St. John's Road at Blue Line Road and Cockshutt Road

Intersection Control Study

Norfolk County

Paradigm Transportation Solutions Limited

July 2025
240475

Project Summary

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<< Original Signed By >>

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Disclaimer

Executive Summary

Content

Paradigm Transportation Solutions Limited has been retained to conduct this Intersection Control Study (ICS) for the St. John's Road intersections with Blue Line Road and Cockshutt Road in Norfolk County.

This study compares the feasibility of implementing traffic signal or roundabout controls at the above-noted intersections based on traffic forecasts for a ten-year horizon (2033). The evaluation of alternative traffic controls is based on intersection operational analysis, costs associated with construction and maintenance, the cost of intersection collisions, and qualitative measures.

Background

In July 2022, additional safety measures were requested at the intersection of St John's Road and Cockshutt Road as the result of a motor vehicle fatality. Additional signs, flashing amber lights and rumble strips have since been installed at this intersection.

Paradigm completed a traffic signal warrant review[1] in October 2023, for the subject intersections. The review assessed warrants and intersection operations for the existing two-way stop control and traffic signal control alternatives under existing traffic conditions.

A council report was prepared after the Paradigm review to summarize the findings and recommend the installation of traffic control signals at the subject intersections and consideration of left-turn lanes on St. John's Road at both intersections.

The purpose of undertaking the ICS is to assess the feasibility of implementing roundabout traffic control at the two intersections as an alternative to traffic control signals.

Study Scope

The scope of the ICS includes:

- **Study Intersections:**

[1] Paradigm Transportation Solutions Limited, *Norfolk County Traffic Signal Operations Review Traffic Signal Warrant Review for St. John's Road at Blueline Road and Cockshutt Road,* October 2023.

  - St. John's Road and Blue Line Road; and
  - St. John's Road and Cockshutt Road.
- **Analysis Periods**: Weekday AM and PM peak hours.
- **Traffic Conditions:** Existing (2023) and ten-year horizon (2033).
- **Traffic Control Alternatives:**
  - Alternative 1 – Single-Lane Roundabout; and
  - Alternative 2 – Traffic Signals.

Summary

Existing Conditions

Under existing traffic conditions, the subject intersections operate under stop control on the Blue Line Road and Cockshutt Road approaches. Based on traffic counts collected in 2023, the intersections are operating with acceptable levels of service.

Adequate sight distance is provided for the Blue Line Road and Cockshutt Road approaches.

Future Traffic Conditions

Under 2033 (ten-year) future traffic conditions, two intersection alternatives have been considered including (1) traffic signals and (2) single-lane roundabout.

Based on 2033 future traffic forecasts, traffic control signals are warranted at both intersections. Operational analyses indicate that all movements at each intersection are forecast to operate with LOS A or B, except for the southbound approach at St. John's Road and Blue Line Road which is forecast to operate with LOS C during the PM peak hour.

For the roundabout alternative, all movements at each intersection are forecast to operate with LOS A during both peak hours.

Economic Analysis

Based on the Region of Waterloo Safety Assessment Methodology for assessing collision costs, roundabout control fares better than traffic signal control assessed over a twenty-year period, due to lower injury rates and virtually no fatalities. However, traffic signal controls result in lower total (twenty-year) period costs due to lower construction and maintenance costs when compared to a roundabout.

Qualitative Evaluation

Roundabout control generally results in opportunities for landscaping, better fuel consumption/emissions, reduced speeds, theoretical elimination of the possibility of a fatal collision, and lower delays and queueing.

Although intersections with traffic signal are qualitatively considered to be better than roundabouts for pedestrian movement, pedestrian and cycling activities are not noted to be significant in the area. In addition, roundabouts are not generally common in Norfolk County/surrounding area and seasonal demand in the area increases non-local travellers who might find new roundabout controls to be unfamiliar and confusing.

Preferred Alternative

Given the high levels of service, lower period costs, better driver expectations for both local users and seasonal travellers, and convenience for commercial vehicles, traffic signal control is identified as the preferred alternative for both Blue Line Road and Cockshutt Road intersections on St. John's Road.

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1 Introduction

1.1 Overview

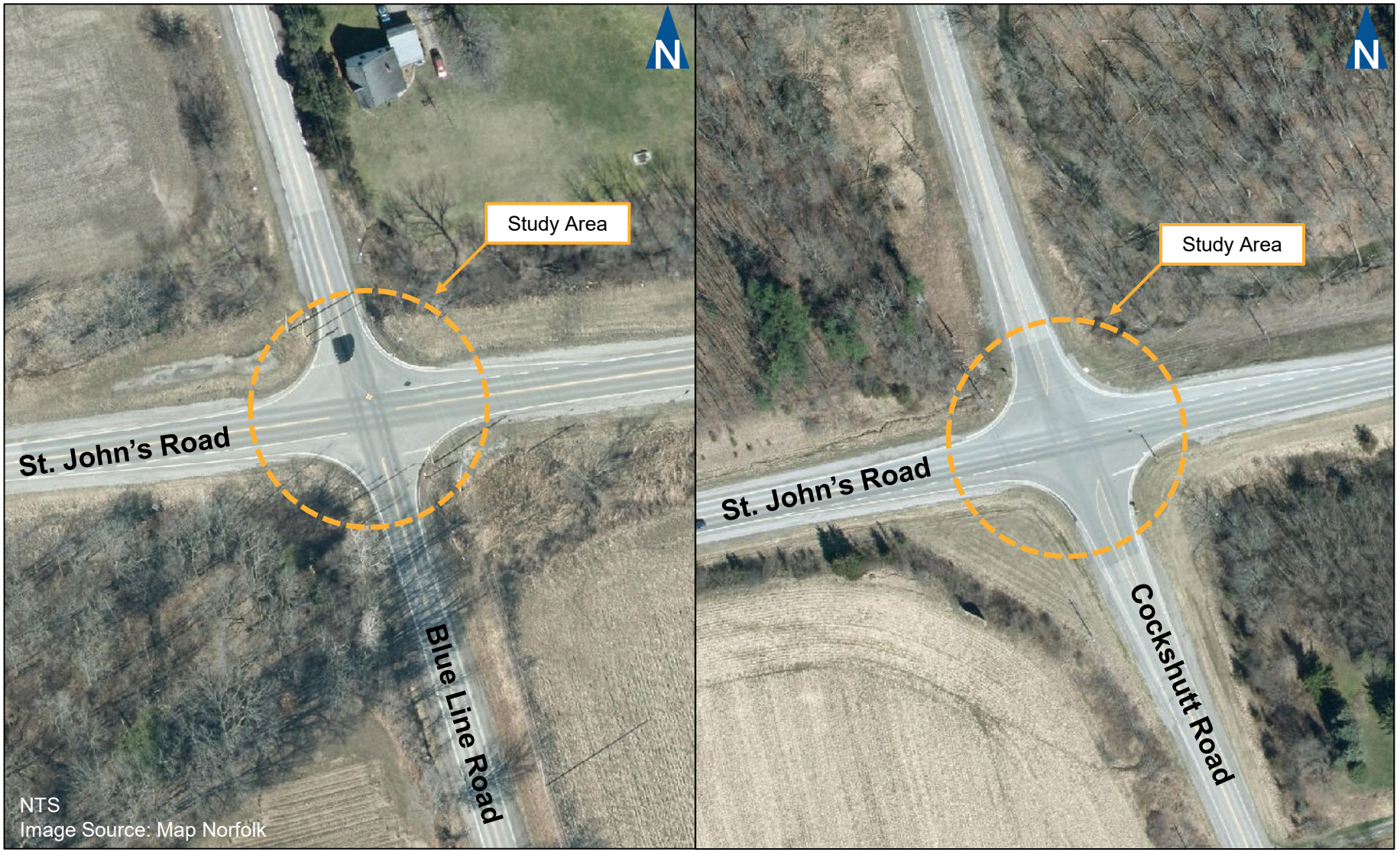
Paradigm Transportation Solutions Limited has been retained to conduct this Intersection Control Study (ICS) for the St. John's Road intersections with Blue Line Road and Cockshutt Road in Norfolk County.

Figure 1.1 illustrates the location of the intersections of St. John's Road at Blue Line Road and Cockshutt Road.

1.2 Purpose and Scope

The purpose of this study is to assess traffic conditions for the St. John's Road intersections with Blue Line Road and Cockshutt Road and compare feasibility of implementing either traffic signal or roundabout control at the two subject intersections. The scope of the study includes:

- Assessment of the current traffic and site conditions within the study area, including sightlines, collision history, and operational conditions;
- Estimates of forecast traffic growth for a ten-year horizon (2033) based on general road traffic growth;
- Assessment the future operational performance of each intersection under roundabout and traffic signal control;
- Evaluation of other factors such as economic analyses, safety performance, and qualitative measures; and
- Recommendations for traffic control at each intersection.



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Study Area

1.3 Background

In July 2022, additional safety measures were requested at the intersection of St John's Road and Cockshutt Road as the result of a motor vehicle fatality. Additional signs, flashing amber lights and rumble strips were installed at this intersection.

Paradigm completed a traffic signal warrant review[2] in October 2023 for the subject intersections. The review assessed warrants and intersection operations for the existing two-way stop control and traffic signal control alternatives under existing traffic conditions.

A council report was prepared after the Paradigm review to summarize the findings and recommend the installation of traffic control signals at the subject intersections and consideration of left-turn lanes on St. John's Road at both intersections.

The purpose of undertaking the ICS is to assess the feasibility of implementing roundabout traffic control at the two intersections as an alternative to traffic control signals.

[2] Paradigm Transportation Solutions Limited, *Norfolk County Traffic Signal Operations Review Traffic Signal Warrant Review for St. John's Road at Blueline Road and Cockshutt Road,* October 2023.

2 Existing Conditions

2.1 Intersection Context

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

- **St. John's Road (Norfolk County Road 3)** is an east-west arterial roadway providing a two-lane rural cross-section (one lane in each direction). The posted maximum speed limit is 80 km/h. The roadway has a relatively flat grade and minimal horizontal curvature.
- **Blue Line Road** is a north-south local roadway providing a two-lane rural cross-section (one lane in each direction). The posted maximum speed limit is 80 km/h. The roadway has a relatively flat grade and minimal horizontal curvature.
- **Cockshutt Road (Norfolk County Road 5)** is a north-south arterial roadway providing a two-lane rural cross-section (one lane in each direction). The posted maximum speed limit is 80 km/h. Cockshutt Road slopes downward to the south at the intersection with St. John's Road and has minimal horizontal curvature.

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

Under existing conditions, the St. John's Road intersections with Blue Line Road and Cockshutt Road are unsignalized. St. John's Road is considered the major road, while Blue Line Road and Cockshutt Road are considered minor roads.

Stop control is provided on the minor road (northbound and southbound) approaches. At Blue Line Road, an overhead flashing beacon, flashing beacons on the primary stop signs, and secondary stop signs on the left-side of the road are provided. At both intersections, single lane approaches (shared left-through-right) are provided for all legs, with right-turn tapers included on St. John's Road.

The surrounding land uses are rural, consisting of farms, woodlots and single-family detached dwellings. The LE & N Rail Trail crosses Blueline Road approximately 250 metres north of St. John's Road and crosses St. John's Road approximately 160 metres east of Blue Line Road.

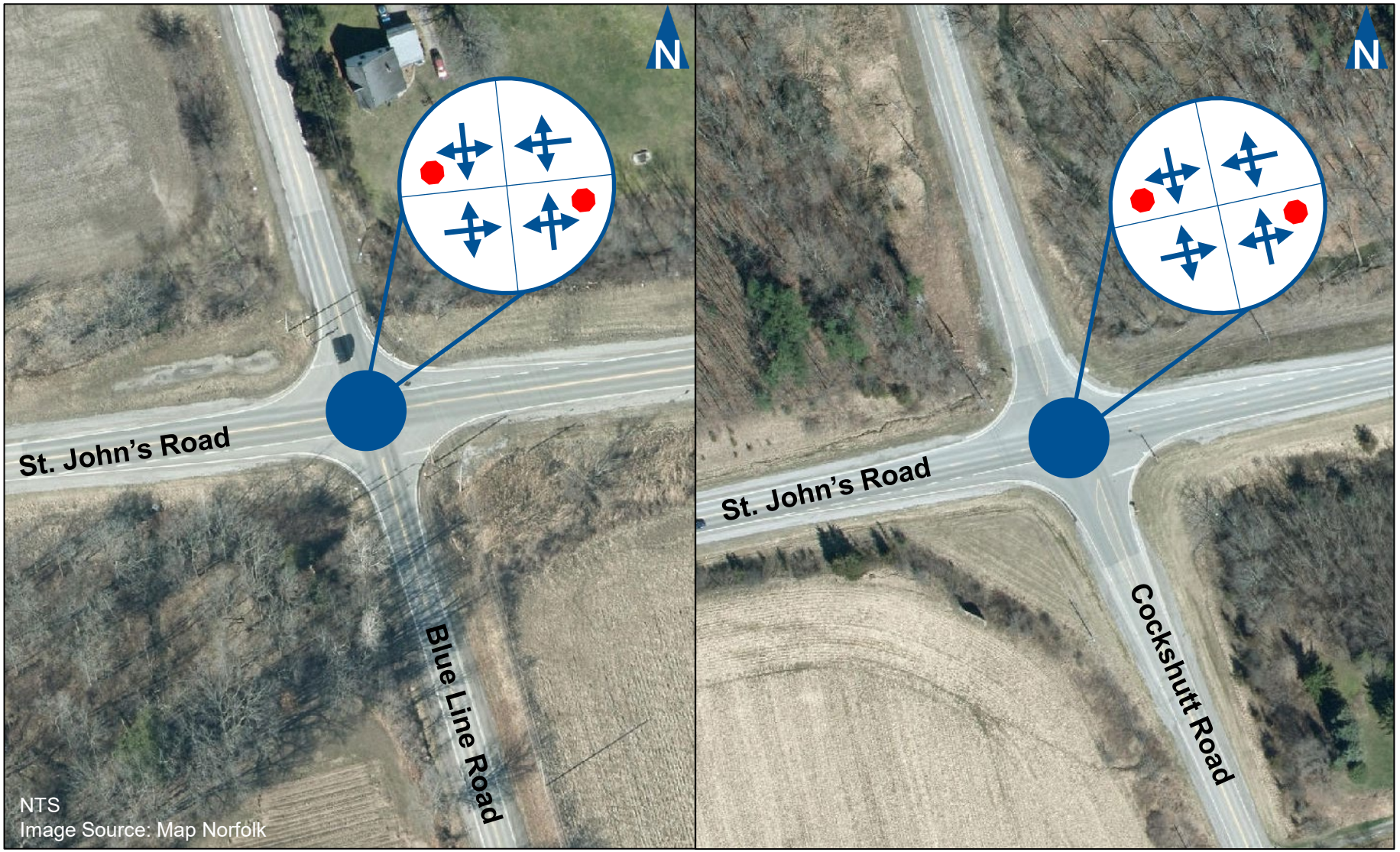

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Image Source: Map Norfolk

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Existing Lane Configuration and Traffic Control

2.2 Traffic Volumes

The County provided weekday turning movement counts (TMCs) for the subject intersections, collected on August 3, 2023 during the morning (7:00 to 9:00 AM), mid-day (11:00 AM to 2:00 PM), and afternoon (3:00 to 6:00 PM) peak periods. The data was collected in 15-minute intervals and vehicles were classified by type. **Table 2.1** summarizes the peak hour start time for each intersection.

TABLE 2.1: EXISTING TMC SUMMARY

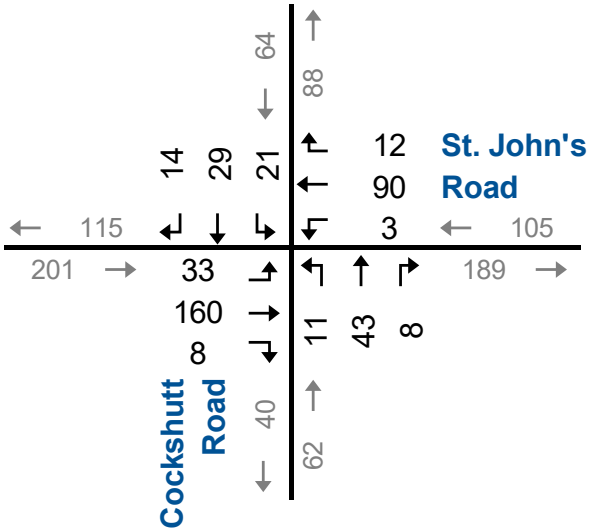
Intersection	Date	AM Peak Hour	PM Peak Hour
St. John's Road and Cockshutt Road	August 3, 2023	7:00 AM	4:15 PM
St. John's Road and Blue Line Road		8:00 AM	3:30 PM

Figure 2.2 summarizes the existing (2023) weekday AM and PM peak traffic volumes.

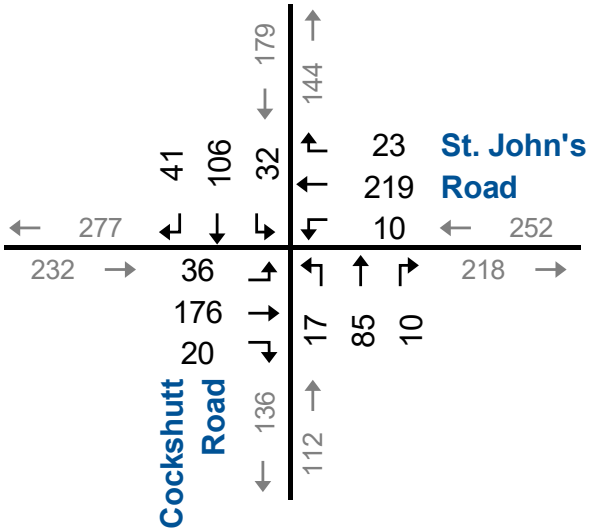
Appendix A provides the detailed traffic count data for reference.

St. John's Road and Cockshutt Road

AM Peak Hour (7:00 - 8:00 AM)

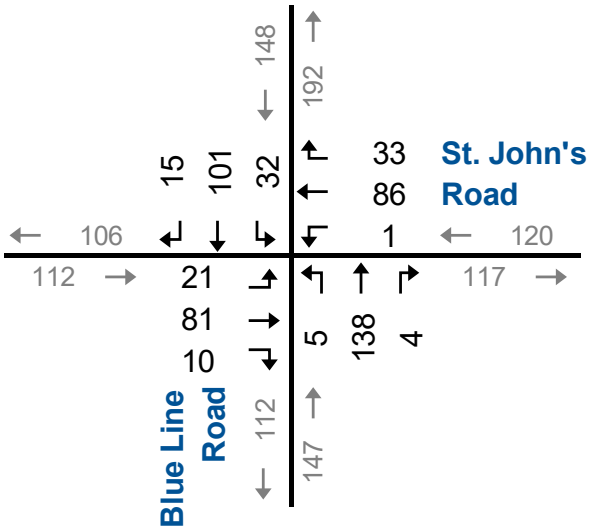


PM Peak Hour (4:15 - 5:15 PM)

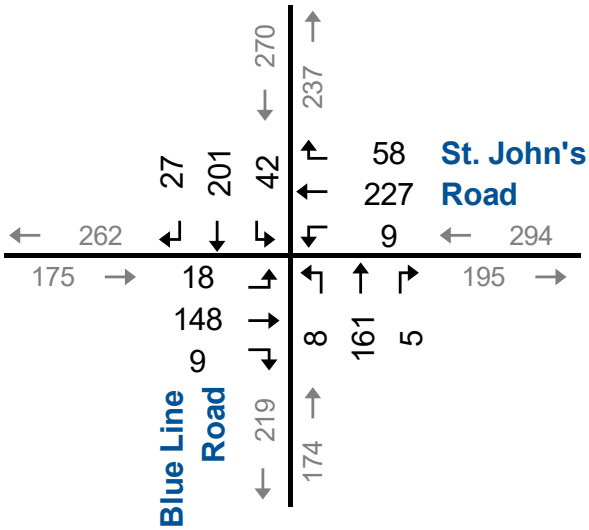


St. John's Road and Blue Line Road

AM Peak Hour (8:00 - 9:00 AM)



PM Peak Hour (3:30 - 4:30 PM)



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Existing (2023) Peak Hour Traffic Volumes

2.3 Sightline Review

Sightline assessments at the St. John's Road intersections with Blue Line Road and Cockshutt Road were conducted to determine available sight distance. The assessment was carried out based on the methodology contained in the *Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads* [3]. For intersections with stop control on the minor road, Case B applies. This considers three situations:

- Case B1 – Left turns from the minor road;
- Case B2 – Right turns from the minor road; and
- Case B3 – Crossing the major road from a minor-road approach.

The following object heights were used in obtaining field measurements:

- Driver Eye Height: 1.05 metres;
- Top of Car: 1.30 metres (for departure sight distance, height of approaching vehicle); and
- Vehicle Headlight or Tail/Brake Light: 0.60 metres (for approach sight distance, height of vehicle/target object).

The measurements were taken at a point 5.0 metres back from the existing edge of pavement on St. John's Road, representing the position of a driver/vehicle performing a turning movement. The sight distance requirements are based on a design speed of 100 km/h (20 km/h above the posted speed limit of 80 km/h).

Table 2.2 summarizes the observed and design turning sight distances at the unsignalized intersections. Table 9.9.4 and Table 9.9.6 from the TAC manual provided the design sight distance requirements for left-turn and right-turn/crossing manoeuvres from a stop, respectively. **Table 2.2** indicates all minor road approaches meet the design sight distance requirements set out in the guidebook.

[3] Transportation Association of Canada, *Geometric Design Guide for Canadian Roads*, (Ottawa: TAC, 2017).

TABLE 2.2: TURNING SIGHT DISTANCES

Intersection	Movement	Observed Sight Distance	Design Sight Distance	Meets Criterion
St. John's Road and Blue Line Road	Northbound Left-Turn	393 m	210 m	Yes
	Northbound Right-Turn/Crossing	393 m	185 m	Yes
	Southbound Left-Turn	286 m	210 m	Yes
	Southbound Right-Turn/Crossing	286 m	185 m	Yes
St. John's Road and Cockshutt Road	Northbound Left-Turn	333 m	210 m	Yes
	Northbound Right-Turn/Crossing	333 m	185 m	Yes
	Southbound Left-Turn	284 m	210 m	Yes
	Southbound Right-Turn/Crossing	580 m	185 m	Yes

2.4 Collision Data

The County provided a summary of collisions for the period between January 2015 to July 2023 at the intersections of Blue Line Road and Cockshutt Road at St. John's Road. The collision history was analyzed to identify trends and potential safety concerns. Full collision reports were not available from the Ministry of Transportation (MTO) to assess trends and hazards in greater detail.

Appendix B contains the collision data provided by the County.

Table 2.3 summarizes the collision data for the St. John's Road intersections with Blue Line Road and Cockshutt Road by severity classification.

TABLE 2.3: COLLISION HISTORY BY SEVERITY CLASSIFICATION

Severity Classification	Number of Collisions (%)	
	St. John's Road and Blue Line Road	St. John's Road and Cockshutt Road
Property Damage Only	27 (75%)	31 (76%)
Non-Fatal Injury	8 (22%)	8 (20%)
Fatal Injury	1 (3%)	1 (2%)
Other	-	1 (2%)
Total	**36**	**41**

Table 2.4 summarizes the collision data for the St. John's Road intersections with Blueline Road and Cockshutt Road by collision cause.

TABLE 2.4: COLLISION HISTORY BY COLLISION CAUSE

Collision Cause	St. John's Road and Blue Line Road	St. John's Road and Cockshutt Road
Ability Impaired (Alcohol)	1 (3%)	3 (8%)
Animal – Wild or Domestic	13 (36%)	20 (49%)
Disobeyed Traffic Control	3 (8%)	1 (2%)
Driver Fatigue	1 (3%)	-
Failed to Yield Right of Way	9 (25%)	5 (12%)
Following too Closely	2 (5%)	2 (5%)
Improper Turn	1 (3%)	-
Inattentive Driver	4 (11%)	5 (12%)
Lost Control	-	1 (2%)
Mechanical Failure	1 (3%)	-
Speed	-	1 (2%)
Unknown	1 (3%)	3 (8%)
Total	**36**	**41**

The collision data indicate:

- St. John's Road and Blue Line Road:
  - A total of 36 collisions occurred during the eight-and-a-half-year period, or an average of approximately four collisions per year;
  - Most collisions (27 or 75%) resulted in property damage only (PDO), eight (22%) in non-fatal injury collisions, and one fatality (3%);
  - Animal collisions (13 or 36%) and failed to yield right-of-way (9 or 25%) were the most common causes of collisions. Inattentive driver (4 or 11%), disobeyed traffic control (3 or 8%), and following too closely (2 or 5%) were other notable actions;
  - Most collisions occurred on a Friday (8 or 22%), with the least number of collisions occurring on a Saturday (0 or 0%); and
  - Almost all collisions (32 or 89%) occurred during the daytime hours from 6:00 AM to 9:00 PM, with most during the 6:00 AM, 5:00 PM or 6:00 PM hours (4 or 11% each). Collisions occurring during the overnight, dawn and dusk hours typically involved animals.
- St. John's Road and Cockshutt Road:
  - 41 collisions occurred during the eight-and-a-half-year period, or an average of approximately five collisions per year;

- Most collisions (31 or 76%) resulted in property damage only (PDO), eight (20%) in non-fatal injury collisions and one fatality (2%). One collision (2%) was classified as other;
- Animal collisions (20 or 49%), failed to yield right-of-way (5 or 12%), and inattentive driver (5 or 12%) were the most common causes of collisions. Ability impaired (alcohol) (3 or 8%) and unknown (3 or 8%) were other notable actions;
- Most collisions occurred on a Monday (8 or 20%), with the least number of collisions occurring on a Wednesday (3 or 8%); and
- Majority of collisions (29 or 70%) occurred during the daytime hours from 6:00 AM to 9:00 PM, with most during the 5:00 AM (5 or 12%) and 6:00 AM (6 or 15%) hours. Collisions occurring during the overnight, dawn and dusk hours typically involved animals.

2.5 Traffic Operations

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

The highest possible rating is LOS A, under which the average total delay is equal or less than 10 seconds per vehicle. When the average delay exceeds 80 seconds for signalized intersections, 50 seconds for unsignalized intersections or when the volume to capacity ratio is greater than 1.00, the movement is classed as LOS F, and remedial measures are usually implemented if they are feasible.

Per *Norfolk County TIS Guidelines*[4], movements at signalized intersections with a volume to capacity (v/c) ratio greater than 0.85 are deemed critical. As the TIS guidelines do not specify a threshold for unsignalized intersections, it is assumed that movements with Level of Service (LOS) 'F' are deemed critical.

