0	76
Hourly Total		170	0	132	0	302	0	0	0	0	0	0	184	106	0	290	69	238	0	0	307
17:00	17:15	62	0	40	0	102	0	0	0	0	0	0	48	30	0	78	18	75	0	0	93
17:15	17:30	48	0	33	0	81	0	0	0	0	0	0	59	29	0	88	24	65	0	0	89
17:30	17:45	30	0	28	0	58	0	0	0	0	0	1	54	30	0	85	13	54	0	0	67
17:45	18:00	28	0	29	0	57	0	0	0	0	0	0	46	36	0	82	17	44	0	0	61
Hourly Total		168	0	130	0	298	0	0	0	0	0	1	207	125	0	333	72	238	0	0	310
Grand Total		976	0	819	0	1795	1	0	0	0	1	1	1364	915	0	2280	610	1307	0	0	1917
Truck %		6%	0%	6%	0%	6%	0%	0%	0%	0%	0%	0%	9%	8%	0%	9%	8%	7%	0%	0%	7%

Appendix B TERMS OF REFERENCE AND CONSULTATION WITH TOWNSHIP OF WEST LINCOLN AND REGION OF NIAGARA

From: Dunsmore, Susan <Susan.Dunsmore@niagararegion.ca>
Sent: Thursday, March 28, 2024 4:24 AM
To: Yip, Wilson
Cc: Wilson, Connor; Mirhoseini, Arash; Del Rosario, Christine; Kapolnas, Stephen; Mammel, Suzanne; Bureau, Stephen
Subject: RE: Traffic Impact Study (TIS) in support of Smithville Block 3A Area 9 Phase 1 Development: Overview and Request for Available Information from Region

Follow Up Flag: Follow up
Flag Status: Flagged

Good Morning

Regional transportation planning staff has reviewed the terms of reference and has added their comments in green. For Regional traffic data requests please use the following link: https://www.niagararegion.ca/living/roads/permits/traffic-data-requests.aspx

Any improvements to Regional roads and infrastructure require functional designs to be included in the TIS submitted for review and approval.

If you require anything further please contact me at your convenience.

Thank you

Growing Better Together
Niagara Region

Susan M. Dunsmore, P.Eng.
ACTING DIRECTOR, INFRASTRUCTURE PLANNING &DEVELOPMENT ENGINEERING
Niagara Region, 1815 Sir Isaac Brock Way, Thorold, ON, L2V 4T7

P : (905) 980 - 6000 ext. 3661
W : www.niagararegion.ca
E : susan.dunsmore@niagararegion.ca

From: Yip, Wilson <Wilson.Yip@stantec.com>
Sent: Wednesday, March 20, 2024 3:44 PM
To: Dunsmore, Susan <Susan.Dunsmore@niagararegion.ca>
Cc: Wilson, Connor <Connor.Wilson@niagararegion.ca>; Mirhoseini, Arash <Arash.Mirhoseini@stantec.com>; Del Rosario, Christine <Christine.DelRosario@stantec.com>; Kapolnas, Stephen <Steve.Kapolnas@stantec.com>; Mammel, Suzanne <Suzanne.Mammel@stantec.com>
Subject: Traffic Impact Study (TIS) in support of Smithville Block 3A Area 9 Phase 1 Development: Overview and Request for Available Information from Region

Good afternoon Susan,

My name is Wilson. I am working with Christine on a Traffic Impact Study (TIS) in support of a proposed development in Smithville – Smithville Block 3A Area 9 Phase 1. Thanks for responding to Christine's inquiry and connecting us with Connor.

To provide you with some background information, the development site is located approximately 800m west of the intersection of Townline Road and St Catharines Street in the Township of West Lincoln, Ontario (see figure below).

We submitted a Terms of Reference (ToR) to the Township back in January/February, which included a series of data request. The approved ToR, with the comments that we received from the Township in red, is attached as PDF and provided as follows:

"We would appreciate it if the Township could provide us with the following transportation related data to be used in the traffic impact study:

- Turning Movement Counts (TMC) at the following study area intersections: The Township does not have TMC data to provide, the Niagara Region may be able to assist with data for their roads
    - Townline Road and St Catharines Street (Roundabout) St. Catharines St is Regional road
    - Townline Road and Canborough Street (Unsignalized) Canborough St is a Regional road
    - Townline Road and Port Davidson Road (Unsignalized) Townline Rd west of Canborough St is a Regional road
    - Staff believe the intersections of Townline Road and Shurie Road should also be reviewed, and Townline Road and Alma Dr for the full Block Plan 9 area.
    - Please review the intersection of St Catharines Street (Regional Road 20) & Industrial Park Road (unsignalized); TMC available June 2023

- Any historical AADT or mid-block traffic counts available along study area corridors: the last traffic counts for Township roads are out of date, your consultant should acquire new data
    - Townline Road
    - St Catharines Street
    - Canborough Street, and
    - Port Davidson Road
    - Shurie Road
    - Alma Dr
- Future background developments including the information or assumptions to be used in this TIS for the other phases/subphases of Smithville MCEA including the land use and expected build-out. The development of 2 parcels within the East Smithville Secondary Plan area located on the north side of St. Catharines St at the roundabout with Townline Rd to construct approximately 725 units is in the process of submitting applications so that is a likely consideration for timing.
- Future transportation network mitigations and infrastructure plans adjacent to the study area and their expected completion to be included in the TIS. Road network improvements required for growth are available in the TMP

- Traffic growth rate and transit data for the study area section 3.2.1 of the TMP discusses growth rate. Niagara Region Transit offers OnDemand transit to West Lincoln residents throughout the Region, there are no local transit services offered, transportation in town is primarily private vehicle use. The Region's forecasting EMME model output recommends using an annual growth rate of 3%.

- Truck routes and limitations, and there are no designated truck routes for the roads in the immediate area
  Any guideline or design criteria to be used in the TIS study including access requirements, specific design vehicles (fire trucks, waste collection truck), etc. refer to Niagara Region Access Guidelines" The updated Niagara Region Transportation Impact Assessment guidelines and Access Management guidelines are both accessible at: https://www.niagararegion.ca/business/default.aspx?topnav=1

The Township also provided us with the Region's Traffic Impact Assessment and Access Management Guidelines. We were also able to obtain the Average Annual Daily Traffic volumes (AADTs) in 2020 from some of the relevant road segments in our study area in the Region's Open Data Portal, NiagaraOpenData.ca (see attached spreadsheet). Please let us know if there is any updated version of this data available.

Given the response from the Township, we would like to request the following traffic data from the Region:

1. Turning movement counts (TMCs), if available, from the following intersections: The Region do not have recent TMC's for following intersections.
   - Townline Road and St Catharines Street (Roundabout)
   - Townline Road and Canborough Street (Unsignalized)
   - Townline Road and Port Davidson Road (Unsignalized)
   - Townline Road and Shurie Road/Carter Drive (Unsignalized)
   - Townline Road and Alma Drive (Unsignalized)
2. Mid-block traffic counts, if available, along the following corridors: The AADTs volumes you have are the most recent data available.
   - Townline Road
   - St Catharines Street
   - Canborough Street
   - Port Davidson Road

We understand that some of the intersections (e.g. Townline Rd and Shurie Rd/Carter Dr, Townline Rd and Alma Dr) and road segments (e.g. Port Davidson Rd, Townline Rd east of Canborough St) are not under the Region's jurisdiction, but just want to make sure that we have all available data located.

In addition to the data requested, please provide any documents that you believe should be considered in our study.

Just for your information, please note that this subdivision is within the proximity of Regional Road 20 Reconstruction project. For future road improvements and resurfacing along the regional road, please review updates found in the Region's website:
https://www.niagararegion.ca/projects/regional-road-20

Please feel free to contact Christine or myself if you need further clarifications on the information shared, or if you have any questions, comments, or concerns.

Best regards,

Wilson Yip B.ASc., M.Eng. (he/him/his)
Senior Transportation Planner

Direct: 416-507-3479
Wilson.Yip@stantec.com

100-401 Wellington St W
Toronto ON M5V 1E7

Stantec Consulting Ltd.
300 – 675 Cochrane Drive West tower, Markham, ON L3R 0B8

December 13, 2023
File: 161414102

Reference: Term of Reference for Transportation Impact Study | Smithville Block 3A, Township of West Lincoln

The purpose of this letter is to present the proposed Terms of Reference for Smithville Block 3A Transportation Impact Study (TIS) to the Township of West Lincoln and the Region of Niagara to confirm scope, methodology and assumptions to conduct the required study for the proposed development. This document provides the opportunity to consult and confirm with the Township and the Region, the methodology and data to be used in this study. The Site is located approximately 800m west of the intersection of Townline Road and St Catharines Street in the Township of West Lincoln, Ontario.

The scope presented within this document is based on the available information at the time of preparation and follows the requirements outlines in the "Niagara Region Guidelines for Transportation Impact Studies" dated May 2012.

STUDY AREA

The proposed study area includes the following intersections:

- Townline Road and St Catharines Street (Roundabout)
- Townline Road and Canborough Street (Unsignalized)
- Townline Road and Port Davidson Road (Unsignalized), and
- Townline Road and Site Access (Unsignalized)

Reference: Term of Reference for Transportation Impact Study | Smithville Block 3A, Township of West Lincoln

Figure 1: Study Area Intersections

STUDY HORIZONS

The study horizons are proposed to include the following scenarios:

- Existing Conditions (2024) Weekday AM/PM Peak Hours
- Future Background Horizon (2029) Weekday AM/PM Peak Hours, and
- Future Total Horizon (2029) Weekday AM/PM Peak Hours

TIS SCOPE:

Based on our review of the proposed development, the surrounding context, Township of West Lincoln Comprehensive Block Plan and MESP Guidelines and the Region's TIS requirements, the following scope of work is proposed:

1. **Pre-Consultation**: This ToR document provides the opportunity to consult with the Township to conduct a pre-consultation and agree on the study specific requirements to confirm the study area, scope of work, and background transportation assumptions to be included in this TIS study.

Reference: Term of Reference for Transportation Impact Study | Smithville Block 3A, Township of West Lincoln

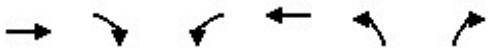
2. **Data Collection:** We will submit a data collection request to the Township to obtain the transportation related data required for the study. The main data that will be collected is listed as follows:
    - Turning Movement Counts (TMC) at study area intersections
    - Any historical AADT or mid-block traffic counts available along study area corridors
    - Future background developments and infrastructure plans adjacent to the study area (within the TIS study horizons)
    - Traffic growth rate and transit data for the study area, and
    - Truck routes and limitations

3. **Existing Conditions:** We will document intersection and roadway lane configurations, existing turning and parking restrictions, active transportation facilities, and transit service and facilities within the study area.
4. **Existing Operations:** An intersection operational analysis will be conducted for the existing conditions at the study area intersections during the weekday AM and PM peak hours. Synchro software will be utilized to conduct this operational analysis. The analysis will follow the Region TIS Guideline requirements.
5. **Future Conditions:** The future conditions will document the planned works in the study area which would affect the operational conditions of automobiles, active transportation connectivity, and transit service. The planned works in the study area will be incorporated into the future background and future total road networks.
6. **Future Background Operations:** We will conduct operational analysis for the future background conditions at the study area intersections during the weekday AM and PM peak hours. The future background traffic will include the nearby development traffic and the existing traffic volumes projected to represent the volumes during the future horizon.
7. **Site Trips:** Site trips for the proposed development will be estimated for the weekday AM and PM peak hours based on the latest ITE Trip Generation Manual, 11th Edition and the proposed development land use plan.
8. **Trip Distribution & Assignment:** The trip distribution and assignment for the proposed development will be estimated using existing traffic count patterns , the information that will be extracted from 2016 TTS dataset for the adjacent area, and the available road network.
9. **Future Total Operations:** We will conduct an intersection operational analysis for the future total conditions at the study area intersections during the weekday AM and PM peak hours. The future total traffic includes the background development traffic, the existing traffic volumes grown to represent the volumes during the future horizons, and the site additional generated traffic.
10. **Access Study:** We will assess the site accesses and internal circulation and will conduct a sightline assessment at the proposed site access following the methodology outlined in the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads, 2017.

Reference: Term of Reference for Transportation Impact Study | Smithville Block 3A, Township of West Lincoln

11. **Mitigation Measures:** We will highlight and propose mitigation measures to any issues that may arise out of the study. We note that this does not include design services, but a traffic operational assessment of mitigation measures. Design solutions can be developed, if required, based on separate client authorization.
12. **Prepare Draft Report:** The recommendations and conclusions based on the above findings will be documented in a Draft Report and included in the Block Plan submission.
13. **Finalize Report:** Once the Township and Region have reviewed the transportation/traffic components described above we will liaise with these agencies, address comments and prepare a final report.

