70 FIRST LAKE DRIVE DEVELOPMENT
REVISED TRAFFIC IMPACT STUDY
FINAL REPORT

PREPARED FOR:
FIRST MUTUAL PROPERTIES

Project No. CA0019009.4561

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wsp

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1 INTRODUCTION

Background

Plans are being prepared to add residential apartments onto an existing commercial site, creating a mixed development at 70 First Lake Drive in Lower Sackville, Nova Scotia. The proposed development is planned to include two 77-unit high-rise apartment buildings (154 units total). The Tim Horton's restaurant currently within the site is being relocated to Building C and the floor area of the new restaurant will remain similar to the current site and the relocation is not expected to impact the number of trips generated to and from the site. Only one restaurant will be operational at a time and the existing restaurant will be demolished upon construction of the new site. The site concept is shown in Figure 1.

Halifax Regional Municipality (HRM) has requested that a Traffic Impact Study (TIS) be completed to review the impacts to the adjacent road network and WSP Canada Inc. has been retained to complete the TIS.

A Traffic Impact Study Usually Considers Four Questions

A TIS usually consists of determining answers for the following questions:

1. **What is the existing transportation situation** adjacent to the study site? How have volumes changed historically?
2. **What transportation changes are expected** at key Study Area locations? How many vehicle and active mode trips are expected to be generated by the proposed development during weekday peak hours? What routes are the trips expected to use to travel within and through the Study Area?
3. **What transportation impacts will occur** on Study Area roads, sidewalks, and intersections?
4. **What transportation improvements are required** to mitigate project impacts on Study Area travel? Are there transportation modifications that should be made to improve the travel experience for all users?

Study Objectives

1. Develop projected 2032 background weekday AM and PM peak hourly volumes for Study Intersections.
2. Estimate the number of weekday AM and PM peak hour trips that will be generated by the proposed development.
3. Distribute and assign site generated trips to Study Intersections to project 2032 peak hourly volumes that include site generated trips.
4. Evaluate impacts of site generated traffic on the performance of Study Intersections.
5. Complete warrant analyses, as necessary, for Study Intersections and recommend improvements that may be needed at Study Intersections to mitigate the impacts of site development.