An operational analysis was conducted for the weekday AM and PM peak hours for the St. John's Road intersections with Blue Line Road and Cockshutt Road under existing traffic control. The analysis was performed using Synchro software. The parameters used in the analysis include:

- Existing lane configurations;
- Heavy vehicle percentages derived from the available count data;
- Conflicting pedestrian volumes derived from the available count data; and
- Synchro default values for all other inputs.

Table 2.5 summarizes the operational analysis results for the subject intersections under existing two-way stop conditions. The results include the LOS, average delay in seconds, v/c ratio, and 95th percentile queue lengths in metres.

[4] Norfolk County, *Integrated Sustainable Master Plan (ISMP) Appendix J TIS Guidelines. Prepared by MMM Group*, September 2016.

The results indicate that all movements at both intersections are operating at acceptable levels of service. No critical movements are identified.

Appendix C contains the Synchro analysis outputs for reference.

TABLE 2.5: EXISTING TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach															
				Eastbound				Westbound				Northbound				Southbound			
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach
AM Peak Hour	Cockshutt Road & St. John's Road	TWSC	LOS	<	A	>	**A**	<	A	>	**A**	<	B	>	**B**	<	B	>	**B**
			Delay	<	8	>	**1**	<	8	>	**0**	<	12	>	**12**	<	12	>	**12**
			V/C	<	0.02	>		<	0.00	>		<	0.12	>		<	0.12	>	
			Q	<	1	>		<	0	>		<	3	>		<	3	>	
	Blue Line Road & St. John's Road	TWSC	LOS	<	A	>	**A**	<	A	>	**A**	<	B	>	**B**	<	B	>	**B**
			Delay	<	8	>	**1**	<	7	>	**0**	<	13	>	**13**	<	13	>	**13**
			V/C	<	0.02	>		<	0.00	>		<	0.26	>		<	0.26	>	
			Q	<	0	>		<	0	>		<	8	>		<	8	>	
PM Peak Hour	Cockshutt Road & St. John's Road	TWSC	LOS	<	A	>	**A**	<	A	>	**A**	<	C	>	**C**	<	C	>	**C**
			Delay	<	8	>	**1**	<	8	>	**0**	<	18	>	**18**	<	19	>	**19**
			V/C	<	0.03	>		<	0.01	>		<	0.30	>		<	0.44	>	
			Q	<	1	>		<	0	>		<	9	>		<	16	>	
	Blue Line Road & St. John's Road	TWSC	LOS	<	A	>	**A**	<	A	>	**A**	<	C	>	**C**	<	D	>	**D**
			Delay	<	8	>	**1**	<	8	>	**0**	<	20	>	**20**	<	30	>	**30**
			V/C	<	0.02	>		<	0.01	>		<	0.44	>		<	0.68	>	
			Q	<	1	>		<	0	>		<	16	>		<	38	>	

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds
V/C - Volume to Capacity Ratio
Q - 95th Percentile Queue Length (m)
TWSC - Two-Way Stop Control
< / > - Shared with through movement

3 Future Traffic Forecasts

Future traffic forecasts were prepared to assess the suitability, effectiveness, and impact of alternative traffic control measures for the subject intersections.

Future AM/PM peak hour and 8-hour traffic volumes were forecast for a ten-year (2033) horizon based on background road traffic growth.

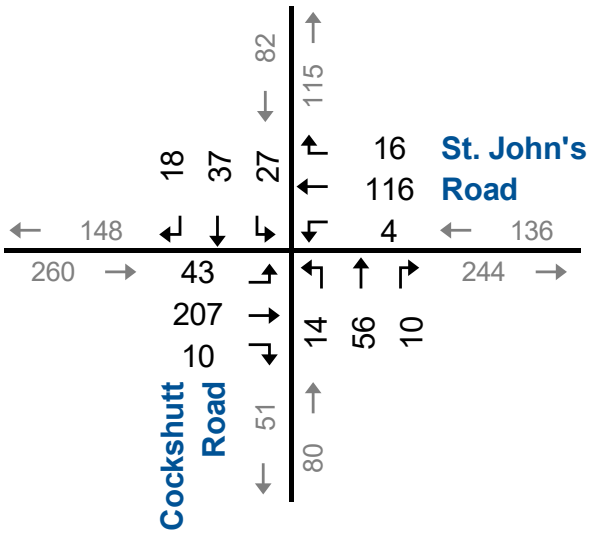
Average Annual Daily Traffic (AADT) data between 2010 and 2024 was provided by the County. The data indicates growth rates between 1.2% and 2.6% for the study roads. To derive the forecast ten-year (2033) traffic volumes, a growth rate of 2.6% compounded per year has been conservatively applied to the base year (2023) traffic volumes.

Figure 3.1 illustrates the 2033 forecast peak hour traffic volumes.

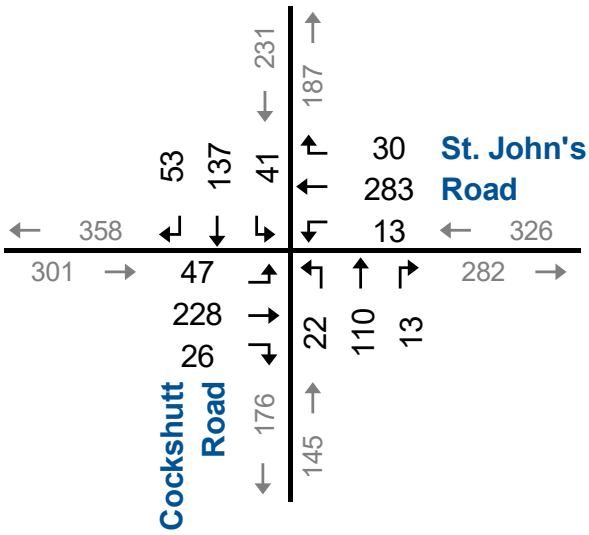
Appendix D contains the forecast 8-hour traffic volumes.

St. John's Road and Cockshutt Road

AM Peak Hour (7:00 - 8:00 AM)

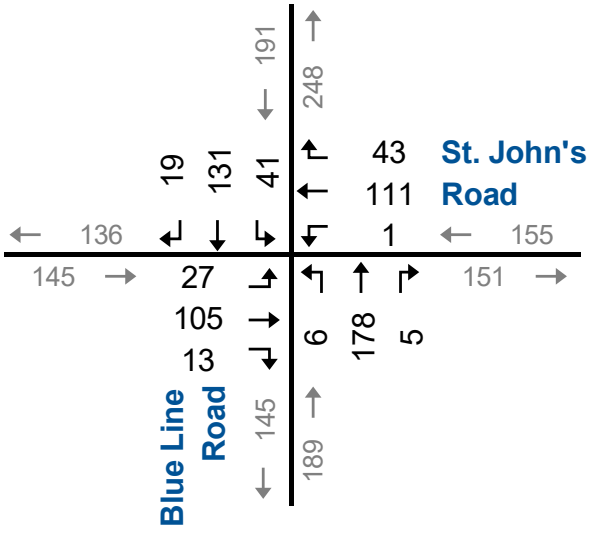


PM Peak Hour (4:15 - 5:15 PM)

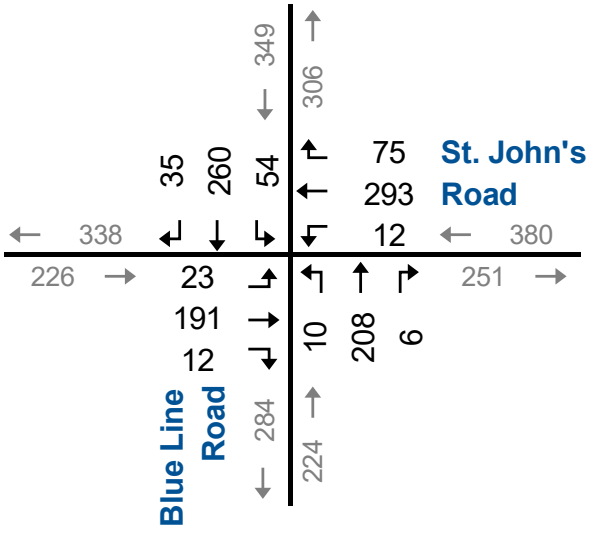


St. John's Road and Blue Line Road

AM Peak Hour (8:00 - 9:00 AM)



PM Peak Hour (3:30 - 4:30 PM)



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Future (2033) Forecast Peak Hour Traffic Volumes

4 Intersection Control Alternatives

Under 2033 forecast traffic conditions, two intersection control alternatives are considered at the St. John's Road intersections with Blue Line Road and Cockshutt Road:

- **Alternative 1 – Single-Lane Roundabout:** This alternative involves the installation of a single-lane roundabout with single-lane entries and exits on all approaches.
- **Alternative 2 - Traffic Signals:** This alternative involves the installation of traffic signals, with a single shared lane for the northbound and southbound approaches (Blue Line Road and Cockshutt Road) and left-turn lane and shared through/right-turn lane on the eastbound and westbound (St. John's Road) approaches.

Appendix E contains the intersection configuration drawings for each alternative.

4.1 Signal Warrants

A traffic signal warrant justification analysis has been conducted in accordance with the OTM *Book 12 – Traffic Signals*[5] for the St. John's Road intersections with Blue Line Road and Cockshutt Road. This involves an assessment of justification thresholds based on major and minor street traffic volumes and the delay to the minor street during an eight-hour period.

Table 4.1 and **Table 4.2** provide a summary of the traffic signal justification analysis for the St. John's Road intersections with Blue Line Road and Cockshutt Road, respectively.

Under OTM *Book 12* methodology, traffic signals are warranted at both locations based on Justification 1.

Appendix F contains the traffic signal warrant worksheets.

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

TABLE 4.1: ST. JOHN'S ROAD AND BLUE LINE ROAD SIGNAL WARRANT SUMMARY

Justification		Compliance		Justified	
				Yes	No
1. Minimum Vehicular	A. Total Volume	100%	>100%, 8 of 8 hours	√	
	B. Crossing Volume	100%	>100%, 8 of 8 hours		
2. Delay to Cross Traffic	A. Main Road	89%	>100%, 4 of 8 hours		√
	B. Crossing Volume	100%	>100%, 8 of 8 hours		
At least one Justification met?				YES	

TABLE 4.2: ST. JOHN'S ROAD AND COCKSHUTT ROAD SIGNAL WARRANT SUMMARY

Justification		Compliance		Justified	
				Yes	No
1. Minimum Vehicular	A. Total Volume	100%	>100%, 8 of 8 hours	√	
	B. Crossing Volume	100%	>100%, 8 of 8 hours		
2. Delay to Cross Traffic	A. Main Road	90%	>100%, 3 of 8 hours		√
	B. Crossing Volume	100%	>100%, 8 of 8 hours		
At least one Justification met?				YES	

4.2 Intersection Operations

The 2033 forecast traffic volumes (**Figure 3.1**) have been analyzed using ARCADY for the roundabout alternative and Synchro 11 software for the traffic signal control alternative at each of the two intersections.

Table 4.3 summarizes the results of the 2033 traffic operations for the traffic signal control and roundabout alternatives.

For both alternatives, the subject intersections are forecast to operate within the critical movement thresholds identified in **Section 2.5**.

For the roundabout alternative, all movements at each intersection are forecast to operate with LOS A during both peak hours.

For the traffic signal control alternative, all movements are forecast to operate with LOS A or B, except for the southbound approach at St. John's Road and Blue Line Road which is forecast to operate with LOS C during the PM peak hour.

Appendix G contains the supporting detailed operations reports.

TABLE 4.3: FUTURE TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Cockshutt Road & St. John's Road	TCS	LOS	A	A	>	**A**	A	A	>	**A**	<	B	>	**B**	<	B	>	**B**	**A**
			Delay	6	6	>	**6**	6	6	>	**6**	<	13	>	**13**	<	12	>	**12**	**8**
			V/C	0.05	0.20	>		0.01	0.13	>		<	0.19	>		<	0.23	>		
			Q	5	20	>		1	12	>		<	13	>		<	13	>		
			Stor.	15	-	>		15	-	>		<	-	>		<	-	>		
			Avail.	10	-	>		14	-	>		<	-	>		<	-	>		
		RBT	LOS	<	A	>	**A**	<	A	>	**A**	<	A	>	**A**	<	A	>	**A**	**A**
			Delay	<	4	>	**4**	<	4	>	**4**	<	3	>	**3**	<	3	>	**3**	**4**
			V/C	<	0.22	>		<	0.12	>		<	0.07	>		<	0.07	>		
			Q	<	8	>		<	8	>		<	8	>		<	8	>		
	Blue Line Road & St. John's Road	TCS	LOS	A	A	>	**A**	A	A	>	**A**	<	B	>	**B**	<	B	>	**B**	**B**
			Delay	7	7	>	**7**	7	6	>	**6**	<	15	>	**15**	<	16	>	**16**	**11**
			V/C	0.05	0.12	>		0.00	0.19	>		<	0.38	>		<	0.43	>		
			Q	5	13	>		1	15	>		<	26	>		<	27	>		
			Stor.	15	-	>		15	-	>		<	-	>		<	-	>		
			Avail.	10	-	>		14	-	>		<	-	>		<	-	>		
		RBT	LOS	<	A	>	**A**	<	A	>	**A**	<	A	>	**A**	<	A	>	**A**	**A**
			Delay	<	3	>	**3**	<	4	>	**4**	<	4	>	**4**	<	3	>	**3**	**4**
			V/C	<	0.13	>		<	0.14	>		<	0.17	>		<	0.16	>		
			Q	<	8	>		<	8	>		<	8	>		<	8	>		
PM Peak Hour	Cockshutt Road & St. John's Road	TCS	LOS	A	A	>	**A**	A	B	>	**B**	<	B	>	**B**	<	B	>	**B**	**B**
			Delay	9	9	>	**9**	8	10	>	**10**	<	14	>	**14**	<	17	>	**17**	**12**
			V/C	0.11	0.34	>		0.03	0.42	>		<	0.34	>		<	0.54	>		
			Q	8	30	>		3	37	>		<	21	>		<	31	>		
			Stor.	15	-	>		15	-	>		<	-	>		<	-	>		
			Avail.	7	-	>		12	-	>		<	-	>		<	-	>		
		RBT	LOS	<	A	>	**A**	<	A	>	**A**	<	A	>	**A**	<	A	>	**A**	**A**
			Delay	<	4	>	**4**	<	4	>	**4**	<	4	>	**4**	<	4	>	**4**	**4**
			V/C	<	0.27	>		<	0.29	>		<	0.14	>		<	0.22	>		
			Q	<	8	>		<	8	>		<	8	>		<	8	>		
	Blue Line Road & St. John's Road	TCS	LOS	B	B	>	**B**	A	B	>	**B**	<	B	>	**B**	<	C	>	**C**	**B**
			Delay	10	11	>	**11**	10	13	>	**13**	<	15	>	**15**	<	21	>	**21**	**15**
			V/C	0.07	0.29	>		0.03	0.52	>		<	0.41	>		<	0.70	>		
			Q	6	29	>		4	53	>		<	33	>		<	54	>		
			Stor.	15	-	>		15	-	>		<	-	>		<	-	>		
			Avail.	9	-	>		11	-	>		<	-	>		<	-	>		
		RBT	LOS	<	A	>	**A**	<	A	>	**A**	<	A	>	**A**	<	A	>	**A**	**A**
			Delay	<	4	>	**4**	<	5	>	**5**	<	4	>	**4**	<	5	>	**5**	**5**
			V/C	<	0.22	>		<	0.35	>		<	0.21	>		<	0.33	>		
			Q	<	8	>		<	8	>		<	8	>		<	8	>		

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds
V/C - Volume to Capacity Ratio
Q - 95th Percentile Queue Length (m)
Stor. - Existing Storage (m)
Avail. - Available Storage (m)
TCS - Traffic Control Signal
RBT - Roundabout
< / > - Shared with through movement

4.3 Safety Performance Comparison

Future safety performance was determined based on the *Region of Waterloo Intersection Control Studies Safety Assessment Methodology (HSM)* worksheet. The worksheet uses a Safety Performance Function (SPF) for the prediction of collisions at intersections based on methodology in the Highway Safety Manual (HSM)[6]. The model assumes the existing collision experience continues into the future.

At roundabouts, injury collisions are taken to represent 10% of the total collisions, with all remaining collisions being property damage only (PDO) and fatal collisions assumed to be negligible.

The 2033 forecasts were used for the 10-year horizon forecasts required for input into the Region's worksheet. To determine the AADT input for the worksheet, the PM peak hour volumes have been multiplied by 10. **Appendix H** contains the worksheets.

Table 4.4 summarizes the predicted annual crash frequencies.

TABLE 4.4: ANNUAL ESTIMATED COLLISION RATES

Location	Future Expected Collisions by Severity	Total	PDO	Injury	Fatal
St. John's Road and Blue Line Road	Signalized	2.49	1.65	0.84	0.01
	Roundabout	5.10	4.59	0.51	0.00
St. John's Road and Cockshutt Road	Signalized	2.34	1.54	0.79	0.01
	Roundabout	3.98	3.58	0.40	0.00

It is noted that for this specific lane arrangement and AADT, a signalized intersection is predicted to result in a lower number of total collisions when compared to the roundabout, but with higher injury and fatality rates.

[6] AASHTO, *Highway Safety Manual*, 2010.

4.4 Economic Analysis

4.4.1 Cost of Collisions

Costs related to the safety performance comparison in **Section 4.3** have been calculated based on capital collision costs for each type of collision including $1,656,500 for fatal, $60,500 for injury, $5,000 for signalized PDO and $4,500 for roundabout PDO. **Table 4.5** summarizes the 20-year present value collision costs.

TABLE 4.5: 20-YEAR PRESENT VALUE COLLISION COSTS

Location	Future Expected Collisions by Severity	Total	PDO	Injury	Fatal
St. John's Road and Blue Line Road	Signalized	$791,528	$94,627	$582,901	$114,000
	Roundabout	$590,813	$236,910	$353,903	$0
St. John's Road and Cockshutt Road	Signalized	$750,523	$88,318	$548,205	$114,000
	Roundabout	$461,395	$185,015	$276,380	$0

The roundabout alternative is estimated to result in lower collision costs by approximately $200,715 and $289,128 at Blue Line Road and at Cockshutt Road, respectively, when compared to the signalized alternative.

Fatal collisions are mainly observed with signalized and stop-control intersections, with roundabouts assumed to eliminate fatal collisions.

4.4.2 Construction Costs

Based on costs for a very similar design in the Region of Waterloo at Trussler Road and Cedar Creek Road (Hwy 97), the average estimated construction cost of the roundabout alternative is $3,300,000 at each intersection. This includes the splitter and centre islands.

The estimated construction cost of the signalized intersection is $1,622,250 at the Blue Line Road intersection and $1,782,120 at Cockshutt Road. This includes additional turn lanes and corresponding widening and illumination.

It is noted that the construction cost for both alternatives does not include land acquisition costs. Some property impacts are expected at Blue Line Road and none at Cockshutt Road. Additionally, the cost

does not include allowances for relocation of utilities which would be required for the roundabout alternative at both intersections.

Appendix I contains the detailed cost estimates.

4.4.3 Study Period Costs

Study period costs consist of the societal costs of motor vehicle collisions, plus the construction and maintenance costs associated with a signalized intersection and a roundabout.

For maintenance costs, an amount of $3,000 per year was assumed for annual traffic signal maintenance and $1,000 per year for landscaping maintenance at a roundabout.

Table 4.6 summarizes the total study period costs.

TABLE 4.6: TOTAL STUDY PERIOD COSTS

Location	Alternative	Construction	Maintenance	Collision	Total Study Period Costs
St. John's Road and Blue Line Road	Signalized	$1,622,250	$60,000	$791,528	$2,473,778
	Roundabout	$3,300,000	$20,000	$590,813	$3,910,813
St. John's Road and Cockshutt Road	Signalized	$1,782,120	$60,000	$750,523	$2,592,643
	Roundabout	$3,300,000	$20,000	$461,395	$3,781,395

Although the roundabout alternative has a lower collision and maintenance cost, the total period costs are lower for the signalized intersection by $1,437,035 to $1,188,752 for the Blue Line Road and Cockshutt Road intersections, respectively.

4.5 Qualitative Evaluation

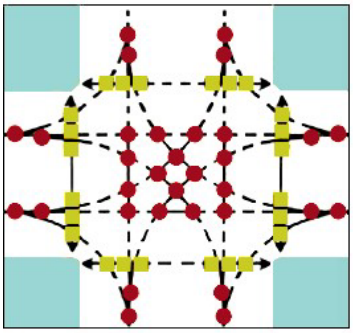
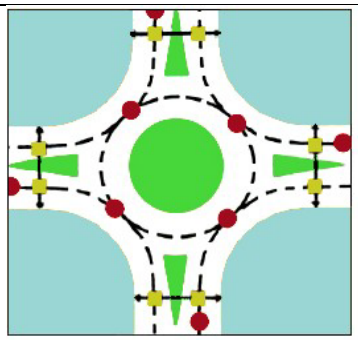
Several qualitative criteria are also considered but not formally evaluated including community factors, environmental considerations, safety, and conditions for trucks, pedestrians and cyclists.

Table 4.7 summarizes comments associated with each criterion for both alternatives.

The summary in **Table 4.7** indicates that the roundabout alternative performs better under most criteria. The traffic signal control alternative would seem to be at some advantage for criteria such as land acquisition, driver expectancy and pedestrian movements. However, land may not be a critical issue at the subject intersections and existing traffic counts indicate that the subject intersections are not used by

pedestrians given the rural location. Roundabouts are not common in Norfolk County/surrounding areas which also has significant numbers of seasonal travellers. Installing new roundabouts may create confusion among users who are not familiar with roundabout traffic control for intersections.

TABLE 4.7: QUALITATIVE COMPARISON

Criteria		Traffic Signals	Roundabout
Community	Aesthetics	Limited options for landscaping and enhancements on the perimeter of the intersection.	Opportunities for landscaping and enhancements on the central and splitter island, and the perimeter of intersection.
	Property	Smaller footprint than roundabouts.	Larger footprint than signalized intersections. Utility relocation required at the subject intersections.
Environment	Emissions and Energy Consumption	Stopping and idling during red time increases emissions and fuel consumption. Energy is required to operate signals.	Less frequent stopping due to yield control and increased efficiency of traffic flow reduces emissions and fuel consumption. No energy required to operate.
	Noise	Noise caused by vehicles stopping and starting.	Less frequent stopping reduces noise.
Safety	Conflicts	 32 Vehicle conflicts 24 Pedestrian conflicts	 8 Vehicle conflicts 8 Pedestrian conflicts
	Driver Expectancy	Status quo.	Most drivers in the County would not be familiar with roundabouts.
	Speed Control and Access Management	Vehicle speeds controlled only during red signal indication.	Vehicle speeds controlled at all times due to intersection geometry.
Other Road Users	Pedestrians	Crosswalks with signal control provide controlled crossing for pedestrians. Must wait until the pedestrian signal indication to cross the intersection.	Have the right-of-way with vehicles required to yield. Detecting pedestrian presence can pose a challenge especially in rural applications.

		Required to cross two or more lanes with traffic travelling in both directions. Typically, more accessible to persons with low vision than roundabouts.	Can proceed to cross with available gaps, but if gaps are not available and drivers are not yielding right-of-way, pedestrians may have to wait for extended periods to cross. Only required to cross one or two travel lanes at once with traffic travelling in only one direction. Typically, less accessible to persons with low vision than signalized intersections.
	Cyclists	Travel through the intersection as a vehicle unless facilities with bicycle signals are provided, but could dismount and walk across. Higher speeds may impact bicycle safety while travelling through the intersection.	Typically have two options: travel through the intersection as a vehicle or dismount and travel on the sidewalk. Some cyclists feel less uncomfortable travelling through the intersection with the flow of motor vehicle traffic. Lower speeds may increase bicycle safety while travelling through the intersection.
	Commercial Vehicles	During green signal indication, commercial vehicles can proceed through the intersection with minimal disruptions. May need full side street approach to make a right-turn movement.	Wider entry/exit lanes and truck aprons needed for single-lane roundabouts to accommodate commercial vehicles. Need to get back up to speed regardless of the movement. Generally more cumbersome for commercial vehicles to navigate roundabouts and potential risk of rollover when mounting the apron.

4.6 Overall Evaluation

A Multiple Criteria Evaluation (MCE) is provided for the different traffic control alternatives at the subject intersections, including operations, period costs, speed, driver expectancy, and environment.

Table 4.8 summarizes the evaluation criteria used in the MCE.

Each criterion was given a score of good, average and poor against all criteria except for the period costs which is based on the relative cost for each alternative.

TABLE 4.8: EVALUATION OF ALTERNATIVES

Criteria	Traffic Signals	Roundabout
Operations	●	●
Period Costs	$$	$$$
Speed Control	◖	●
Driver Expectancy	●	○
Environment	◖	●
Vulnerable Road Users	●	◖
Commercial Vehicles	●	◖

● Good ◖ Average ○ Poor

Overall, the two alternatives are forecast to have similar levels of service. The roundabout alternative is estimated to have higher period costs, better speed control and a lower environmental impact; however, it may cause some confusion for drivers that aren't familiar with roundabouts.

The traffic signal alternative is estimated to have lower period costs and is more familiar to drivers and vulnerable road users; however, it provides minimal speed control when the signal head is green and is less environmentally friendly (energy and emissions).

Of the two alternatives, traffic signal control is identified as the preferred alternative.

5 Summary of Evaluation

This ICS reviews intersection control alternatives for the St. John's Road intersections with Blue Line Road and Cockshutt Road in Norfolk County.

Existing Conditions

Under existing traffic conditions, the subject intersections operate under stop control on the Blue Line Road and Cockshutt Road approaches. Based on traffic counts collected in 2023, the intersections are operating with acceptable levels of service.

Adequate sight distance is provided for the Blue Line Road and Cockshutt Road approaches.

Future Traffic Conditions

Under 2033 (ten-year) future traffic conditions, two intersection alternatives have been considered including (1) traffic signals and (2) single-lane roundabout.

Based on 2033 future traffic forecasts, traffic control signals are warranted at both intersections. Operational analyses indicate that all movements at each intersection are forecast to operate with LOS A or B, except for the southbound approach at St. John's Road and Blue Line Road which is forecast to operate with LOS C during the PM peak hour.

For the roundabout alternative, all movements at each intersection are forecast to operate with LOS A during both peak hours.

Economic Analysis

Based on the Region of Waterloo Safety Assessment Methodology for assessing collision costs, roundabout control fares better than traffic signal control assessed over a twenty-year period, due to lower injury rates and virtually no fatalities. However, traffic signal controls result in lower total (twenty-year) period costs due to lower construction and maintenance costs when compared to a roundabout.

Qualitative Evaluation

Roundabout control generally results in opportunities for landscaping, better fuel consumption/emissions, reduced speeds, theoretical elimination of the possibility of a fatal collision, and lower delays and queueing.