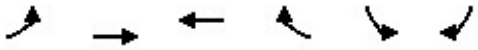
Appendix C SYNCHO OUTPUTS – EXISTING CONDITIONS



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	87	11	43	79	13	63
Future Volume (Veh/h)	87	11	43	79	13	63
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	95	12	47	86	14	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			107		281	101
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			107		281	101
tC, single (s)			4.2		6.6	6.2
tC, 2 stage (s)						
tF (s)			2.3		3.7	3.3
p0 queue free %			97		98	93
cM capacity (veh/h)			1453		645	952

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	107	133	82
Volume Left	0	47	14
Volume Right	12	0	68
cSH	1700	1453	880
Volume to Capacity	0.06	0.03	0.09
Queue Length 95th (m)	0.0	0.8	2.3
Control Delay (s)	0.0	2.8	9.5
Lane LOS		A	A
Approach Delay (s)	0.0	2.8	9.5
Approach LOS			A

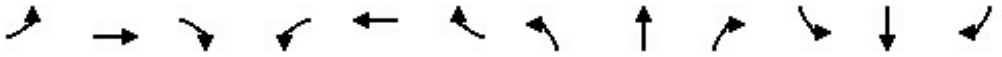
Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	24.5%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	88	60	46	30	11	76
Future Volume (vph)	88	60	46	30	11	76
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	96	65	50	33	12	83

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	161	83	95
Volume Left (vph)	96	0	12
Volume Right (vph)	0	33	83
Hadj (s)	0.22	-0.12	-0.27
Departure Headway (s)	4.4	4.2	4.2
Degree Utilization, x	0.20	0.10	0.11
Capacity (veh/h)	793	837	810
Control Delay (s)	8.5	7.6	7.7
Approach Delay (s)	8.5	7.6	7.7
Approach LOS	A	A	A

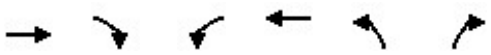
Intersection Summary			
Delay	8.1		
Level of Service	A		
Intersection Capacity Utilization	26.7%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	3	62	9	5	43	4	23	0	9	5	0	2
Future Volume (vph)	3	62	9	5	43	4	23	0	9	5	0	2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	67	10	5	47	4	25	0	10	5	0	2

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	80	56	35	7
Volume Left (vph)	3	5	25	5
Volume Right (vph)	10	4	10	2
Hadj (s)	0.06	0.20	0.02	0.46
Departure Headway (s)	4.1	4.3	4.2	4.7
Degree Utilization, x	0.09	0.07	0.04	0.01
Capacity (veh/h)	858	828	816	740
Control Delay (s)	7.5	7.6	7.4	7.7
Approach Delay (s)	7.5	7.6	7.4	7.7
Approach LOS	A	A	A	A

Intersection Summary				
Delay	7.5			
Level of Service	A			
Intersection Capacity Utilization	14.5%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	74	5	12	34	11	45
Future Volume (Veh/h)	74	5	12	34	11	45
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	80	5	13	37	12	49
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			85		146	82
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			85		146	82
tC, single (s)			4.2		6.4	6.3
tC, 2 stage (s)						
tF (s)			2.3		3.5	3.4
p0 queue free %			99		99	95
cM capacity (veh/h)			1474		844	963

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	85	50	61
Volume Left	0	13	12
Volume Right	5	0	49
cSH	1700	1474	937
Volume to Capacity	0.05	0.01	0.07
Queue Length 95th (m)	0.0	0.2	1.6
Control Delay (s)	0.0	2.0	9.1
Lane LOS		A	A
Approach Delay (s)	0.0	2.0	9.1
Approach LOS			A

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	19.2%	ICU Level of Service	A
Analysis Period (min)	15		

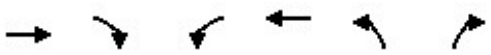
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Right Turn Channelized						
Traffic Volume (veh/h)	76	48	17	327	166	32
Future Volume (veh/h)	76	48	17	327	166	32
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	83	52	18	355	180	35
Approach Volume (veh/h)	135			373	215	
Crossing Volume (veh/h)	180			83	18	
High Capacity (veh/h)	1203			1298	1365	
High v/c (veh/h)	0.11			0.29	0.16	
Low Capacity (veh/h)	996			1082	1144	
Low v/c (veh/h)	0.14			0.34	0.19	

Intersection Summary			
Maximum v/c High	0.29		
Maximum v/c Low	0.34		
Intersection Capacity Utilization	44.9%	ICU Level of Service	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	60	53	227	176	60	143
Future Volume (Veh/h)	60	53	227	176	60	143
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	65	58	247	191	65	155
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	532	247			438	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	532	247			438	
tC, single (s)	6.5	6.4			4.2	
tC, 2 stage (s)						
tF (s)	3.6	3.5			2.3	
p0 queue free %	86	92			94	
cM capacity (veh/h)	465	756			1096	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	65	58	247	191	65	155
Volume Left	65	0	0	0	65	0
Volume Right	0	58	0	191	0	0
cSH	465	756	1700	1700	1096	1700
Volume to Capacity	0.14	0.08	0.15	0.11	0.06	0.09
Queue Length 95th (m)	3.7	1.9	0.0	0.0	1.4	0.0
Control Delay (s)	14.0	10.2	0.0	0.0	8.5	0.0
Lane LOS	B	B			A	
Approach Delay (s)	12.2		0.0		2.5	
Approach LOS	B					

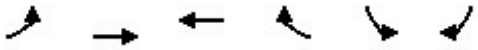
Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	28.6%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	149	21	79	149	12	50
Future Volume (Veh/h)	149	21	79	149	12	50
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	162	23	86	162	13	54
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			185		508	174
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			185		508	174
tC, single (s)			4.2		6.6	6.3
tC, 2 stage (s)						
tF (s)			2.3		3.7	3.4
p0 queue free %			94		97	94
cM capacity (veh/h)			1343		467	855

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	185	248	67
Volume Left	0	86	13
Volume Right	23	0	54
cSH	1700	1343	736
Volume to Capacity	0.11	0.06	0.09
Queue Length 95th (m)	0.0	1.6	2.3
Control Delay (s)	0.0	3.1	10.4
Lane LOS		A	B
Approach Delay (s)	0.0	3.1	10.4
Approach LOS			B

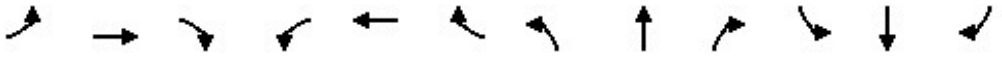
Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	35.1%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	120	71	68	40	57	152
Future Volume (vph)	120	71	68	40	57	152
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	130	77	74	43	62	165

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	207	117	227
Volume Left (vph)	130	0	62
Volume Right (vph)	0	43	165
Hadj (s)	0.16	-0.21	-0.34
Departure Headway (s)	4.7	4.5	4.3
Degree Utilization, x	0.27	0.15	0.27
Capacity (veh/h)	719	751	783
Control Delay (s)	9.5	8.2	8.9
Approach Delay (s)	9.5	8.2	8.9
Approach LOS	A	A	A

Intersection Summary			
Delay	9.0		
Level of Service	A		
Intersection Capacity Utilization	36.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	1	95	37	21	90	3	35	0	9	2	0	0
Future Volume (vph)	1	95	37	21	90	3	35	0	9	2	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	103	40	23	98	3	38	0	10	2	0	0

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	144	124	48	2
Volume Left (vph)	1	23	38	2
Volume Right (vph)	40	3	10	0
Hadj (s)	-0.08	0.05	0.11	0.20
Departure Headway (s)	4.1	4.2	4.6	4.7
Degree Utilization, x	0.16	0.15	0.06	0.00
Capacity (veh/h)	867	838	735	703
Control Delay (s)	7.9	7.9	7.9	7.8
Approach Delay (s)	7.9	7.9	7.9	7.8
Approach LOS	A	A	A	A

Intersection Summary				
Delay	7.9			
Level of Service	A			
Intersection Capacity Utilization	26.7%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	82	8	53	105	15	25
Future Volume (Veh/h)	82	8	53	105	15	25
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	89	9	58	114	16	27
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			98		324	94
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			98		324	94
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			96		98	97
cM capacity (veh/h)			1508		649	969

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	98	172	43
Volume Left	0	58	16
Volume Right	9	0	27
cSH	1700	1508	819
Volume to Capacity	0.06	0.04	0.05
Queue Length 95th (m)	0.0	0.9	1.3
Control Delay (s)	0.0	2.7	9.6
Lane LOS		A	A
Approach Delay (s)	0.0	2.7	9.6
Approach LOS			A

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	25.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Right Turn Channelized						
Traffic Volume (veh/h)	70	41	45	250	379	120
Future Volume (veh/h)	70	41	45	250	379	120
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	45	49	272	412	130
Approach Volume (veh/h)	121			321	542	
Crossing Volume (veh/h)	412			76	49	
High Capacity (veh/h)	1001			1305	1333	
High v/c (veh/h)	0.12			0.25	0.41	
Low Capacity (veh/h)	815			1089	1114	
Low v/c (veh/h)	0.15			0.29	0.49	

Intersection Summary			
Maximum v/c High	0.41		
Maximum v/c Low	0.49		
Intersection Capacity Utilization	59.3%	ICU Level of Service	B

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	196	135	204	116	80	282
Future Volume (Veh/h)	196	135	204	116	80	282
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	213	147	222	126	87	307
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	703	222			348	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	703	222			348	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	43	82			93	
cM capacity (veh/h)	373	820			1194	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	213	147	222	126	87	307
Volume Left	213	0	0	0	87	0
Volume Right	0	147	0	126	0	0
cSH	373	820	1700	1700	1194	1700
Volume to Capacity	0.57	0.18	0.13	0.07	0.07	0.18
Queue Length 95th (m)	25.9	4.9	0.0	0.0	1.8	0.0
Control Delay (s)	26.7	10.3	0.0	0.0	8.3	0.0
Lane LOS	D	B			A	
Approach Delay (s)	20.0		0.0		1.8	
Approach LOS	C					

Intersection Summary			
Average Delay	7.2		
Intersection Capacity Utilization	36.0%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix D ARCADY OUTPUTS – EXISTING CONDITIONS

Junctions 9

ARCADY 9 - Roundabout Module

Filename: Smithville Existing.j9
Path: C:\Users\rlei\Desktop\Smithville
Report generation date: 8/16/2024 8:35:15 PM

Summary of intersection performance

	Existing PM						
	Queue (Veh)	95% Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	Townline Road and Regional Road 20						
Regional Road 20 North		2.2	7.01	0.42	A	6.23	A
Townline Road West		0.5	5.44	0.14	A		
Regional Rd 20 South		1.0	5.21	0.26	A		

There are warnings associated with this model run - see the 'Data Errors and Warnings' tables.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

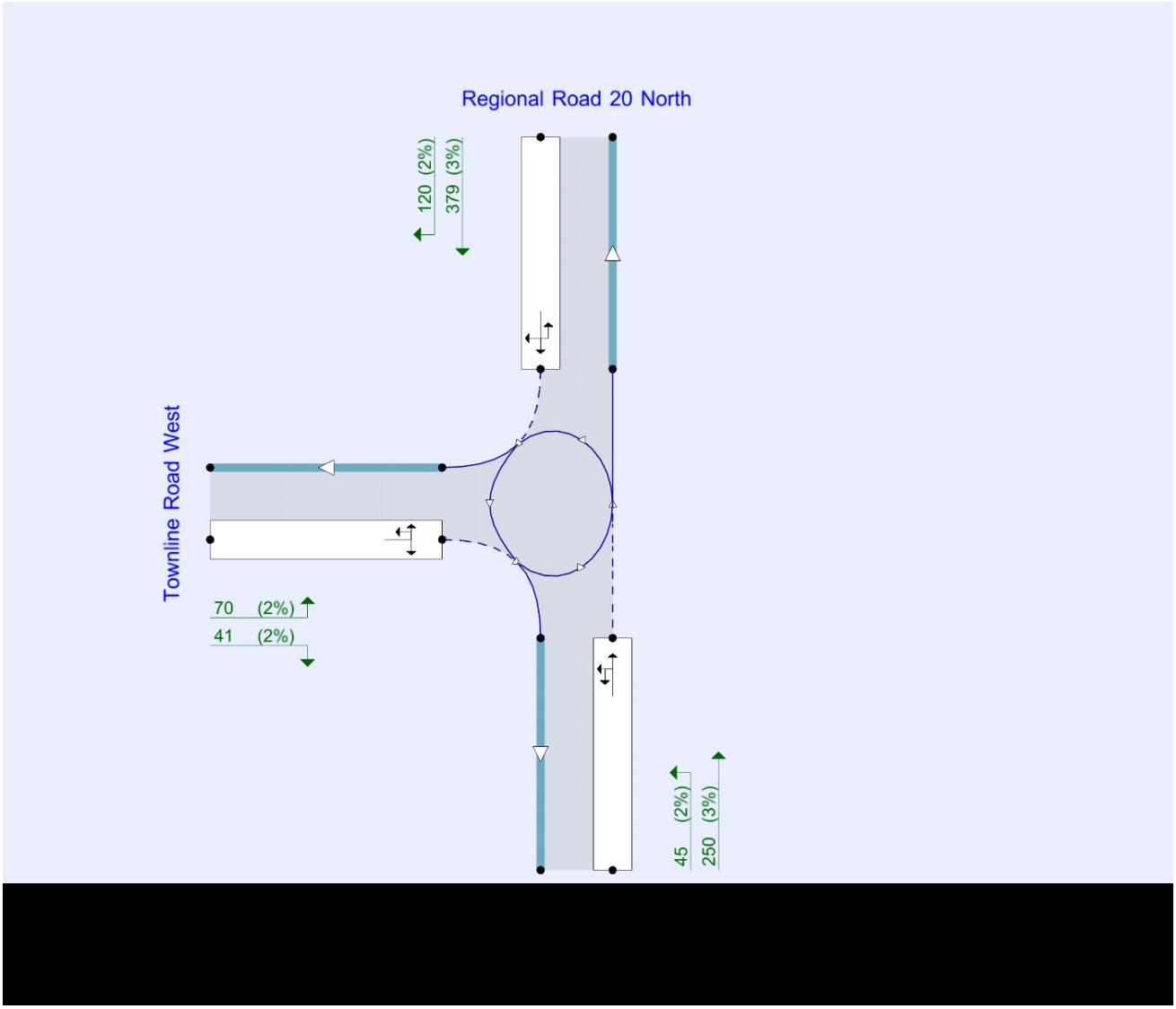
File summary

File Description

Title	
Location	
Site number	
Date	10/17/2023
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	CORP\rlei
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	Veh	Veh	perHour	s	-Min	perMin



The intersection diagram reflects the last run of Intersections.