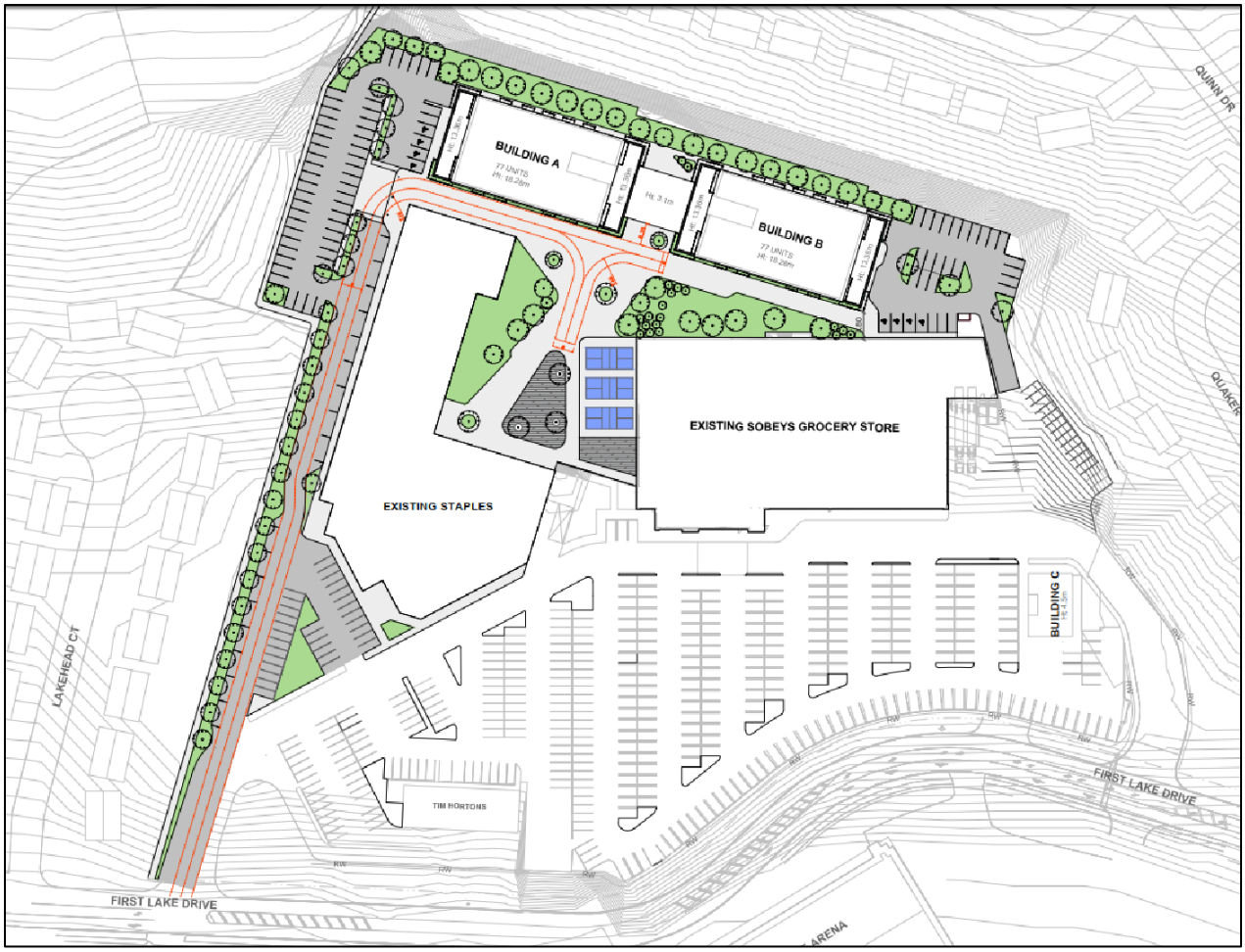


Figure 1 – Site Plan

2 STUDY AREA DESCRIPTIONS

Description of Existing Development

70 First Lake Drive is currently occupied with a Sobey's store, Tim Horton's with a drive-through, Glass Repair Shop, Recreation Sport Centre with a batting cage and a variety of small commercial stores. There are two access points from First Lake Driveway, one driveway to the west and one driveway to the east. The existing commercial stores are expected to remain with the proposed development include the Sobey's store and the Tim Horton's restaurant. There is a Call Centre on the property which formally closed in January of 2023. Approximately 2,300 square feet of retail space behind the Sobey's store is expected to be removed for the construction of the new development. These trips have been considered a credit for trip generation.

Description of Proposed Development

The proposed 70 First Lake Drive development is planning to add 154 high-rise apartment units to the partly developed site. The access to the proposed development will be via the existing driveways on First Lake Drive, as shown in Figure 2. It is anticipated that the development will be completed by 2027 and a 2032 horizon year has been used for this TIS.

Figure 2 – Study Area with the Study Intersections

Existing Study Road Descriptions

First Lake Drive is a major collector road that has two lanes, one lane in each direction, and a posted speed limit of 50 km/h. There are transit stops servicing Routes #82 and #182 on both sides of First Lake Drive on the east side of the east driveway and on both sides of the west driveway. There is a sidewalk along the south side of the road.

Metropolitan Avenue is a major collector roadway with two lanes, one lane in each direction and a posted speed limit within the study area of 50 km/h. There is a concrete sidewalk on both sides of Metropolitan Avenue between First Lake Drive and Kingfisher Way and along the west side north of First Lake Drive and south of Kingfisher Way. There are transit stops that service Routes #82 and #182 along both sides of Metropolitan Avenue north of First Lake Drive.

Glendale Drive is an arterial road that has two lanes, one lane in each direction, and a posted speed limit of 60 km/h. There is a paved asphalt sidewalk on the north side of Glendale Drive and transit services for Route #84 in this area.

Existing Study Intersection Descriptions

Intersection #1 – Metropolitan Avenue at First Lake Drive is a 3-legged signalized intersection with shared lane approaches and marked pedestrian crossings on all approaches.

Intersection #2 – First Lake Drive at West Driveway is a 3-legged intersection with STOP control on the driveway (southbound) approach. First Lake Drive has one through lane in each direction and an added eastbound left-turn lane. The West Driveway has separate left-turn and right-turn lanes. There is a marked pedestrian crossing at the driveway approach and at the eastbound approach.

Intersection #3 – First Lake Drive at East Driveway is a 4-legged intersection with STOP control on the East Driveway/Sackville Arena Driveway approaches. First Lake Drive has one through lane in each direction and added left-turn lanes for traffic turning into each driveway. The East Driveway has separate left-turn and right-turn lanes. There are marked pedestrian crossings on the northbound, southbound, and westbound approaches at this intersection.

Intersection #4 – Glendale Drive at Metropolitan Avenue is a 3-legged signalized intersection. The eastbound approach has a through lane and a left-turn lane, and the westbound approach has a through lane and a right-turn yield lane. The southbound approach has a left-turn lane and a right-turn yield channel. There are marked pedestrian crossings at the southbound and westbound approaches at this intersection.

Vehicle Circulation

Vehicles are able to access the proposed parking garage entrances via the paths displayed in Figure 3 and it is expected that the parking lots will be internally connected.