Although intersections with traffic signal are qualitatively considered to be better than roundabouts for pedestrian movement, pedestrian and cycling activities are not noted to be significant in the area. In addition, roundabouts are not generally common in Norfolk County/surrounding area and seasonal demand in the area increases non-local travellers who might find new roundabout controls to be unfamiliar and confusing.

Preferred Alternative

Given the high levels of service, lower period costs, better driver expectations for both local users and seasonal travellers, and convenience for commercial vehicles, traffic signal control is identified as the preferred alternative for both Blue Line Road and Cockshutt Road intersections on St. John's Road.

Appendix A

Existing Traffic Data

St John's Road & Cockshutt Road

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 9:00:00

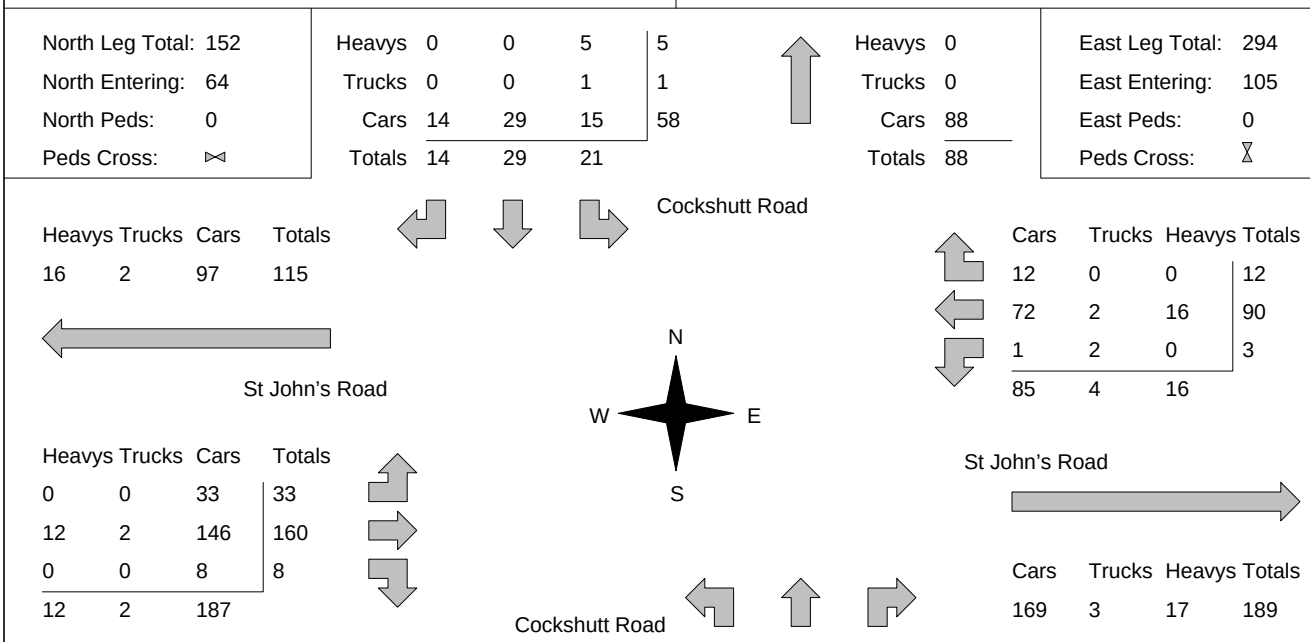
One Hour Peak
From: 7:00:00
To: 8:00:00

Municipality: Norfolk
Site #: 0000005302
Intersection: St John's Road & Cockshutt Road
TFR File #: 1
Count date: 3-Aug-2023

Weather conditions:
Clear
Person(s) who counted:

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

Major Road: St John's Road runs W/E



Comments

St John's Road & Cockshutt Road

Mid-day Peak Diagram

Specified Period
From: 11:00:00
To: 14:00:00

One Hour Peak
From: 11:45:00
To: 12:45:00

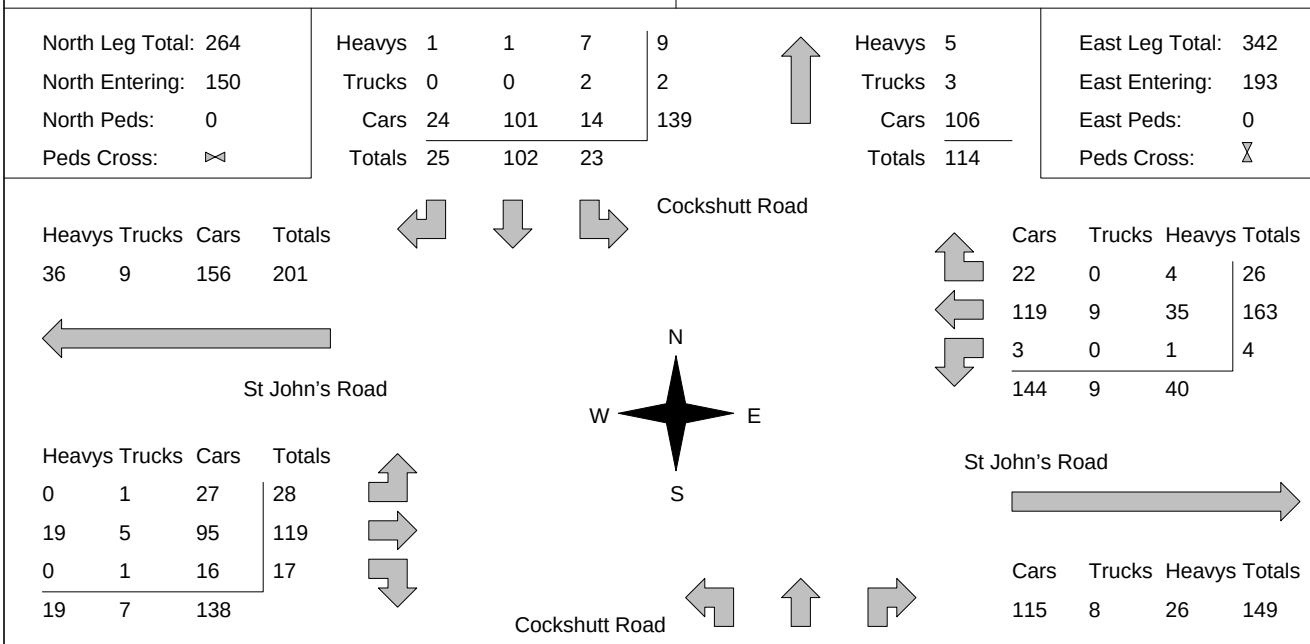
Municipality: Norfolk
Site #: 0000005302
Intersection: St John's Road & Cockshutt Road
TFR File #: 1
Count date: 3-Aug-2023

Weather conditions:
Clear

Person(s) who counted:

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

Major Road: St John's Road runs W/E



Comments

St John's Road & Cockshutt Road

Afternoon Peak Diagram

Specified Period
From: 15:00:00
To: 18:00:00

One Hour Peak
From: 16:15:00
To: 17:15:00

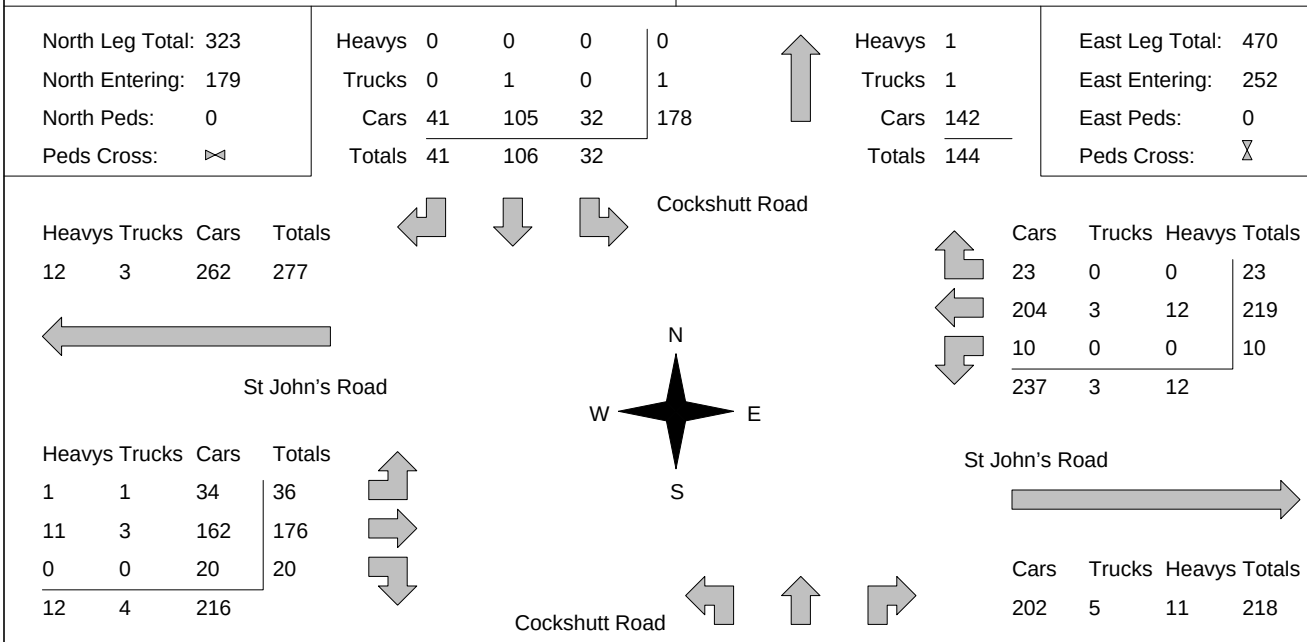
Municipality: Norfolk
Site #: 0000005302
Intersection: St John's Road & Cockshutt Road
TFR File #: 1
Count date: 3-Aug-2023

Weather conditions:
Clear

Person(s) who counted:

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

Major Road: St John's Road runs W/E



Comments

St John's Road & Cockshutt Road

Total Count Diagram

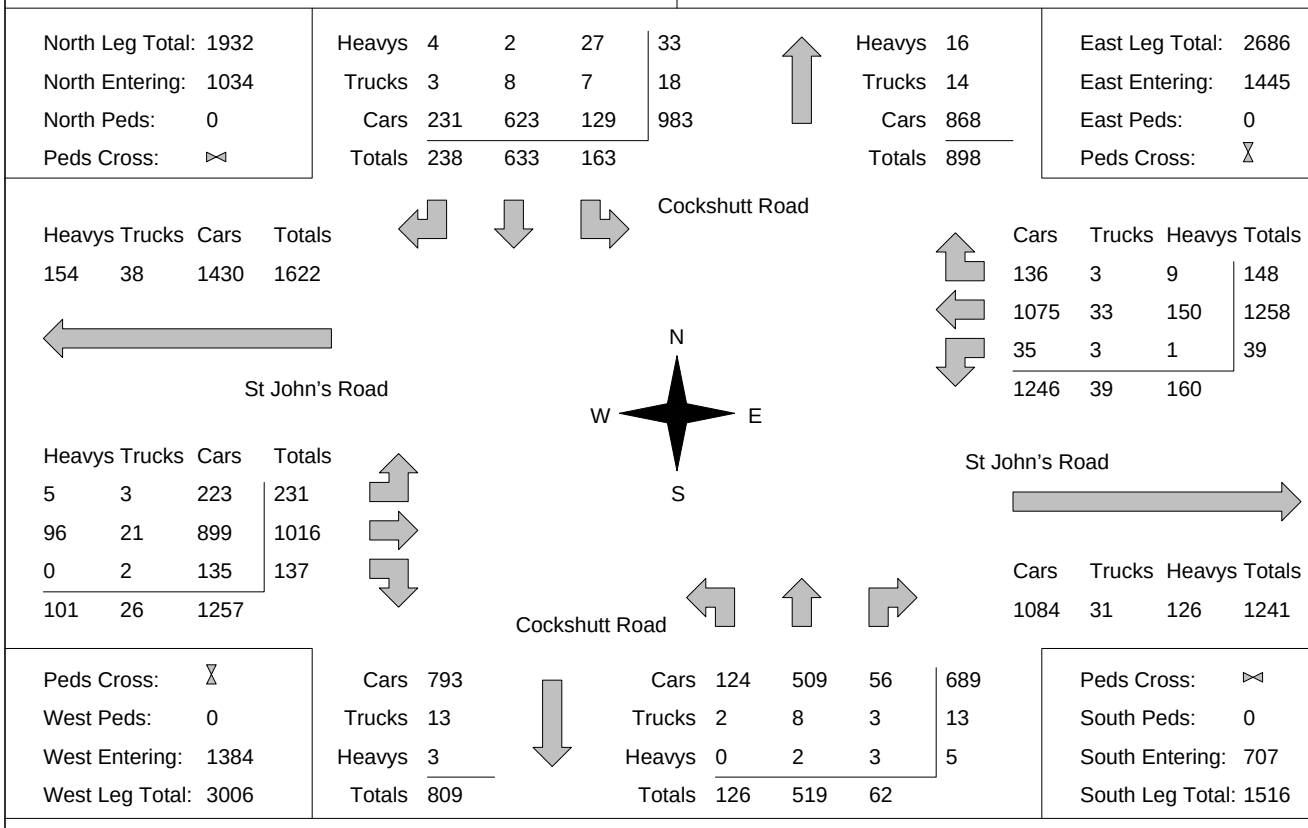
Municipality: Norfolk
Site #: 0000005302
Intersection: St John's Road & Cockshutt Road
TFR File #: 1
Count date: 3-Aug-2023

Weather conditions:
Clear

Person(s) who counted:

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

Major Road: St John's Road runs W/E



Comments

St John's Road & Cockshutt Road
Traffic Count Summary

Intersection: St John's Road & Cockshutt Road | **Count Date:** 3-Aug-2023 | **Municipality:** Norfolk

North Approach Totals

Hour Ending	Includes Cars, Trucks, & Heavys: Left	Thru	Right	Grand Total	Total Peds	North/South Total Approaches
7:00:00	0	0	0	0	0	0
8:00:00	21	29	14	64	0	126
9:00:00	17	51	18	86	0	169
11:00:00	0	0	0	0	0	0
12:00:00	19	80	31	130	0	209
13:00:00	21	110	26	157	0	254
14:00:00	15	90	24	129	0	225
15:00:00	0	0	0	0	0	0
16:00:00	19	91	36	146	0	232
17:00:00	31	98	45	174	0	276
18:00:00	20	84	44	148	0	250
Totals:	163	633	238	1034	0	1741

South Approach Totals

Hour Ending	Includes Cars, Trucks, & Heavys: Left	Thru	Right	Grand Total	Total Peds
7:00:00	0	0	0	0	0
8:00:00	11	43	8	62	0
9:00:00	17	63	3	83	0
11:00:00	0	0	0	0	0
12:00:00	14	58	7	79	0
13:00:00	15	74	8	97	0
14:00:00	20	67	9	96	0
15:00:00	0	0	0	0	0
16:00:00	16	61	9	86	0
17:00:00	18	74	10	102	0
18:00:00	15	79	8	102	0
Totals:	126	519	62	707	0

East Approach Totals

Hour Ending	Includes Cars, Trucks, & Heavys: Left	Thru	Right	Grand Total	Total Peds	East/West Total Approaches
7:00:00	0	0	0	0	0	0
8:00:00	3	90	12	105	0	306
9:00:00	4	85	13	102	0	230
11:00:00	0	0	0	0	0	0
12:00:00	4	179	17	200	0	355
13:00:00	6	151	26	183	0	328
14:00:00	4	144	18	166	0	333
15:00:00	0	0	0	0	0	0
16:00:00	5	187	30	222	0	380
17:00:00	9	226	25	260	0	481
18:00:00	4	196	7	207	0	416
Totals:	39	1258	148	1445	0	2829

West Approach Totals

Hour Ending	Includes Cars, Trucks, & Heavys: Left	Thru	Right	Grand Total	Total Peds
7:00:00	0	0	0	0	0
8:00:00	33	160	8	201	0
9:00:00	24	98	6	128	0
11:00:00	0	0	0	0	0
12:00:00	26	113	16	155	0
13:00:00	24	106	15	145	0
14:00:00	23	121	23	167	0
15:00:00	0	0	0	0	0
16:00:00	23	107	28	158	0
17:00:00	40	163	18	221	0
18:00:00	38	148	23	209	0
Totals:	231	1016	137	1384	0

Calculated Values for Traffic Crossing Major Street

Hours Ending:	8:00	9:00	12:00	13:00	14:00	16:00	17:00	18:00
Crossing Values:	75	97	113	146	125	126	147	119

St John's Road & Blueline Road

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 9:00:00

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

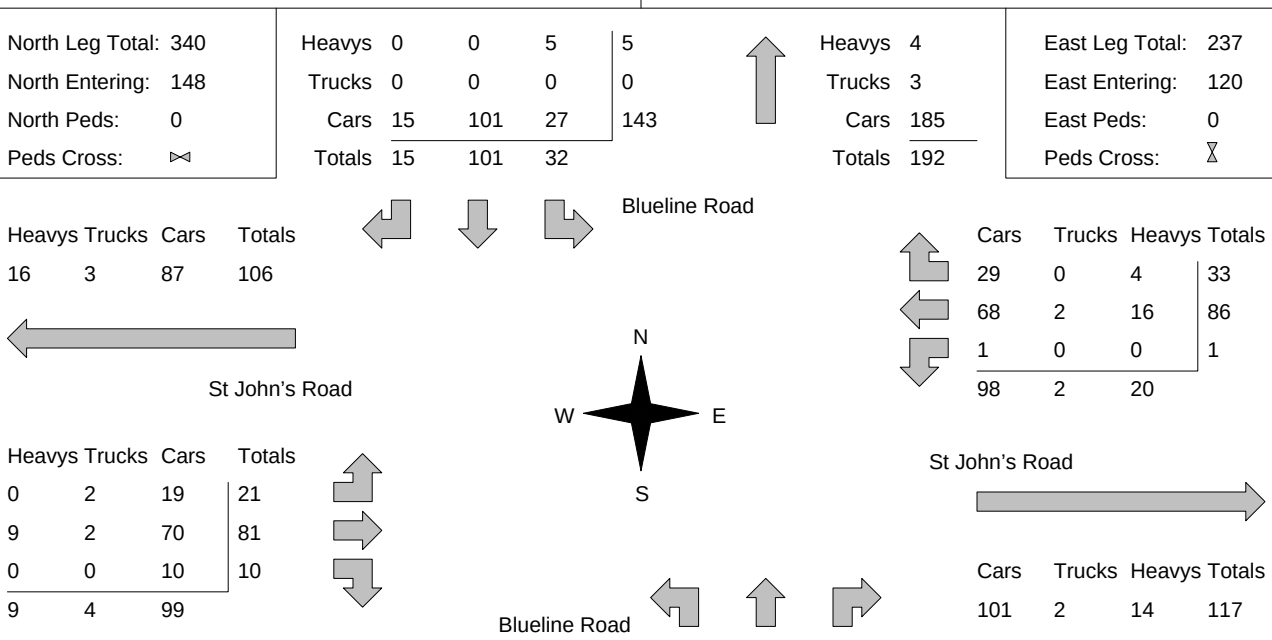
Municipality: Norfolk
Site #: 0000005303
Intersection: St John's Road & Blueline Road
TFR File #: 1
Count date: 3-Aug-2023

Weather conditions:
Clear

Person(s) who counted:

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

Major Road: St John's Road runs W/E



Comments

St John's Road & Blueline Road

Mid-day Peak Diagram

Specified Period
From: 11:00:00
To: 14:00:00

One Hour Peak
From: 12:30:00
To: 13:30:00

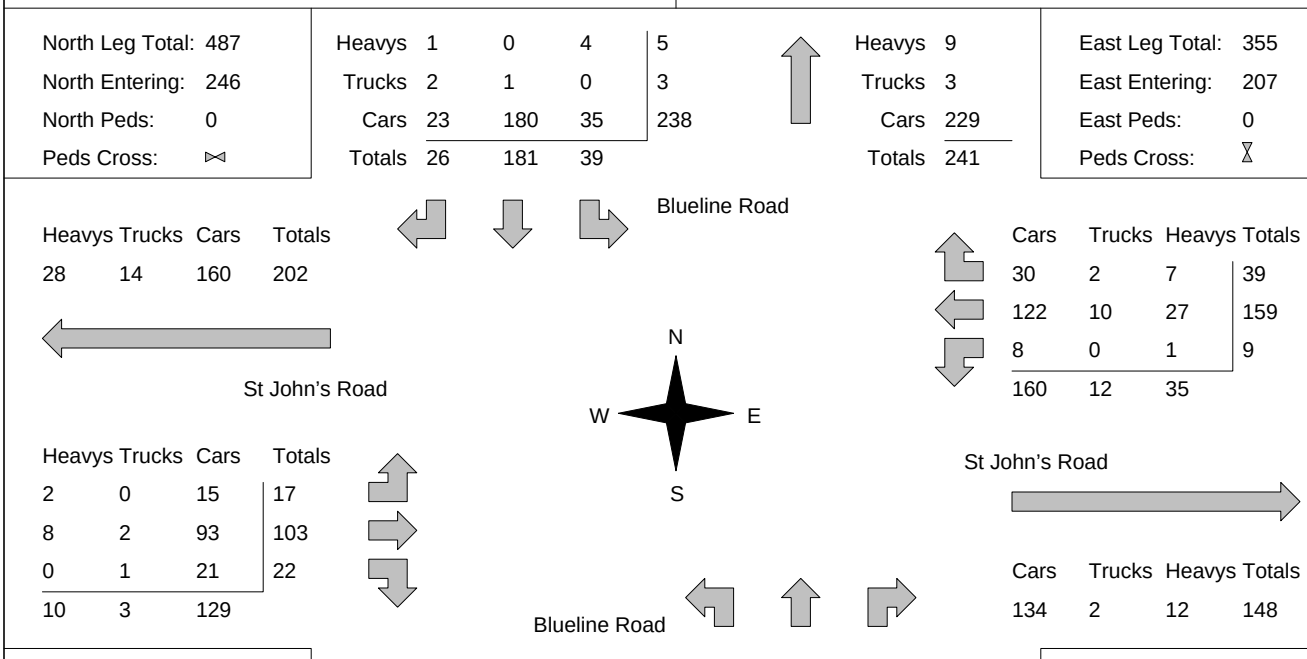
Municipality: Norfolk
Site #: 0000005303
Intersection: St John's Road & Blueline Road
TFR File #: 1
Count date: 3-Aug-2023

Weather conditions:
Clear

Person(s) who counted:

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

Major Road: St John's Road runs W/E



Comments

St John's Road & Blueline Road

Afternoon Peak Diagram

Specified Period
From: 15:00:00
To: 18:00:00

One Hour Peak
From: 15:30:00
To: 16:30:00

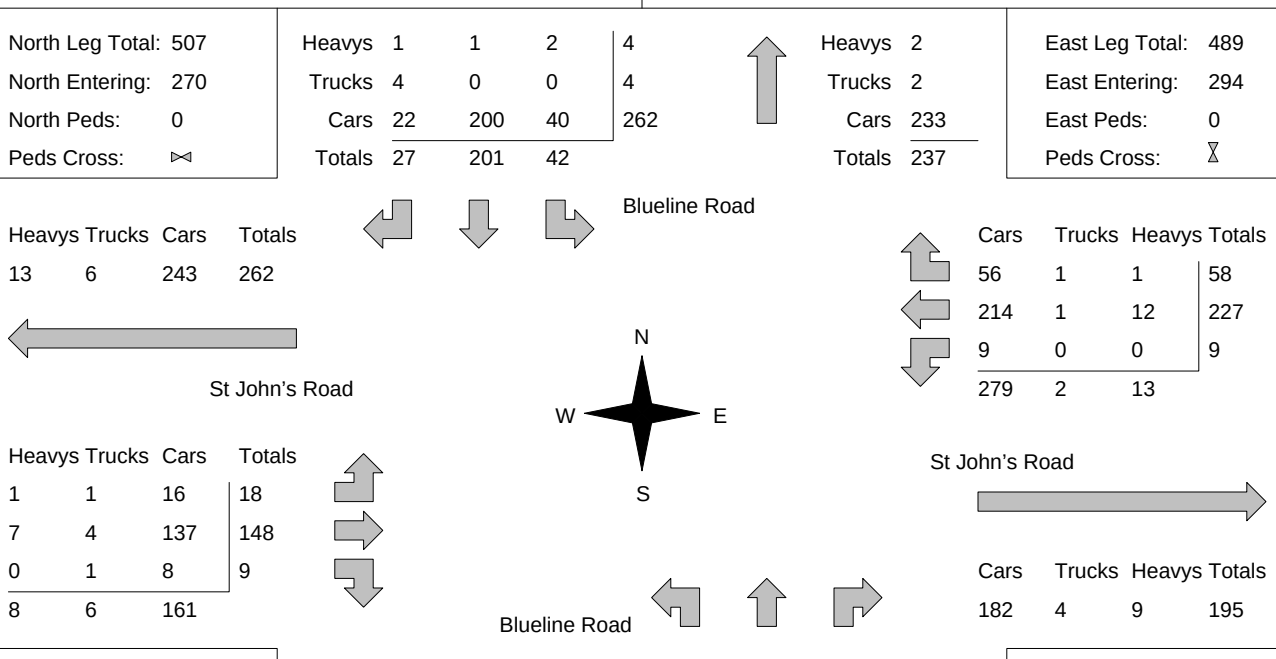
Municipality: Norfolk
Site #: 0000005303
Intersection: St John's Road & Blueline Road
TFR File #: 1
Count date: 3-Aug-2023

Weather conditions:
Clear

Person(s) who counted:

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

Major Road: St John's Road runs W/E



Comments

St John's Road & Blueline Road

Total Count Diagram

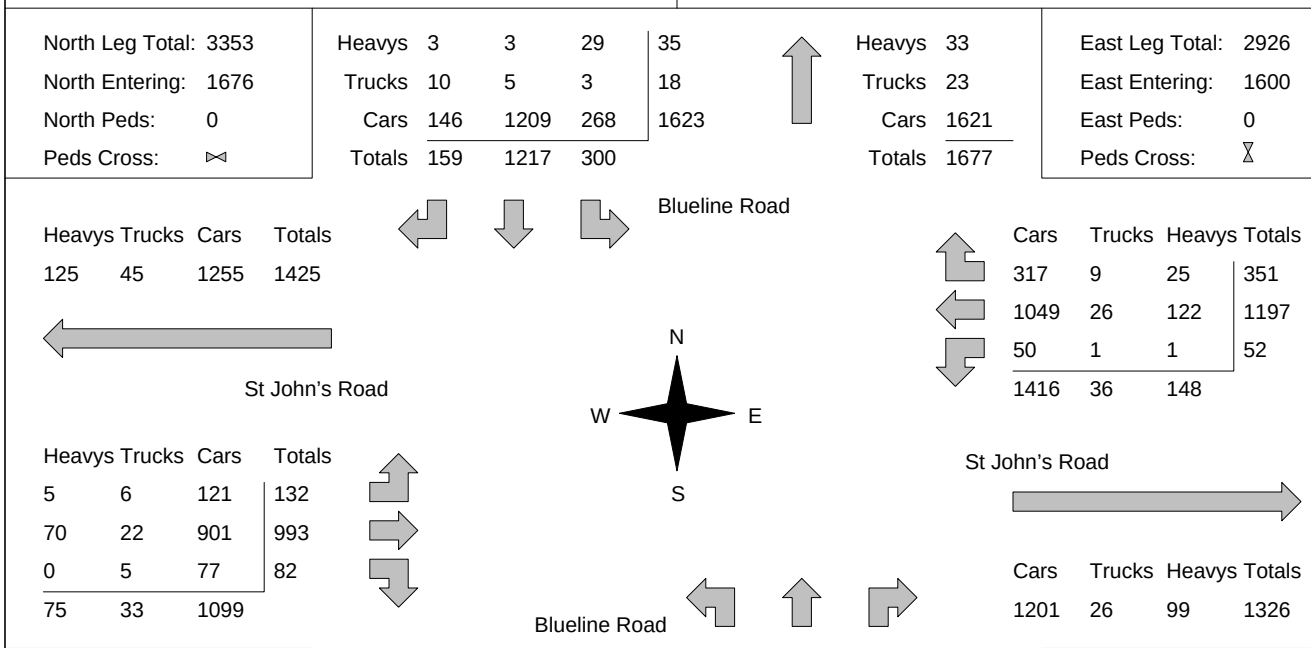
Municipality: Norfolk
Site #: 0000005303
Intersection: St John's Road & Blueline Road
TFR File #: 1
Count date: 3-Aug-2023

Weather conditions:
Clear

Person(s) who counted:

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

Major Road: St John's Road runs W/E



Comments

St John's Road & Blueline Road
Traffic Count Summary

Intersection: St John's Road & Blueline Road | **Count Date:** 3-Aug-2023 | **Municipality:** Norfolk

North Approach Totals

Hour Ending	Includes Cars, Trucks, & Heavys Left	Thru	Right	Grand Total	Total Peds	North/South Total Approaches
7:00:00	0	0	0	0	0	0
8:00:00	38	51	14	103	0	212
9:00:00	32	101	15	148	0	295
11:00:00	0	0	0	0	0	0
12:00:00	34	171	13	218	0	390
13:00:00	24	168	19	211	0	385
14:00:00	46	178	25	249	0	437
15:00:00	0	0	0	0	0	0
16:00:00	44	193	19	256	0	421
17:00:00	42	175	33	250	0	424
18:00:00	40	180	21	241	0	408
Totals:	300	1217	159	1676	0	2972

South Approach Totals

Hour Ending	Includes Cars, Trucks, & Heavys Left	Thru	Right	Grand Total	Total Peds
7:00:00	0	0	0	0	0
8:00:00	4	104	1	109	0
9:00:00	5	138	4	147	0
11:00:00	0	0	0	0	0
12:00:00	13	155	4	172	0
13:00:00	12	159	3	174	0
14:00:00	17	166	5	188	0
15:00:00	0	0	0	0	0
16:00:00	9	154	2	165	0
17:00:00	4	162	8	174	0
18:00:00	5	156	6	167	0
Totals:	69	1194	33	1296	0

East Approach Totals

Hour Ending	Includes Cars, Trucks, & Heavys Left	Thru	Right	Grand Total	Total Peds	East/West Total Approaches
7:00:00	0	0	0	0	0	0
8:00:00	3	81	34	118	0	258
9:00:00	1	86	33	120	0	232
11:00:00	0	0	0	0	0	0
12:00:00	14	189	42	245	0	389
13:00:00	6	147	41	194	0	345
14:00:00	8	151	35	194	0	337
15:00:00	0	0	0	0	0	0
16:00:00	5	177	44	226	0	374
17:00:00	11	188	63	262	0	445
18:00:00	4	178	59	241	0	427
Totals:	52	1197	351	1600	0	2807

West Approach Totals

Hour Ending	Includes Cars, Trucks, & Heavys Left	Thru	Right	Grand Total	Total Peds
7:00:00	0	0	0	0	0
8:00:00	13	127	0	140	0
9:00:00	21	81	10	112	0
11:00:00	0	0	0	0	0
12:00:00	14	114	16	144	0
13:00:00	24	113	14	151	0
14:00:00	8	114	21	143	0
15:00:00	0	0	0	0	0
16:00:00	13	126	9	148	0
17:00:00	18	160	5	183	0
18:00:00	21	158	7	186	0
Totals:	132	993	82	1207	0

Calculated Values for Traffic Crossing Major Street

Hours Ending:	8:00	9:00	12:00	13:00	14:00	16:00	17:00	18:00
Crossing Values:	146	175	218	204	241	246	221	225

Appendix B

Collision Data

Date	Time	Self Reported	Location	Jurisdiction	Roadway Intersection	Occurrence	Traffic Report #	Officer	MVC Type	Primary Cause	Report Type	Year	Month	Day of the Week	Hour of day
15-Apr-16	2:30	No	BLUELINE	NORFOLK COUNTY	ST JOHNS	LP16108208	585754	13312	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2016	April	Fri	02
08-Jul-18	4:30	No	ST JOHNS	NORFOLK COUNTY	BLUELINE	LP18198371	742348	13971	Property Damage Only	Driver fatigue	Motor Vehicle	2018	July	Sun	04
21-Mar-21	6:30	No	BLUELINE	NORFOLK COUNTY	ST JOHNS	LP21093665	926988	14396	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2021	March	Sun	06
25-Feb-21	6:15	Yes	ST JOHNS	NORFOLK COUNTY	BLUELINE	RM21021173	922980	13713	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2021	February	Thu	06
10-Apr-18	6:25	No	ST JOHNS	NORFOLK COUNTY	BLUELINE	LP18095240	725238	11117	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2018	April	Tue	06
12-Jan-21	6:20	Yes	ST JOHNS	NORFOLK COUNTY	BLUELINE	RM21003447	916588	10984	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2021	January	Tue	06
17-Nov-21	7:00	No	ST JOHNS	NORFOLK COUNTY	BLUELINE	E210937815	966775	14688	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2021	November	Wed	07
30-Aug-21	8:37	No	BLUELINE	NORFOLK COUNTY	ST JOHNS RD E	E210594691	950206	14944	Non-Fatal Injury	Failed to yield right of way	Motor Vehicle	2021	August	Mon	08
22-Jun-17	9:38	No	ST JOHNS	NORFOLK COUNTY	BLUELINE	LP17178006	666206	11085	Property Damage Only	Failed to yield right of way	Motor Vehicle	2017	June	Thu	09
11-Nov-21	9:17	No	BLUELINE	NORFOLK COUNTY	ST JOHNS	E210912680	965129	14177	Non-Fatal Injury	Failed to yield right of way	Motor Vehicle	2021	November	Thu	09
13-May-22	10:39	No	BLUELINE	NORFOLK COUNTY	ST JOHNS	E220502564	1002742	14946	Non-Fatal Injury	Improper turn	Motor Vehicle	2022	May	Fri	10
27-Oct-19	11:22	No	BLUELINE	NORFOLK COUNTY	ST JOHNS RD E	LP19333057	839387	14071	Property Damage Only	Following too closely	Motor Vehicle	2019	October	Sun	11
03-Nov-21	11:53	No	BLUELINE	NORFOLK COUNTY	ST JOHNS	E210880294	964006	13988	Property Damage Only	Mechanical failure	Motor Vehicle	2021	November	Wed	11
16-Feb-15	12:15	No	ST JOHNS	NORFOLK COUNTY	BLUELINE	LP15041448	511667	11117	Property Damage Only	Failed to yield right of way	Motor Vehicle	2015	February	Mon	12
29-May-17	12:18	No	BLUELINE	NORFOLK COUNTY	ST JOHNS	LP17151326	661965	11338	Non-Fatal Injury	Inattentive driver	Motor Vehicle	2017	May	Mon	12
10-Dec-20	12:54	No	ST JOHNS	NORFOLK COUNTY	BLUELINE RD	LP20382271	911174	15128	Property Damage Only	Failed to yield right of way	Motor Vehicle	2020	December	Thu	12
13-May-22	13:14	No	BLUELINE	NORFOLK COUNTY	ST JOHNS	E220503340	1003080	15953	Fatal Injury	Disobeyed traffic control	Motor Vehicle	2022	May	Fri	13
09-Jan-23	13:00	Yes	BLUELINE	NORFOLK COUNTY	ST JOHNS	RM23005683	1055824	13713	Property Damage Only	Disobeyed traffic control	Motor Vehicle	2023	January	Mon	13
29-Sep-15	13:06	No	BLUELINE	NORFOLK COUNTY	ST JOHNS	LP15289057	548469	9630	Property Damage Only	Following too closely	Motor Vehicle	2015	September	Tue	13
20-Dec-19	14:42	No	BLUELINE	NORFOLK COUNTY	ST JOHNS RD E	LP19388534	854696	14071	Property Damage Only	Ability Impaired â Alcohol	Motor Vehicle	2019	December	Fri	14
31-Jul-17	14:07	Yes	ST JOHNS	NORFOLK COUNTY	BLUELINE	LP17221830	672631	9367	Property Damage Only	Inattentive driver	Motor Vehicle	2017	July	Mon	14
14-Oct-18	14:46	No	BLUELINE	NORFOLK COUNTY	ST JOHNS	LP18309241	761949	14866	Non-Fatal Injury	Inattentive driver	Motor Vehicle	2018	October	Sun	14
11-Feb-16	15:36	No	BLUELINE	NORFOLK COUNTY	ST JOHNS	LP16041631	575303	13966	Non-Fatal Injury	Failed to yield right of way	Motor Vehicle	2016	February	Thu	15
15-Nov-19	17:30	No	ST JOHNS	NORFOLK COUNTY	BLUELINE RD	LP19352897	844936	15128	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2019	November	Fri	17
24-Nov-20	17:30	No	ST JOHNS	NORFOLK COUNTY	BLUELINE	LP20366684	907719	14177	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2020	November	Tue	17
18-May-16	17:35	No	BLUELINE	NORFOLK COUNTY	ST JOHNS	LP16145697	590638	11117	Non-Fatal Injury	Disobeyed traffic control	Motor Vehicle	2016	May	Wed	17
16-Dec-20	17:00	Yes	ST JOHNS	NORFOLK COUNTY	BLUELINE RD	RM20146580	912506	13713	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2020	December	Wed	17
20-Oct-17	18:40	No	BLUELINE	NORFOLK COUNTY	ST JOHNS	LP17309383	687523	11338	Property Damage Only	Failed to yield right of way	Motor Vehicle	2017	October	Fri	18
23-Aug-19	18:10	No	BLUELINE	NORFOLK COUNTY	ST JOHNS RD E	LP19259697	826896	14071	Property Damage Only	Failed to yield right of way	Motor Vehicle	2019	August	Fri	18
07-Apr-15	18:25	No	ST JOHNS	NORFOLK COUNTY	BLUELINE	LP15091635	517549	11085	Property Damage Only	Inattentive driver	Motor Vehicle	2015	April	Tue	18
20-Dec-22	18:35	No	BLUELINE	NORFOLK COUNTY	ST JOHNS	E221505051	1051512	15711	Property Damage Only	Failed to yield right of way	Motor Vehicle	2022	December	Tue	18
13-Dec-19	19:25	No	ST JOHNS	NORFOLK COUNTY	BLUELINE RD	LP19381880	854802	14071	Property Damage Only	Unknown	Motor Vehicle	2019	December	Fri	19
10-Jan-18	19:30	No	BLUELINE	NORFOLK COUNTY	ST JOHNS	LP18008858	707870	11117	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2018	January	Wed	19
07-Jan-18	20:11	No	BLUELINE	NORFOLK COUNTY	ST JOHNS	LP18006066	709116	12187	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2018	January	Sun	20
28-Apr-16	21:30	No	ST JOHNS	NORFOLK COUNTY	BLUELINE	LP16123789	587816	11338	Non-Fatal Injury	Animal - Wild or Domestic	Motor Vehicle	2016	April	Thu	21
19-Dec-16	22:00	No	ST JOHNS	NORFOLK COUNTY	BLUELINE	LP16389186	632491	11117	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2016	December	Mon	22

Row Labels	Count of Primary Cause
Animal - Wild or Domestic	13
Failed to yield right of way	9
Inattentive driver	4
Disobeyed traffic control	3
Following too closely	2
Unknown	1
Driver fatigue	1
Improper turn	1
Ability Impaired â Alcohol	1
Mechanical failure	1
Grand Total	**36**

Row Labels	Count of MVC Type
Property Damage Only	27
Non-Fatal Injury	8
Fatal Injury	1
Grand Total	**36**

Status	Date	Time	Self Reported	Location	Jurisdiction	Roadway Intersection	Occurrence	Traffic Report #	Officer	MVC Type	Primary Cause	Report Type	Year	Month	Day of the Week	Hour of day
C	31-Jul-22	0:25	No	COCKSHUTT	NORFOLK COUNTY	ST JOHNS	E220884335	1019794	16059	Non-Fatal Injury	Ability Impaired â Alcohol	Motor Vehicle	2022	July	Sunday	00
C	16-Jan-19	1:00	No	COCKSHUTT	NORFOLK COUNTY	ST JOHNS	LP19013984	783040	8483	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2019	January	Wednesday	01
C	01-Dec-15	5:15	No	COCKSHUTT	NORFOLK COUNTY	ST JOHNS	LP15354223	561686	13542	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2015	December	Tuesday	05
C	01-Dec-15	5:20	No	COCKSHUTT	NORFOLK COUNTY	ST JOHNS	LP15354409	561857	13651	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2015	December	Tuesday	05
C	26-Apr-16	5:45	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT	LP16120544	587331	12504	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2016	April	Tuesday	05
C	12-Dec-17	5:05	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT	LP17361205	699734	13312	Property Damage Only	Speed -- too fast for conditions	Motor Vehicle	2017	December	Tuesday	05
C	27-May-20	5:00	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT RD	LP20145317	878622	15153	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2020	May	Wednesday	05
C	19-Jan-18	6:19	Yes	ST JOHNS	NORFOLK COUNTY	COCKSHUTT	LP18016211	710282	13971	Property Damage Only	Inattentive driver	Motor Vehicle	2018	January	Friday	06
C	26-Jul-21	6:05	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT	E210426546	944466	15058	Property Damage Only	Unknown	Motor Vehicle	2021	July	Monday	06
C	19-Jan-20	6:10	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT RD	LP20018193	860675	14688	Property Damage Only	Unknown	Motor Vehicle	2020	January	Sunday	06
C	22-Oct-15	6:50	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT	LP15313264	552794	13744	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2015	October	Thursday	06
C	22-Feb-18	6:35	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT	LP18048089	717509	11117	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2018	February	Thursday	06
C	27-Jan-22	6:00	Yes	COCKSHUTT	NORFOLK COUNTY	ST JOHNS	RM22015796	983156	172345	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2022	January	Thursday	06
C	30-Nov-15	7:30	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT	LP15353232	561854	13651	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2015	November	Monday	07
C	08-Feb-23	7:18	No	COCKSHUTT	NORFOLK COUNTY	ST JOHNS	E230154607	1062550	16103	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2023	February	Wednesday	07
C	20-Jan-20	10:59	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT RD	LP20019116	860992	14944	Property Damage Only	Following too closely	Motor Vehicle	2020	January	Monday	10
C	30-Oct-22	10:50	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT	E221296791	1038364	16298	Property Damage Only	Following too closely	Motor Vehicle	2022	October	Sunday	10
C	03-Nov-20	10:44	No	COCKSHUTT	NORFOLK COUNTY	ST JOHNS RD E	LP20343349	904143	15060	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2020	November	Tuesday	10
C	20-Jun-21	12:30	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT	E210246181	942438	12571	Other	Unknown	Motor Vehicle	2021	June	Sunday	12
C	10-Aug-20	13:28	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT RD	LP20244178	889004	14177	Non-Fatal Injury	Failed to yield right of way	Motor Vehicle	2020	August	Monday	13
C	19-Nov-22	13:52	No	COCKSHUTT	NORFOLK COUNTY	ST JOHNS	E221379338	1044032	15248	Property Damage Only	Lost control	Motor Vehicle	2022	November	Saturday	13
C	25-Jul-19	13:00	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT RD	LP19222322	820681	8010	Non-Fatal Injury	Failed to yield right of way	Motor Vehicle	2019	July	Thursday	13
C	05-Feb-16	14:50	No	COCKSHUTT	NORFOLK COUNTY	ST JOHNS	LP16035385	573419	11117	Property Damage Only	Failed to yield right of way	Motor Vehicle	2016	February	Friday	14
C	15-Jun-19	14:38	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT	LP19171474	812863	14983	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2019	June	Saturday	14
C	10-Jul-22	14:17	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT	E220784908	1015984	15522	Non-Fatal Injury	Inattentive driver	Motor Vehicle	2022	July	Sunday	14
C	09-Feb-17	15:05	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT	LP17037183	643891	13753	Property Damage Only	Inattentive driver	Motor Vehicle	2017	February	Thursday	15
C	20-Nov-20	16:25	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT RD	LP20362575	906809	14688	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2020	November	Friday	16
C	25-Jun-19	16:52	No	COCKSHUTT	NORFOLK COUNTY	ST JOHNS	LP19183062	814534	12187	Non-Fatal Injury	Failed to yield right of way	Motor Vehicle	2019	June	Tuesday	16
C	20-Nov-20	17:51	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT RD	LP20362654	906812	14688	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2020	November	Friday	17
C	17-Jun-22	17:15	No	COCKSHUTT	NORFOLK COUNTY	ST JOHNS	E220669660	1009681	14396	Non-Fatal Injury	Disobeyed traffic control	Motor Vehicle	2022	June	Friday	17
C	13-Dec-19	18:30	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT RD	LP19381825	854333	11327	Non-Fatal Injury	Inattentive driver	Motor Vehicle	2019	December	Friday	18
C	23-Sep-18	18:18	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT	LP18287526	757834	11951	Property Damage Only	Failed to yield right of way	Motor Vehicle	2018	September	Sunday	18
C	14-Jun-22	19:00	No	ST JOHNS	NORFOLK COUNTY	Cockshutt Rd	E220656211	1009028	11136	Fatal Injury	Inattentive driver	Motor Vehicle	2022	June	Tuesday	19
C	30-Sep-17	20:10	No	COCKSHUTT	NORFOLK COUNTY	ST JOHNS	LP17287986	683728	11117	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2017	September	Saturday	20
C	10-Oct-20	20:00	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT RD	LP20318804	899703	14866	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2020	October	Saturday	20
C	14-Nov-20	20:08	No	COCKSHUTT	NORFOLK COUNTY	ST JOHNS RD E	LP20356193	905322	11951	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2020	November	Saturday	20
C	09-Aug-21	21:00	Yes	ST JOHNS	NORFOLK COUNTY	COCKSHUTT	RM21099505	946872	10984	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2021	August	Monday	21
C	04-Feb-17	21:13	No	COCKSHUTT	NORFOLK COUNTY	ST JOHNS	LP17032810	644078	12187	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2017	February	Saturday	21
C	26-Mar-18	22:00	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT	LP18080233	722903	11117	Property Damage Only	Animal - Wild or Domestic	Motor Vehicle	2018	March	Monday	22
C	25-Jul-22	22:40	No	ST JOHNS	NORFOLK COUNTY	Cockshutt Rd	E220858036	1019563	13988	Non-Fatal Injury	Ability Impaired â Alcohol	Motor Vehicle	2022	July	Monday	22
C	26-Jun-23	23:23	No	ST JOHNS	NORFOLK COUNTY	COCKSHUTT	E230837076	1090684	15893	Property Damage Only	Ability Impaired â Alcohol	Motor Vehicle	2023	June	Monday	23

Row Labels	Count of Primary Cause
Animal - Wild or Domestic	20
Failed to yield right of way	5
Inattentive driver	5
Ability Impaired â Alcohol	3
Unknown	3
Following too closely	2
Lost control	1
Disobeyed traffic control	1
Speed -- too fast for conditions	1
Grand Total	**41**

Row Labels	Count of MVC Type
Property Damage Only	31
Non-Fatal Injury	8
Fatal Injury	1
Other	1
Grand Total	**41**

Appendix C

Existing Traffic Operations Reports

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	33	160	8	3	90	12	11	43	8	21	29	14
Future Volume (vph)	33	160	8	3	90	12	11	43	8	21	29	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.994			0.985			0.982			0.971	
Flt Protected		0.992			0.999			0.991			0.984	
Satd. Flow (prot)	0	1748	0	0	1572	0	0	1849	0	0	1657	0
Flt Permitted		0.992			0.999			0.991			0.984	
Satd. Flow (perm)	0	1748	0	0	1572	0	0	1849	0	0	1657	0
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		563.0			633.9			316.4			311.0	
Travel Time (s)		25.3			28.5			14.2			14.0	
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
Heavy Vehicles (%)	0%	9%	0%	67%	20%	0%	0%	0%	0%	29%	0%	0%
Adj. Flow (vph)	36	174	9	3	98	13	12	47	9	23	32	15
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	219	0	0	114	0	0	68	0	0	70	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 30.3%		ICU Level of Service A	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	4.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	33	160	8	3	90	12	11	43	8	21	29	14
Future Vol, veh/h	33	160	8	3	90	12	11	43	8	21	29	14
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	9	0	67	20	0	0	0	0	29	0	0
Mvmt Flow	36	174	9	3	98	13	12	47	9	23	32	15

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	111	0	0	183	0	0	385	368	179	390	366	105
Stage 1	-	-	-	-	-	-	251	251	-	111	111	-
Stage 2	-	-	-	-	-	-	134	117	-	279	255	-
Critical Hdwy	4.1	-	-	4.77	-	-	7.1	6.5	6.2	7.39	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.39	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.39	5.5	-
Follow-up Hdwy	2.2	-	-	2.803	-	-	3.5	4	3.3	3.761	4	3.3
Pot Cap-1 Maneuver	1492	-	-	1081	-	-	577	564	869	523	566	955
Stage 1	-	-	-	-	-	-	758	703	-	832	807	-
Stage 2	-	-	-	-	-	-	874	803	-	672	700	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1492	-	-	1081	-	-	531	547	869	473	549	955
Mov Cap-2 Maneuver	-	-	-	-	-	-	531	547	-	473	549	-
Stage 1	-	-	-	-	-	-	738	684	-	810	805	-
Stage 2	-	-	-	-	-	-	824	801	-	603	681	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.2	0.2	12.1	12.2
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	571	1492	-	-	1081	-	-	572
HCM Lane V/C Ratio	0.118	0.024	-	-	0.003	-	-	0.122
HCM Control Delay (s)	12.1	7.5	0	-	8.3	0	-	12.2
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.4	0.1	-	-	0	-	-	0.4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	21	81	10	1	86	33	5	138	4	32	101	15
Future Volume (vph)	21	81	10	1	86	33	5	138	4	32	101	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.988			0.963			0.997			0.987	
Flt Protected		0.991						0.998			0.989	
Satd. Flow (prot)	0	1800	0	0	1546	0	0	1861	0	0	1792	0
Flt Permitted		0.991						0.998			0.989	
Satd. Flow (perm)	0	1800	0	0	1546	0	0	1861	0	0	1792	0
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		352.7			306.6			208.0			214.3	
Travel Time (s)		15.9			13.8			9.4			9.6	
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
Heavy Vehicles (%)	10%	2%	0%	0%	21%	12%	20%	1%	0%	16%	0%	0%
Adj. Flow (vph)	23	88	11	1	93	36	5	150	4	35	110	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	122	0	0	130	0	0	159	0	0	161	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 38.5%		ICU Level of Service A	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	7.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	21	81	10	1	86	33	5	138	4	32	101	15
Future Vol, veh/h	21	81	10	1	86	33	5	138	4	32	101	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	10	2	0	0	21	12	20	1	0	16	0	0
Mvmt Flow	23	88	11	1	93	36	5	150	4	35	110	16

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	129	0	0	99	0	0	316	271	94	330	258	111
Stage 1	-	-	-	-	-	-	140	140	-	113	113	-
Stage 2	-	-	-	-	-	-	176	131	-	217	145	-
Critical Hdwy	4.2	-	-	4.1	-	-	7.3	6.51	6.2	7.26	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.3	5.51	-	6.26	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.3	5.51	-	6.26	5.5	-
Follow-up Hdwy	2.29	-	-	2.2	-	-	3.68	4.009	3.3	3.644	4	3.3
Pot Cap-1 Maneuver	1409	-	-	1507	-	-	603	637	968	597	650	948
Stage 1	-	-	-	-	-	-	822	783	-	859	806	-
Stage 2	-	-	-	-	-	-	786	790	-	755	781	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1409	-	-	1507	-	-	508	626	968	478	638	948
Mov Cap-2 Maneuver	-	-	-	-	-	-	508	626	-	478	638	-
Stage 1	-	-	-	-	-	-	808	770	-	844	805	-
Stage 2	-	-	-	-	-	-	666	789	-	595	768	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.4	0.1	12.7	12.9
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	627	1409	-	-	1507	-	-	614
HCM Lane V/C Ratio	0.255	0.016	-	-	0.001	-	-	0.262
HCM Control Delay (s)	12.7	7.6	0	-	7.4	0	-	12.9
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	1	0	-	-	0	-	-	1

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	36	176	20	10	219	23	17	85	10	32	106	41
Future Volume (vph)	36	176	20	10	219	23	17	85	10	32	106	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.988			0.988			0.988			0.969	
Flt Protected		0.992			0.998			0.993			0.991	
Satd. Flow (prot)	0	1740	0	0	1766	0	0	1831	0	0	1814	0
Flt Permitted		0.992			0.998			0.993			0.991	
Satd. Flow (perm)	0	1740	0	0	1766	0	0	1831	0	0	1814	0
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		563.0			633.9			316.4			311.0	
Travel Time (s)		25.3			28.5			14.2			14.0	
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
Heavy Vehicles (%)	6%	8%	0%	0%	7%	0%	0%	0%	20%	0%	1%	0%
Adj. Flow (vph)	39	191	22	11	238	25	18	92	11	35	115	45
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	252	0	0	274	0	0	121	0	0	195	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 46.4%		ICU Level of Service A	
Analysis Period (min) 15			

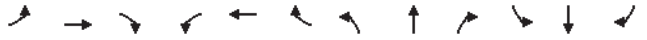
Intersection	
Int Delay, s/veh	7.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	36	176	20	10	219	23	17	85	10	32	106	41
Future Vol, veh/h	36	176	20	10	219	23	17	85	10	32	106	41
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	6	8	0	0	7	0	0	0	20	0	1	0
Mvmt Flow	39	191	22	11	238	25	18	92	11	35	115	45