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	V/C Ratio Threshold	Average Delay threshold (s)	Queue threshold (PCE)
✓		0.85	36.00	20.00

HCM Calibration

HCM Calibration	Lane type	Num circulating lanes	Num exit lanes	A	B
1	Single lane	1		1380.00	-0.00102
2	Single lane	2		1420.00	-0.00085
3	Nearside	1		1420.00	-0.00091
4	Nearside	2		1420.00	-0.00085
5	Offside	1		1420.00	-0.00091
6	Offside	2		1350.00	-0.00092
7	Yielding bypass		1	1380.00	-0.00102
8	Yielding bypass		2	1420.00	-0.00085
9	Non-yielding bypass		1	99999.00	0.00000

Demand Set Summary

ID	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D1	Existing AM	PHF	08:00	09:00	15
D2	Existing PM	PHF	17:00	18:00	15

Analysis Set Details

ID	Name	Network flow scaling factor (%)
A1	Townline Road and Regional Road 20	100.000

Townline Road and Regional Road 20 - , Existing AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	HCM Model	D1 - , Existing AM	Demand Set 11: HCM models are most typically used with PHF traffic flow profiles and single time segments. Use of HCM models with other flow profiles is at the user's own risk
Warning	HCM Model		One or more intersections use HCM methodologies. These methods are not associated with TRL. The user should apply judgement when interpreting the results.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Intersection Network

Intersections

Intersection	Name	Intersection type	Use circulating lanes	Leg order	Intersection Delay (s)	Intersection LOS
1	Townline Road and Regional Road 20	HCM Roundabout		2, 3, 4	5.25	A

Intersection Network Options

Driving side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Name	Description
2	Regional Road 20 North	
3	Townline Road West	
4	Regional Rd 20 South	

HCM Lanes

Leg	HCM Lane	Lane type	Number of conflicting lanes	Destination legs
Regional Road 20 North	1	Single lane	1	2, 3, 4
Townline Road West	1	Single lane	1	2, 3, 4
Regional Rd 20 South	1	Single lane	1	2, 3, 4

Traffic Demand

Demand Set Details

ID	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D1	Existing AM	PHF	08:00	09:00	15

Vehicle mix source	PCE Factor for a Truck (PCE)
Truck Percentages	2.00

Demand overview (Traffic)

Leg	Linked leg	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
Regional Road 20 North		✓	198	100.000
Townline Road West		✓	124	100.000
Regional Rd 20 South		✓	344	100.000

Peak Hour Factor Data (Traffic)

Leg	Hourly volume (Veh/hr)	Peak hour factor	Peak time segment
Regional Road 20 North	198	0.92	SecondQuarter
Townline Road West	124	0.92	SecondQuarter
Regional Rd 20 South	344	0.92	SecondQuarter

Origin-Destination Data

Demand (Veh/hr)

		To		
		Regional Road 20 North	Townline Road West	Regional Rd 20 South
From	Regional Road 20 North	0	32	166
	Townline Road West	76	0	48
	Regional Rd 20 South	327	17	0

Vehicle Mix

Truck Percentages

		To		
		Regional Road 20 North	Townline Road West	Regional Rd 20 South
From	Regional Road 20 North	0	13	8
	Townline Road West	8	0	0
	Regional Rd 20 South	6	24	0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max 95th percentile Queue (Veh)	Max LOS
Regional Road 20 North	0.17	4.38	0.6	A
Townline Road West	0.12	4.44	0.4	A
Regional Rd 20 South	0.32	6.05	1.4	A

Main Results for each time segment

08:00 - 08:15

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Regional Road 20 North	187	16	0.00	1243	0.150	0.5	4.158	A
Townline Road West	117	156	0.00	1107	0.105	0.4	4.162	A
Regional Rd 20 South	324	72	0.00	1193	0.272	1.1	5.496	A

08:15 - 08:30

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Regional Road 20 North	215	18	0.00	1239	0.174	0.6	4.384	A
Townline Road West	135	180	0.00	1078	0.125	0.4	4.440	A
Regional Rd 20 South	374	83	0.00	1179	0.317	1.4	6.053	A

08:30 - 08:45

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Regional Road 20 North	204	17	0.00	1241	0.164	0.6	4.293	A
Townline Road West	128	171	0.00	1090	0.117	0.4	4.326	A
Regional Rd 20 South	354	78	0.00	1184	0.299	1.3	5.824	A

08:45 - 09:00

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Regional Road 20 North	187	16	0.00	1243	0.150	0.5	4.158	A
Townline Road West	117	156	0.00	1107	0.105	0.4	4.162	A
Regional Rd 20 South	324	72	0.00	1193	0.272	1.1	5.496	A

Queue Variation Results for each time segment

HCM: Lane Results

Lane Results: 08:00-08:15

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Regional Road 20 North	1	2, 3, 4		187	0.00	16	1243	0.53	4.16	0.15	A
Townline Road West	1	2, 3, 4		117	0.00	156	1107	0.35	4.16	0.11	A
Regional Rd 20 South	1	2, 3, 4		324	0.00	72	1193	1.11	5.50	0.27	A

Lane Results: 08:15-08:30

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Regional Road 20 North	1	2, 3, 4		215	0.00	18	1239	0.63	4.38	0.17	A
Townline Road West	1	2, 3, 4		135	0.00	180	1078	0.43	4.44	0.12	A
Regional Rd 20 South	1	2, 3, 4		374	0.00	83	1179	1.37	6.05	0.32	A

Lane Results: 08:30-08:45

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Regional Road 20 North	1	2, 3, 4		204	0.00	17	1241	0.59	4.29	0.16	A
Townline Road West	1	2, 3, 4		128	0.00	171	1090	0.40	4.33	0.12	A
Regional Rd 20 South	1	2, 3, 4		354	0.00	78	1184	1.26	5.82	0.30	A

Lane Results: 08:45-09:00

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Regional Road 20 North	1	2, 3, 4		187	0.00	16	1243	0.53	4.16	0.15	A
Townline Road West	1	2, 3, 4		117	0.00	156	1107	0.35	4.16	0.11	A
Regional Rd 20 South	1	2, 3, 4		324	0.00	72	1193	1.11	5.50	0.27	A

Townline Road and Regional Road 20 - , Existing PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	HCM Model	D2 - , Existing PM	Demand Set 12: HCM models are most typically used with PHF traffic flow profiles and single time segments. Use of HCM models with other flow profiles is at the user's own risk
Warning	HCM Model		One or more intersections use HCM methodologies. These methods are not associated with TRL. The user should apply judgement when interpreting the results.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Intersection Network

Intersections

Intersection	Name	Intersection type	Use circulating lanes	Leg order	Intersection Delay (s)	Intersection LOS
1	Townline Road and Regional Road 20	HCM Roundabout		2, 3, 4	6.23	A

Intersection Network Options

Driving side	Lighting
Right	Normal/unknown

Traffic Demand

Demand Set Details

ID	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D2	Existing PM	PHF	17:00	18:00	15

Vehicle mix source	PCE Factor for a Truck (PCE)
Truck Percentages	2.00

Demand overview (Traffic)

Leg	Linked leg	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
Regional Road 20 North		✓	499	100.000
Townline Road West		✓	111	100.000
Regional Rd 20 South		✓	295	100.000

Peak Hour Factor Data (Traffic)

Leg	Hourly volume (Veh/hr)	Peak hour factor	Peak time segment
Regional Road 20 North	499	0.92	SecondQuarter
Townline Road West	111	0.92	SecondQuarter
Regional Rd 20 South	295	0.92	SecondQuarter

Origin-Destination Data

Demand (Veh/hr)

		To		
		Regional Road 20 North	Townline Road West	Regional Rd 20 South
From	Regional Road 20 North	0	120	379
	Townline Road West	70	0	41
	Regional Rd 20 South	250	45	0

Vehicle Mix

Truck Percentages

		To		
		Regional Road 20 North	Townline Road West	Regional Rd 20 South
From	Regional Road 20 North	0	2	3
	Townline Road West	2	0	2
	Regional Rd 20 South	3	2	0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max 95th percentile Queue (Veh)	Max LOS
Regional Road 20 North	0.42	7.01	2.2	A
Townline Road West	0.14	5.44	0.5	A
Regional Rd 20 South	0.26	5.21	1.0	A

Main Results for each time segment

17:00 - 17:15

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Regional Road 20 North	470	42	0.00	1285	0.366	1.7	6.238	A
Townline Road West	105	357	0.00	930	0.112	0.4	4.924	A
Regional Rd 20 South	278	66	0.00	1253	0.222	0.8	4.800	A

17:15 - 17:30

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Regional Road 20 North	542	49	0.00	1276	0.425	2.2	7.013	A
Townline Road West	121	412	0.00	878	0.137	0.5	5.442	A
Regional Rd 20 South	321	76	0.00	1240	0.259	1.0	5.207	A

17:30 - 17:45

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Regional Road 20 North	513	46	0.00	1280	0.401	2.0	6.691	A
Townline Road West	114	390	0.00	898	0.127	0.4	5.227	A
Regional Rd 20 South	304	72	0.00	1245	0.244	1.0	5.041	A

17:45 - 18:00

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Regional Road 20 North	470	42	0.00	1285	0.366	1.7	6.238	A
Townline Road West	105	357	0.00	930	0.112	0.4	4.924	A
Regional Rd 20 South	278	66	0.00	1253	0.222	0.8	4.800	A

Queue Variation Results for each time segment

HCM: Lane Results

Lane Results: 17:00-17:15

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Regional Road 20 North	1	2, 3, 4		470	0.00	42	1285	1.70	6.24	0.37	A
Townline Road West	1	2, 3, 4		105	0.00	357	930	0.38	4.92	0.11	A
Regional Rd 20 South	1	2, 3, 4		278	0.00	66	1253	0.85	4.80	0.22	A

Lane Results: 17:15-17:30

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Regional Road 20 North	1	2, 3, 4		542	0.00	49	1276	2.17	7.01	0.42	A
Townline Road West	1	2, 3, 4		121	0.00	412	878	0.48	5.44	0.14	A
Regional Rd 20 South	1	2, 3, 4		321	0.00	76	1240	1.04	5.21	0.26	A

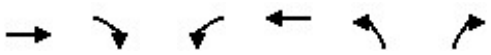
Lane Results: 17:30-17:45

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Regional Road 20 North	1	2, 3, 4		513	0.00	46	1280	1.97	6.69	0.40	A
Townline Road West	1	2, 3, 4		114	0.00	390	898	0.44	5.23	0.13	A
Regional Rd 20 South	1	2, 3, 4		304	0.00	72	1245	0.96	5.04	0.24	A

Lane Results: 17:45-18:00

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Regional Road 20 North	1	2, 3, 4		470	0.00	42	1285	1.70	6.24	0.37	A
Townline Road West	1	2, 3, 4		105	0.00	357	930	0.38	4.92	0.11	A
Regional Rd 20 South	1	2, 3, 4		278	0.00	66	1253	0.85	4.80	0.22	A

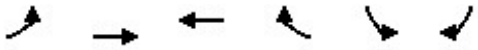
Appendix E SYNCHRO OUTPUTS – FUTURE BACKGROUND CONDITIONS (2030)



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	127	21	123	163	40	240
Future Volume (Veh/h)	127	21	123	163	40	240
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	138	23	134	177	43	261
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			161		594	150
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			161		594	150
tC, single (s)			4.2		6.6	6.2
tC, 2 stage (s)						
tF (s)			2.3		3.7	3.3
p0 queue free %			90		89	71
cM capacity (veh/h)			1388		393	894

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	161	311	304
Volume Left	0	134	43
Volume Right	23	0	261
cSH	1700	1388	757
Volume to Capacity	0.09	0.10	0.40
Queue Length 95th (m)	0.0	2.4	14.8
Control Delay (s)	0.0	3.9	12.9
Lane LOS		A	B
Approach Delay (s)	0.0	3.9	12.9
Approach LOS			B

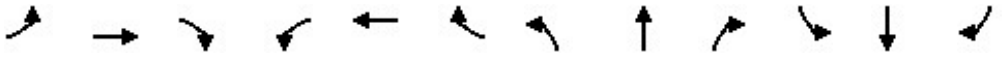
Intersection Summary			
Average Delay	6.6		
Intersection Capacity Utilization	50.4%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	193	172	166	83	29	120
Future Volume (vph)	193	172	166	83	29	120
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	210	187	180	90	32	130

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	397	270	162
Volume Left (vph)	210	0	32
Volume Right (vph)	0	90	130
Hadj (s)	0.21	-0.08	-0.20
Departure Headway (s)	4.9	4.8	5.3
Degree Utilization, x	0.54	0.36	0.24
Capacity (veh/h)	706	719	607
Control Delay (s)	13.5	10.4	9.9
Approach Delay (s)	13.5	10.4	9.9
Approach LOS	B	B	A

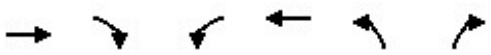
Intersection Summary			
Delay	11.8		
Level of Service	B		
Intersection Capacity Utilization	52.5%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	4	234	17	21	160	5	44	0	55	6	0	2
Future Volume (vph)	4	234	17	21	160	5	44	0	55	6	0	2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	254	18	23	174	5	48	0	60	7	0	2

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	276	202	108	9
Volume Left (vph)	4	23	48	7
Volume Right (vph)	18	5	60	2
Hadj (s)	0.08	0.21	-0.21	0.48
Departure Headway (s)	4.5	4.7	4.8	5.7
Degree Utilization, x	0.35	0.27	0.14	0.01
Capacity (veh/h)	773	730	682	566
Control Delay (s)	9.9	9.4	8.6	8.8
Approach Delay (s)	9.9	9.4	8.6	8.8
Approach LOS	A	A	A	A

Intersection Summary				
Delay	9.5			
Level of Service	A			
Intersection Capacity Utilization	33.6%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	292	6	14	165	13	54
Future Volume (Veh/h)	292	6	14	165	13	54
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	317	7	15	179	14	59
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			324		530	320
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			324		530	320
tC, single (s)			4.2		6.4	6.3
tC, 2 stage (s)						
tF (s)			2.3		3.5	3.4
p0 queue free %			99		97	92
cM capacity (veh/h)			1203		507	709

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	324	194	73
Volume Left	0	15	14
Volume Right	7	0	59
cSH	1700	1203	659
Volume to Capacity	0.19	0.01	0.11
Queue Length 95th (m)	0.0	0.3	2.8
Control Delay (s)	0.0	0.7	11.1
Lane LOS		A	B
Approach Delay (s)	0.0	0.7	11.1
Approach LOS			B

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	31.0%	ICU Level of Service	A
Analysis Period (min)	15		

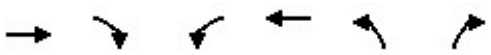
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Right Turn Channelized						
Traffic Volume (veh/h)	188	145	49	390	198	76
Future Volume (veh/h)	188	145	49	390	198	76
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	204	158	53	424	215	83
Approach Volume (veh/h)	362			477	298	
Crossing Volume (veh/h)	215			204	53	
High Capacity (veh/h)	1170			1180	1329	
High v/c (veh/h)	0.31			0.40	0.22	
Low Capacity (veh/h)	967			976	1110	
Low v/c (veh/h)	0.37			0.49	0.27	

Intersection Summary			
Maximum v/c High	0.40		
Maximum v/c Low	0.49		
Intersection Capacity Utilization	67.6%	ICU Level of Service	C

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	98	113	433	273	90	228
Future Volume (Veh/h)	98	113	433	273	90	228
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	107	123	471	297	98	248
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	915	471			768	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	915	471			768	
tC, single (s)	6.5	6.4			4.2	
tC, 2 stage (s)						
tF (s)	3.6	3.5			2.3	
p0 queue free %	59	78			88	
cM capacity (veh/h)	258	563			824	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	107	123	471	297	98	248
Volume Left	107	0	0	0	98	0
Volume Right	0	123	0	297	0	0
cSH	258	563	1700	1700	824	1700
Volume to Capacity	0.41	0.22	0.28	0.17	0.12	0.15
Queue Length 95th (m)	14.6	6.3	0.0	0.0	3.1	0.0
Control Delay (s)	28.5	13.2	0.0	0.0	10.0	0.0
Lane LOS	D	B			A	
Approach Delay (s)	20.3		0.0		2.8	
Approach LOS	C					