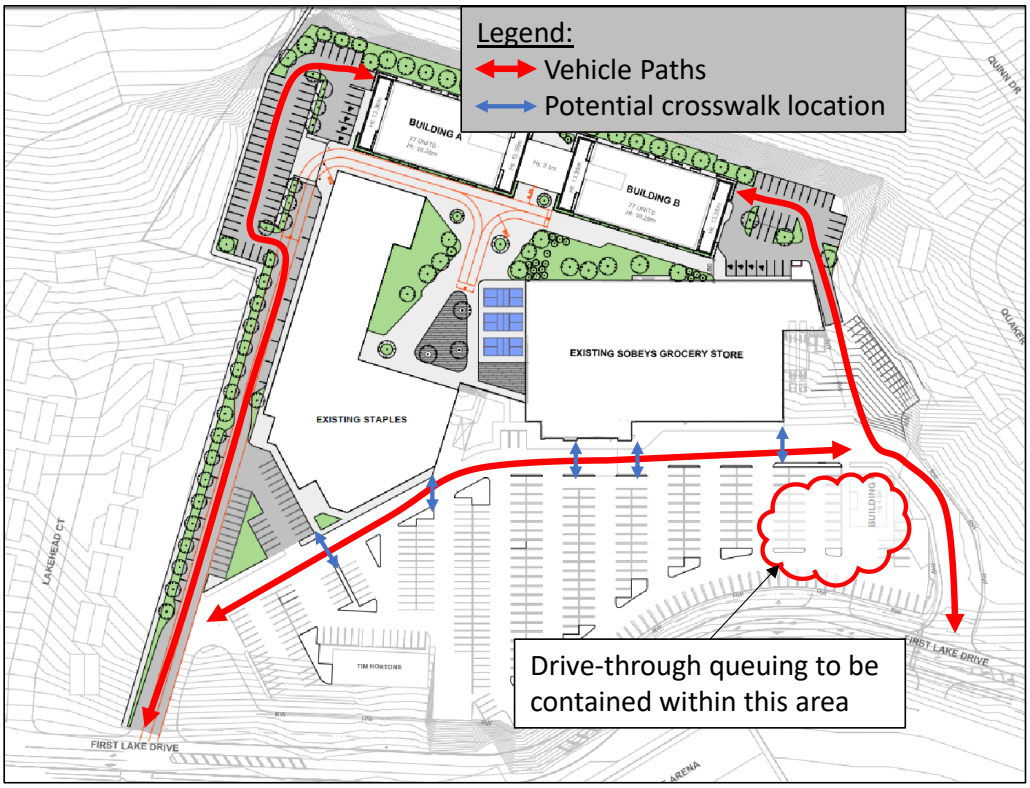


Figure 3 – Vehicle Access

3 BACKGROUND TRAFFIC

Turning Movement Counts

Turning movement counts were collected by WSP on Wednesday, February 2nd, 2022 at Study Intersection 1 during the morning (7:00-9:00AM) and afternoon (4:00-6:00PM) peak periods and at Study Intersection 3 during the morning (7:00-9:00AM), midday (11:30AM-1:30PM) and afternoon (4:00-6:00PM) peak periods. Intersection counts have been tabulated in 15-minute intervals with peak hours indicated by shaded areas. Turning movement volumes are provided in Tables A-1 to A-2, Appendix A.

Counts were not available for the West Drive (Intersection 2). It is expected to be considerably busier than Study Intersection 3, so it was estimated that 60% of eastbound vehicles and 35% of westbound vehicles access the site, and that the remaining traffic travelling along First Lake Drive comes from Intersection 2.

Additional turning movement counts were collected by WSP on Tuesday, January 9th, 2024 at Study Intersection 4 (Glendale Drive at Metropolitan Avenue) during the morning (7:00-9:00AM) and afternoon (4:00-6:00PM) peak periods.

Additional Background Traffic Growth

Additional background traffic estimates for the vacant commercial space were included in this TIS. Future occupation of this vacant commercial space was assumed to be Strip Retail Plaza (Land Use 822) and trip generation estimates for the additional development are summarized in Table 1. It is estimated that the occupation of the vacant commercial space will generate:

- 9 two-way vehicle trips (5 entering and 4 exiting) during the AM peak hour; and,
- 21 two-way vehicle trips (11 entering and 10 exiting) during the PM peak hour.

Table 1 – Trip Generation Estimates for the Unoccupied Retail Space

Land Use[1]	Units[2]	Trip Generation Rates[3]				Trip Generation Estimates[3]			
		AM Peak		PM Peak		AM Peak		PM Peak	
		In	Out	In	Out	In	Out	In	Out
Strip Retail Plaza (<40k) LU822	2.0	Equations from Page 229 & 230				6	4	12	12
Baseline Vehicle Trips for the Commercial Infill						6	4	12	12
Estimated Person Trips for the Commercial Infill						7	4	14	15
Estimated Auto Driver Trips for the Commercial Infill[4]						5	4	11	10

NOTES:
1. Rates and equations are from T*rip Generation, 11th Edition* , Institute of Transportation Engineers, 2021.
2. Units are KGLA (1000 square feet of gross leasable area).
3. Rates are 'vehicles per hour per unit'; trips generated are 'vehicles per hour for peak hours'.
4. A 75% auto driver modal share has been applied to these trips, consistent with the residential modal share included in Table 3.