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	263	0	0	213	0	0	633	565	202	605	564	251
Stage 1	-	-	-	-	-	-	280	280	-	273	273	-
Stage 2	-	-	-	-	-	-	353	285	-	332	291	-
Critical Hdwy	4.16	-	-	4.1	-	-	7.1	6.5	6.4	7.1	6.51	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.51	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.51	-
Follow-up Hdwy	2.254	-	-	2.2	-	-	3.5	4	3.48	3.5	4.009	3.3
Pot Cap-1 Maneuver	1278	-	-	1369	-	-	395	437	795	413	436	793
Stage 1	-	-	-	-	-	-	731	683	-	737	686	-
Stage 2	-	-	-	-	-	-	668	679	-	686	673	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1278	-	-	1369	-	-	284	418	795	327	417	793
Mov Cap-2 Maneuver	-	-	-	-	-	-	284	418	-	327	417	-
Stage 1	-	-	-	-	-	-	705	659	-	711	680	-
Stage 2	-	-	-	-	-	-	519	673	-	561	649	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.2	0.3	17.6	19.3
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	406	1278	-	-	1369	-	-	443
HCM Lane V/C Ratio	0.3	0.031	-	-	0.008	-	-	0.439
HCM Control Delay (s)	17.6	7.9	0	-	7.7	0	-	19.3
HCM Lane LOS	C	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	1.2	0.1	-	-	0	-	-	2.2



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Volume (vph)	18	148	9	9	227	58	8	161	5	42	201	27
Future Volume (vph)	18	148	9	9	227	58	8	161	5	42	201	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.993			0.973			0.996			0.987	
Flt Protected		0.995			0.998			0.998			0.992	
Satd. Flow (prot)	0	1744	0	0	1753	0	0	1877	0	0	1812	0
Flt Permitted		0.995			0.998			0.998			0.992	
Satd. Flow (perm)	0	1744	0	0	1753	0	0	1877	0	0	1812	0
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		352.7			306.6			208.0			214.3	
Travel Time (s)		15.9			13.8			9.4			9.6	
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
Heavy Vehicles (%)	11%	7%	11%	0%	6%	3%	13%	0%	0%	5%	0%	19%
Adj. Flow (vph)	20	161	10	10	247	63	9	175	5	46	218	29
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	191	0	0	320	0	0	189	0	0	293	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	51.1%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	12.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	18	148	9	9	227	58	8	161	5	42	201	27
Future Vol, veh/h	18	148	9	9	227	58	8	161	5	42	201	27
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	11	7	11	0	6	3	13	0	0	5	0	19
Mvmt Flow	20	161	10	10	247	63	9	175	5	46	218	29

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	310	0	0	171	0	0	628	536	166	595	510	279
Stage 1	-	-	-	-	-	-	206	206	-	299	299	-
Stage 2	-	-	-	-	-	-	422	330	-	296	211	-
Critical Hdwy	4.21	-	-	4.1	-	-	7.23	6.5	6.2	7.15	6.5	6.39
Critical Hdwy Stg 1	-	-	-	-	-	-	6.23	5.5	-	6.15	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.23	5.5	-	6.15	5.5	-
Follow-up Hdwy	2.299	-	-	2.2	-	-	3.617	4	3.3	3.545	4	3.471
Pot Cap-1 Maneuver	1201	-	-	1418	-	-	380	454	884	412	469	721
Stage 1	-	-	-	-	-	-	771	735	-	703	670	-
Stage 2	-	-	-	-	-	-	588	649	-	706	731	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1201	-	-	1418	-	-	223	442	884	278	456	721
Mov Cap-2 Maneuver	-	-	-	-	-	-	223	442	-	278	456	-
Stage 1	-	-	-	-	-	-	757	722	-	690	664	-
Stage 2	-	-	-	-	-	-	375	643	-	522	718	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.8	0.2	19.8	29.7
HCM LOS			C	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	429	1201	-	-	1418	-	-	429
HCM Lane V/C Ratio	0.441	0.016	-	-	0.007	-	-	0.684
HCM Control Delay (s)	19.8	8	0	-	7.6	0	-	29.7
HCM Lane LOS	C	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	2.2	0.1	-	-	0	-	-	5

Appendix D

Forecast 8-Hour Traffic Volumes

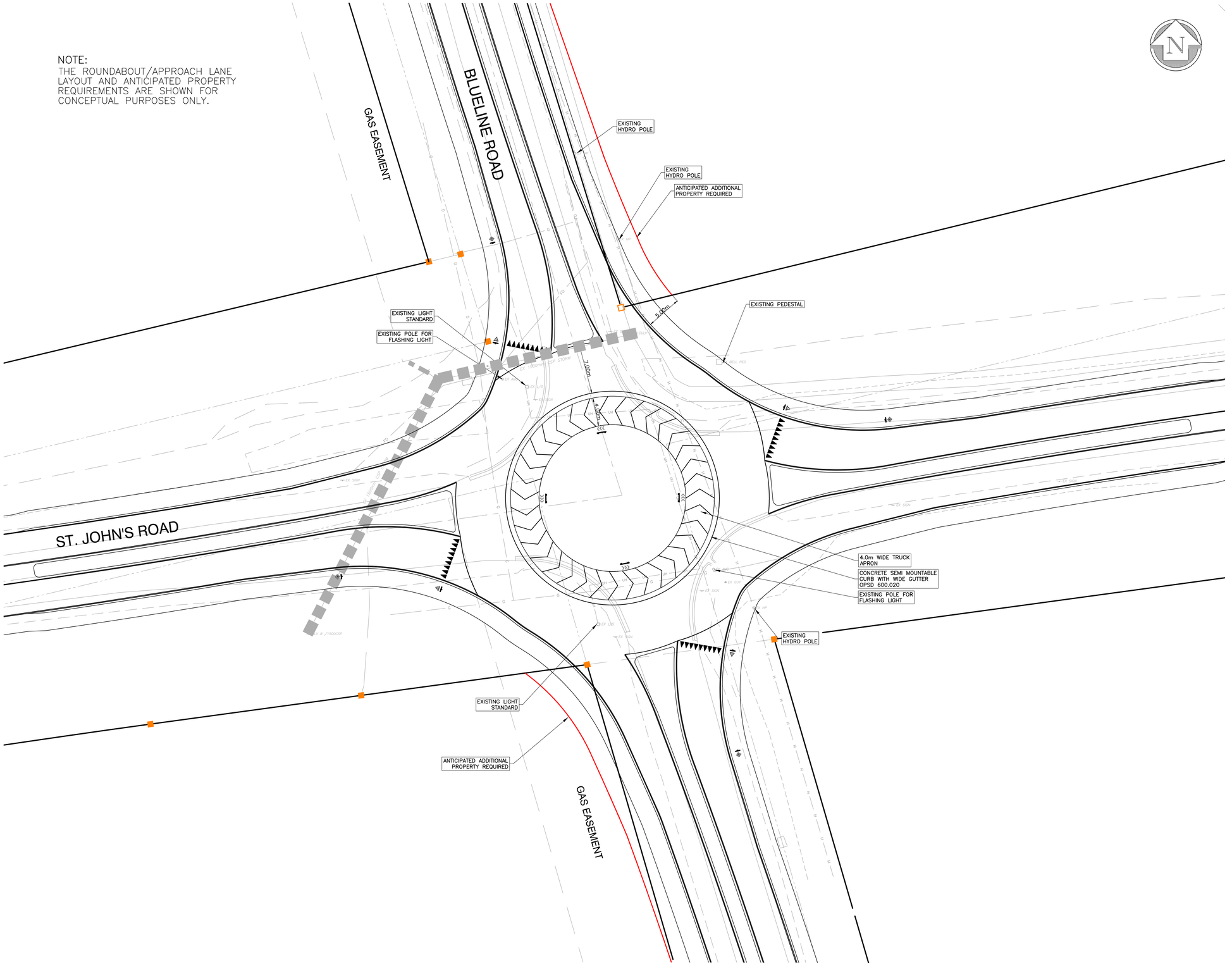
Start	St. John's Road						Cockshutt Road					
Time	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
700	43	207	10	4	116	16	14	56	10	27	37	18
800	31	127	8	5	110	17	22	81	4	22	66	23
1100	34	146	21	5	231	22	18	75	9	25	103	40
1200	31	137	19	8	195	34	19	96	10	27	142	34
1300	30	156	30	5	186	23	26	87	12	19	116	31
1500	30	138	36	6	242	39	21	79	12	25	118	47
1600	52	211	23	12	292	32	23	96	13	40	127	58
1700	49	191	30	5	253	9	19	102	10	26	109	57
Total	**300**	**1313**	**177**	**50**	**1625**	**192**	**162**	**672**	**80**	**211**	**818**	**308**

Start	St. John's Road						Blue Line Road					
Time	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
700	17	164	0	4	105	44	5	134	1	49	66	18
800	27	105	13	1	111	43	6	178	5	41	131	19
1100	18	147	21	18	244	54	17	200	5	44	221	17
1200	31	146	18	8	190	53	16	206	4	31	217	25
1300	10	147	27	10	195	45	22	215	6	59	230	32
1500	17	163	12	6	229	57	12	199	3	57	249	25
1600	23	207	6	14	243	81	5	209	10	54	226	43
1700	27	204	9	5	230	76	6	202	8	52	233	27
Total	**170**	**1283**	**106**	**66**	**1547**	**453**	**89**	**1543**	**42**	**387**	**1573**	**206**

Appendix E

Alternative Intersection Configuration Drawings

NOTE:
THE ROUNDABOUT/APPROACH LANE LAYOUT AND ANTICIPATED PROPERTY REQUIREMENTS ARE SHOWN FOR CONCEPTUAL PURPOSES ONLY.



REV. No.	DATE	REVISION
0	11/13/24	ISSUED FOR COST/BENEFIT ANALYSIS

NOTE:
THE CONTRACTOR IS CAUTIONED THAT ALL OF THE EXISTING UTILITIES ARE NOT INDICATED ON THIS DRAWING. THE CONTRACTOR MUST ARRANGE FOR LOCATES FROM EACH AREA UTILITY COMPANY PRIOR TO ANY CONSTRUCTION OR EXCAVATION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE PROTECTION OF ALL UTILITIES INCLUDING THOSE NOT INDICATED ON THIS DRAWING. G. DOUGLAS VALLEE LTD. CAN NOT ACCEPT RESPONSIBILITY FOR DAMAGE TO ANY EXISTING UTILITY WHICH MAY OR MAY NOT BE INDICATED ON THIS DRAWING.

SCALE: 1:250

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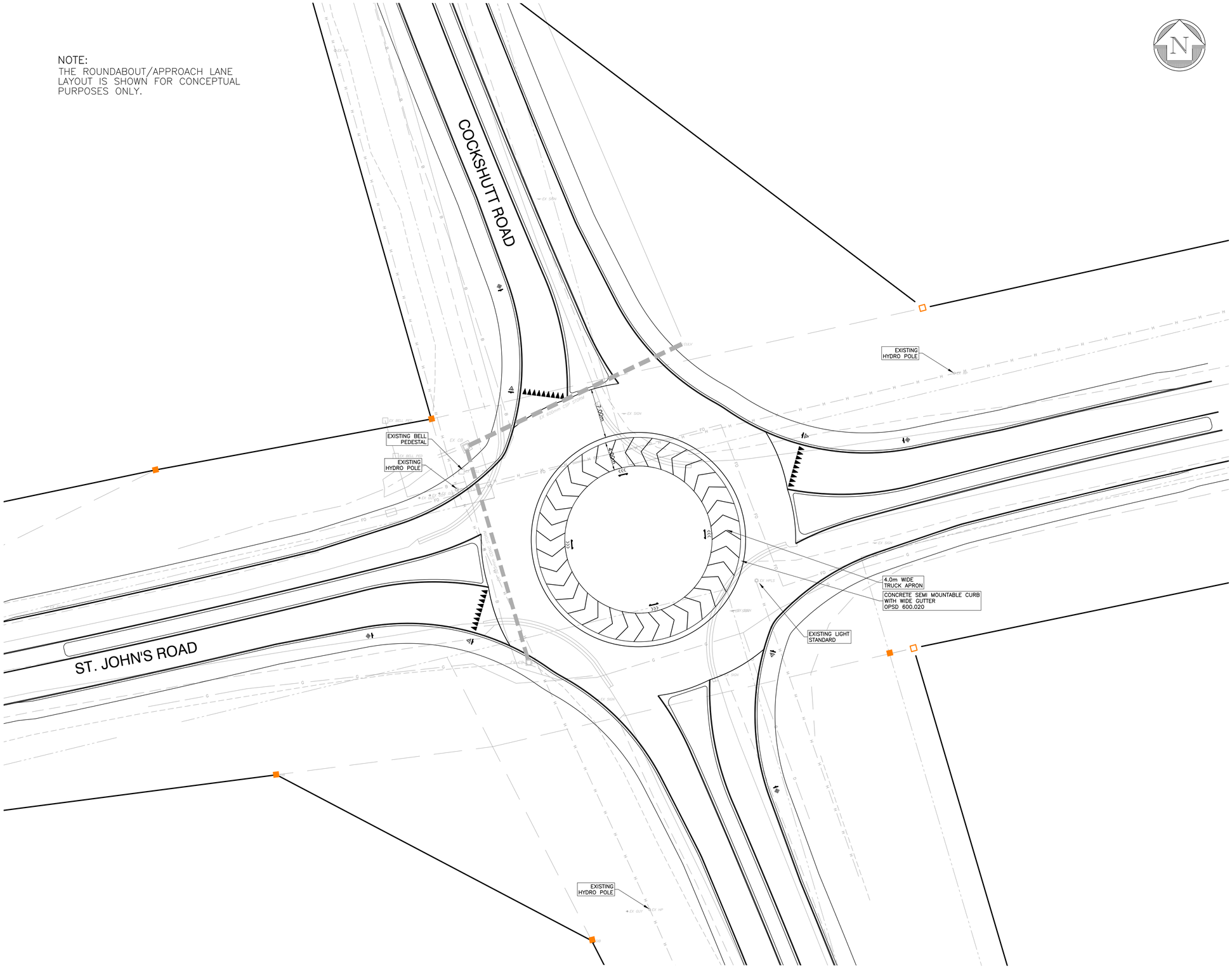
Project Title
EIS-ENG-25-##
ST. JOHN'S ROAD TRAFFIC CONTROL
NORFOLK COUNTY

Drawing Title
ST. JOHN'S AND BLUELINE ROUNDABOUT

Designed by : NLO/TGS	Drawn By : NLO/RCS
Checked by : NLO/TGS	Date Started : 4/5/23
Drawing Scale : AS SHOWN	Drawing No. 01
Project No. 24-003	

DATE LAST PLOTTED November 13, 2024

NOTE:
THE ROUNDABOUT/APPROACH LANE LAYOUT IS SHOWN FOR CONCEPTUAL PURPOSES ONLY.



REV. No.	DATE	REVISION
0	11/13/24	ISSUED FOR COST/BENEFIT ANALYSIS

NOTE:
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Project Title
EIS-ENG-25-##
ST. JOHN'S ROAD TRAFFIC CONTROL
NORFOLK COUNTY

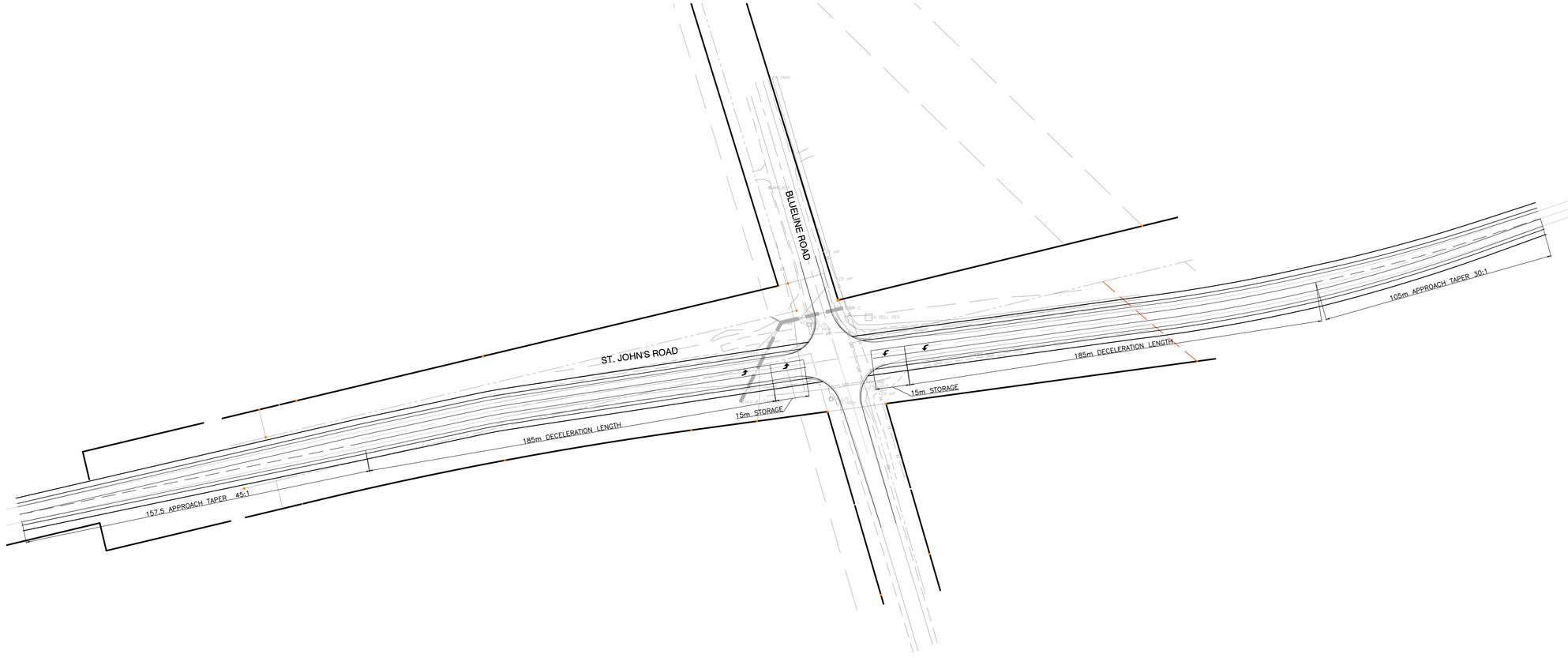
Drawing Title
ST. JOHN'S AND COCKSHUTT ROUNDABOUT

Designed by : NLO/TGS	Drawn By : NLO/RCS
Checked by : NLO/TGS	Date Started : 4/5/23
Drawing Scale : AS SHOWN	Drawing No. 02
Project No. 24-003	

DATE LAST PLOTTED : November 13, 2024

NOTE:
THE LEFT TURN LANES AND APPROACH TAPERS ARE SHOWN FOR CONCEPTUAL PURPOSES ONLY.

LANES ALONG ST. JOHN'S ROAD ARE 3.50m WIDE, WITH 1.5m WIDE ASPHALT AND 2.5m WIDE GRAVEL SHOULDERS.



REV. No.	DATE	REVISION
0	11/13/24	ISSUED FOR COST/BENEFIT ANALYSIS

NOTE:
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SCALE: 1:1000
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Project Title
EIS-ENG-25-##
ST. JOHN'S ROAD TRAFFIC CONTROL
NORFOLK COUNTY

Drawing Title
ST. JOHN'S AND BLUELINE SIGNALIZED INTERSECTION

Designed by : NLO/TGS	Drawn By : NLO/RCS
Checked by : NLO/TGS	Date Started : 4/5/23
Drawing Scale : 1 : 1000	Drawing No. 03
Project No. 24-003	

DATE LAST PLOTTED : November 13, 2024

NOTE:
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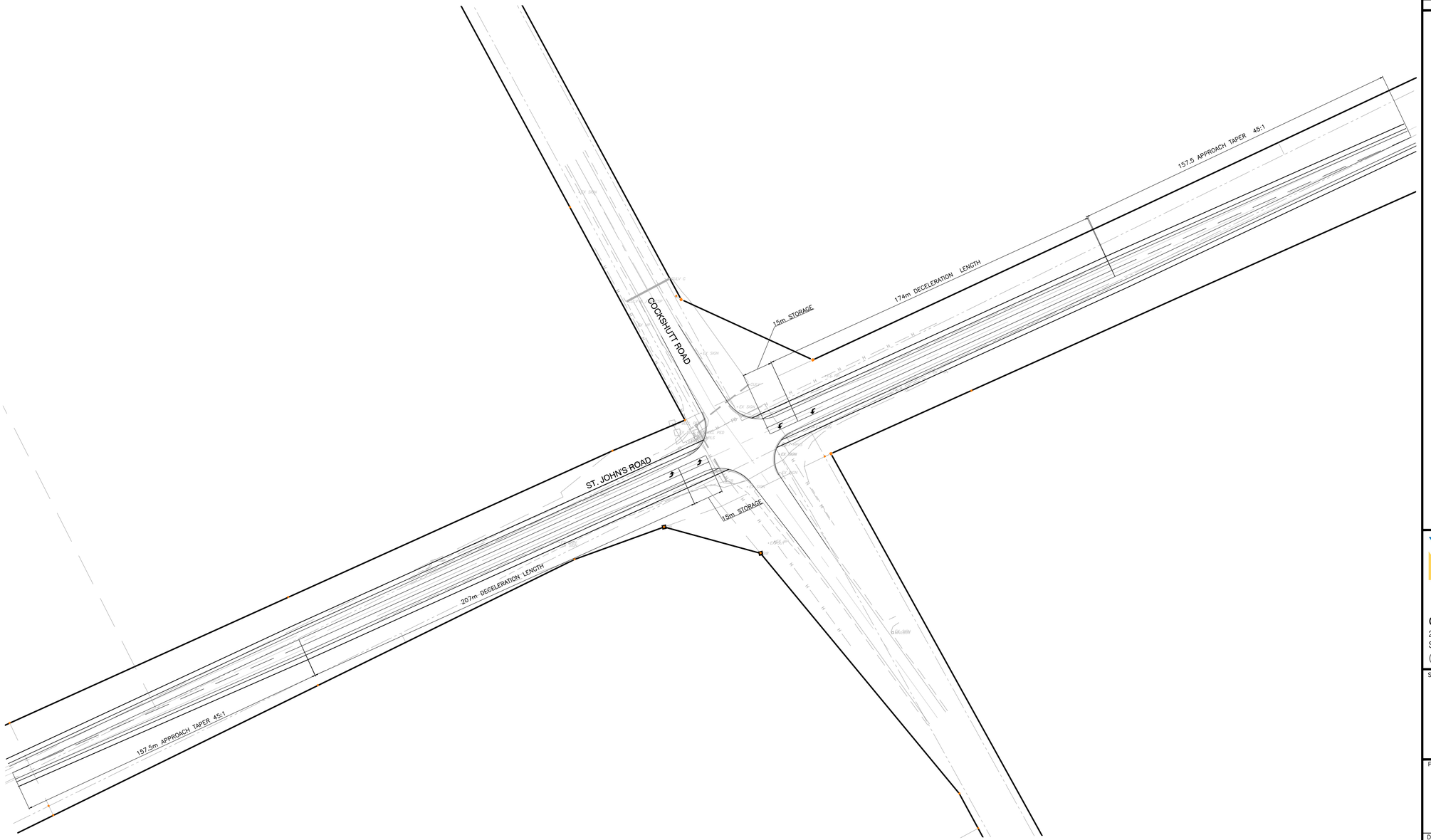

REV. No.	DATE	REVISION
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SCALE: 1:1000

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Project Title
EIS-ENG-25-##
ST. JOHN'S ROAD TRAFFIC CONTROL

NORFOLK COUNTY

Drawing Title
ST. JOHN'S AND COCKSHUTT SIGNALIZED INTERSECTION

Designed by :	Drawn By :
NLO/TGS	NLO/RCS
Checked by :	Date Started :
NLO/TGS	4/5/23
Drawing Scale :	Drawing No.
1 : 1000	04
Project No.	
24-003	

DATE LAST PLOTTED : November 13, 2024

Appendix F

Signal Warrants

Signal Justification Calculation
(OTM Book 12 - Justifications 1, 2, 3)

Horizon Year: 2033 Forecast Traffic
Region/City/Township: Norfolk County

Major Street: St. John's Road
Minor Street: Blue Line Road
North/South?: N

Number of Approach Lanes: 1
Tee Intersection? N
Flow Conditions: Free

PM Forecast Only? N

	Major Street						Minor Street						
	St. John's Road						Blue Line Road						
	Eastbound			Westbound			Northbound			Southbound			Peds
Hour	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	Crossing
7:00 - 8:00	17	164	0	4	105	44	5	134	1	49	66	18	0
8:00 - 9:00	27	105	13	1	111	43	6	178	5	41	131	19	0
11:00 - 12:00	18	147	21	18	244	54	17	200	5	44	221	17	0
12:00 - 13:00	31	146	18	8	190	53	16	206	4	31	217	25	0
13:00 - 14:00	10	147	27	10	195	45	22	215	6	59	230	32	0
15:00 - 16:00	17	163	12	6	229	57	12	199	3	57	249	25	0
16:00 - 17:00	23	207	6	14	243	81	5	209	10	54	226	43	0
17:00 - 18:00	27	204	9	5	230	76	6	202	8	52	233	27	0

	1A		1B		2A		2B	
Hour	All Approach Lanes		Minor Street Both		Major Street Both		Traffic Crossing Major Street	
Threshold	480		120		480		50	
1	607	100%	273	100%	334	70%	188	100%
2	680	100%	380	100%	300	63%	225	100%
3	1006	100%	504	100%	502	100%	282	100%
4	945	100%	499	100%	446	93%	264	100%
5	998	100%	564	100%	434	90%	311	100%
6	1029	100%	545	100%	484	100%	318	100%
7	1121	100%	547	100%	574	100%	285	100%
8	1079	100%	528	100%	551	100%	291	100%
8 Hours 100% Fulfilled?		Yes		Yes		No		Yes
8 Hours 80% Fulfilled?		Yes		Yes		No		Yes

Justification Results	
stification 1 (Minimum Vehicle Volume)	Yes
Justification 2 (Delay To Cross Traffic	No
fication 3 (Volume/Delay Combination)	Yes

Is A Signal Justfied? Yes

Signal Justification Calculation
(OTM Book 12 - Justifications 1, 2, 3)

Horizon Year: 2033 Forecast Traffic
Region/City/Township: Norfolk County

Major Street: St. John's Road
Minor Street: Cockshutt Road
North/South?: N

Number of Approach Lanes: 1
Tee Intersection? N
Flow Conditions: Free

PM Forecast Only? N

	Major Street						Minor Street						
	St. John's Road						Cockshutt Road						
	Eastbound			Westbound			Northbound			Southbound			Peds
Hour	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	Crossing
7:00 - 8:00	43	207	10	4	116	16	14	56	10	27	37	18	0
8:00 - 9:00	31	127	8	5	110	17	22	81	4	22	66	23	0
11:00 - 12:00	34	146	21	5	231	22	18	75	9	25	103	40	0
12:00 - 13:00	31	137	19	8	195	34	19	96	10	27	142	34	0
13:00 - 14:00	30	156	30	5	186	23	26	87	12	19	116	31	0
15:00 - 16:00	30	138	36	6	242	39	21	79	12	25	118	47	0
16:00 - 17:00	52	211	23	12	292	32	23	96	13	40	127	58	0
17:00 - 18:00	49	191	30	5	253	9	19	102	10	26	109	57	0