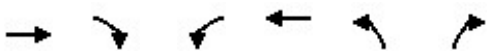
Intersection Summary				
Average Delay	4.2			
Intersection Capacity Utilization	43.2%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	190	12	8	205	37	24
Future Volume (Veh/h)	190	12	8	205	37	24
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	207	13	9	223	40	26
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			220		454	214
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			220		454	214
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		93	97
cM capacity (veh/h)			1349		560	827

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	220	232	66
Volume Left	0	9	40
Volume Right	13	0	26
cSH	1700	1349	641
Volume to Capacity	0.13	0.01	0.10
Queue Length 95th (m)	0.0	0.2	2.6
Control Delay (s)	0.0	0.4	11.3
Lane LOS		A	B
Approach Delay (s)	0.0	0.4	11.3
Approach LOS			B

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	27.5%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	208	6	15	196	17	44
Future Volume (Veh/h)	208	6	15	196	17	44
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	226	7	16	213	18	48
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			233		474	230
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			233		474	230
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		97	94
cM capacity (veh/h)			1335		542	810

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	233	229	66
Volume Left	0	16	18
Volume Right	7	0	48
cSH	1700	1335	714
Volume to Capacity	0.14	0.01	0.09
Queue Length 95th (m)	0.0	0.3	2.3
Control Delay (s)	0.0	0.6	10.6
Lane LOS		A	B
Approach Delay (s)	0.0	0.6	10.6
Approach LOS			B

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	33.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	7	61	128	2	20	60
Future Volume (Veh/h)	7	61	128	2	20	60
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	66	139	2	22	65
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	249	140			141	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	249	140			141	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	93			98	
cM capacity (veh/h)	728	908			1442	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	74	141	87
Volume Left	8	0	22
Volume Right	66	2	0
cSH	884	1700	1442
Volume to Capacity	0.08	0.08	0.02
Queue Length 95th (m)	2.1	0.0	0.4
Control Delay (s)	9.4	0.0	2.0
Lane LOS	A		A
Approach Delay (s)	9.4	0.0	2.0
Approach LOS	A		

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	25.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	7	61	69	2	20	46
Future Volume (Veh/h)	7	61	69	2	20	46
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	66	75	2	22	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	170	76			77	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	170	76			77	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	93			99	
cM capacity (veh/h)	808	985			1522	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	74	77	72
Volume Left	8	0	22
Volume Right	66	2	0
cSH	962	1700	1522
Volume to Capacity	0.08	0.05	0.01
Queue Length 95th (m)	1.9	0.0	0.3
Control Delay (s)	9.1	0.0	2.3
Lane LOS	A		A
Approach Delay (s)	9.1	0.0	2.3
Approach LOS	A		

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	21.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	3	61	11	1	20	33
Future Volume (Veh/h)	3	61	11	1	20	33
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	66	12	1	22	36
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	92	12			13	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	92	12			13	
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	94			99	
cM capacity (veh/h)	895	1068			1606	

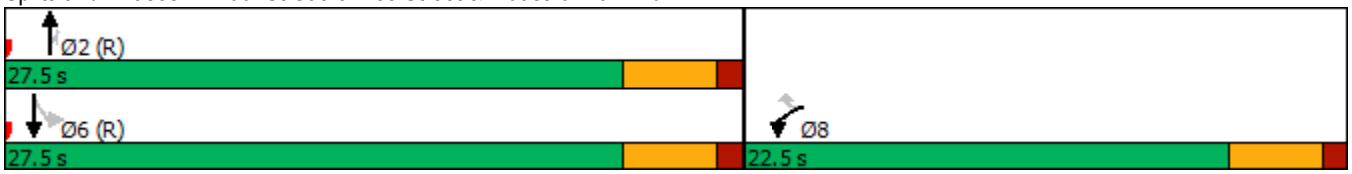
Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	69	13	58
Volume Left	3	0	22
Volume Right	66	1	0
cSH	1059	1700	1606
Volume to Capacity	0.07	0.01	0.01
Queue Length 95th (m)	1.6	0.0	0.3
Control Delay (s)	8.6	0.0	2.8
Lane LOS	A		A
Approach Delay (s)	8.6	0.0	2.8
Approach LOS	A		

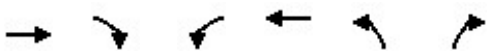
Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	20.1%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	98	113	433	273	90	228
Future Volume (vph)	98	113	433	273	90	228
Satd. Flow (prot)	1659	1396	1715	1484	1706	1746
Flt Permitted	0.950				0.384	
Satd. Flow (perm)	1659	1396	1715	1484	689	1746
Satd. Flow (RTOR)		123		297		
Adj. Flow (vph)	107	123	471	297	98	248
Lane Group Flow (vph)	107	123	471	297	98	248
Turn Type	Prot	Perm	NA	Perm	Perm	NA
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Total Split (s)	22.5	22.5	27.5	27.5	27.5	27.5
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Act Effct Green (s)	18.0	18.0	23.0	23.0	23.0	23.0
Actuated g/C Ratio	0.36	0.36	0.46	0.46	0.46	0.46
v/c Ratio	0.18	0.21	0.60	0.35	0.31	0.31
Control Delay	12.0	3.9	14.0	2.6	11.9	9.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.0	3.9	14.0	2.6	11.9	9.9
LOS	B	A	B	A	B	A
Approach Delay	7.7		9.6			10.4
Approach LOS	A		A			B
Queue Length 50th (m)	6.3	0.0	28.9	0.0	5.1	12.8
Queue Length 95th (m)	14.4	7.7	52.0	9.5	13.6	24.6
Internal Link Dist (m)	199.1		398.4			245.1
Turn Bay Length (m)	60.0			55.0	100.0	
Base Capacity (vph)	597	581	788	843	316	803
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.18	0.21	0.60	0.35	0.31	0.31

Intersection Summary	
Cycle Length: 50	
Actuated Cycle Length: 50	
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green	
Control Type: Pretimed	
Maximum v/c Ratio: 0.60	
Intersection Signal Delay: 9.5	Intersection LOS: A
Intersection Capacity Utilization 44.5%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 106: St Catharines Street & Industrial Park Rd

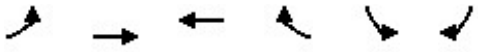




Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	201	33	164	245	38	226
Future Volume (Veh/h)	201	33	164	245	38	226
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	218	36	178	266	41	246
Pedestrians						
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			254		858	236
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			254		858	236
tC, single (s)			4.2		6.6	6.3
tC, 2 stage (s)						
tF (s)			2.3		3.7	3.4
p0 queue free %			86		85	69
cM capacity (veh/h)			1266		265	788

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	254	444	287
Volume Left	0	178	41
Volume Right	36	0	246
cSH	1700	1266	615
Volume to Capacity	0.15	0.14	0.47
Queue Length 95th (m)	0.0	3.7	18.8
Control Delay (s)	0.0	4.2	15.9
Lane LOS		A	C
Approach Delay (s)	0.0	4.2	15.9
Approach LOS			C

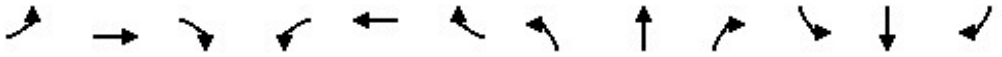
Intersection Summary			
Average Delay	6.5		
Intersection Capacity Utilization	60.6%	ICU Level of Service	B
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	231	186	189	101	86	210
Future Volume (vph)	231	186	189	101	86	210
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	251	202	205	110	93	228

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	453	315	321
Volume Left (vph)	251	0	93
Volume Right (vph)	0	110	228
Hadj (s)	0.15	-0.20	-0.33
Departure Headway (s)	5.5	5.4	5.6
Degree Utilization, x	0.69	0.47	0.50
Capacity (veh/h)	634	632	596
Control Delay (s)	20.0	13.1	14.0
Approach Delay (s)	20.0	13.1	14.0
Approach LOS	C	B	B

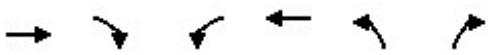
Intersection Summary			
Delay	16.2		
Level of Service	C		
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	1	273	50	39	214	4	61	0	53	2	0	0
Future Volume (vph)	1	273	50	39	214	4	61	0	53	2	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	297	54	42	233	4	66	0	58	2	0	0

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	352	279	124	2
Volume Left (vph)	1	42	66	2
Volume Right (vph)	54	4	58	0
Hadj (s)	-0.01	0.05	-0.12	0.20
Departure Headway (s)	4.6	4.7	5.2	5.8
Degree Utilization, x	0.45	0.36	0.18	0.00
Capacity (veh/h)	764	735	610	531
Control Delay (s)	11.2	10.4	9.4	8.8
Approach Delay (s)	11.2	10.4	9.4	8.8
Approach LOS	B	B	A	A

Intersection Summary			
Delay	10.6		
Level of Service	B		
Intersection Capacity Utilization	47.0%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	300	10	63	246	18	30
Future Volume (Veh/h)	300	10	63	246	18	30
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	326	11	68	267	20	33
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			337		734	332
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			337		734	332
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			94		95	95
cM capacity (veh/h)			1234		368	715

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	337	335	53
Volume Left	0	68	20
Volume Right	11	0	33
cSH	1700	1234	528
Volume to Capacity	0.20	0.06	0.10
Queue Length 95th (m)	0.0	1.3	2.5
Control Delay (s)	0.0	2.1	12.6
Lane LOS		A	B
Approach Delay (s)	0.0	2.1	12.6
Approach LOS			B

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	46.2%	ICU Level of Service	A
Analysis Period (min)	15		

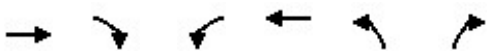
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Right Turn Channelized						
Traffic Volume (veh/h)	191	126	80	299	453	183
Future Volume (veh/h)	191	126	80	299	453	183
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	208	137	87	325	492	199
Approach Volume (veh/h)	345			412	691	
Crossing Volume (veh/h)	492			208	87	
High Capacity (veh/h)	939			1177	1294	
High v/c (veh/h)	0.37			0.35	0.53	
Low Capacity (veh/h)	760			972	1079	
Low v/c (veh/h)	0.45			0.42	0.64	

Intersection Summary			
Maximum v/c High	0.53		
Maximum v/c Low	0.64		
Intersection Capacity Utilization	83.4%	ICU Level of Service	E

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	269	214	399	215	114	397
Future Volume (Veh/h)	269	214	399	215	114	397
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	292	233	434	234	124	432
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	1114	434			668	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1114	434			668	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	63			86	
cM capacity (veh/h)	198	624			908	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	292	233	434	234	124	432
Volume Left	292	0	0	0	124	0
Volume Right	0	233	0	234	0	0
cSH	198	624	1700	1700	908	1700
Volume to Capacity	1.47	0.37	0.26	0.14	0.14	0.25
Queue Length 95th (m)	135.9	13.1	0.0	0.0	3.6	0.0
Control Delay (s)	283.3	14.2	0.0	0.0	9.6	0.0
Lane LOS	F	B			A	
Approach Delay (s)	163.8		0.0		2.1	
Approach LOS	F					

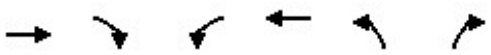
Intersection Summary			
Average Delay	49.9		
Intersection Capacity Utilization	52.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	263	12	8	277	37	24
Future Volume (Veh/h)	263	12	8	277	37	24
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	286	13	9	301	40	26
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			299		612	292
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			299		612	292
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		91	97
cM capacity (veh/h)			1262		454	747

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	299	310	66
Volume Left	0	9	40
Volume Right	13	0	26
cSH	1700	1262	537
Volume to Capacity	0.18	0.01	0.12
Queue Length 95th (m)	0.0	0.2	3.2
Control Delay (s)	0.0	0.3	12.6
Lane LOS		A	B
Approach Delay (s)	0.0	0.3	12.6
Approach LOS			B

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	31.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	281	6	14	266	19	42
Future Volume (Veh/h)	281	6	14	266	19	42
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	305	7	15	289	21	46
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			312		628	308
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			312		628	308
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		95	94
cM capacity (veh/h)			1248		442	732

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	312	304	67
Volume Left	0	15	21
Volume Right	7	0	46
cSH	1700	1248	607
Volume to Capacity	0.18	0.01	0.11
Queue Length 95th (m)	0.0	0.3	2.8
Control Delay (s)	0.0	0.5	11.7
Lane LOS		A	B
Approach Delay (s)	0.0	0.5	11.7
Approach LOS			B

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	35.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	6	62	128	2	21	57
Future Volume (Veh/h)	6	62	128	2	21	57
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	67	139	2	23	62
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	248	140			141	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	248	140			141	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	93			98	
cM capacity (veh/h)	729	908			1442	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	74	141	85
Volume Left	7	0	23
Volume Right	67	2	0
cSH	887	1700	1442
Volume to Capacity	0.08	0.08	0.02
Queue Length 95th (m)	2.1	0.0	0.4
Control Delay (s)	9.4	0.0	2.1
Lane LOS	A		A
Approach Delay (s)	9.4	0.0	2.1
Approach LOS	A		

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	25.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	6	62	69	2	21	42
Future Volume (Veh/h)	6	62	69	2	21	42
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	67	75	2	23	46
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	168	76			77	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	168	76			77	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	93			98	
cM capacity (veh/h)	810	985			1522	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	74	77	69
Volume Left	7	0	23
Volume Right	67	2	0
cSH	965	1700	1522
Volume to Capacity	0.08	0.05	0.02
Queue Length 95th (m)	1.9	0.0	0.3
Control Delay (s)	9.0	0.0	2.5
Lane LOS	A		A
Approach Delay (s)	9.0	0.0	2.5
Approach LOS	A		

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	20.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	3	62	9	1	21	28
Future Volume (Veh/h)	3	62	9	1	21	28
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	67	10	1	23	30
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	10			11	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	86	10			11	
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	94			99	
cM capacity (veh/h)	902	1071			1608	