Estimated Trip Generation for Lakehead Court

As requested by HRM, the trip generation for the 36 residential units on Lakehead Court (Land Use 210) and trip generation estimates are summarized in Table 2. It is estimated that the residential units on Lakehead Court generate:

- 28 two-way vehicle trips (7 entering and 21 exiting) during the AM peak hour; and,
- 31 two-way vehicle trips (20 entering and 11 exiting) during the PM peak hour.

Table 2 – Trip Generation Estimates for Lakehead Court

Land Use[1]	Units[2]	Trip Generation Rates[3]				Trip Generation Estimates[3]			
		AM Peak		PM Peak		AM Peak		PM Peak	
		In	Out	In	Out	In	Out	In	Out
Single-Family Detached Housing LU210	36	Rates from Page 220 & 221				8	25	21	13
Baseline Vehicle Trips for Lakehead Court						8	25	21	13
Estimated Person Trips for Lakehead Court						9	28	25	16
Estimated Auto Driver Trips for Lakehead Court						7	21	20	11

NOTES:
1. Rates and equations are from T*rip Generation, 11th Edition* , Institute of Transportation Engineers, 2021. Directional splits were corrected using the Errata released by ITE.
2. Units are residential units.
3. Rates are 'vehicles per hour per unit'; trips generated are 'vehicles per hour for peak hours'.

Lakehead Court Trips and Distribution

As requested by HRM, estimated trips generated by Lakehead Court have been applied and considered in the balancing of future background traffic volumes along First Lake Drive at the west site access and the Metropolitan Avenue intersection assuming that 80% of Lakehead Court trips are to and from the west along First Lake Drive while the remaining 20% of Lakehead Court trips are to and from the east on First Lake Drive.

Traffic Growth Rate and Future Background Volumes

An annual growth rate of 1.0% was applied to the background volumes for this Traffic Impact Study to project 2032 future background volumes (buildout + five years). 2032 future background volumes that include background growth and trips generated by the reoccupation of unoccupied retail space (See Table 1) as well as consideration of the assignment of Lakehead Court trips have been included in Figure A-1, Appendix A.

4 TRIP GENERATION, DISTRIBUTION, AND ASSIGNMENT

Prepared Trip Generation Estimates

When using the published trip generation rates and equations in the *Trip Generation Manual (Institute of Transportation Engineers)*, the transportation engineer's objective should be to provide a realistic estimate of the number of trips that will be generated by the proposed development.

Anticipated Land Use for the Proposed Development

The proposed development is expected to include 154 high-rise apartment units. Approximately 2,300 square feet of retail space is expected to be removed for the construction of the new development. These trips were subtracted from the trip generation estimates.

Estimation of Trips Generated by the Proposed Development

Trips generated by Multi-family Housing High-Rise (Land Use 222) are estimated for the AM and PM peak hours of traffic by dwelling unit, amd trips generated by Strip Retail Plaza (Land Use 822) are estimated for the AM and PM peak hours of traffic by KLGA. Trip generation estimates for the proposed development were prepared using published rates from *Trip Generation Manual, 11th Edition* (Institute of Transportation Engineers, Washington, 2021).

Appendix B of the ITE Trip Generation Handbook, 3rd Edition (2017) includes baseline modal share data for a variety of land use types including apartments and shopping centers.

Appendix B of the Handbook indicates that the modal share of the sample trip data for apartment land use was 96% vehicle trips.

For this development, it is expected that significantly more than 4% of the person trips will be by transit and active modes and the multimodal trip generation methodology identified in Figure 3.1 of the Handbook has been applied to the trip generation estimates for this development.

Based on the proposed development's proximity to numerous amenities and that the site lies within an area of HRM with trail connectivity and transit fronting the site, many of the trips generated by the proposed development are anticipated to be non-auto trips. Using the methodology provided in *Trip Generation Handbook, 3rd Edition* (Institute of Transportation Engineers, Washington, 2017), estimates of the total person trips generated by the development were prepared (See Table 2).

Trips Generated by the Proposed Development – Total Trips Generated

Trip generation estimates for the proposed development are summarized in Table 3. It is estimated that the development will generate:

- 47 two-way person trips (8 entering and 39 exiting) during the AM peak hour; and,
- 43 two-way person trips (30 entering and 13 exiting) during the PM peak hour.