	1A		1B		2A		2B	
Hour	All Approach Lanes		Minor Street Both		Major Street Both		Traffic Crossing Major Street	
Threshold	480		120		480		50	
1	558	100%	162	100%	396	83%	97	100%
2	516	100%	218	100%	298	62%	125	100%
3	729	100%	270	100%	459	96%	146	100%
4	752	100%	328	100%	424	88%	188	100%
5	721	100%	291	100%	430	90%	161	100%
6	793	100%	302	100%	491	100%	164	100%
7	979	100%	357	100%	622	100%	190	100%
8	860	100%	323	100%	537	100%	154	100%
ı Hours 100% Fulfilled?		Yes		Yes		No		Yes
8 Hours 80% Fulfilled?		Yes		Yes		No		Yes

Justification Results	
ıtification 1 (Minimum Vehicle Volume)	Yes
Justification 2 (Delay To Cross Traffic	No
fication 3 (Volume/Delay Combination)	Yes

Is A Signal Justfied? Yes

Appendix G

Future Traffic Operations Reports

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	43	207	10	4	116	16	14	56	10	27	37	18
Future Volume (vph)	43	207	10	4	116	16	14	56	10	27	37	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	15.0		0.0	15.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.993			0.982			0.983			0.970	
Flt Protected	0.950			0.950				0.991			0.984	
Satd. Flow (prot)	1805	1738	0	1081	1586	0	0	1851	0	0	1657	0
Flt Permitted	0.666			0.612				0.919			0.858	
Satd. Flow (perm)	1265	1738	0	696	1586	0	0	1716	0	0	1445	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			17			11			20	
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		563.0			633.9			316.4			311.0	
Travel Time (s)		25.3			28.5			14.2			14.0	
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
Heavy Vehicles (%)	0%	9%	0%	67%	20%	0%	0%	0%	0%	29%	0%	0%
Adj. Flow (vph)	47	225	11	4	126	17	15	61	11	29	40	20
Shared Lane Traffic (%)												
Lane Group Flow (vph)	47	236	0	4	143	0	0	87	0	0	89	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	20.0	20.0		20.0	20.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	26.3	26.3		26.3	26.3		15.7	15.7		15.7	15.7	
Total Split (s)	38.0	38.0		38.0	38.0		22.0	22.0		22.0	22.0	
Total Split (%)	63.3%	63.3%		63.3%	63.3%		36.7%	36.7%		36.7%	36.7%	
Maximum Green (s)	31.7	31.7		31.7	31.7		16.3	16.3		16.3	16.3	
Yellow Time (s)	4.6	4.6		4.6	4.6		4.6	4.6		4.6	4.6	
All-Red Time (s)	1.7	1.7		1.7	1.7		1.1	1.1		1.1	1.1	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	6.3	6.3		6.3	6.3			5.7			5.7	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Act Effct Green (s)	27.2	27.2		27.2	27.2			10.2			10.2	
Actuated g/C Ratio	0.69	0.69		0.69	0.69			0.26			0.26	
v/c Ratio	0.05	0.20		0.01	0.13			0.19			0.23	
Control Delay	6.0	6.1		6.0	5.7			12.6			12.3	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	6.0	6.1		6.0	5.7			12.6			12.3	
LOS	A	A		A	A			B			B	
Approach Delay		6.1			5.7			12.6			12.3	
Approach LOS		A			A			B			B	

Intersection Summary			
Area Type:	Other		
Cycle Length: 60			
Actuated Cycle Length: 39.6			
Natural Cycle: 45			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.23			
Intersection Signal Delay: 7.8		Intersection LOS: A	
Intersection Capacity Utilization 54.1%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 1: Cockshutt Road & St. John's Road

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	47	236	4	143	87	89
v/c Ratio	0.05	0.20	0.01	0.13	0.19	0.23
Control Delay	6.0	6.1	6.0	5.7	12.6	12.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.0	6.1	6.0	5.7	12.6	12.3
Queue Length 50th (m)	1.8	9.4	0.2	4.9	4.6	4.2
Queue Length 95th (m)	5.4	19.5	1.2	11.9	12.7	12.7
Internal Link Dist (m)		539.0		609.9	292.4	287.0
Turn Bay Length (m)	15.0		15.0			
Base Capacity (vph)	1078	1483	593	1355	724	616
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	0.04	0.16	0.01	0.11	0.12	0.14

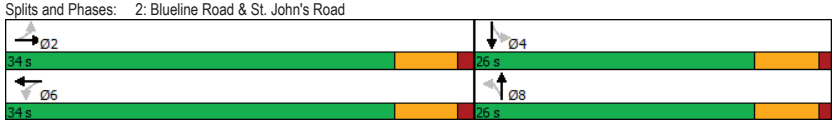
Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	27	105	13	1	111	43	6	178	5	41	131	19
Future Volume (vph)	27	105	13	1	111	43	6	178	5	41	131	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	15.0		0.0	15.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.984			0.958			0.997			0.986	
Flt Protected	0.950			0.950				0.998			0.989	
Satd. Flow (prot)	1641	1837	0	1805	1536	0	0	1860	0	0	1791	0
Flt Permitted	0.651			0.675				0.982			0.900	
Satd. Flow (perm)	1124	1837	0	1282	1536	0	0	1830	0	0	1630	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		14			44			2			10	
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		352.7			306.6			208.0			214.3	
Travel Time (s)		15.9			13.8			9.4			9.6	
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
Heavy Vehicles (%)	10%	2%	0%	0%	21%	12%	20%	1%	0%	16%	0%	0%
Adj. Flow (vph)	29	114	14	1	121	47	7	193	5	45	142	21
Shared Lane Traffic (%)												
Lane Group Flow (vph)	29	128	0	1	168	0	0	205	0	0	208	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	20.0	20.0		20.0	20.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	25.8	25.8		25.8	25.8		15.6	15.6		15.6	15.6	
Total Split (s)	34.0	34.0		34.0	34.0		26.0	26.0		26.0	26.0	
Total Split (%)	56.7%	56.7%		56.7%	56.7%		43.3%	43.3%		43.3%	43.3%	
Maximum Green (s)	28.2	28.2		28.2	28.2		20.4	20.4		20.4	20.4	
Yellow Time (s)	4.6	4.6		4.6	4.6		4.6	4.6		4.6	4.6	
All-Red Time (s)	1.2	1.2		1.2	1.2		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	5.8	5.8		5.8	5.8			5.6			5.6	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Act Effct Green (s)	22.7	22.7		22.7	22.7			11.6			11.6	
Actuated g/C Ratio	0.57	0.57		0.57	0.57			0.29			0.29	
v/c Ratio	0.05	0.12		0.00	0.19			0.38			0.43	
Control Delay	7.2	6.8		7.0	6.3			15.0			15.5	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	7.2	6.8		7.0	6.3			15.0			15.5	
LOS	A	A		A	A			B			B	
Approach Delay		6.9			6.3			15.0			15.5	
Approach LOS		A			A			B			B	

Intersection Summary			
Area Type:	Other		
Cycle Length: 60			
Actuated Cycle Length: 39.6			
Natural Cycle: 45			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.43			
Intersection Signal Delay: 11.4		Intersection LOS: B	
Intersection Capacity Utilization 56.9%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 2: Blueline Road & St. John's Road



Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	29	128	1	168	205	208
v/c Ratio	0.05	0.12	0.00	0.19	0.38	0.43
Control Delay	7.2	6.8	7.0	6.3	15.0	15.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.2	6.8	7.0	6.3	15.0	15.5
Queue Length 50th (m)	1.0	4.2	0.0	4.7	12.9	12.8
Queue Length 95th (m)	4.7	12.8	0.6	15.0	26.3	26.7
Internal Link Dist (m)		328.7		282.6	184.0	190.3
Turn Bay Length (m)	15.0		15.0			
Base Capacity (vph)	814	1335	929	1125	985	881
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	0.04	0.10	0.00	0.15	0.21	0.24

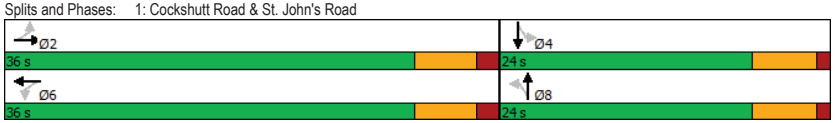
Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	47	228	26	13	283	30	22	110	13	41	137	53
Future Volume (vph)	47	228	26	13	283	30	22	110	13	41	137	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	15.0		0.0	15.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.985			0.985			0.988			0.969	
Flt Protected	0.950			0.950				0.992			0.991	
Satd. Flow (prot)	1703	1746	0	1805	1760	0	0	1830	0	0	1814	0
Flt Permitted	0.556			0.590				0.921			0.907	
Satd. Flow (perm)	997	1746	0	1121	1760	0	0	1699	0	0	1660	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		13			13			8			26	
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		563.0			633.9			316.4			311.0	
Travel Time (s)		25.3			28.5			14.2			14.0	
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
Heavy Vehicles (%)	6%	8%	0%	0%	7%	0%	0%	0%	20%	0%	1%	0%
Adj. Flow (vph)	51	248	28	14	308	33	24	120	14	45	149	58
Shared Lane Traffic (%)												
Lane Group Flow (vph)	51	276	0	14	341	0	0	158	0	0	252	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	20.0	20.0		20.0	20.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	26.3	26.3		26.3	26.3		15.7	15.7		15.7	15.7	
Total Split (s)	36.0	36.0		36.0	36.0		24.0	24.0		24.0	24.0	
Total Split (%)	60.0%	60.0%		60.0%	60.0%		40.0%	40.0%		40.0%	40.0%	
Maximum Green (s)	29.7	29.7		29.7	29.7		18.3	18.3		18.3	18.3	
Yellow Time (s)	4.6	4.6		4.6	4.6		4.6	4.6		4.6	4.6	
All-Red Time (s)	1.7	1.7		1.7	1.7		1.1	1.1		1.1	1.1	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	6.3	6.3		6.3	6.3			5.7			5.7	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Act Effct Green (s)	20.0	20.0		20.0	20.0			11.8			11.8	
Actuated g/C Ratio	0.46	0.46		0.46	0.46			0.27			0.27	
v/c Ratio	0.11	0.34		0.03	0.42			0.34			0.54	
Control Delay	8.6	9.4		7.8	10.3			14.3			16.9	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	8.6	9.4		7.8	10.3			14.3			16.9	
LOS	A	A		A	B			B			B	
Approach Delay		9.3			10.2			14.3			16.9	
Approach LOS		A			B			B			B	

Intersection Summary			
Area Type:	Other		
Cycle Length: 60			
Actuated Cycle Length: 43.9			
Natural Cycle: 45			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.54			
Intersection Signal Delay: 12.1		Intersection LOS: B	
Intersection Capacity Utilization 66.5%		ICU Level of Service C	
Analysis Period (min) 15			

Splits and Phases: 1: Cockshutt Road & St. John's Road



Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	51	276	14	341	158	252
v/c Ratio	0.11	0.34	0.03	0.42	0.34	0.54
Control Delay	8.6	9.4	7.8	10.3	14.3	16.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.6	9.4	7.8	10.3	14.3	16.9
Queue Length 50th (m)	2.0	11.6	0.5	15.1	9.5	15.1
Queue Length 95th (m)	7.8	29.6	3.1	37.1	20.6	31.1
Internal Link Dist (m)		539.0		609.9	292.4	287.0
Turn Bay Length (m)	15.0		15.0			
Base Capacity (vph)	676	1187	760	1197	714	708
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	0.08	0.23	0.02	0.28	0.22	0.36

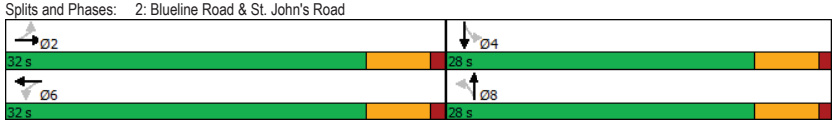
Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	23	191	12	12	293	75	10	208	6	54	260	35
Future Volume (vph)	23	191	12	12	293	75	10	208	6	54	260	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	15.0		0.0	15.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.991			0.969			0.996			0.986	
Flt Protected	0.950			0.950				0.998			0.992	
Satd. Flow (prot)	1626	1756	0	1805	1747	0	0	1878	0	0	1810	0
Flt Permitted	0.479			0.620				0.974			0.914	
Satd. Flow (perm)	820	1756	0	1178	1747	0	0	1832	0	0	1668	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		7			27			3			11	
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		352.7			306.6			208.0			214.3	
Travel Time (s)		15.9			13.8			9.4			9.6	
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
Heavy Vehicles (%)	11%	7%	11%	0%	6%	3%	13%	0%	0%	5%	0%	19%
Adj. Flow (vph)	25	208	13	13	318	82	11	226	7	59	283	38
Shared Lane Traffic (%)												
Lane Group Flow (vph)	25	221	0	13	400	0	0	244	0	0	380	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	20.0	20.0		20.0	20.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	25.8	25.8		25.8	25.8		15.6	15.6		15.6	15.6	
Total Split (s)	32.0	32.0		32.0	32.0		28.0	28.0		28.0	28.0	
Total Split (%)	53.3%	53.3%		53.3%	53.3%		46.7%	46.7%		46.7%	46.7%	
Maximum Green (s)	26.2	26.2		26.2	26.2		22.4	22.4		22.4	22.4	
Yellow Time (s)	4.6	4.6		4.6	4.6		4.6	4.6		4.6	4.6	
All-Red Time (s)	1.2	1.2		1.2	1.2		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	5.8	5.8		5.8	5.8			5.6			5.6	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Act Effct Green (s)	20.8	20.8		20.8	20.8			15.4			15.4	
Actuated g/C Ratio	0.44	0.44		0.44	0.44			0.32			0.32	
v/c Ratio	0.07	0.29		0.03	0.52			0.41			0.70	
Control Delay	10.3	10.8		9.7	13.0			14.6			21.2	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	10.3	10.8		9.7	13.0			14.6			21.2	
LOS	B	B		A	B			B			C	
Approach Delay		10.8			12.9			14.6			21.2	
Approach LOS		B			B			B			C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 60			
Actuated Cycle Length: 47.8			
Natural Cycle: 50			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.70			
Intersection Signal Delay: 15.3		Intersection LOS: B	
Intersection Capacity Utilization 64.8%		ICU Level of Service C	
Analysis Period (min) 15			

Splits and Phases: 2: Blueline Road & St. John's Road



Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	25	221	13	400	244	380
v/c Ratio	0.07	0.29	0.03	0.52	0.41	0.70
Control Delay	10.3	10.8	9.7	13.0	14.6	21.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.3	10.8	9.7	13.0	14.6	21.2
Queue Length 50th (m)	1.2	11.2	0.6	21.8	15.7	26.8
Queue Length 95th (m)	5.6	28.7	3.5	52.7	32.9	54.5
Internal Link Dist (m)		328.7		282.6	184.0	190.3
Turn Bay Length (m)	15.0		15.0			
Base Capacity (vph)	455	977	653	981	871	797
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	0.05	0.23	0.02	0.41	0.28	0.48

Intersection Summary

Junctions 8

ARCADY 8 - Roundabout Module

Filename: St Johns Rd & Cockshutt.arc8
Path: C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Project\Personal Project Files\240475-Arcady
Report generation date: 2024-10-21 1:38:19 PM

Summary of intersection performance

	AM						
	Queue (PCE)	95% Queue (PCE)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	A1 - 2033						
Leg North	0.08	~1	3.29	0.07	A	3.61	A
Leg West	0.30	~1	3.75	0.22	A		
Leg South	0.08	~1	3.29	0.07	A		
Leg East	0.16	~1	3.75	0.12	A		

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

"D1 - 2033, AM " model duration: 7:00 AM - 8:30 AM
"D2 - 2033, PM" model duration: 4:15 PM - 5:45 PM

Run using Junctions 8.0.6.541 at 2024-10-21 1:38:19 PM

File summary

Title	(untitled)
Location	
Site Number	
Date	2024-10-21
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	AdamMorrison
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	V/C Ratio Threshold	Average Delay Threshold (s)	Queue Threshold (PCE)
7.50	✓		N/A	0.85	36.00	20.00

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	PCE	PCE	perHour	s	-Min	perMin

(Default Analysis Set) - 2033, AM

Data Errors and Warnings

No errors or warnings

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set (s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
(Default Analysis Set)	ARCADY		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
2033, AM	2033	AM		ONE HOUR	07:00	08:30	90	15				✓		

Intersection Network

Intersections

Intersection	Name	Intersection Type	Leg Order	Grade Separated	Large Roundabout	Do Geometric Delay	Intersection Delay (s)	Intersection LOS
1	(untitled)	Roundabout	North,West,South,East				3.61	A

Intersection Network Options

Driving Side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Leg	Name	Description
North	North	Cockshutt Road	
West	West	St. John's Road	
South	South	Cockshutt Road	
East	East	St. John's Road	

Capacity Options

Leg	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)	Assume Flat Start Profile	Initial Queue (PCE)
North	0.00	99999.00		0.00
West	0.00	99999.00		0.00
South	0.00	99999.00		0.00
East	0.00	99999.00		0.00

Roundabout Geometry

Leg	V - Approach road half-width (m)	E - Entry width (m)	I' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
North	3.50	4.50	30.00	20.00	40.00	25.00	
West	3.50	4.50	30.00	20.00	40.00	25.00	
South	3.50	4.50	30.00	20.00	40.00	25.00	
East	3.50	4.50	30.00	20.00	40.00	25.00	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Leg	Enter slope and intercept directly	Entered slope	Entered intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)
North		(calculated)	(calculated)	0.579	1357.445
West		(calculated)	(calculated)	0.579	1357.445
South		(calculated)	(calculated)	0.579	1357.445
East		(calculated)	(calculated)	0.579	1357.445

The slope and intercept shown above include any corrections and adjustments.

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCE Factor for a Truck (PCE)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	Truck Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Leg	Profile Type	Use Turning Counts	Average Demand Flow (PCE/hr)	Flow Scaling Factor (%)
North	ONE HOUR	✓	82.00	100.000
West	ONE HOUR	✓	260.00	100.000
South	ONE HOUR	✓	80.00	100.000
East	ONE HOUR	✓	136.00	100.000

Turning Proportions

Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.000	18.000	37.000	27.000
	West	43.000	0.000	10.000	207.000
	South	56.000	14.000	0.000	10.000
	East	16.000	116.000	4.000	0.000

Turning Proportions (PCE) - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.00	0.22	0.45	0.33
	West	0.17	0.00	0.04	0.80
	South	0.70	0.18	0.00	0.13
	East	0.12	0.85	0.03	0.00

Vehicle Mix

Average PCE Per Vehicle - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	1.000	1.000	1.000	1.290
	West	1.000	1.000	1.000	1.090
	South	1.000	1.000	1.000	1.000
	East	1.000	1.200	1.670	1.000

Truck Percentages - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.0	0.0	0.0	29.0
	West	0.0	0.0	0.0	9.0
	South	0.0	0.0	0.0	0.0
	East	0.0	20.0	67.0	0.0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max Queue (PCE)	Max 95th percentile Queue (PCE)	Max LOS	Average Demand (PCE/hr)	Total Intersection Arrivals (PCE)	Total Queueing Delay (PCE-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (PCE-min/min)	Inclusive Total Queueing Delay (PCE-min)	Inclusive Average Queueing Delay (s)
North	0.07	3.29	0.08	~1	A	75.24	112.87	6.03	3.21	0.07	6.03	3.21
West	0.22	3.75	0.30	~1	A	238.58	357.87	21.27	3.57	0.24	21.28	3.57
South	0.07	3.29	0.08	~1	A	73.41	110.11	5.82	3.17	0.06	5.82	3.17
East	0.12	3.75	0.16	~1	A	124.80	187.19	11.31	3.63	0.13	11.32	3.63

Main Results for each time segment

Main results: (07:00-07:15)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	61.73	15.43	61.52	86.27	100.49	0.00	1299.28	815.72	0.048	0.00	0.05	3.140	A
West	195.74	48.94	195.00	111.00	51.01	0.00	1327.92	973.15	0.147	0.00	0.18	3.399	A
South	60.23	15.06	60.02	38.26	207.76	0.00	1237.20	660.44	0.049	0.00	0.05	3.058	A
East	102.39	25.60	101.99	183.01	84.77	0.00	1308.38	929.84	0.078	0.00	0.10	3.527	A

Main results: (07:15-07:30)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	73.72	18.43	73.67	103.31	120.38	0.00	1287.78	815.72	0.057	0.05	0.07	3.201	A
West	233.73	58.43	233.56	132.95	61.09	0.00	1322.09	973.15	0.177	0.18	0.23	3.539	A
South	71.92	17.98	71.87	45.82	248.83	0.00	1213.43	660.44	0.059	0.05	0.06	3.152	A
East	122.26	30.57	122.17	219.19	101.51	0.00	1298.69	929.84	0.094	0.10	0.12	3.616	A

Main results: (07:30-07:45)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	90.28	22.57	90.22	126.51	147.41	0.00	1272.13	815.72	0.071	0.07	0.08	3.288	A
West	286.27	71.57	285.99	162.81	74.81	0.00	1314.15	973.15	0.218	0.23	0.30	3.747	A
South	88.08	22.02	88.01	56.11	304.70	0.00	1181.10	660.44	0.075	0.06	0.08	3.292	A
East	149.74	37.43	149.61	268.40	124.31	0.00	1285.50	929.84	0.116	0.12	0.16	3.745	A

Main results: (07:45-08:00)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	90.28	22.57	90.28	126.62	147.54	0.00	1272.06	815.72	0.071	0.08	0.08	3.289	A
West	286.27	71.57	286.26	162.95	74.87	0.00	1314.11	973.15	0.218	0.30	0.30	3.747	A
South	88.08	22.02	88.08	56.15	304.98	0.00	1180.94	660.44	0.075	0.08	0.08	3.293	A
East	149.74	37.43	149.74	268.65	124.41	0.00	1285.44	929.84	0.116	0.16	0.16	3.745	A

Main results: (08:00-08:15)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	73.72	18.43	73.78	103.49	120.59	0.00	1287.65	815.72	0.057	0.08	0.07	3.204	A
West	233.73	58.43	234.00	133.18	61.19	0.00	1322.03	973.15	0.177	0.30	0.23	3.541	A
South	71.92	17.98	71.99	45.89	249.29	0.00	1213.16	660.44	0.059	0.08	0.06	3.156	A
East	122.26	30.57	122.39	219.59	101.69	0.00	1298.59	929.84	0.094	0.16	0.12	3.617	A

Main results: (08:15-08:30)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	61.73	15.43	61.78	86.65	100.97	0.00	1299.01	815.72	0.048	0.07	0.05	3.144	A
West	195.74	48.94	195.92	111.52	51.23	0.00	1327.79	973.15	0.147	0.23	0.19	3.406	A
South	60.23	15.06	60.28	38.43	208.73	0.00	1236.64	660.44	0.049	0.06	0.05	3.059	A
East	102.39	25.60	102.48	183.86	85.14	0.00	1308.17	929.84	0.078	0.12	0.10	3.528	A

Queueing Delay Results for each time segment

Queueing Delay results: (07:00-07:15)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	0.79	0.05	3.140	A	A
West	2.71	0.18	3.399	A	A
South	0.75	0.05	3.058	A	A
East	1.47	0.10	3.527	A	A

Queueing Delay results: (07:15-07:30)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	0.97	0.06	3.201	A	A
West	3.39	0.23	3.539	A	A
South	0.93	0.06	3.152	A	A
East	1.81	0.12	3.616	A	A

Queueing Delay results: (07:30-07:45)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	1.22	0.08	3.288	A	A
West	4.38	0.29	3.747	A	A
South	1.19	0.08	3.292	A	A
East	2.30	0.15	3.745	A	A

Queueing Delay results: (07:45-08:00)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	1.23	0.08	3.289	A	A
West	4.46	0.30	3.747	A	A
South	1.21	0.08	3.293	A	A
East	2.33	0.16	3.745	A	A

Queueing Delay results: (08:00-08:15)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	1.00	0.07	3.204	A	A
West	3.52	0.23	3.541	A	A
South	0.96	0.06	3.156	A	A
East	1.88	0.13	3.617	A	A

Queueing Delay results: (08:15-08:30)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	0.82	0.05	3.144	A	A
West	2.83	0.19	3.406	A	A
South	0.78	0.05	3.059	A	A
East	1.53	0.10	3.528	A	A

Queue Variation Results for each time segment

Queue Variation results: (07:00-07:15)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.05	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.18	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.05	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.10	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (07:15-07:30)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.07	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.23	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.06	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.12	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (07:30-07:45)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.08	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.30	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.08	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.16	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (07:45-08:00)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.08	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.30	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.08	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.16	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (08:00-08:15)

	Mean	Q05	Q50	Q90	Q95		Marker	Probability Of Reaching	Probability Of Exactly

Leg	(PCE)	(PCE)	(PCE)	(PCE)	(PCE)	Percentile Message	Message	Or Exceeding Marker	Reaching Marker
North	0.07	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.23	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.06	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.12	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (08:15-08:30)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.05	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.19	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.05	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.10	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Junctions 8

ARCADY 8 - Roundabout Module

Filename: St Johns Rd & Cockshutt.arc8
Path: C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Project\Personal Project Files\240475-Arcady
Report generation date: 2024-10-21 1:38:48 PM

Summary of intersection performance

	PM						
	Queue (PCE)	95% Queue (PCE)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	A1 - 2033						
Leg North	0.28	~1	4.02	0.22	A	4.14	A
Leg West	0.39	~1	4.26	0.27	A		
Leg South	0.16	~1	3.67	0.14	A		
Leg East	0.43	~1	4.31	0.29	A		

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

"D1 - 2033, AM" model duration: 7:00 AM - 8:30 AM
"D2 - 2033, PM " model duration: 4:15 PM - 5:45 PM

Run using Junctions 8.0.6.541 at 2024-10-21 1:38:48 PM

File summary

Title	(untitled)
Location	
Site Number	
Date	2024-10-21
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	AdamMorrison
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	V/C Ratio Threshold	Average Delay Threshold (s)	Queue Threshold (PCE)
7.50	✓		N/A	0.85	36.00	20.00

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	PCE	PCE	perHour	s	-Min	perMin

(Default Analysis Set) - 2033, PM

Data Errors and Warnings

No errors or warnings

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set (s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
(Default Analysis Set)	ARCADY		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
2033, PM	2033	PM		ONE HOUR	16:15	17:45	90	15				✓		

Intersection Network

Intersections

Intersection	Name	Intersection Type	Leg Order	Grade Separated	Large Roundabout	Do Geometric Delay	Intersection Delay (s)	Intersection LOS
1	(untitled)	Roundabout	North,West,South,East				4.14	A

Intersection Network Options

Driving Side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Leg	Name	Description
North	North	Cockshutt Road	
West	West	St. John's Road	
South	South	Cockshutt Road	
East	East	St. John's Road	

Capacity Options

Leg	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)	Assume Flat Start Profile	Initial Queue (PCE)
North	0.00	99999.00		0.00
West	0.00	99999.00		0.00
South	0.00	99999.00		0.00
East	0.00	99999.00		0.00

Roundabout Geometry

Leg	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
North	3.50	4.50	30.00	20.00	40.00	25.00	
West	3.50	4.50	30.00	20.00	40.00	25.00	
South	3.50	4.50	30.00	20.00	40.00	25.00	
East	3.50	4.50	30.00	20.00	40.00	25.00	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Leg	Enter slope and intercept directly	Entered slope	Entered intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)
North		(calculated)	(calculated)	0.579	1357.445
West		(calculated)	(calculated)	0.579	1357.445
South		(calculated)	(calculated)	0.579	1357.445
East		(calculated)	(calculated)	0.579	1357.445

The slope and intercept shown above include any corrections and adjustments.