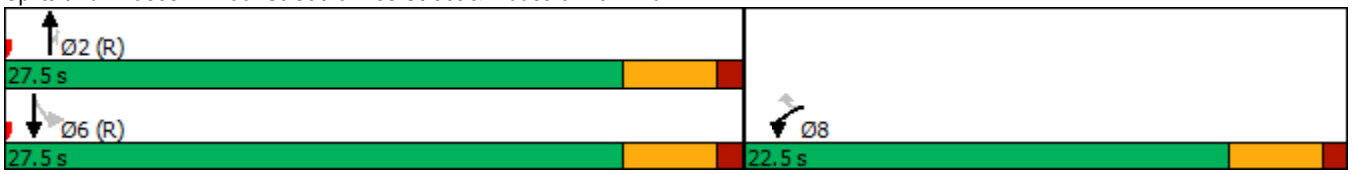
Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	70	11	53
Volume Left	3	0	23
Volume Right	67	1	0
cSH	1062	1700	1608
Volume to Capacity	0.07	0.01	0.01
Queue Length 95th (m)	1.6	0.0	0.3
Control Delay (s)	8.6	0.0	3.2
Lane LOS	A		A
Approach Delay (s)	8.6	0.0	3.2
Approach LOS	A		

Intersection Summary			
Average Delay	5.8		
Intersection Capacity Utilization	20.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	319	198	349	194	151	509
Future Volume (vph)	319	198	349	194	151	509
Satd. Flow (prot)	1772	1617	1847	1484	1738	1830
Flt Permitted	0.950				0.474	
Satd. Flow (perm)	1772	1617	1847	1484	867	1830
Satd. Flow (RTOR)		215		211		
Adj. Flow (vph)	347	215	379	211	164	553
Lane Group Flow (vph)	347	215	379	211	164	553
Turn Type	Prot	Perm	NA	Perm	Perm	NA
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Total Split (s)	22.5	22.5	27.5	27.5	27.5	27.5
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Act Effct Green (s)	18.0	18.0	23.0	23.0	23.0	23.0
Actuated g/C Ratio	0.36	0.36	0.46	0.46	0.46	0.46
v/c Ratio	0.54	0.30	0.45	0.27	0.41	0.66
Control Delay	16.7	3.4	11.3	2.5	13.0	15.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.7	3.4	11.3	2.5	13.0	15.1
LOS	B	A	B	A	B	B
Approach Delay	11.6		8.2			14.6
Approach LOS	B		A			B
Queue Length 50th (m)	23.7	0.0	21.2	0.0	9.0	35.1
Queue Length 95th (m)	43.4	10.0	38.1	8.1	21.3	62.2
Internal Link Dist (m)	199.1		398.4			245.1
Turn Bay Length (m)	60.0			55.0	100.0	
Base Capacity (vph)	637	719	849	796	398	841
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.30	0.45	0.27	0.41	0.66

Intersection Summary		
Cycle Length: 50		
Actuated Cycle Length: 50		
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green		
Control Type: Pretimed		
Maximum v/c Ratio: 0.66		
Intersection Signal Delay: 11.7	Intersection LOS: B	
Intersection Capacity Utilization 55.7%	ICU Level of Service B	
Analysis Period (min) 15		

Splits and Phases: 106: St Catharines Street & Industrial Park Rd



Appendix F ARCADY OUTPUTS – FUTURE BACKGROUND AND FUTURE TOTAL CONDITIONS (2030)

Junctions 9

ARCADY 9 - Roundabout Module

Filename: Smithville FUTURE.j9
Path: C:\Users\rlei\Desktop
Report generation date: 8/16/2024 5:51:47 PM

Summary of intersection performance

	2030 Future Total PM						
	Queue (Veh)	95% Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	Townline Road and Regional Road 20						
Townline Road East		1.1	8.87	0.26	A	22.59	C
Regional Road 20 North		14.6	32.98	0.92	D		
Townline Road West		3.7	15.38	0.58	C		
Regional Rd 20 South		4.9	14.42	0.65	B		

There are warnings associated with this model run - see the 'Data Errors and Warnings' tables.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

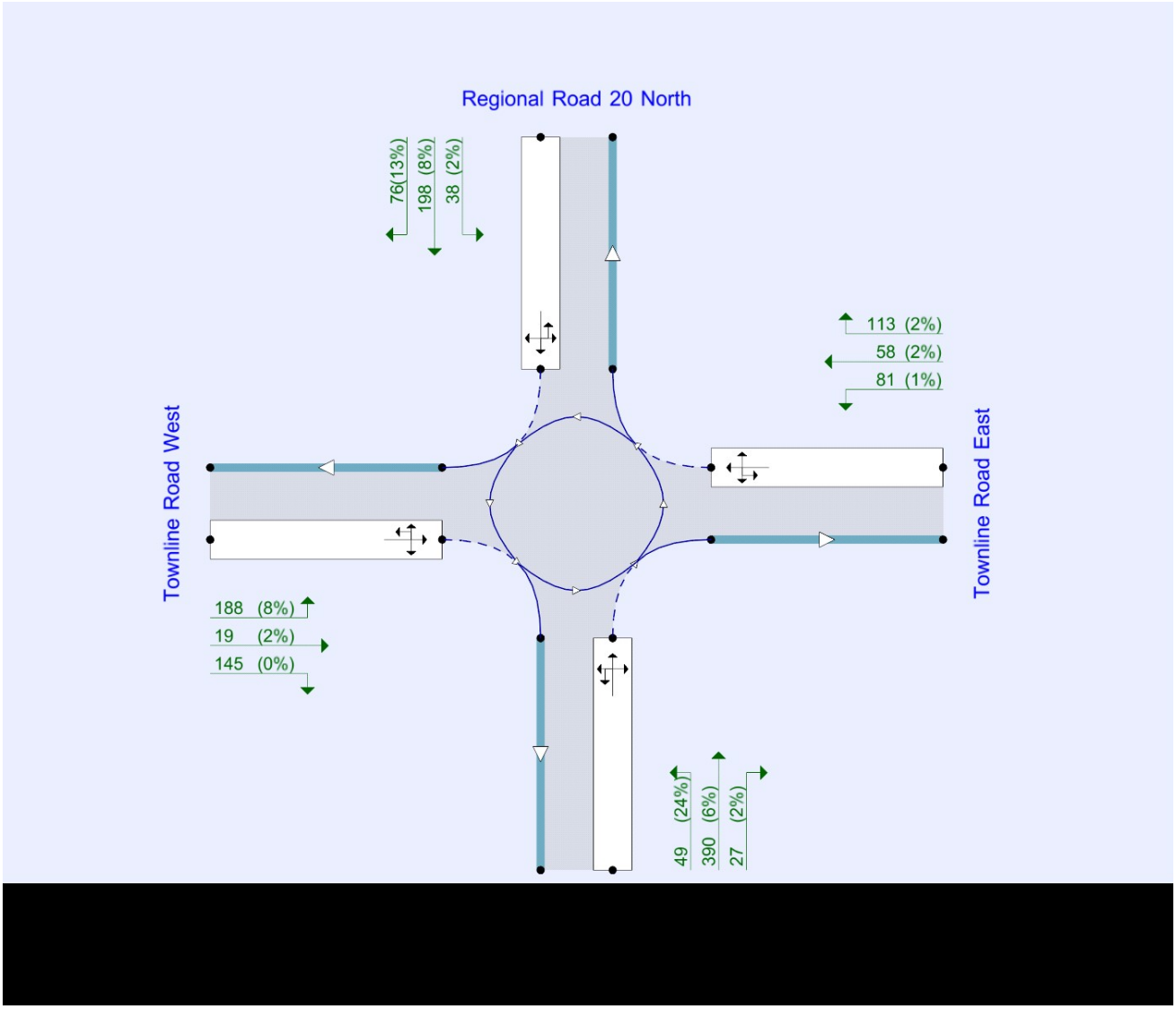
File summary

File Description

Title	
Location	
Site number	
Date	10/17/2023
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	CORP\rlei
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	Veh	Veh	perHour	s	-Min	perMin



The intersection diagram reflects the last run of Intersections.

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	V/C Ratio Threshold	Average Delay threshold (s)	Queue threshold (PCE)
✓		0.85	36.00	20.00

HCM Calibration

HCM Calibration	Lane type	Num circulating lanes	Num exit lanes	A	B
1	Single lane	1		1380.00	-0.00102
2	Single lane	2		1420.00	-0.00085
3	Nearside	1		1420.00	-0.00091
4	Nearside	2		1420.00	-0.00085
5	Offside	1		1420.00	-0.00091
6	Offside	2		1350.00	-0.00092
7	Yielding bypass		1	1380.00	-0.00102
8	Yielding bypass		2	1420.00	-0.00085
9	Non-yielding bypass		1	99999.00	0.00000

Demand Set Summary

ID	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D1	2030 Future Background AM	PHF	08:00	09:00	15
D2	2030 Future Background PM	PHF	17:00	18:00	15
D3	2030 Future Total AM	PHF	08:00	09:00	15
D4	2030 Future Total PM	PHF	17:00	18:00	15

Analysis Set Details

ID	Name	Network flow scaling factor (%)
A1	Townline Road and Regional Road 20	100.000

Townline Road and Regional Road 20 - , 2030 Future Background AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	HCM Model	D1 - , 2030 Future Background AM	Demand Set 11: HCM models are most typically used with PHF traffic flow profiles and single time segments. Use of HCM models with other flow profiles is at the user's own risk
Warning	HCM Model		One or more intersections use HCM methodologies. These methods are not associated with TRL. The user should apply judgement when interpreting the results.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Intersection Network

Intersections

Intersection	Name	Intersection type	Use circulating lanes	Leg order	Intersection Delay (s)	Intersection LOS
1	Townline Road and Regional Road 20	HCM Roundabout		1, 2, 3, 4	9.52	A

Intersection Network Options

Driving side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Name	Description
1	Townline Road East	
2	Regional Road 20 North	
3	Townline Road West	
4	Regional Rd 20 South	

HCM Lanes

Leg	HCM Lane	Lane type	Number of conflicting lanes	Destination legs
Townline Road East	1	Single lane	1	1, 2, 3, 4
Regional Road 20 North	1	Single lane	1	1, 2, 3, 4
Townline Road West	1	Single lane	1	1, 2, 3, 4
Regional Rd 20 South	1	Single lane	1	1, 2, 3, 4

Traffic Demand

Demand Set Details

ID	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D1	2030 Future Background AM	PHF	08:00	09:00	15

Vehicle mix source	PCE Factor for a Truck (PCE)
Truck Percentages	2.00

Demand overview (Traffic)

Leg	Linked leg	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
Townline Road East		✓	252	100.000
Regional Road 20 North		✓	312	100.000
Townline Road West		✓	352	100.000
Regional Rd 20 South		✓	466	100.000

Peak Hour Factor Data (Traffic)

Leg	Hourly volume (Veh/hr)	Peak hour factor	Peak time segment
Townline Road East	252	0.92	SecondQuarter
Regional Road 20 North	312	0.92	SecondQuarter
Townline Road West	352	0.92	SecondQuarter
Regional Rd 20 South	466	0.92	SecondQuarter

Origin-Destination Data

Demand (Veh/hr)

		To			
		Townline Road East	Regional Road 20 North	Townline Road West	Regional Rd 20 South
From	Townline Road East	0	113	58	81
	Regional Road 20 North	38	0	76	198
	Townline Road West	19	188	0	145
	Regional Rd 20 South	27	390	49	0

Vehicle Mix

Truck Percentages

		To			
		Townline Road East	Regional Road 20 North	Townline Road West	Regional Rd 20 South
From	Townline Road East	0	2	2	1
	Regional Road 20 North	2	0	13	8
	Townline Road West	2	8	0	0
	Regional Rd 20 South	2	6	24	0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max 95th percentile Queue (Veh)	Max LOS
Townline Road East	0.43	11.89	2.1	B
Regional Road 20 North	0.33	6.97	1.5	A
Townline Road West	0.42	8.86	2.1	A
Regional Rd 20 South	0.53	10.51	3.2	B

Main Results for each time segment

08:00 - 08:15

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Townline Road East	237	591	0.00	708	0.335	1.5	9.304	A
Regional Road 20 North	294	177	0.00	1048	0.280	1.2	6.172	A
Townline Road West	332	299	0.00	959	0.346	1.6	7.456	A
Regional Rd 20 South	439	231	0.00	997	0.440	2.3	8.617	A

08:15 - 08:30

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Townline Road East	274	682	0.00	641	0.428	2.1	11.890	B
Regional Road 20 North	339	204	0.00	1017	0.333	1.5	6.967	A
Townline Road West	383	345	0.00	913	0.419	2.1	8.860	A
Regional Rd 20 South	507	266	0.00	960	0.528	3.2	10.506	B

08:30 - 08:45

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Townline Road East	259	645	0.00	667	0.389	1.8	10.738	B
Regional Road 20 North	321	193	0.00	1029	0.312	1.3	6.634	A
Townline Road West	362	326	0.00	931	0.389	1.9	8.256	A
Regional Rd 20 South	480	252	0.00	974	0.492	2.8	9.679	A

08:45 - 09:00

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Townline Road East	237	591	0.00	708	0.335	1.5	9.304	A
Regional Road 20 North	294	177	0.00	1048	0.280	1.2	6.172	A
Townline Road West	332	299	0.00	959	0.346	1.6	7.456	A
Regional Rd 20 South	439	231	0.00	997	0.440	2.3	8.617	A

Queue Variation Results for each time segment

HCM: Lane Results

Lane Results: 08:00-08:15

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Townline Road East	1	1, 2, 3, 4		237	0.00	591	708	1.48	9.30	0.34	A
Regional Road 20 North	1	1, 2, 3, 4		294	0.00	177	1048	1.16	6.17	0.28	A
Townline Road West	1	1, 2, 3, 4		332	0.00	299	959	1.56	7.46	0.35	A
Regional Rd 20 South	1	1, 2, 3, 4		439	0.00	231	997	2.28	8.62	0.44	A

Lane Results: 08:15-08:30

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Townline Road East	1	1, 2, 3, 4		274	0.00	682	641	2.14	11.89	0.43	B
Regional Road 20 North	1	1, 2, 3, 4		339	0.00	204	1017	1.47	6.97	0.33	A
Townline Road West	1	1, 2, 3, 4		383	0.00	345	913	2.10	8.86	0.42	A
Regional Rd 20 South	1	1, 2, 3, 4		507	0.00	266	960	3.18	10.51	0.53	B

Lane Results: 08:30-08:45

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Townline Road East	**1**	1, 2, 3, 4		259	0.00	645	667	1.84	10.74	0.39	B
Regional Road 20 North	**1**	1, 2, 3, 4		321	0.00	193	1029	1.34	6.63	0.31	A
Townline Road West	**1**	1, 2, 3, 4		362	0.00	326	931	1.86	8.26	0.39	A
Regional Rd 20 South	**1**	1, 2, 3, 4		480	0.00	252	974	2.78	9.68	0.49	A