Table 3 – Trip Generation Estimates for the Proposed Development

Land Use[1]	Units[2]	Trip Generation Rates[3]				Trip Generation Estimates[3]			
		AM Peak		PM Peak		AM Peak		PM Peak	
		In	Out	In	Out	In	Out	In	Out
Multifamily Housing (High-Rise) LU222	154	Equations from Page 307 & 308				14	39	39	24
Strip Retail Plaza (<40k) LU822	2.3	Equations from Page 229 & 230				7	4	14	14
Baseline Vehicle Trips for the Proposed Development						7	35	25	10
Estimated Person Trips for the Proposed Development						8	39	30	13

NOTES:
1. Rates and equations are from T*rip Generation, 11th Edition*, Institute of Transportation Engineers, 2021. Directional splits were corrected using the Errata released by ITE.
2. Units are residential units.
3. Rates are 'vehicles per hour per unit'; trips generated are 'vehicles per hour for peak hours'.

Estimated Modal Shares of Development Trips

The site is located near several transit routes (Routes #82, #84, and #182), and there is an existing path along Glendale Drive and an existing multi-use pathway around First Lake and Second Lake. There is a non-auto reduction target of 26% set out in HRM's Integrated Mobility Plan for the Inner Suburban Area, which better matches the characteristics of this site than does Outer Suburban Area. Within the site itself there are numerous existing amenities including a grocery store and a (relocated) Tim Horton's Restaurant which will draw active mode trips generated by the proposed residential units. The site is also less than 1km walking distance from Sackville High School, Leslie Thomas Jr. High, Sackville Sports Stadium, Kinsmen Community Centre and Park, and 1.5km from Cavalier Drive School. While WSP expects that the active modal share will be higher given the onsite synergies and proximity to nearby amenities identified above, the 5% active mode share has been used as requested by HRM. The estimated person trips generated by the site development by modal share is included in Table 4.

It is estimated that the development will generate:

- 35 two-way vehicle trips (6 entering and 29 exiting) during the AM peak hour; and,
- 33 two-way vehicle trips (23 entering and 10 exiting) during the PM peak hour.

Table 4 - Total Trip Generation Estimates for the Proposed Development

Travel Mode	Modal Share	AM Peak		PM Peak	
		In	Out	In	Out
External Person Trips		**8**	**39**	**30**	**13**
Auto Driver	**75%**	6	29	23	10
Auto Passenger	**10%**	1	4	3	1
Transit	**10%**	1	4	3	1
Active Modes	**5%**	0	2	1	1

Trip Distribution and Assignment

Trips generated by the proposed development were distributed to the Study Intersections based on counted volumes and local knowledge of the area considering major trip origins and destinations in the region. The estimated directional distributions are provided below. Trips were assigned to the driveways such that 80% of westbound traffic uses the west driveway and 80% of eastbound traffic uses the east driveway.

Direction	Distribution	Description
North	5%	(Beaver Bank and surrounding areas)
South	50%	(Sackville, Bedford and surrounding areas)
West	20%	(Middle Sackville and surrounding areas)
East	25%	(Lakeview Airport and surrounding areas)

Volume Figures

Traffic volume figures were prepared for future traffic scenarios for 2032 without and with the proposed development and they are included in Appendix A.

Tim Horton's Drive through Queuing

While not expected to add traffic to the site, the relocation of the Tim Horton's restaurant with drive-through has been considered with respect to the queuing space required. Queuing space for 18 drive-through vehicles should be contained within the area identified in Figure 3 so as not to impact operations of the site driveway or traffic along First Lake Drive. This queuing and locations of menu boards, speaker boxes, and other features should be considered in preparing the final site plan for the drive-through.

5 INTERSECTION OPERATIONAL ANALYSIS

Intersection Capacity Analysis was completed to estimate how intersections may be expected to operate into the future without and with site generated trips. This section of the report addresses how left-turn lane warrants and traffic signal warrants were conducted and how each intersection was evaluated. The following subsections identify each study intersection and summarize the results of the operational analysis.

Left-Turn Lane Warrant Analysis

Left-turn movements on a two-lane street may cause both operational and safety problems. Operational problems result as a vehicle stopped waiting for an opportunity to turn across 'heavy' opposing traffic causes a queue of stopped vehicles to form. Safety problems result from rear end collisions when a stopped left-turning vehicle is struck by an advancing vehicle, or from head-on or right-angle collisions when a left-turning vehicle is struck by an opposing vehicle.

The *Geometric Design Standards for Ontario Highways Manual* contains nomographs for left-turn lane analysis for two lane streets at unsignalized intersections. The analysis method, which is normally used by WSP Atlantic to evaluate the need for left-turn lanes, uses a series of nomographs that consider speed, advancing volumes, left-turns as a percentage of advancing volumes, and opposing volumes. A point, based on 'opposing' and 'advancing' volumes, plotted to the right of the 'warrant line' of the appropriate '% left-turns' and 'approach speed' nomograph, indicates that a left-turn lane is warranted for the conditions used in the analysis. Similarly, a point that is plotted to the left of the warrant line indicates that a left-turn lane is not warranted.

No left-turn lane warrant analyses were completed for this project, as the site accesses have existing left-turn lanes on First Lake Drive.