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCE Factor for a Truck (PCE)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	Truck Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Leg	Profile Type	Use Turning Counts	Average Demand Flow (PCE/hr)	Flow Scaling Factor (%)
North	ONE HOUR	✓	231.00	100.000
West	ONE HOUR	✓	301.00	100.000
South	ONE HOUR	✓	145.00	100.000
East	ONE HOUR	✓	326.00	100.000

Turning Proportions

Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.000	53.000	137.000	41.000
	West	47.000	0.000	26.000	228.000
	South	110.000	22.000	0.000	13.000
	East	30.000	283.000	13.000	0.000

Turning Proportions (PCE) - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.00	0.23	0.59	0.18
	West	0.16	0.00	0.09	0.76
	South	0.76	0.15	0.00	0.09
	East	0.09	0.87	0.04	0.00

Vehicle Mix

Average PCE Per Vehicle - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	1.000	1.000	1.010	1.000
	West	1.060	1.000	1.000	1.080
	South	1.000	1.000	1.000	1.200
	East	1.000	1.070	1.000	1.000

Truck Percentages - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.0	0.0	1.0	0.0
	West	6.0	0.0	0.0	8.0
	South	0.0	0.0	0.0	20.0
	East	0.0	7.0	0.0	0.0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max Queue (PCE)	Max 95th percentile Queue (PCE)	Max LOS	Average Demand (PCE/hr)	Total Intersection Arrivals (PCE)	Total Queueing Delay (PCE-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (PCE-min/min)	Inclusive Total Queueing Delay (PCE-min)	Inclusive Average Queueing Delay (s)
North	0.22	4.02	0.28	~1	A	211.97	317.95	19.79	3.74	0.22	19.79	3.74
West	0.27	4.26	0.39	~1	A	276.20	414.30	27.31	3.96	0.30	27.31	3.96
South	0.14	3.67	0.16	~1	A	133.05	199.58	11.55	3.47	0.13	11.55	3.47
East	0.29	4.31	0.43	~1	A	299.14	448.71	29.85	3.99	0.33	29.85	3.99

Main Results for each time segment

Main results: (16:15-16:30)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	173.91	43.48	173.24	140.25	238.44	0.00	1219.45	833.89	0.143	0.00	0.17	3.459	A
West	226.61	56.65	225.69	268.44	143.24	0.00	1274.54	965.50	0.178	0.00	0.23	3.667	A
South	109.16	27.29	108.77	131.99	236.94	0.00	1220.31	761.26	0.089	0.00	0.10	3.288	A
East	245.43	61.36	244.43	211.45	134.26	0.00	1279.74	869.11	0.192	0.00	0.25	3.683	A

Main results: (16:30-16:45)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	207.66	51.92	207.49	167.97	285.61	0.00	1192.14	833.89	0.174	0.17	0.21	3.677	A
West	270.59	67.65	270.35	321.54	171.56	0.00	1258.15	965.50	0.215	0.23	0.29	3.896	A
South	130.35	32.59	130.25	158.08	283.82	0.00	1193.18	761.26	0.109	0.10	0.12	3.437	A
East	293.07	73.27	292.80	253.29	160.79	0.00	1264.39	869.11	0.232	0.25	0.32	3.927	A

Main results: (16:45-17:00)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	254.34	63.58	254.05	205.67	349.70	0.00	1155.05	833.92	0.220	0.21	0.28	4.018	A
West	331.41	82.85	331.02	393.70	210.06	0.00	1235.87	965.49	0.268	0.29	0.39	4.253	A
South	159.65	39.91	159.50	193.56	347.51	0.00	1156.32	761.27	0.138	0.12	0.16	3.665	A
East	358.93	89.73	358.50	310.13	196.88	0.00	1243.50	869.10	0.289	0.32	0.43	4.311	A

Main results: (17:00-17:15)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	254.34	63.58	254.33	205.89	350.12	0.00	1154.81	833.92	0.220	0.28	0.28	4.021	A
West	331.41	82.85	331.40	394.16	210.29	0.00	1235.74	965.49	0.268	0.39	0.39	4.257	A
South	159.65	39.91	159.65	193.78	347.92	0.00	1156.08	761.27	0.138	0.16	0.16	3.666	A
East	358.93	89.73	358.93	310.48	197.08	0.00	1243.38	869.10	0.289	0.43	0.43	4.315	A

Main results: (17:15-17:30)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	207.66	51.92	207.94	168.32	286.29	0.00	1191.75	833.89	0.174	0.28	0.21	3.680	A
West	270.59	67.65	270.98	322.29	171.94	0.00	1257.93	965.50	0.215	0.39	0.29	3.903	A
South	130.35	32.59	130.50	158.44	284.48	0.00	1192.80	761.26	0.109	0.16	0.13	3.442	A
East	293.07	73.27	293.50	253.87	161.11	0.00	1264.20	869.11	0.232	0.43	0.32	3.933	A

Main results: (17:30-17:45)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	173.91	43.48	174.09	140.92	239.67	0.00	1218.73	833.89	0.143	0.21	0.17	3.468	A
West	226.61	56.65	226.86	269.82	143.94	0.00	1274.14	965.50	0.178	0.29	0.23	3.676	A
South	109.16	27.29	109.26	132.64	238.16	0.00	1219.61	761.26	0.090	0.13	0.10	3.290	A
East	245.43	61.36	245.71	212.53	134.89	0.00	1279.38	869.11	0.192	0.32	0.25	3.695	A

Queueing Delay Results for each time segment

Queueing Delay results: (16:15-16:30)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	2.45	0.16	3.459	A	A
West	3.38	0.23	3.667	A	A
South	1.46	0.10	3.288	A	A
East	3.67	0.24	3.683	A	A

Queueing Delay results: (16:30-16:45)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	3.12	0.21	3.677	A	A
West	4.31	0.29	3.896	A	A
South	1.84	0.12	3.437	A	A
East	4.70	0.31	3.927	A	A

Queueing Delay results: (16:45-17:00)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	4.17	0.28	4.018	A	A
West	5.74	0.38	4.253	A	A
South	2.39	0.16	3.665	A	A
East	6.29	0.42	4.311	A	A

Queueing Delay results: (17:00-17:15)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	4.24	0.28	4.021	A	A
West	5.85	0.39	4.257	A	A
South	2.43	0.16	3.666	A	A
East	6.42	0.43	4.315	A	A

Queueing Delay results: (17:15-17:30)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	3.25	0.22	3.680	A	A
West	4.50	0.30	3.903	A	A
South	1.90	0.13	3.442	A	A
East	4.91	0.33	3.933	A	A

Queueing Delay results: (17:30-17:45)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service

North	2.56	0.17	3.468	A	A
West	3.54	0.24	3.676	A	A
South	1.52	0.10	3.290	A	A
East	3.85	0.26	3.695	A	A

Queue Variation Results for each time segment

Queue Variation results: (16:15-16:30)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.17	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.23	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.10	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.25	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (16:30-16:45)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.21	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.29	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.12	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.32	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (16:45-17:00)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.28	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.39	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.16	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.43	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (17:00-17:15)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.28	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.39	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.16	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.43	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (17:15-17:30)

	Mean	Q05	Q50	Q90	Q95		Marker	Probability Of Reaching	Probability Of Exactly

Leg	(PCE)	(PCE)	(PCE)	(PCE)	(PCE)	Percentile Message	Message	Or Exceeding Marker	Reaching Marker
North	0.21	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.29	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.13	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.32	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (17:30-17:45)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.17	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.23	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.10	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.25	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Junctions 8

ARCADY 8 - Roundabout Module

Filename: St Johns Rd & Blueline.arc8
Path: C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Project\Personal Project Files\240475-Arcady
Report generation date: 2024-10-21 1:37:50 PM

Summary of intersection performance

	AM						
	Queue (PCE)	95% Queue (PCE)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	A1 - 2033						
Leg North	0.20	~1	3.46	0.16	A	3.60	A
Leg West	0.15	~1	3.42	0.13	A		
Leg South	0.20	~1	3.51	0.17	A		
Leg East	0.19	~1	4.04	0.14	A		

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

"D1 - 2033, AM " model duration: 8:00 AM - 9:30 AM
"D2 - 2033, PM" model duration: 3:30 PM - 5:00 PM

Run using Junctions 8.0.6.541 at 2024-10-21 1:37:50 PM

File summary

Title	(untitled)
Location	
Site Number	
Date	2024-10-21
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	AdamMorrison
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	V/C Ratio Threshold	Average Delay Threshold (s)	Queue Threshold (PCE)
7.50	✓		N/A	0.85	36.00	20.00

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	PCE	PCE	perHour	s	-Min	perMin

(Default Analysis Set) - 2033, AM

Data Errors and Warnings

No errors or warnings

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set (s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
(Default Analysis Set)	ARCADY		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
2033, AM	2033	AM		ONE HOUR	08:00	09:30	90	15				✓		

Intersection Network

Intersections

Intersection	Name	Intersection Type	Leg Order	Grade Separated	Large Roundabout	Do Geometric Delay	Intersection Delay (s)	Intersection LOS
1	(untitled)	Roundabout	North,West,South,East				3.60	A

Intersection Network Options

Driving Side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Leg	Name	Description
North	North	Blue Line Road	
West	West	St. John's Road	
South	South	Blue Line Road	
East	East	St. John's Road	

Capacity Options

Leg	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)	Assume Flat Start Profile	Initial Queue (PCE)
North	0.00	99999.00		0.00
West	0.00	99999.00		0.00
South	0.00	99999.00		0.00
East	0.00	99999.00		0.00

Roundabout Geometry

Leg	V - Approach road half-width (m)	E - Entry width (m)	I' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
North	3.50	4.50	30.00	20.00	40.00	25.00	
West	3.50	4.50	30.00	20.00	40.00	25.00	
South	3.50	4.50	30.00	20.00	40.00	25.00	
East	3.50	4.50	30.00	20.00	40.00	25.00	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Leg	Enter slope and intercept directly	Entered slope	Entered intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)
North		(calculated)	(calculated)	0.579	1357.445
West		(calculated)	(calculated)	0.579	1357.445
South		(calculated)	(calculated)	0.579	1357.445
East		(calculated)	(calculated)	0.579	1357.445

The slope and intercept shown above include any corrections and adjustments.

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCE Factor for a Truck (PCE)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	Truck Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Leg	Profile Type	Use Turning Counts	Average Demand Flow (PCE/hr)	Flow Scaling Factor (%)
North	ONE HOUR	✓	191.00	100.000
West	ONE HOUR	✓	145.00	100.000
South	ONE HOUR	✓	189.00	100.000
East	ONE HOUR	✓	155.00	100.000

Turning Proportions

Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.000	19.000	131.000	41.000
	West	27.000	0.000	13.000	105.000
	South	178.000	6.000	0.000	5.000
	East	43.000	111.000	1.000	0.000

Turning Proportions (PCE) - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.00	0.10	0.69	0.21
	West	0.19	0.00	0.09	0.72
	South	0.94	0.03	0.00	0.03
	East	0.28	0.72	0.01	0.00

Vehicle Mix

Average PCE Per Vehicle - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	1.000	1.000	1.000	1.160
	West	1.100	1.000	1.000	1.020
	South	1.010	1.200	1.000	1.000
	East	1.120	1.210	1.000	1.000

Truck Percentages - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.0	0.0	0.0	16.0
	West	10.0	0.0	0.0	2.0
	South	1.0	20.0	0.0	0.0
	East	12.0	21.0	0.0	0.0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max Queue (PCE)	Max 95th percentile Queue (PCE)	Max LOS	Average Demand (PCE/hr)	Total Intersection Arrivals (PCE)	Total Queueing Delay (PCE-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (PCE-min/min)	Inclusive Total Queueing Delay (PCE-min)	Inclusive Average Queueing Delay (s)
North	0.16	3.46	0.20	~1	A	175.26	262.90	14.54	3.32	0.16	14.54	3.32
West	0.13	3.42	0.15	~1	A	133.05	199.58	10.93	3.28	0.12	10.93	3.28
South	0.17	3.51	0.20	~1	A	173.43	260.14	14.54	3.35	0.16	14.54	3.35
East	0.14	4.04	0.19	~1	A	142.23	213.35	13.74	3.86	0.15	13.74	3.86

Main Results for each time segment

Main results: (08:00-08:15)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	143.79	35.95	143.29	186.03	88.48	0.00	1306.24	999.87	0.110	0.00	0.13	3.188	A
West	109.16	27.29	108.78	101.98	129.78	0.00	1282.33	833.26	0.085	0.00	0.10	3.166	A
South	142.29	35.57	141.78	108.78	129.79	0.00	1282.33	794.20	0.111	0.00	0.13	3.201	A
East	116.69	29.17	116.21	113.28	158.29	0.00	1265.83	820.15	0.092	0.00	0.12	3.699	A

Main results: (08:15-08:30)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	171.71	42.93	171.59	222.78	105.99	0.00	1296.10	999.87	0.132	0.13	0.16	3.298	A
West	130.35	32.59	130.26	122.16	155.42	0.00	1267.50	833.26	0.103	0.10	0.12	3.266	A
South	169.91	42.48	169.79	130.26	155.42	0.00	1267.50	794.20	0.134	0.13	0.16	3.327	A
East	139.34	34.84	139.23	135.65	189.55	0.00	1247.74	820.15	0.112	0.12	0.15	3.838	A

Main results: (08:30-08:45)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	210.29	52.57	210.12	272.81	129.79	0.00	1282.33	999.87	0.164	0.16	0.20	3.459	A
West	159.65	39.91	159.52	149.59	190.32	0.00	1247.30	833.26	0.128	0.12	0.15	3.415	A
South	208.09	52.02	207.91	159.51	190.32	0.00	1247.30	794.20	0.167	0.16	0.20	3.514	A
East	170.66	42.66	170.49	166.12	232.11	0.00	1223.11	820.15	0.140	0.15	0.19	4.043	A

Main results: (08:45-09:00)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	210.29	52.57	210.29	273.05	129.92	0.00	1282.25	999.87	0.164	0.20	0.20	3.459	A
West	159.65	39.91	159.65	149.74	190.47	0.00	1247.21	833.26	0.128	0.15	0.15	3.415	A
South	208.09	52.02	208.09	159.65	190.47	0.00	1247.21	794.20	0.167	0.20	0.20	3.515	A
East	170.66	42.66	170.66	166.25	232.31	0.00	1222.99	820.15	0.140	0.19	0.19	4.043	A

Main results: (09:00-09:15)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	171.71	42.93	171.88	223.19	106.21	0.00	1295.98	999.87	0.132	0.20	0.16	3.302	A
West	130.35	32.59	130.48	122.40	155.68	0.00	1267.34	833.26	0.103	0.15	0.12	3.270	A
South	169.91	42.48	170.09	130.48	155.68	0.00	1267.34	794.20	0.134	0.20	0.16	3.329	A
East	139.34	34.84	139.51	135.88	189.88	0.00	1247.55	820.15	0.112	0.19	0.15	3.842	A

Main results: (09:15-09:30)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	143.79	35.95	143.91	186.87	88.92	0.00	1305.98	999.87	0.110	0.16	0.13	3.192	A
West	109.16	27.29	109.25	102.49	130.35	0.00	1282.00	833.26	0.085	0.12	0.10	3.170	A
South	142.29	35.57	142.41	109.25	130.35	0.00	1282.00	794.20	0.111	0.16	0.13	3.205	A
East	116.69	29.17	116.81	113.77	158.99	0.00	1265.43	820.15	0.092	0.15	0.12	3.707	A

Queueing Delay Results for each time segment

Queueing Delay results: (08:00-08:15)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	1.87	0.12	3.188	A	A
West	1.41	0.09	3.166	A	A
South	1.86	0.12	3.201	A	A
East	1.76	0.12	3.699	A	A

Queueing Delay results: (08:15-08:30)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	2.32	0.15	3.298	A	A
West	1.75	0.12	3.266	A	A
South	2.32	0.15	3.327	A	A
East	2.19	0.15	3.838	A	A

Queueing Delay results: (08:30-08:45)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	2.98	0.20	3.459	A	A
West	2.23	0.15	3.415	A	A
South	2.99	0.20	3.514	A	A
East	2.82	0.19	4.043	A	A

Queueing Delay results: (08:45-09:00)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	3.02	0.20	3.459	A	A
West	2.27	0.15	3.415	A	A
South	3.04	0.20	3.515	A	A
East	2.87	0.19	4.043	A	A

Queueing Delay results: (09:00-09:15)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	2.40	0.16	3.302	A	A
West	1.81	0.12	3.270	A	A
South	2.40	0.16	3.329	A	A
East	2.27	0.15	3.842	A	A

Queueing Delay results: (09:15-09:30)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service

North	1.94	0.13	3.192	A	A
West	1.46	0.10	3.170	A	A
South	1.93	0.13	3.205	A	A
East	1.83	0.12	3.707	A	A

Queue Variation Results for each time segment

Queue Variation results: (08:00-08:15)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.13	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.10	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.13	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.12	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (08:15-08:30)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.16	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.12	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.16	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.15	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (08:30-08:45)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.20	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.15	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.20	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.19	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (08:45-09:00)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.20	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.15	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.20	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.19	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (09:00-09:15)

	Mean	Q05	Q50	Q90	Q95		Marker	Probability Of Reaching	Probability Of Exactly

Leg	(PCE)	(PCE)	(PCE)	(PCE)	(PCE)	Percentile Message	Message	Or Exceeding Marker	Reaching Marker
North	0.16	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.12	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.16	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.15	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (09:15-09:30)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.13	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.10	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.13	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.12	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Junctions 8

ARCADY 8 - Roundabout Module

Filename: St Johns Rd & Blueline.arc8
Path: C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Project\Personal Project Files\240475-Arcady
Report generation date: 2024-10-21 1:32:19 PM

Summary of intersection performance

	PM						
	Queue (PCE)	95% Queue (PCE)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	A1 - 2033						
Leg North	0.51	1.02	4.77	0.33	A	4.52	A
Leg West	0.30	~1	4.30	0.22	A		
Leg South	0.26	~1	3.85	0.21	A		
Leg East	0.56	1.05	4.82	0.35	A		

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

"D1 - 2033, AM" model duration: 8:00 AM - 9:30 AM
"D2 - 2033, PM " model duration: 3:30 PM - 5:00 PM

Run using Junctions 8.0.6.541 at 2024-10-21 1:32:19 PM

File summary

Title	(untitled)
Location	
Site Number	
Date	2024-10-21
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	AdamMorrison
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	V/C Ratio Threshold	Average Delay Threshold (s)	Queue Threshold (PCE)
7.50	✓		N/A	0.85	36.00	20.00

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	PCE	PCE	perHour	s	-Min	perMin

(Default Analysis Set) - 2033, PM

Data Errors and Warnings

No errors or warnings

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set (s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
(Default Analysis Set)	ARCADY		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
2033, PM	2033	PM		ONE HOUR	15:30	17:00	90	15				✓		

Intersection Network

Intersections

Intersection	Name	Intersection Type	Leg Order	Grade Separated	Large Roundabout	Do Geometric Delay	Intersection Delay (s)	Intersection LOS
1	(untitled)	Roundabout	North,West,South,East				4.52	A

Intersection Network Options

Driving Side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Leg	Name	Description
North	North	Blue Line Road	
West	West	St. John's Road	
South	South	Blue Line Road	
East	East	St. John's Road	

Capacity Options

Leg	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)	Assume Flat Start Profile	Initial Queue (PCE)
North	0.00	99999.00		0.00
West	0.00	99999.00		0.00
South	0.00	99999.00		0.00
East	0.00	99999.00		0.00

Roundabout Geometry

Leg	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
North	3.50	4.50	30.00	20.00	40.00	25.00	
West	3.50	4.50	30.00	20.00	40.00	25.00	
South	3.50	4.50	30.00	20.00	40.00	25.00	
East	3.50	4.50	30.00	20.00	40.00	25.00	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Leg	Enter slope and intercept directly	Entered slope	Entered intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)
North		(calculated)	(calculated)	0.579	1357.445
West		(calculated)	(calculated)	0.579	1357.445
South		(calculated)	(calculated)	0.579	1357.445
East		(calculated)	(calculated)	0.579	1357.445

The slope and intercept shown above include any corrections and adjustments.

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCE Factor for a Truck (PCE)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	Truck Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Leg	Profile Type	Use Turning Counts	Average Demand Flow (PCE/hr)	Flow Scaling Factor (%)
North	ONE HOUR	✓	349.00	100.000
West	ONE HOUR	✓	226.00	100.000
South	ONE HOUR	✓	224.00	100.000
East	ONE HOUR	✓	380.00	100.000

Turning Proportions

Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.000	35.000	260.000	54.000
	West	23.000	0.000	12.000	191.000
	South	208.000	10.000	0.000	6.000
	East	75.000	293.000	12.000	0.000

Turning Proportions (PCE) - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.00	0.10	0.74	0.15
	West	0.10	0.00	0.05	0.85
	South	0.93	0.04	0.00	0.03
	East	0.20	0.77	0.03	0.00

Vehicle Mix

Average PCE Per Vehicle - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	1.000	1.190	1.000	1.050
	West	1.110	1.000	1.110	1.070
	South	1.000	1.130	1.000	1.000
	East	1.030	1.060	1.000	1.000

Truck Percentages - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.0	19.0	0.0	5.0
	West	11.0	0.0	11.0	7.0
	South	0.0	13.0	0.0	0.0
	East	3.0	6.0	0.0	0.0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max Queue (PCE)	Max 95th percentile Queue (PCE)	Max LOS	Average Demand (PCE/hr)	Total Intersection Arrivals (PCE)	Total Queueing Delay (PCE-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (PCE-min/min)	Inclusive Total Queueing Delay (PCE-min)	Inclusive Average Queueing Delay (s)
North	0.33	4.77	0.51	1.02	A	320.25	480.37	34.39	4.30	0.38	34.39	4.30
West	0.22	4.30	0.30	~1	A	207.38	311.07	20.70	3.99	0.23	20.70	3.99
South	0.21	3.85	0.26	~1	A	205.55	308.32	18.52	3.60	0.21	18.52	3.60
East	0.35	4.82	0.56	1.05	A	348.69	523.04	37.95	4.35	0.42	37.96	4.35

Main Results for each time segment

Main results: (15:30-15:45)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	262.75	65.69	261.63	229.47	236.13	0.00	1220.78	940.31	0.215	0.00	0.28	3.839	A
West	170.14	42.54	169.45	253.37	244.39	0.00	1216.00	852.22	0.140	0.00	0.17	3.699	A
South	168.64	42.16	168.01	212.90	200.93	0.00	1241.15	806.20	0.136	0.00	0.16	3.370	A
East	286.08	71.52	284.85	188.19	180.75	0.00	1252.83	853.15	0.228	0.00	0.31	3.907	A

Main results: (15:45-16:00)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	313.74	78.44	313.41	274.85	282.88	0.00	1193.73	940.31	0.263	0.28	0.36	4.187	A
West	203.17	50.79	202.98	303.53	292.76	0.00	1188.01	852.22	0.171	0.17	0.22	3.932	A
South	201.37	50.34	201.21	255.04	240.70	0.00	1218.14	806.20	0.165	0.16	0.20	3.558	A
East	341.61	85.40	341.25	225.43	216.48	0.00	1232.16	853.15	0.277	0.31	0.40	4.248	A

Main results: (16:00-16:15)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	384.26	96.06	383.69	336.52	346.31	0.00	1157.01	940.31	0.332	0.36	0.51	4.764	A
West	248.83	62.21	248.53	371.60	358.40	0.00	1150.02	852.22	0.216	0.22	0.30	4.296	A
South	246.63	61.66	246.37	312.23	294.70	0.00	1186.88	806.20	0.208	0.20	0.26	3.846	A
East	418.39	104.60	417.77	276.01	265.07	0.00	1204.04	853.15	0.347	0.40	0.56	4.812	A

Main results: (16:15-16:30)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	384.26	96.06	384.25	336.91	346.81	0.00	1156.72	940.31	0.332	0.51	0.51	4.771	A
West	248.83	62.21	248.83	372.14	358.92	0.00	1149.71	852.22	0.216	0.30	0.30	4.299	A
South	246.63	61.66	246.63	312.68	295.07	0.00	1186.67	806.20	0.208	0.26	0.26	3.849	A
East	418.39	104.60	418.38	276.35	265.34	0.00	1203.88	853.15	0.348	0.56	0.56	4.820	A

Main results: (16:30-16:45)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	313.74	78.44	314.30	275.47	283.68	0.00	1193.26	940.31	0.263	0.51	0.37	4.196	A
West	203.17	50.79	203.46	304.39	293.59	0.00	1187.53	852.22	0.171	0.30	0.22	3.937	A
South	201.37	50.34	201.62	255.76	241.29	0.00	1217.80	806.20	0.165	0.26	0.20	3.563	A
East	341.61	85.40	342.22	225.98	216.93	0.00	1231.90	853.15	0.277	0.56	0.41	4.259	A

Main results: (16:45-17:00)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	262.75	65.69	263.09	230.62	237.45	0.00	1220.02	940.31	0.215	0.37	0.28	3.854	A
West	170.14	42.54	170.33	254.79	245.75	0.00	1215.22	852.22	0.140	0.22	0.18	3.706	A
South	168.64	42.16	168.80	214.09	202.00	0.00	1240.54	806.20	0.136	0.20	0.16	3.378	A
East	286.08	71.52	286.46	189.18	181.62	0.00	1252.33	853.15	0.228	0.41	0.31	3.922	A