Lane Results: 08:45-09:00

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Townline Road East	**1**	1, 2, 3, 4		237	0.00	591	708	1.48	9.30	0.34	A
Regional Road 20 North	**1**	1, 2, 3, 4		294	0.00	177	1048	1.16	6.17	0.28	A
Townline Road West	**1**	1, 2, 3, 4		332	0.00	299	959	1.56	7.46	0.35	A
Regional Rd 20 South	**1**	1, 2, 3, 4		439	0.00	231	997	2.28	8.62	0.44	A

Townline Road and Regional Road 20 - , 2030 Future Background PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	HCM Model	D2 - , 2030 Future Background PM	Demand Set 12: HCM models are most typically used with PHF traffic flow profiles and single time segments. Use of HCM models with other flow profiles is at the user's own risk
Warning	HCM Model		One or more intersections use HCM methodologies. These methods are not associated with TRL. The user should apply judgement when interpreting the results.
Last Run	Last Run	Regional Road 20 North - HCM Lane 1	HCM model: Leg 2, Lane 1: V/C Ratio is above 0.85 for one or more time segments. HCM results may be unreliable. Consider using ARCADY model instead. See User Guide for more details.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Intersection Network

Intersections

Intersection	Name	Intersection type	Use circulating lanes	Leg order	Intersection Delay (s)	Intersection LOS
1	Townline Road and Regional Road 20	HCM Roundabout		1, 2, 3, 4	18.24	C

Intersection Network Options

Driving side	Lighting
Right	Normal/unknown

Traffic Demand

Demand Set Details

ID	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D2	2030 Future Background PM	PHF	17:00	18:00	15

Vehicle mix source	PCE Factor for a Truck (PCE)
Truck Percentages	2.00

Demand overview (Traffic)

Leg	Linked leg	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
Townline Road East		✓	157	100.000
Regional Road 20 North		✓	836	100.000
Townline Road West		✓	317	100.000
Regional Rd 20 South		✓	512	100.000

Peak Hour Factor Data (Traffic)

Leg	Hourly volume (Veh/hr)	Peak hour factor	Peak time segment
Townline Road East	157	0.92	SecondQuarter
Regional Road 20 North	836	0.92	SecondQuarter
Townline Road West	317	0.92	SecondQuarter
Regional Rd 20 South	512	0.92	SecondQuarter

Origin-Destination Data

Demand (Veh/hr)

		To			
		Townline Road East	Regional Road 20 North	Townline Road West	Regional Rd 20 South
From	Townline Road East	0	75	36	46
	Regional Road 20 North	124	0	259	453
	Townline Road West	60	158	0	99
	Regional Rd 20 South	77	299	136	0

Vehicle Mix

Truck Percentages

		To			
		Townline Road East	Regional Road 20 North	Townline Road West	Regional Rd 20 South
From	Townline Road East	0	2	2	8
	Regional Road 20 North	2	0	2	3
	Townline Road West	2	2	0	2
	Regional Rd 20 South	2	3	2	0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max 95th percentile Queue (Veh)	Max LOS
Townline Road East	0.25	8.35	1.0	A
Regional Road 20 North	0.87	25.08	11.7	D
Townline Road West	0.52	13.74	3.0	B
Regional Rd 20 South	0.61	12.92	4.3	B

Main Results for each time segment

17:00 - 17:15

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Townline Road East	148	559	0.00	742	0.199	0.7	7.056	A
Regional Road 20 North	788	205	0.00	1084	0.727	6.7	15.220	C
Townline Road West	299	587	0.00	730	0.409	2.0	10.358	B
Regional Rd 20 South	482	322	0.00	962	0.501	2.9	9.949	A

17:15 - 17:30

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Townline Road East	171	645	0.00	678	0.252	1.0	8.346	A
Regional Road 20 North	909	237	0.00	1049	0.867	11.7	25.082	D
Townline Road West	345	677	0.00	663	0.519	3.0	13.736	B
Regional Rd 20 South	557	372	0.00	914	0.609	4.3	12.922	B

17:30 - 17:45

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Townline Road East	162	610	0.00	703	0.230	0.9	7.795	A
Regional Road 20 North	860	224	0.00	1063	0.810	9.3	19.997	C
Townline Road West	326	641	0.00	689	0.473	2.6	12.196	B
Regional Rd 20 South	527	352	0.00	933	0.565	3.6	11.570	B

17:45 - 18:00

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Townline Road East	148	559	0.00	742	0.199	0.7	7.056	A
Regional Road 20 North	788	205	0.00	1084	0.727	6.7	15.220	C
Townline Road West	299	587	0.00	730	0.409	2.0	10.358	B
Regional Rd 20 South	482	322	0.00	962	0.501	2.9	9.949	A

Queue Variation Results for each time segment

HCM: Lane Results

Lane Results: 17:00-17:15

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Townline Road East	1	1, 2, 3, 4		148	0.00	559	742	0.74	7.06	0.20	A
Regional Road 20 North	1	1, 2, 3, 4		788	0.00	205	1084	6.74	15.22	0.73	C
Townline Road West	1	1, 2, 3, 4		299	0.00	587	730	2.00	10.36	0.41	B
Regional Rd 20 South	1	1, 2, 3, 4		482	0.00	322	962	2.88	9.95	0.50	A

Lane Results: 17:15-17:30

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Townline Road East	1	1, 2, 3, 4		171	0.00	645	678	0.99	8.35	0.25	A
Regional Road 20 North	1	1, 2, 3, 4		909	0.00	237	1049	11.68	25.08	0.87	D
Townline Road West	1	1, 2, 3, 4		345	0.00	677	663	3.01	13.74	0.52	B
Regional Rd 20 South	1	1, 2, 3, 4		557	0.00	372	914	4.27	12.92	0.61	B

Lane Results: 17:30-17:45

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Townline Road East	1	1, 2, 3, 4		162	0.00	610	703	0.88	7.79	0.23	A
Regional Road 20 North	1	1, 2, 3, 4		860	0.00	224	1063	9.32	20.00	0.81	C
Townline Road West	1	1, 2, 3, 4		326	0.00	641	689	2.55	12.20	0.47	B
Regional Rd 20 South	1	1, 2, 3, 4		527	0.00	352	933	3.63	11.57	0.56	B

Lane Results: 17:45-18:00

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Townline Road East	1	1, 2, 3, 4		148	0.00	559	742	0.74	7.06	0.20	A
Regional Road 20 North	1	1, 2, 3, 4		788	0.00	205	1084	6.74	15.22	0.73	C
Townline Road West	1	1, 2, 3, 4		299	0.00	587	730	2.00	10.36	0.41	B
Regional Rd 20 South	1	1, 2, 3, 4		482	0.00	322	962	2.88	9.95	0.50	A

Townline Road and Regional Road 20 - , 2030 Future Total AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	HCM Model	D3 - , 2030 Future Total AM	Demand Set 9: HCM models are most typically used with PHF traffic flow profiles and single time segments. Use of HCM models with other flow profiles is at the user's own risk
Warning	HCM Model		One or more intersections use HCM methodologies. These methods are not associated with TRL. The user should apply judgement when interpreting the results.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Intersection Network

Intersections

Intersection	Name	Intersection type	Use circulating lanes	Leg order	Intersection Delay (s)	Intersection LOS
1	Townline Road and Regional Road 20	HCM Roundabout		1, 2, 3, 4	10.31	B

Intersection Network Options

Driving side	Lighting
Right	Normal/unknown

Traffic Demand

Demand Set Details

ID	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D3	2030 Future Total AM	PHF	08:00	09:00	15

Vehicle mix source	PCE Factor for a Truck (PCE)
Truck Percentages	2.00

Demand overview (Traffic)

Leg	Linked leg	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
Townline Road East		✓	252	100.000
Regional Road 20 North		✓	322	100.000
Townline Road West		✓	403	100.000
Regional Rd 20 South		✓	474	100.000

Peak Hour Factor Data (Traffic)

Leg	Hourly volume (Veh/hr)	Peak hour factor	Peak time segment
Townline Road East	252	0.92	SecondQuarter
Regional Road 20 North	322	0.92	SecondQuarter
Townline Road West	403	0.92	SecondQuarter
Regional Rd 20 South	474	0.92	SecondQuarter

Origin-Destination Data

Demand (Veh/hr)

		To			
		Townline Road East	Regional Road 20 North	Townline Road West	Regional Rd 20 South
From	Townline Road East	0	113	58	81
	Regional Road 20 North	38	0	86	198
	Townline Road West	19	217	0	167
	Regional Rd 20 South	27	390	57	0

Vehicle Mix

Truck Percentages

		To			
		Townline Road East	Regional Road 20 North	Townline Road West	Regional Rd 20 South
From	Townline Road East	0	2	2	1
	Regional Road 20 North	2	0	13	8
	Townline Road West	2	8	0	0
	Regional Rd 20 South	2	6	24	0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max 95th percentile Queue (Veh)	Max LOS
Townline Road East	0.45	12.80	2.3	B
Regional Road 20 North	0.35	7.23	1.6	A
Townline Road West	0.48	9.94	2.7	A
Regional Rd 20 South	0.56	11.47	3.5	B

Main Results for each time segment

08:00 - 08:15

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Townline Road East	237	626	0.00	681	0.349	1.6	9.841	A
Regional Road 20 North	303	185	0.00	1037	0.293	1.2	6.366	A
Townline Road West	380	299	0.00	959	0.396	1.9	8.177	A
Regional Rd 20 South	447	258	0.00	965	0.463	2.5	9.211	A

08:15 - 08:30

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Townline Road East	274	722	0.00	612	0.448	2.3	12.799	B
Regional Road 20 North	350	213	0.00	1005	0.348	1.6	7.228	A
Townline Road West	438	345	0.00	912	0.480	2.7	9.936	A
Regional Rd 20 South	515	298	0.00	924	0.557	3.5	11.469	B

08:30 - 08:45

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Townline Road East	259	683	0.00	639	0.406	2.0	11.470	B
Regional Road 20 North	331	202	0.00	1017	0.326	1.4	6.867	A
Townline Road West	415	326	0.00	931	0.446	2.3	9.169	A
Regional Rd 20 South	488	282	0.00	941	0.519	3.1	10.468	B

08:45 - 09:00

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Townline Road East	237	626	0.00	681	0.349	1.6	9.841	A
Regional Road 20 North	303	185	0.00	1037	0.293	1.2	6.366	A
Townline Road West	380	299	0.00	959	0.396	1.9	8.177	A
Regional Rd 20 South	447	258	0.00	965	0.463	2.5	9.211	A

Queue Variation Results for each time segment

HCM: Lane Results

Lane Results: 08:00-08:15

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Townline Road East	1	1, 2, 3, 4		237	0.00	626	681	1.56	9.84	0.35	A
Regional Road 20 North	1	1, 2, 3, 4		303	0.00	185	1037	1.22	6.37	0.29	A
Townline Road West	1	1, 2, 3, 4		380	0.00	299	959	1.92	8.18	0.40	A
Regional Rd 20 South	1	1, 2, 3, 4		447	0.00	258	965	2.49	9.21	0.46	A

Lane Results: 08:15-08:30

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Townline Road East	1	1, 2, 3, 4		274	0.00	722	612	2.31	12.80	0.45	B
Regional Road 20 North	1	1, 2, 3, 4		350	0.00	213	1005	1.57	7.23	0.35	A
Townline Road West	1	1, 2, 3, 4		438	0.00	345	912	2.65	9.94	0.48	A
Regional Rd 20 South	1	1, 2, 3, 4		515	0.00	298	924	3.53	11.47	0.56	B

Lane Results: 08:30-08:45

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Townline Road East	1	1, 2, 3, 4		259	0.00	683	639	1.97	11.47	0.41	B
Regional Road 20 North	1	1, 2, 3, 4		331	0.00	202	1017	1.43	6.87	0.33	A
Townline Road West	1	1, 2, 3, 4		415	0.00	326	931	2.33	9.17	0.45	A
Regional Rd 20 South	1	1, 2, 3, 4		488	0.00	282	941	3.07	10.47	0.52	B

Lane Results: 08:45-09:00

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Townline Road East	1	1, 2, 3, 4		237	0.00	626	681	1.56	9.84	0.35	A
Regional Road 20 North	1	1, 2, 3, 4		303	0.00	185	1037	1.22	6.37	0.29	A
Townline Road West	1	1, 2, 3, 4		380	0.00	299	959	1.92	8.18	0.40	A
Regional Rd 20 South	1	1, 2, 3, 4		447	0.00	258	965	2.49	9.21	0.46	A

Townline Road and Regional Road 20 - , 2030 Future Total PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	HCM Model	D4 - , 2030 Future Total PM	Demand Set 10: HCM models are most typically used with PHF traffic flow profiles and single time segments. Use of HCM models with other flow profiles is at the user's own risk
Warning	HCM Model		One or more intersections use HCM methodologies. These methods are not associated with TRL. The user should apply judgement when interpreting the results.
Last Run	Last Run	Regional Road 20 North - HCM Lane 1	HCM model: Leg 2, Lane 1: V/C Ratio is above 0.85 for one or more time segments. HCM results may be unreliable. Consider using ARCADY model instead. See User Guide for more details.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Intersection Network

Intersections

Intersection	Name	Intersection type	Use circulating lanes	Leg order	Intersection Delay (s)	Intersection LOS
1	Townline Road and Regional Road 20	HCM Roundabout		1, 2, 3, 4	22.59	C

Intersection Network Options

Driving side	Lighting
Right	Normal/unknown

Traffic Demand

Demand Set Details

ID	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D4	2030 Future Total PM	PHF	17:00	18:00	15

Vehicle mix source	PCE Factor for a Truck (PCE)
Truck Percentages	2.00

Demand overview (Traffic)

Leg	Linked leg	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
Townline Road East		✓	157	100.000
Regional Road 20 North		✓	871	100.000
Townline Road West		✓	351	100.000
Regional Rd 20 South		✓	533	100.000

Peak Hour Factor Data (Traffic)

Leg	Hourly volume (Veh/hr)	Peak hour factor	Peak time segment
Townline Road East	157	0.92	SecondQuarter
Regional Road 20 North	871	0.92	SecondQuarter
Townline Road West	351	0.92	SecondQuarter
Regional Rd 20 South	533	0.92	SecondQuarter

Origin-Destination Data

Demand (Veh/hr)

		To			
		Townline Road East	Regional Road 20 North	Townline Road West	Regional Rd 20 South
From	Townline Road East	0	75	36	46
	Regional Road 20 North	124	0	294	453
	Townline Road West	60	179	0	112
	Regional Rd 20 South	77	299	157	0