Traffic Signal Warrant Analysis

A signal warrant analysis is completed to determine if the installation of traffic signals at an intersection will provide a positive impact on total intersection operation. That is, the benefits in time saved and improved safety that will accrue to vehicles entering from a side street will exceed the impact that signals will have in time lost and potential additional collisions for vehicles approaching the intersection on the main street.

The *Canadian Traffic Signal Warrant Matrix Analysis (Transportation Association of Canada (TAC), 2005)* considers 100 warrant points as an indication that traffic signals will provide a positive impact. Signal warrant analysis uses vehicular and pedestrian volumes, and intersection, roadway and study area characteristics to calculate a warrant point value.

Traffic signal warrant analyses indicate that both site accesses do not warrant signalization with results included in Appendix B.

Intersection Capacity Analysis Results

Synchro 11 software have been used for performance evaluation of the Study Intersections. Summaries of the results are provided in the following sub-sections and detailed results of the analyses are included in Appendix C.

5.1 ANALYSIS SCENARIOS

Summary Analysis Scenarios Considered

Scenario 1 – Future 2032 without Site: Represents future 2032 traffic volumes on the existing road network, including the existing traffic control and lane configurations of the Study Intersections without the proposed development.

***Scenario 2 – Future 2032 with Site*:** Represents future 2032 traffic volumes on the existing road network, including the existing traffic control and lane configurations of the Study Intersections with the proposed development.

5.2 INT #1: METROPOLITAN AVENUE AT FIRST LAKE DRIVE

Intersection #1 – Metropolitan Avenue at First Lake Drive:
Operational performance results for this intersection are provided in Table 5 for both the AM and PM peak hours.

The intersection is expected to operate within HRM acceptable limits during the AM and PM peak hours. Minimal changes in the operational performance of this intersection are expected with the addition of the proposed development. All movements are expected to operate at with a v/c ratio of 0.71 or better. With about 90m of spacing along the northbound approach to the upstream intersection at Kingfisher Way, no spillback of traffic queues to that intersection is anticipated by 2032 without and with development trips.

Table 5 - Intersection Capacity Analysis: Metropolitan Avenue at First Lake Drive

LOS Criteria	Control Delay (sec/veh), v/c Ratio, and 95th %ile Queue (m) by Intersection Movement			Overall Intersection
	First Lake Drive	Metropolitan Avenue		
	WB-LR	NB-TR	SB-LT	Delay
Scenario 1 - Future 2032 without Site AM Peak Hour (Page C-1)				
Delay	14.2	9.6	13.4	12.2
v/c	0.48	0.46	0.48	
Queue	34.3	37.1	43.3	
Scenario 2 - Future 2032 with Site AM Peak Hour (Page C-9)				
Delay	14.9	10.8	14.3	12.6
v/c	0.51	0.47	0.48	
Queue	37.9	37.3	43.3	
Scenario 1 - Future 2032 without Site PM Peak Hour (Page C-5)				
Delay	20.7	15.4	11.2	16.5
v/c	0.63	0.70	0.26	
Queue	66.1	78.0	25.5	
Scenario 2 - Future 2032 with Site PM Peak Hour (Page C-13)				
Delay	21.5	15.9	11.6	17.1
v/c	0.65	0.71	0.27	
Queue	70.9	83.6	26.7	

5.3 INT #2: FIRST LAKE DRIVE AT WEST DRIVEWAY

Intersection #2 – First Lake Drive at West Driveway:
Operational performance results for this intersection are provided in Table 6 for both the AM and PM peak hours. A traffic signal warrant was completed for the 2032 Future with Site scenario, and it was determined that:

- 2032 Future with Site: Traffic signals are not warranted (**17 Warrant Points**, Table B-1, Appendix B).

The intersection is expected to operate within HRM acceptable limits during the AM and PM peak hours. Negligible changes in the operational performance of this intersection are expected with the addition of the trips generated by the proposed development. All movements are expected to operate with a v/c ratio of 0.23 or better with 95th percentile queues of two vehicles or less.

Table 6 - Intersection Capacity Analysis: First Lake Drive at West Driveway

LOS Criteria	Control Delay (sec/veh), v/c Ratio, and 95th %ile Queue (m) by Intersection Movement					Overall Intersection
	First Lake Drive			West Driveway		
	EB-L	EB-T	WB-TR	SB-L	SB-R	Delay
Scenario 1 - Future 2032 without Site AM Peak Hour (Page C-3)						
Delay	7.9	0.0	0.0	13.3	9.6	4.6
v/c	0.11	0.06	0.10	0.01	0.15	
Queue	3.0	0.0	0.0	0.3	4.1	
Scenario 2 - Future 2032 with Site AM Peak Hour (Page C-11)						
Delay	7.9	0.0	0.0	13.5	9.8	4.9
v/c	0.11	0.06	0.10	0.02	0.17	
Queue	3.1	0.0	0.0	0.4	4.8	
Scenario 1 - Future 2032 without Site PM Peak Hour (Page C-7)						
Delay	8.2	0.0	0.0	16.8	10.5	5.0
v/c	0.16	0.07	0.14	0.02	0.22	
Queue	4.6	0.0	0.0	0.5	6.6	
Scenario 2 - Future 2032 with Site PM Peak Hour (Page C-15)						
Delay	8.3	0.0	0.0	17.7	10.6	5.1
v/c	0.18	0.07	0.14	0.02	0.23	
Queue	5.1	0.0	0.0	0.6	6.9	