Queueing Delay Results for each time segment

Queueing Delay results: (15:30-15:45)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	4.09	0.27	3.839	A	A
West	2.56	0.17	3.699	A	A
South	2.32	0.15	3.370	A	A
East	4.54	0.30	3.907	A	A

Queueing Delay results: (15:45-16:00)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	5.35	0.36	4.187	A	A
West	3.26	0.22	3.932	A	A
South	2.93	0.20	3.558	A	A
East	5.91	0.39	4.248	A	A

Queueing Delay results: (16:00-16:15)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	7.42	0.49	4.764	A	A
West	4.35	0.29	4.296	A	A
South	3.87	0.26	3.846	A	A
East	8.16	0.54	4.812	A	A

Queueing Delay results: (16:15-16:30)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	7.60	0.51	4.771	A	A
West	4.44	0.30	4.299	A	A
South	3.94	0.26	3.849	A	A
East	8.36	0.56	4.820	A	A

Queueing Delay results: (16:30-16:45)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	5.62	0.37	4.196	A	A
West	3.40	0.23	3.937	A	A
South	3.05	0.20	3.563	A	A
East	6.22	0.41	4.259	A	A

Queueing Delay results: (16:45-17:00)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service

North	4.31	0.29	3.854	A	A
West	2.68	0.18	3.706	A	A
South	2.41	0.16	3.378	A	A
East	4.78	0.32	3.922	A	A

Queue Variation Results for each time segment

Queue Variation results: (15:30-15:45)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.28	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.17	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.16	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.31	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (15:45-16:00)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.36	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.22	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.20	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.40	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (16:00-16:15)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.51	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.30	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.26	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.56	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (16:15-16:30)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.51	0.00	0.00	0.00	1.02			N/A	N/A
West	0.30	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.26	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.56	0.00	0.00	0.00	1.05			N/A	N/A

Queue Variation results: (16:30-16:45)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.37	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or		N/A	N/A

						very big.			
West	0.22	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.20	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.41	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (16:45-17:00)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.28	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.18	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.16	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.31	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Appendix H

Roundabout Screening Worksheet

INTERSECTION CONTROL STUDIES
SAFETY ASSESSMENT METHODOLOGY (HSM)

Region of Waterloo

Last Rev JAN 2021

Scenario: 2033 Horizon

Major Road: St. John's Road

Minor Road: Cockshutt Road

Major Road Direction:	East / West
Urban or Rural:	Rural
Proposed Control:	Signalized
Proposed Config.	4-Leg Intersection

LT Lanes Proposed (non roundabout):		RT Lanes Proposed (non roundabout):	
Major	2 Approaches	**Major**	No RT Lanes
Minor	No LT Lanes	**Minor**	No RT Lanes

Is there going to be any fully protected left-turn phasing? NO

Number of approaches with FPLTP: N/A

Is the proposed intersection "new" or is it existing: EXISTING

Does control and number of approaches remain the same: NO

Will the proposed intersection have illumination: YES

5-Year Total Collisions: 0

5-Year PDO Collisions: 0

Proposed RA Configuration? SINGLE - 4 x 1

** Proposed RA config. - 1st number represents approaches while 2nd represents lanes*

Major Road (mid-block) 10-Year Horizon AADT: 6,590

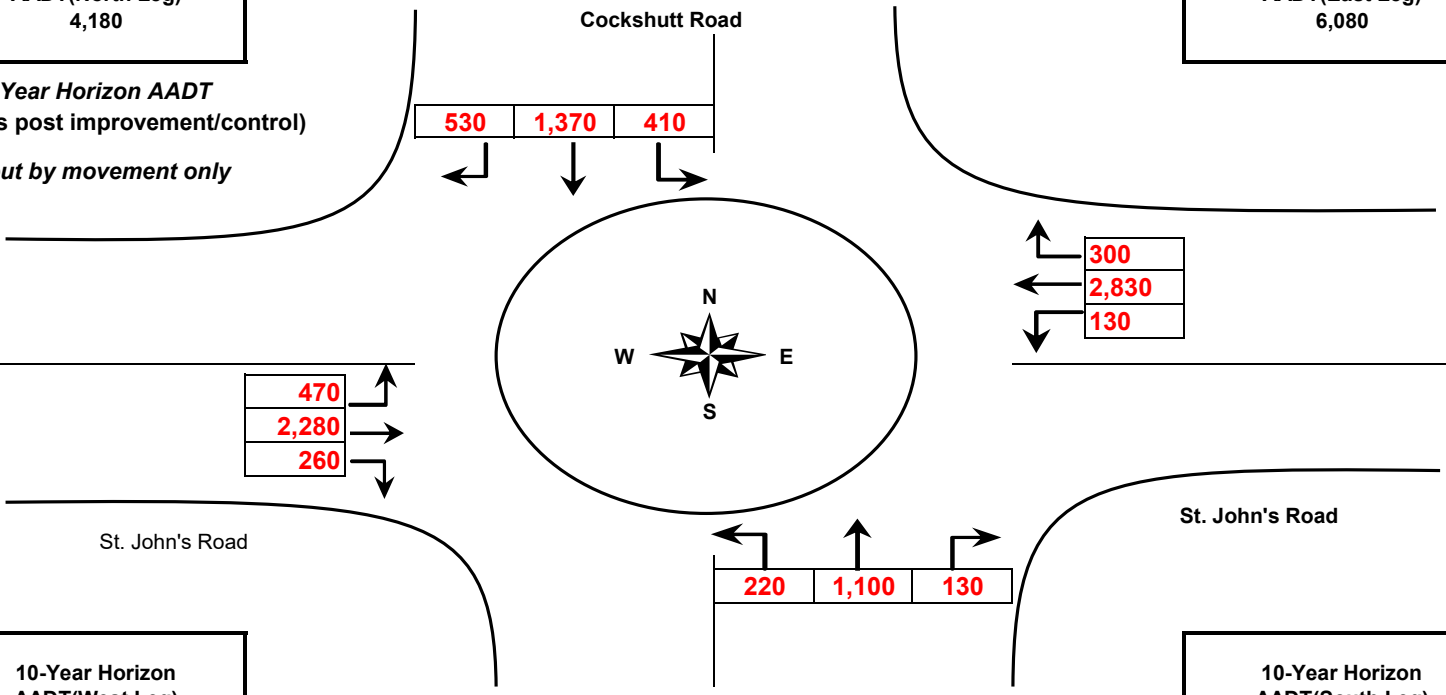
Minor Road (mid-block) 10-Year Horizon AADT: 4,180

10-Year Horizon AADT(North Leg) 4,180

10-Year Horizon AADT(East Leg) 6,080

**** 10-Year Horizon AADT (10ys post improvement/control)***

**** Input by movement only***



10-Year Horizon AADT(West Leg) 6,590

10-Year Horizon AADT(South Leg) 3,210

Direct Capital Costs

Fatal =	$1,656,500
Injury =	$60,500
PDO_{SIG} =	$5,000
PDO_{RA} =	$4,500
Discount Rate =	0.06

20-Year Present Value Collision Costs (DIRECT CAPITAL COSTS)

Collisions by Severity	Total	PDO	Injury	Fatal
Signalized	$750,522.83	$88,318.39	$548,204.88	$113,999.55
Roundabout	$461,394.80	$185,014.75	$276,380.05	$0.00

* Roundabout calibration Factor - 0.5

INTERSECTION CONTROL STUDIES
SAFETY ASSESSMENT METHODOLOGY (HSM)

Region of Waterloo

Last Rev JAN 2021

Scenario: **2033 Horizon**

Major Road: **St. John's Road**
Minor Road: **Cockshutt Road**

Major Road Direction: East / West

Urban or Rural: Rural

Proposed Control: Signalized

Proposed Config. 4-Leg Intersection

Roundabout Conflicts: **14950**

5-Year Total Collisions: **0**

5-Year PDO Collisions: **0**

Estimated **ANNUAL (1-YEAR ONLY)** Collisions				
Future Expected Collisions by Severity	**Total**	**PDO**	**Injury**	**Fatal**
Signalized	**2.34**	**1.54**	**0.79**	**0.01**
Roundabout	**3.98**	**3.58**	**0.40**	**0.00**

TOTAL CRASH COEFFICIENTS USED IN CALCULATION						Fatal/Inj. Ratio	Collision Factor
Control	Intersection Config	Intercept	AADTmaj	AADTmin	Overdispersion		
Signalized	4-Leg Intersection	**-5.13**	**0.6**	**0.2**	**N/A**	**0.007**	**n/a**

PDO CRASH COEFFICIENTS USED IN CALCULATION						Fatal/Inj. Ratio	Collision Factor
Control	Intersection Config	Intercept	AADTmaj	AADTmin	Overdispersion		
Signalized	4-Leg Intersection	**-5.13**	**0.6**	**0.2**	**N/A**	**0.007**	**0.66**

Collision Modification Factors (cmf's)	Left Turn Lane	Right Turn Lane	Calibration Factor	Empirical Bays Weighting	
	0.67		**0.64**	Total	PDO
				N/A	**N/A**
	Illumination	Protected LT Phasing			
	0.89	**1.00**			

Comments:

INTERSECTION CONTROL STUDIES
SAFETY ASSESSMENT METHODOLOGY (HSM)

Region of Waterloo

Last Rev JAN 2021

Scenario: 2033 Horizon

Major Road: St. John's Road

Minor Road: Blue Line Road

Major Road Direction:	East / West
Urban or Rural:	Rural
Proposed Control:	Signalized
Proposed Config.	4-Leg Intersection

LT Lanes Proposed (non roundabout):		RT Lanes Proposed (non roundabout):	
Major	2 Approaches	**Major**	No RT Lanes
Minor	No LT Lanes	**Minor**	No RT Lanes

Is there going to be any fully protected left-turn phasing? NO

Number of approaches with FPLTP: N/A

Is the proposed intersection "new" or is it existing: EXISTING

Does control and number of approaches remain the same: NO

Will the proposed intersection have illumination: YES

5-Year Total Collisions: 0

5-Year PDO Collisions: 0

Proposed RA Configuration? SINGLE - 4 x 1

** Proposed RA config. - 1st number represents approaches while 2nd represents lanes*

Major Road (mid-block) 10-Year Horizon AADT: 6,310

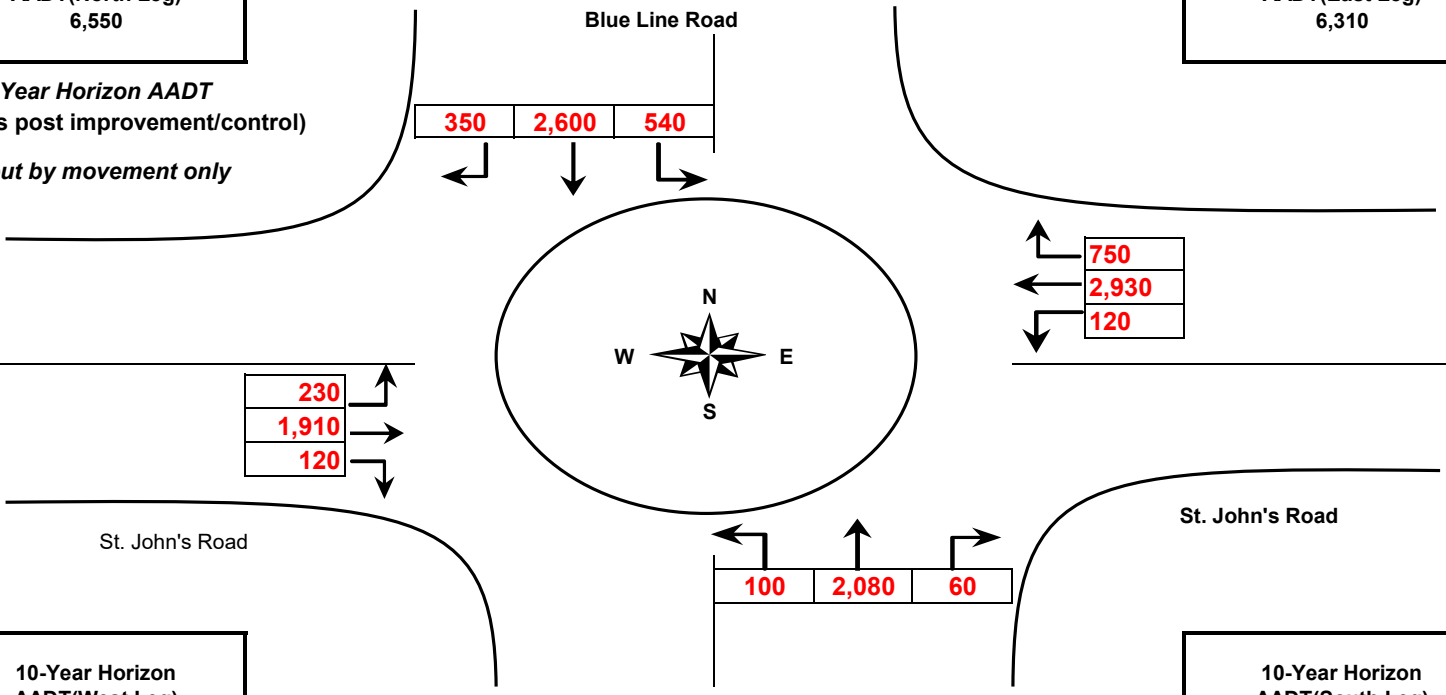
Minor Road (mid-block) 10-Year Horizon AADT: 6,550

10-Year Horizon AADT(North Leg) 6,550

10-Year Horizon AADT(East Leg) 6,310

**** 10-Year Horizon AADT***
(10ys post improvement/control)

**** Input by movement only***



10-Year Horizon AADT(West Leg) 5,640

10-Year Horizon AADT(South Leg) 5,080

Direct Capital Costs

Fatal =	$1,656,500
Injury =	$60,500
PDO_{SIG} =	$5,000
PDO_{RA} =	$4,500
Discount Rate =	0.06

20-Year Present Value Collision Costs (DIRECT CAPITAL COSTS)

Collisions by Severity	Total	PDO	Injury	Fatal
Signalized	$791,527.79	$94,626.85	$582,901.40	$113,999.55
Roundabout	$590,813.16	$236,910.23	$353,902.94	$0.00

* Roundabout calibration Factor - 0.5

INTERSECTION CONTROL STUDIES
SAFETY ASSESSMENT METHODOLOGY (HSM)

Region of Waterloo

Last Rev JAN 2021

Scenario: **2033 Horizon**

Major Road: **St. John's Road**
Minor Road: **Blue Line Road**

Major Road Direction: East / West

Urban or Rural: Rural

Proposed Control: Signalized

Proposed Config. 4-Leg Intersection

Roundabout Conflicts: **20250**

5-Year Total Collisions: **0**

5-Year PDO Collisions: **0**

Estimated **ANNUAL (1-YEAR ONLY)** Collisions				
Future Expected Collisions by Severity	**Total**	**PDO**	**Injury**	**Fatal**
Signalized	**2.49**	**1.65**	**0.84**	**0.01**
Roundabout	**5.10**	**4.59**	**0.51**	**0.00**

TOTAL CRASH COEFFICIENTS USED IN CALCULATION						Fatal/Inj. Ratio	Collision Factor
Control	Intersection Config	Intercept	AADTmaj	AADTmin	Overdispersion		
Signalized	4-Leg Intersection	**-5.13**	**0.6**	**0.2**	**N/A**	**0.007**	**n/a**

PDO CRASH COEFFICIENTS USED IN CALCULATION						Fatal/Inj. Ratio	Collision Factor
Control	Intersection Config	Intercept	AADTmaj	AADTmin	Overdispersion		
Signalized	4-Leg Intersection	**-5.13**	**0.6**	**0.2**	**N/A**	**0.007**	**0.66**

Collision Modification Factors (cmf's)	Left Turn Lane	Right Turn Lane	Calibration Factor	Empirical Bays Weighting	
	0.67		**0.64**	Total	PDO
				N/A	**N/A**
	Illumination	Protected LT Phasing			
	0.89	**1.00**			

Comments:

Appendix I

Detailed Cost Estimates

Cockshutt Road

A. GENERAL CONTRACT ITEMS

Line Item (Number)	Item Name	Description	Unit of Measure	Quantity	Estimated Unit Price	Estimated Total Price
1	General Contract Items	Mobilization, de-mobilization, bonding and insurance.	L.S.	1	$ 25,000.00	$ 25,000.00
2	General Contract Items	Traffic Control.	L.S.	1	$ 25,000.00	$ 25,000.00
3	General Contract Items	Design, construct, maintain and protect all environmental protection works as may be required including cleanup and remedial work immediately following any failure. Light Duty Silt Fence	m	400	$ 15.00	$ 6,000.00
4	General Contract Items	Provide hydro-vac excavation as required to avoid/protect conflicts. Hourly rate to be based on duration of excavation and not standby time. ONLY TO BE USED UPON AUTHORIZATION OF THE ENGINEER.	hr	12	$ 500.00	$ 6,000.00
5	General Contract Items	Hold hydro, street light and/or utility poles to allow for the installation of the infrastructure. ONLY TO BE USED UPON AUTHORIZATION OF THE ENGINEER.	ea	1	$ 5,000.00	$ 5,000.00

B. ROAD CONSTRUCTION						
Line Item (Number)	Item Name	Description	Unit of Measure	Quantity	Estimated Unit Price	Estimated Total Price
2.1	Road Construction	Remove and lawfully dispose of existing surfaces within the existing roadway. Include all saw cutting at limits. Concrete Curb and Gutter	m	90	$ 8.00	$ 720.00
3	Road Construction	Strip and remove existing topsoil from boulevards as required for the completion of the works.	L.S.	1	$ 5,000.00	$ 5,000.00
4	Road Construction	Mill existing asphalt road surface within project limits (50mm depth x full road width).	sq m	7900	$ 25.00	$ 197,500.00
6	Road Construction	Excavate, grade, and proof roll to a depth of 750mm for road base along St. John's Road for road width expansion.	L.S.	1	$ 20,000.00	$ 20,000.00
9	Road Construction	Supply, place and compact 450mm Granular B along St. John's Road for road width expansion and new curb.	tonne	10650	$ 25.00	$ 266,250.00
10	Road Construction	Supply, place and compact 150mm Granular A along St. John's Road for road width expansion and new curb.	tonne	3300	$ 25.00	$ 82,500.00
11	Road Construction	Supply, place and compact 100mm HL8 base asphalt (2x50mm Lifts) along St. John's Road for road width expansion and new curb.	tonne	1000	$ 140.00	$ 140,000.00
12	Road Construction	Supply, place and compact 50mm HL3 along St. John's Road and Blueline Road.	tonne	1600	$ 150.00	$ 240,000.00
17	Road Construction	Supply and apply asphalt tack coat on all milled surfaces and base asphalt prior to placement of surface asphalt.	sq m	11550	$ 3.00	$ 34,650.00
12	Road Construction	Supply, place and compact 150mm Granular A for 2.5m wide gravel shoulders along St. John's Road after paving.	tonne	1550	$ 25.00	$ 38,750.00
19	Road Construction	Construct OPSD 600.010 concrete barrier curb with wide gutters as per drawings including curb cut for outlet per OPSD 604.010.	m	120	$ 80.00	$ 9,600.00
29.2	Road Construction	Supply and install line painting. 60cm wide white stop bars	m	30	$ 50.00	$ 1,500.00
29.3	Road Construction	Double solid yellow line (2x10cm)	m	830	$ 15.00	$ 12,450.00
29.4	Road Construction	10cm solid white line	m	2180	$ 8.00	$ 17,440.00
29.6	Road Construction	10cm broken white line	m	320	$ 8.00	$ 2,560.00
29.7	Road Construction	Solid white turn arrow markings	ea.	6	$ 250.00	$ 1,500.00
30	Road Construction	Regrade existing ditches along St. John's Road and restore grassed areas adjacent to roadworks with 100mm of topsoil and hydroseed.	sq m	2950	$ 30.00	$ 88,500.00
32	Road Construction	Supply and install calcium chloride for dust control.	kg	2000	$ 3.00	$ 6,000.00
33.1	Road Construction	Remove and replace all existing signs with new signs and new posts.	ea	8	$ 400.00	$ 3,200.00

E. TRAFFIC SIGNALS						
Line Item (Number)	Item Name	Description	Unit of Measure	Quantity		
1.1	Traffic Signals	Allowance for traffic signals and interseciton lighting - reference James Street project constructed in 2024 at $250,000 plus 10% for inflation. Included both new traffic lights and intersection lighting.	LS	1	$ 275,000.00	$ 275,000.00
D. SOIL MANAGEMENT						
Line Item (Number)	Item Name	Description	Unit of Measure	Quantity	Estimated Unit Price	Estimated Total Price
1	Soil Management	Retain the services of Qualified Person (QP) to prepare an Excess Soil Destination Assessment Report for approval.	L.S.	1	$ 5,000.00	$ 5,000.00
2	Soil Management	Provide all documentation and complete tracking record of all excess soil removed from the site.	L.S.	1	$ 10,000.00	$ 10,000.00
E. CONTRACT CONTINGENCY						
Line Item (Number)	Item Name	Description	Unit of Measure	Quantity	Estimated Unit Price	Estimated Total Price
1	Contract Contingency	Estimating Contingency at 15% or construction items	LS	1	$ 227,000.00	$ 227,000.00
2	Contract Contingency	Allowance for Asphalt Price Index price adjustment. Item will be paid using the actual amount of the adjustment, positive for owing and negative for credit.	Allow	1	$ 30,000.00	$ 30,000.00

$ 1,782,120.00

Blue Line Road

A. GENERAL CONTRACT ITEMS

Line Item (Number)	Item Name	Description	Unit of Measure	Quantity	Estimated Unit Price	Estimated Total Price
1	General Contract Items	Mobilization, de-mobilization, bonding and insurance.	L.S.	1	$ 25,000.00	$ 25,000.00
2	General Contract Items	Traffic Control.	L.S.	1	$ 25,000.00	$ 25,000.00
3	General Contract Items	Design, construct, maintain and protect all environmental protection works as may be required including cleanup and remedial work immediately following any failure. Light Duty Silt Fence	m	400	$ 15.00	$ 6,000.00
4	General Contract Items	Provide hydro-vac excavation as required to avoid/protect conflicts. Hourly rate to be based on duration of excavation and not standby time. ONLY TO BE USED UPON AUTHORIZATION OF THE ENGINEER.	hr	12	$ 500.00	$ 6,000.00
5	General Contract Items	Hold hydro, street light and/or utility poles to allow for the installation of the infrastructure. ONLY TO BE USED UPON AUTHORIZATION OF THE ENGINEER.	ea	1	$ 5,000.00	$ 5,000.00

B. ROAD CONSTRUCTION						
Line Item (Number)	Item Name	Description	Unit of Measure	Quantity	Estimated Unit Price	Estimated Total Price
2.1	Road Construction	Remove and lawfully dispose of existing surfaces within the existing roadway. Include all saw cutting at limits. Concrete Curb and Gutter	m	85	$ 8.00	$ 680.00
3	Road Construction	Strip and remove existing topsoil from boulevards as required for the completion of the works.	L.S.	1	$ 5,000.00	$ 5,000.00
4	Road Construction	Mill existing asphalt road surface within project limits (50mm depth x full road width).	sq m	6450	$ 25.00	$ 161,250.00
6	Road Construction	Excavate, grade, and proof roll to a depth of 750mm for road base along St. John's Road for road width expansion.	L.S.	1	$ 20,000.00	$ 20,000.00
9	Road Construction	Supply, place and compact 450mm Granular B along St. John's Road for road width expansion and new curb.	tonne	10050	$ 25.00	$ 251,250.00
10	Road Construction	Supply, place and compact 150mm Granular A along St. John's Road for road width expansion and new curb.	tonne	3100	$ 25.00	$ 77,500.00
11	Road Construction	Supply, place and compact 100mm HL8 base asphalt (2x50mm Lifts) along St. John's Road for road width expansion and new curb.	tonne	1000	$ 140.00	$ 140,000.00
12	Road Construction	Supply, place and compact 50mm HL3 along St. John's Road and Blueline Road.	tonne	1400	$ 150.00	$ 210,000.00
17	Road Construction	Supply and apply asphalt tack coat on all milled surfaces and base asphalt prior to placement of surface asphalt.	sq m	10020	$ 3.00	$ 30,060.00
12	Road Construction	Supply, place and compact 150mm Granular A for 2.5m wide gravel shoulders along St. John's Road after paving.	tonne	1450	$ 25.00	$ 36,250.00
19	Road Construction	Construct OPSD 600.010 concrete barrier curb with wide gutters as per drawings including curb cut for outlet per OPSD 604.010.	m	120	$ 80.00	$ 9,600.00
29.2	Road Construction	Supply and install line painting. 60cm wide white stop bars	m	30	$ 50.00	$ 1,500.00
29.3	Road Construction	Double solid yellow line (2x10cm)	m	780	$ 15.00	$ 11,700.00
29.4	Road Construction	10cm solid white line	m	2080	$ 8.00	$ 16,640.00
29.6	Road Construction	10cm broken white line	m	265	$ 8.00	$ 2,120.00
29.7	Road Construction	Solid white turn arrow markings	ea.	6	$ 250.00	$ 1,500.00
30	Road Construction	Regrade existing ditches along St. John's Road and restore grassed areas adjacent to roadworks with 100mm of topsoil and hydroseed.	sq m	2700	$ 30.00	$ 81,000.00
32	Road Construction	Supply and install calcium chloride for dust control.	kg	2000	$ 3.00	$ 6,000.00
33.1	Road Construction	Remove and replace all existing signs with new signs and new posts.	ea	8	$ 400.00	$ 3,200.00

C. TRAFFIC SIGNALS						
Line Item (Number)	Item Name	Description	Unit of Measure	Quantity		
1	Traffic Signals	Allowance for traffic signals and interseciton lighting - reference James Street project constructed in 2024 at $250,000 plus 10% for inflation. Included both new traffic lights and intersection lighting.	LS	1	$ 275,000.00	$ 275,000.00
D. SOIL MANAGEMENT						
Line Item (Number)	Item Name	Description	Unit of Measure	Quantity	Estimated Unit Price	Estimated Total Price
1	Soil Management	Retain the services of Qualified Person (QP) to prepare an Excess Soil Destination Assessment Report for approval.	L.S.	1	$ 5,000.00	$ 5,000.00
2	Soil Management	Provide all documentation and complete tracking record of all excess soil removed from the site.	L.S.	1	$ 10,000.00	$ 10,000.00
E. CONTRACT CONTINGENCY						
Line Item (Number)	Item Name	Description	Unit of Measure	Quantity	Estimated Unit Price	Estimated Total Price
1	Contract Contingency	Estimating Contingency at 15% or construction items	LS	1	$ 170,000.00	$ 170,000.00
2	Contract Contingency	Allowance for Asphalt Price Index price adjustment. Item will be paid using the actual amount of the adjustment, positive for owing and negative for credit.	Allow	1	$ 30,000.00	$ 30,000.00

$ 1,622,250.00