Vehicle Mix

Truck Percentages

		To			
		Townline Road East	Regional Road 20 North	Townline Road West	Regional Rd 20 South
From	Townline Road East	0	2	2	8
	Regional Road 20 North	2	0	2	3
	Townline Road West	2	2	0	2
	Regional Rd 20 South	2	3	2	0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max 95th percentile Queue (Veh)	Max LOS
Townline Road East	0.26	8.87	1.1	A
Regional Road 20 North	0.92	32.98	14.6	D
Townline Road West	0.58	15.38	3.7	C
Regional Rd 20 South	0.65	14.42	4.9	B

Main Results for each time segment

17:00 - 17:15

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Townline Road East	148	598	0.00	712	0.208	0.8	7.419	A
Regional Road 20 North	821	225	0.00	1062	0.772	8.0	17.695	C
Townline Road West	331	587	0.00	730	0.453	2.4	11.225	B
Regional Rd 20 South	502	342	0.00	943	0.533	3.2	10.747	B

17:15 - 17:30

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Townline Road East	171	690	0.00	646	0.264	1.1	8.874	A
Regional Road 20 North	947	260	0.00	1024	0.924	14.6	32.982	D
Townline Road West	382	677	0.00	663	0.575	3.7	15.383	C
Regional Rd 20 South	579	395	0.00	893	0.649	4.9	14.418	B

17:30 - 17:45

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Townline Road East	162	653	0.00	672	0.240	0.9	8.249	A
Regional Road 20 North	896	246	0.00	1039	0.862	11.5	24.810	C
Townline Road West	361	641	0.00	689	0.524	3.1	13.451	B
Regional Rd 20 South	548	374	0.00	912	0.601	4.1	12.716	B

17:45 - 18:00

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Queue95 (Veh)	Delay (s)	Unsignalised level of service
Townline Road East	148	598	0.00	712	0.208	0.8	7.419	A
Regional Road 20 North	821	225	0.00	1062	0.772	8.0	17.695	C
Townline Road West	331	587	0.00	730	0.453	2.4	11.225	B
Regional Rd 20 South	502	342	0.00	943	0.533	3.2	10.747	B

Queue Variation Results for each time segment

HCM: Lane Results

Lane Results: 17:00-17:15

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Townline Road East	1	1, 2, 3, 4		148	0.00	598	712	0.78	7.42	0.21	A
Regional Road 20 North	1	1, 2, 3, 4		821	0.00	225	1062	8.04	17.69	0.77	C
Townline Road West	1	1, 2, 3, 4		331	0.00	587	730	2.37	11.23	0.45	B
Regional Rd 20 South	1	1, 2, 3, 4		502	0.00	342	943	3.23	10.75	0.53	B

Lane Results: 17:15-17:30

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Townline Road East	1	1, 2, 3, 4		171	0.00	690	646	1.06	8.87	0.26	A
Regional Road 20 North	1	1, 2, 3, 4		947	0.00	260	1024	14.62	32.98	0.92	D
Townline Road West	1	1, 2, 3, 4		382	0.00	677	663	3.68	15.38	0.58	C
Regional Rd 20 South	1	1, 2, 3, 4		579	0.00	395	893	4.93	14.42	0.65	B

Lane Results: 17:30-17:45

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Townline Road East	1	1, 2, 3, 4		162	0.00	653	672	0.94	8.25	0.24	A
Regional Road 20 North	1	1, 2, 3, 4		896	0.00	246	1039	11.46	24.81	0.86	C
Townline Road West	1	1, 2, 3, 4		361	0.00	641	689	3.07	13.45	0.52	B
Regional Rd 20 South	1	1, 2, 3, 4		548	0.00	374	912	4.14	12.72	0.60	B

Lane Results: 17:45-18:00

Leg	HCM Lane	Destination legs	Has conflict	Demand (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
Townline Road East	1	1, 2, 3, 4		148	0.00	598	712	0.78	7.42	0.21	A
Regional Road 20 North	1	1, 2, 3, 4		821	0.00	225	1062	8.04	17.69	0.77	C
Townline Road West	1	1, 2, 3, 4		331	0.00	587	730	2.37	11.23	0.45	B
Regional Rd 20 South	1	1, 2, 3, 4		502	0.00	342	943	3.23	10.75	0.53	B

Appendix G TRAFFIC SIGNAL WARRANT – FUTURE BACKGROUND CONDITIONS (2030)

Intersection:	Industrial Park Rd @ Regional Road 20		
Major Street:	North-South	Lanes:	1
Minor Street:	East-West	Lanes:	1
Urban/Rural:	Urban		
Legs:	3		
New/Existing Intersection:	existing		
Scenario:	2030 Background		

	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
AmPHV	0	433	273	90	228	0	0	0	0	98	0	113
PmPHV	0	349	194	151	509	0	0	0	0	319	0	198
AHV	0	196	117	60	184	0	0	0	0	104	0	78

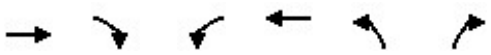
Justification #7

Justification	Description	Minimum Requirement 1 Lane Highway		Minimum Requirement 2 or More Lanes		Compliance Sectional		Compliance Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	830	115%	115%	No
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	273	161%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	420	600	900	557	133%	133%	Yes
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	120	170	104	139%		

Notes:

1. Refer to OTM Book 12, pg 92, March 2012
2. Lowest section percentage governs justification
3. Average hourly volumes estiamted from peak hour volumes, AHV = PHV/2 or (AM + PM) / 4

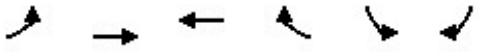
Appendix H SYNCHRO OUTPUTS – FUTURE TOTAL CONDITIONS (2030)



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	131	21	123	175	40	240
Future Volume (Veh/h)	131	21	123	175	40	240
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	142	23	134	190	43	261
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			165		612	154
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			165		612	154
tC, single (s)			4.2		6.6	6.2
tC, 2 stage (s)						
tF (s)			2.3		3.7	3.3
p0 queue free %			90		89	71
cM capacity (veh/h)			1383		383	890

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	165	324	304
Volume Left	0	134	43
Volume Right	23	0	261
cSH	1700	1383	750
Volume to Capacity	0.10	0.10	0.41
Queue Length 95th (m)	0.0	2.4	15.0
Control Delay (s)	0.0	3.8	13.0
Lane LOS		A	B
Approach Delay (s)	0.0	3.8	13.0
Approach LOS			B

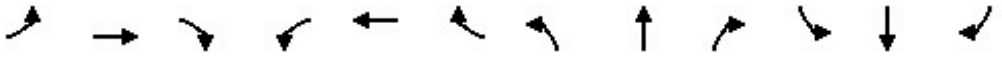
Intersection Summary			
Average Delay	6.5		
Intersection Capacity Utilization	51.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	193	176	178	112	39	120
Future Volume (vph)	193	176	178	112	39	120
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	210	191	193	122	42	130

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	401	315	172
Volume Left (vph)	210	0	42
Volume Right (vph)	0	122	130
Hadj (s)	0.21	-0.11	-0.16
Departure Headway (s)	5.0	4.8	5.4
Degree Utilization, x	0.56	0.42	0.26
Capacity (veh/h)	692	716	589
Control Delay (s)	14.1	11.2	10.3
Approach Delay (s)	14.1	11.2	10.3
Approach LOS	B	B	B

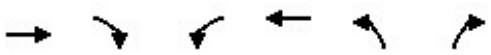
Intersection Summary			
Delay	12.4		
Level of Service	B		
Intersection Capacity Utilization	55.7%	ICU Level of Service	B
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	4	285	17	21	177	5	44	0	55	6	0	2
Future Volume (vph)	4	285	17	21	177	5	44	0	55	6	0	2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	310	18	23	192	5	48	0	60	7	0	2

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	332	220	108	9
Volume Left (vph)	4	23	48	7
Volume Right (vph)	18	5	60	2
Hadj (s)	0.09	0.20	-0.21	0.48
Departure Headway (s)	4.6	4.8	5.0	5.9
Degree Utilization, x	0.42	0.29	0.15	0.01
Capacity (veh/h)	768	720	652	541
Control Delay (s)	10.8	9.8	8.9	8.9
Approach Delay (s)	10.8	9.8	8.9	8.9
Approach LOS	B	A	A	A

Intersection Summary			
Delay	10.1		
Level of Service	B		
Intersection Capacity Utilization	35.1%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	343	6	14	182	13	54
Future Volume (Veh/h)	343	6	14	182	13	54
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	373	7	15	198	14	59
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			380		604	376
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			380		604	376
tC, single (s)			4.2		6.4	6.3
tC, 2 stage (s)						
tF (s)			2.3		3.5	3.4
p0 queue free %			99		97	91
cM capacity (veh/h)			1146		458	659

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	380	213	73
Volume Left	0	15	14
Volume Right	7	0	59
cSH	1700	1146	608
Volume to Capacity	0.22	0.01	0.12
Queue Length 95th (m)	0.0	0.3	3.1
Control Delay (s)	0.0	0.7	11.7
Lane LOS		A	B
Approach Delay (s)	0.0	0.7	11.7
Approach LOS			B

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	31.8%	ICU Level of Service	A
Analysis Period (min)	15		

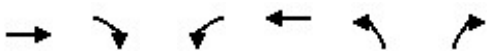
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Right Turn Channelized						
Traffic Volume (veh/h)	217	167	57	390	198	86
Future Volume (veh/h)	217	167	57	390	198	86
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	236	182	62	424	215	93
Approach Volume (veh/h)	418			486	308	
Crossing Volume (veh/h)	215			236	62	
High Capacity (veh/h)	1170			1151	1319	
High v/c (veh/h)	0.36			0.42	0.23	
Low Capacity (veh/h)	967			949	1102	
Low v/c (veh/h)	0.43			0.51	0.28	

Intersection Summary			
Maximum v/c High	0.42		
Maximum v/c Low	0.51		
Intersection Capacity Utilization	71.6%	ICU Level of Service	C

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	103	113	448	287	90	233
Future Volume (Veh/h)	103	113	448	287	90	233
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	112	123	487	312	98	253
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	936	487			799	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	936	487			799	
tC, single (s)	6.5	6.4			4.2	
tC, 2 stage (s)						
tF (s)	3.6	3.5			2.3	
p0 queue free %	55	78			88	
cM capacity (veh/h)	250	551			802	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	112	123	487	312	98	253
Volume Left	112	0	0	0	98	0
Volume Right	0	123	0	312	0	0
cSH	250	551	1700	1700	802	1700
Volume to Capacity	0.45	0.22	0.29	0.18	0.12	0.15
Queue Length 95th (m)	16.5	6.4	0.0	0.0	3.2	0.0
Control Delay (s)	30.6	13.4	0.0	0.0	10.1	0.0
Lane LOS	D	B			B	
Approach Delay (s)	21.6		0.0		2.8	
Approach LOS	C					

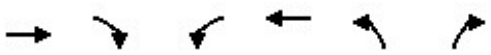
Intersection Summary			
Average Delay	4.4		
Intersection Capacity Utilization	44.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	194	22	14	218	65	42
Future Volume (Veh/h)	194	22	14	218	65	42
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	211	24	15	237	71	46
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			235		490	223
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			235		490	223
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		87	94
cM capacity (veh/h)			1332		531	817

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	235	252	117
Volume Left	0	15	71
Volume Right	24	0	46
cSH	1700	1332	616
Volume to Capacity	0.14	0.01	0.19
Queue Length 95th (m)	0.0	0.3	5.3
Control Delay (s)	0.0	0.6	12.2
Lane LOS		A	B
Approach Delay (s)	0.0	0.6	12.2
Approach LOS			B

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	35.8%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	226	10	26	202	30	77
Future Volume (Veh/h)	226	10	26	202	30	77
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	246	11	28	220	33	84
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			257		528	252
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			257		528	252
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		93	89
cM capacity (veh/h)			1308		500	787

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	257	248	117
Volume Left	0	28	33
Volume Right	11	0	84
cSH	1700	1308	678
Volume to Capacity	0.15	0.02	0.17
Queue Length 95th (m)	0.0	0.5	4.7
Control Delay (s)	0.0	1.1	11.4
Lane LOS		A	B
Approach Delay (s)	0.0	1.1	11.4
Approach LOS			B

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	41.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	10	61	128	3	20	60
Future Volume (Veh/h)	10	61	128	3	20	60
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	66	139	3	22	65
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	250	140			142	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	250	140			142	
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	93			98	
cM capacity (veh/h)	728	907			1441	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	77	142	87
Volume Left	11	0	22
Volume Right	66	3	0
cSH	877	1700	1441
Volume to Capacity	0.09	0.08	0.02
Queue Length 95th (m)	2.2	0.0	0.4
Control Delay (s)	9.5	0.0	2.0
Lane LOS	A		A
Approach Delay (s)	9.5	0.0	2.0
Approach LOS	A		

Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	25.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	10	61	70	3	20	49
Future Volume (Veh/h)	10	61	70	3	20	49
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	66	76	3	22	53
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	174	78			79	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	174	78			79	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	93			99	
cM capacity (veh/h)	804	983			1519	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	77	79	75
Volume Left	11	0	22
Volume Right	66	3	0
cSH	953	1700	1519
Volume to Capacity	0.08	0.05	0.01
Queue Length 95th (m)	2.0	0.0	0.3
Control Delay (s)	9.1	0.0	2.3
Lane LOS	A		A
Approach Delay (s)	9.1	0.0	2.3
Approach LOS	A		

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	21.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	3	61	12	1	20	38
Future Volume (Veh/h)	3	61	12	1	20	38
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	66	13	1	22	41
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	98	14			14	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	98	14			14	
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	94			99	
cM capacity (veh/h)	888	1067			1604	

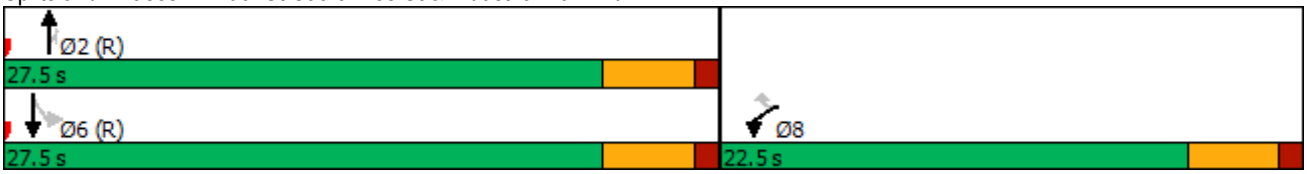
Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	69	14	63
Volume Left	3	0	22
Volume Right	66	1	0
cSH	1057	1700	1604
Volume to Capacity	0.07	0.01	0.01
Queue Length 95th (m)	1.6	0.0	0.3
Control Delay (s)	8.6	0.0	2.6
Lane LOS	A		A
Approach Delay (s)	8.6	0.0	2.6
Approach LOS	A		