5.4 INT #3: FIRST LAKE DRIVE AT EAST DRIVEWAY

Intersection #3 – First Lake Drive at East Driveway:
Operational performance results for this intersection are provided in Table 7 for both the AM and PM peak hours. A traffic signal warrant was completed for the 2032 Future with Site scenario, and it was determined that:

- 2032 Future with Site: Traffic signals are not warranted (**7 Warrant Points**, Table B-2, Appendix B).

The intersection is expected to operate within HRM acceptable limits during the AM and PM peak hours. Negligible changes in the operational performance of this intersection are expected with the addition of the proposed development. All movements are expected to operate with a v/c ratio of 0.13 or better with 95th percentile queue lengths of one vehicle or less.

Table 7 - Intersection Capacity Analysis: First Lake Drive at East Driveway

LOS Criteria	Control Delay (sec/veh), v/c Ratio, and 95th %ile Queue (m) by Intersection Movement							Overall Intersection
	First Lake Drive				Sackville Arena	East Driveway		
	EB-L	EB-TR	WB-L	WB-TR	NB-LTR	SB-L	SB-R	Delay
Scenario 1 - Future 2032 without Site AM Peak Hour (Page C-4)								
Delay	7.5	0.0	7.4	0.0	9.9	10.5	9.2	1.9
v/c	0.00	0.06	0.00	0.09	0.00	0.06	0.01	
Queue	0.1	0.0	0.0	0.0	0.1	1.4	0.4	
Scenario 2 - Future 2032 with Site AM Peak Hour (Page C-12)								
Delay	7.5	0.0	7.4	0.0	10.0	10.6	9.2	2.2
v/c	0.00	0.06	0.00	0.09	0.00	0.07	0.02	
Queue	0.1	0.0	0.0	0.0	0.1	1.7	0.5	
Scenario 1 - Future 2032 without Site PM Peak Hour (Page C-8)								
Delay	7.7	0.0	7.5	0.0	10.9	11.9	9.7	3.2
v/c	0.02	0.07	0.00	0.13	0.02	0.10	0.06	
Queue	0.4	0.0	0.1	0.0	0.6	2.6	1.6	
Scenario 2 - Future 2032 with Site PM Peak Hour (Page C-16)								
Delay	7.7	0.0	7.5	0.0	10.9	12.0	9.7	3.2
v/c	0.02	0.07	0.00	0.13	0.02	0.10	0.06	
Queue	0.4	0.0	0.1	0.0	0.6	2.7	1.7	

5.5 INT #4: GLENDALE DRIVE AT METROPOLITAN AVENUE

Intersection #4 – Glendale Drive at Metropolitan Avenue:
Operational performance results for this intersection are provided in Table 8 for both the AM and PM peak hours.

Negligible changes in the operational performance of this intersection are expected with the addition of the proposed development. All movements are expected to operate with a v/c ratio of 0.89 or better. There are heavy westbound through volumes at this intersection during the PM peak hour and the 95th percentile queues along Glendale Drive are expected to extend beyond Raymond Drive and the RA-5 crosswalk crossing Glendale Drive (approximately 170m) without and with site generated trips. The site is not expected to add trips to the westbound through movement and there is already a separate channelized westbound right turn lane at the intersection. While the operations of this intersection without and with site generated trips fall slightly outside of HRM's guidelines for the westbound through movement, no geometric modifications are recommended.

Table 8 - Intersection Capacity Analysis: Glendale Drive at Metropolitan Avenue

LOS Criteria	Control Delay (sec/veh), v/c Ratio, and 95th %ile Queue (m) by Intersection Movement						Overall Intersection
	Glendale Drive				Metropolitan Avenue		
	EB-L	EB-T	WB-T	WB-R	SB-L	SB-R	Delay
Scenario 1 - Future 2032 without Site AM Peak Hour (Page C-2)							
Delay	7.8	11.3	22.1	5.1	24.3	15.1	14.3
v/c	0.35	0.56	0.54	0.29	0.54	0.46	
Queue	22.7	70.1	53.3	12.3	45.8	29.8	
Scenario 2 - Future 2032 with Site AM Peak Hour (Page C-10)							
Delay	8.0	11.6	22.5	5.1	24.8	15.5	14.7
v/c	0.35	0.56	0.55	0.30	0.56	0.47	
Queue	23.7	71.8	54.4	12.6	48.6	31.7	
Scenario 1 - Future 2032 without Site PM Peak Hour (Page C-6)							
Delay	30.5	6.4	32.7	5.2	54.1	34.4	25.7
v/c	0.71	0.32	0.89	0.37	0.70	0.63	
Queue	50.9	44.6	245.6	29.0	77.8	57.5	
Scenario 2 - Future 2032 with Site PM Peak Hour (Page C-14)							
Delay	32.2	6.4	33.0	5.3	54.2	34.6	25.9
v/c	0.73	0.32	0.89	0.39	0.70	0.63	
Queue	53.1	44.6	245.6	30.0	77.8	57.9	