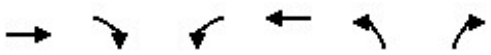
Intersection Summary			
Average Delay	5.2		
Intersection Capacity Utilization	20.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	103	113	448	287	90	233
Future Volume (vph)	103	113	448	287	90	233
Satd. Flow (prot)	1659	1396	1715	1484	1706	1746
Flt Permitted	0.950				0.369	
Satd. Flow (perm)	1659	1396	1715	1484	663	1746
Satd. Flow (RTOR)		123		312		
Adj. Flow (vph)	112	123	487	312	98	253
Lane Group Flow (vph)	112	123	487	312	98	253
Turn Type	Prot	Perm	NA	Perm	Perm	NA
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Total Split (s)	22.5	22.5	27.5	27.5	27.5	27.5
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Act Effct Green (s)	18.0	18.0	23.0	23.0	23.0	23.0
Actuated g/C Ratio	0.36	0.36	0.46	0.46	0.46	0.46
v/c Ratio	0.19	0.21	0.62	0.37	0.32	0.32
Control Delay	12.1	3.9	14.4	2.7	12.3	9.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.1	3.9	14.4	2.7	12.3	9.9
LOS	B	A	B	A	B	A
Approach Delay	7.8		9.9			10.6
Approach LOS	A		A			B
Queue Length 50th (m)	6.6	0.0	30.2	0.0	5.1	13.1
Queue Length 95th (m)	15.0	7.7	54.5	9.8	13.8	25.2
Internal Link Dist (m)	199.1		398.4			245.1
Turn Bay Length (m)	60.0			55.0	100.0	
Base Capacity (vph)	597	581	788	851	304	803
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.21	0.62	0.37	0.32	0.32

Intersection Summary	
Cycle Length: 50	
Actuated Cycle Length: 50	
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green	
Control Type: Pretimed	
Maximum v/c Ratio: 0.62	
Intersection Signal Delay: 9.7	Intersection LOS: A
Intersection Capacity Utilization 45.5%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 106: St Catharines St & Industrial Park Rd

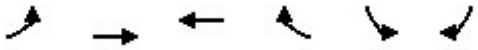




Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	205	33	164	257	38	226
Future Volume (Veh/h)	205	33	164	257	38	226
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	223	36	178	279	41	246
Pedestrians						
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			259		876	241
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			259		876	241
tC, single (s)			4.2		6.6	6.2
tC, 2 stage (s)						
tF (s)			2.3		3.7	3.3
p0 queue free %			86		84	69
cM capacity (veh/h)			1277		253	795

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	259	457	287
Volume Left	0	178	41
Volume Right	36	0	246
cSH	1700	1277	609
Volume to Capacity	0.15	0.14	0.47
Queue Length 95th (m)	0.0	3.7	19.1
Control Delay (s)	0.0	4.1	16.1
Lane LOS		A	C
Approach Delay (s)	0.0	4.1	16.1
Approach LOS			C

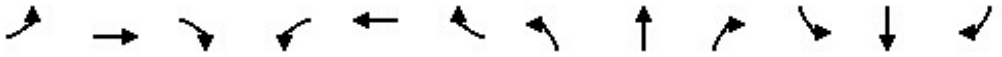
Intersection Summary			
Average Delay	6.5		
Intersection Capacity Utilization	61.4%	ICU Level of Service	B
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	231	190	201	132	96	210
Future Volume (vph)	231	190	201	132	96	210
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	251	207	218	143	104	228

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	458	361	332
Volume Left (vph)	251	0	104
Volume Right (vph)	0	143	228
Hadj (s)	0.22	-0.12	-0.10
Departure Headway (s)	5.8	5.6	6.0
Degree Utilization, x	0.74	0.57	0.55
Capacity (veh/h)	604	609	558
Control Delay (s)	23.3	15.7	16.3
Approach Delay (s)	23.3	15.7	16.3
Approach LOS	C	C	C

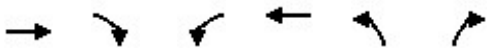
Intersection Summary			
Delay	18.9		
Level of Service	C		
Intersection Capacity Utilization	69.7%	ICU Level of Service	C
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	1	323	50	39	231	4	61	0	53	2	0	0
Future Volume (vph)	1	323	50	39	231	4	61	0	53	2	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	351	54	42	251	4	66	0	58	2	0	0

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	406	297	124	2
Volume Left (vph)	1	42	66	2
Volume Right (vph)	54	4	58	0
Hadj (s)	0.06	0.23	-0.14	0.54
Departure Headway (s)	4.7	5.0	5.4	6.4
Degree Utilization, x	0.53	0.41	0.19	0.00
Capacity (veh/h)	747	697	586	479
Control Delay (s)	12.9	11.4	9.7	9.4
Approach Delay (s)	12.9	11.4	9.7	9.4
Approach LOS	B	B	A	A

Intersection Summary			
Delay	11.9		
Level of Service	B		
Intersection Capacity Utilization	50.6%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	350	10	63	263	18	30
Future Volume (Veh/h)	350	10	63	263	18	30
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	380	11	68	286	20	33
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			391		808	386
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			391		808	386
tC, single (s)			4.2		6.4	6.3
tC, 2 stage (s)						
tF (s)			2.3		3.5	3.4
p0 queue free %			94		94	95
cM capacity (veh/h)			1136		332	651

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	391	354	53
Volume Left	0	68	20
Volume Right	11	0	33
cSH	1700	1136	478
Volume to Capacity	0.23	0.06	0.11
Queue Length 95th (m)	0.0	1.5	2.8
Control Delay (s)	0.0	2.1	13.5
Lane LOS		A	B
Approach Delay (s)	0.0	2.1	13.5
Approach LOS			B

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	49.7%	ICU Level of Service	A
Analysis Period (min)	15		

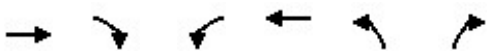
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Right Turn Channelized						
Traffic Volume (veh/h)	222	145	87	299	453	193
Future Volume (veh/h)	222	145	87	299	453	193
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	241	158	95	325	492	210
Approach Volume (veh/h)	399			420	702	
Crossing Volume (veh/h)	492			241	95	
High Capacity (veh/h)	939			1147	1286	
High v/c (veh/h)	0.42			0.37	0.55	
Low Capacity (veh/h)	760			945	1071	
Low v/c (veh/h)	0.53			0.44	0.66	

Intersection Summary			
Maximum v/c High	0.55		
Maximum v/c Low	0.66		
Intersection Capacity Utilization	87.3%	ICU Level of Service	E

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	275	214	412	233	114	402
Future Volume (Veh/h)	275	214	412	233	114	402
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	299	233	448	253	124	437
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	1133	448			701	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1133	448			701	
tC, single (s)	6.5	6.4			4.2	
tC, 2 stage (s)						
tF (s)	3.6	3.5			2.3	
p0 queue free %	0	60			86	
cM capacity (veh/h)	186	581			873	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	299	233	448	253	124	437
Volume Left	299	0	0	0	124	0
Volume Right	0	233	0	253	0	0
cSH	186	581	1700	1700	873	1700
Volume to Capacity	1.61	0.40	0.26	0.15	0.14	0.26
Queue Length 95th (m)	150.6	14.6	0.0	0.0	3.8	0.0
Control Delay (s)	343.1	15.3	0.0	0.0	9.8	0.0
Lane LOS	F	C			A	
Approach Delay (s)	199.5		0.0		2.2	
Approach LOS	F					

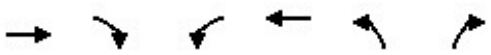
Intersection Summary			
Average Delay	59.9		
Intersection Capacity Utilization	53.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	268	22	14	292	65	43
Future Volume (Veh/h)	268	22	14	292	65	43
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	291	24	15	317	71	47
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			315		650	303
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			315		650	303
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		83	94
cM capacity (veh/h)			1245		429	737

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	315	332	118
Volume Left	0	15	71
Volume Right	24	0	47
cSH	1700	1245	514
Volume to Capacity	0.19	0.01	0.23
Queue Length 95th (m)	0.0	0.3	6.7
Control Delay (s)	0.0	0.5	14.1
Lane LOS		A	B
Approach Delay (s)	0.0	0.5	14.1
Approach LOS			B

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	39.7%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	300	11	25	272	34	74
Future Volume (Veh/h)	300	11	25	272	34	74
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	326	12	27	296	37	80
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			338		682	332
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			338		682	332
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		91	89
cM capacity (veh/h)			1221		406	710

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	338	323	117
Volume Left	0	27	37
Volume Right	12	0	80
cSH	1700	1221	574
Volume to Capacity	0.20	0.02	0.20
Queue Length 95th (m)	0.0	0.5	5.8
Control Delay (s)	0.0	0.9	12.9
Lane LOS		A	B
Approach Delay (s)	0.0	0.9	12.9
Approach LOS			B

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	8	62	128	3	21	57
Future Volume (Veh/h)	8	62	128	3	21	57
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	67	139	3	23	62
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	248	140			142	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	248	140			142	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	93			98	
cM capacity (veh/h)	728	907			1441	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	76	142	85
Volume Left	9	0	23
Volume Right	67	3	0
cSH	882	1700	1441
Volume to Capacity	0.09	0.08	0.02
Queue Length 95th (m)	2.1	0.0	0.4
Control Delay (s)	9.5	0.0	2.1
Lane LOS	A		A
Approach Delay (s)	9.5	0.0	2.1
Approach LOS	A		

Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	25.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	8	62	70	3	21	44
Future Volume (Veh/h)	8	62	70	3	21	44
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	67	76	3	23	48
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	172	78			79	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	172	78			79	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	93			98	
cM capacity (veh/h)	806	983			1519	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	76	79	71
Volume Left	9	0	23
Volume Right	67	3	0
cSH	958	1700	1519
Volume to Capacity	0.08	0.05	0.02
Queue Length 95th (m)	2.0	0.0	0.4
Control Delay (s)	9.1	0.0	2.5
Lane LOS	A		A
Approach Delay (s)	9.1	0.0	2.5
Approach LOS	A		

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	21.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	3	62	10	1	21	32
Future Volume (Veh/h)	3	62	10	1	21	32
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	67	11	1	23	35
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	92	12			12	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	92	12			12	
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	94			99	
cM capacity (veh/h)	895	1069			1607	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	70	12	58
Volume Left	3	0	23
Volume Right	67	1	0
cSH	1060	1700	1607
Volume to Capacity	0.07	0.01	0.01
Queue Length 95th (m)	1.6	0.0	0.3
Control Delay (s)	8.6	0.0	2.9
Lane LOS	A		A
Approach Delay (s)	8.6	0.0	2.9
Approach LOS	A		

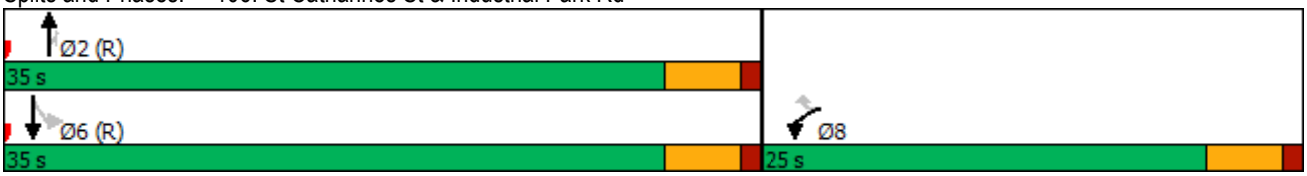
Intersection Summary			
Average Delay	5.5		
Intersection Capacity Utilization	20.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	338	198	358	206	151	524
Future Volume (vph)	338	198	358	206	151	524
Satd. Flow (prot)	1659	1396	1715	1484	1706	1746
Flt Permitted	0.950				0.468	
Satd. Flow (perm)	1659	1396	1715	1484	840	1746
Satd. Flow (RTOR)		215		224		
Adj. Flow (vph)	367	215	389	224	164	570
Lane Group Flow (vph)	367	215	389	224	164	570
Turn Type	Prot	Perm	NA	Perm	Perm	NA
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Total Split (s)	25.0	25.0	35.0	35.0	35.0	35.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Act Effct Green (s)	20.5	20.5	30.5	30.5	30.5	30.5
Actuated g/C Ratio	0.34	0.34	0.51	0.51	0.51	0.51
v/c Ratio	0.65	0.35	0.45	0.26	0.38	0.64
Control Delay	23.1	4.3	11.5	2.2	12.4	15.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.1	4.3	11.5	2.2	12.4	15.0
LOS	C	A	B	A	B	B
Approach Delay	16.2		8.1			14.4
Approach LOS	B		A			B
Queue Length 50th (m)	33.4	0.0	25.0	0.0	10.1	41.9
Queue Length 95th (m)	58.2	11.6	43.1	8.3	22.4	71.2
Internal Link Dist (m)	199.1		398.4			245.1
Turn Bay Length (m)	60.0			55.0	100.0	
Base Capacity (vph)	566	618	871	864	427	887
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.65	0.35	0.45	0.26	0.38	0.64

Intersection Summary

Cycle Length: 60
Actuated Cycle Length: 60
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 0.65
Intersection Signal Delay: 12.9 — Intersection LOS: B
Intersection Capacity Utilization 57.2% — ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 106: St Catharines St & Industrial Park Rd



Appendix I TRAFFIC SIGNAL WARRANT – FUTURE TOTAL CONDITIONS (2030)

Intersection:	Industrial Park Rd @ Regional Road 20
Major Street:	North-South — Lanes: 1
Minor Street:	East-West — Lanes: 1
Urban/Rural:	Urban
Legs:	3
New/Existing Intersection:	existing
Scenario:	2030 Ultimate

	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
AmPHV	0	448	287	90	256	0	0	0	0	103	0	113
PmPHV	0	358	206	151	524	0	0	0	0	338	0	198
AHV	0	202	123	60	195	0	0	0	0	110	0	78

Justification #7

Justification	Description	Minimum Requirement 1 Lane Highway		Minimum Requirement 2 or More Lanes		Compliance Sectional		Compliance Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	862	120%	120%	No
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	282	166%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	420	600	900	580	138%	138%	Yes
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	120	170	110	147%		

Notes:

1. Refer to OTM Book 12, pg 92, March 2012
2. Lowest section percentage governs justification
3. Average hourly volumes estiamted from peak hour volumes, AHV = PHV/2 or (AM + PM) / 4