6 SUMMARY, CONCLUSION & RECOMMENDATIONS

6.1 SUMMARY

Background	1.	Plans are being prepared to add residential units to an existing commercial site at 70 First Lake Drive in Lower Sackville, Nova Scotia. Additionally, the existing Tim Horton's restaurant within the site is being relocated within the site but will remain a similar size and this relocation is not expected to change the horizon year trips entering and exiting the site.
Description of Existing Development	2.	70 First Lake Drive is currently occupied with a Sobey's store, Tim Hortons' with a Drive-through, an unoccupied Call Centre, Glass Repair Shop, Recreation Sport Centre with a batting cage and small commercial stores. There are two access points from First Lake Drive, one driveway to the west and one driveway to the east. The existing commercial stores to remain within the proposed development include the Sobey's store and the Tim Horton's restaurant.
Description of the Proposed Development	3.	The proposed development is planned to include 154 high-rise apartment units. Halifax Regional Municipality (HRM) has requested that a Traffic Impact Study be completed to review the impacts to the adjacent road network.
	4.	The site includes an existing Tim Horton's restaurant with drive-through and the development includes relocation of the Tim Horton's with drive-through within the site. Only one restaurant will be operational at any given time and the existing site will be demolished with construction of the new restaurant. Sufficient queuing space for 18 drive-through vehicles should be accommodated within the site so as not to impact operations of the nearby site driveway or traffic along First Lake Drive.
	5.	It is anticipated that the development will be completed by 2027.
Proposed Site Access	6.	The access to the proposed development will be via the existing driveways on First Lake Drive.
Study Area Roads	7.	***First Lake Drive*** is a major collector road that has two lanes, one lane in each direction, and a posted speed limit of 50 km/h. There are transit stops servicing Routes #82 and #182 on both sides of First Lake Drive on the east side of the east driveway and on both sides of the west driveway. There is a sidewalk along the south side of the road.
	8.	***Metropolitan Avenue*** is a major collector roadway with two lanes, one lane in each direction and a posted speed limit within the study area of 50 km/h. There is a concrete sidewalk on both sides of Metropolitan Avenue between First Lake Drive and Kingfisher Way and along the west side north of First Lake Drive and south of Kingfisher Way. There are transit stops that service Routes #82 and #182 along both sides of Metropolitan Avenue north of First Lake Drive.
	9.	***Glendale Drive*** is an arterial road that has two lanes, one lane in each direction, and a posted speed limit of 60 km/h. There is an asphalt sidewalk on the north side of Glendale Drive and transit services for Route #84 in this area.
Turning Movement Counts	10.	Turning movement counts were collected by WSP on Wednesday, February 2nd, 2022 at Metropolitan Avenue / First Lake Drive during the morning (7:00-9:00AM) and afternoon

	(4:00-6:00PM) peak periods and at First Lake Drive / east driveway during the morning (7:00-9:00AM), midday (11:30AM-1:30PM), and afternoon (4:00-6:00PM) peak periods. 11. Additional turning movement counts were collected by WSP on Tuesday, January 9th, 2024 at the Glendale Drive / Metropolitan Avenue intersection during the morning (7:00-9:00AM) and afternoon (4:00-6:00PM) peak periods.
Background Traffic Volumes	12. Projected 2032 peak hour future background volumes include: • 1.0% annual growth between 2022-2032. • Retail trips generated by the unoccupied retail space with the 2022 counts.
Estimation of Proposed Development Trips	13. Trip generation estimates for the proposed development were prepared using rates published in *Trip Generation, 11th Edition* (Institute of Transportation Engineers, Washington, 2021), and methodology provided in *Trip Generation Handbook, 3rd Edition* (Institute of Transportation Engineers, Washington, 2017). 14. It is estimated that the development will generate: • 35 two-way vehicle trips (6 entering and 29 exiting) during the AM peak hour; and, • 33 two-way vehicle trips (23 entering and 10 exiting) during the PM peak hour.
Trip Distribution and Assignment	15. Proposed development generated trips were distributed to the Study Intersections based on counted volumes and local knowledge of the area considering major trip origins and destinations in the region. Trips were distributed to the north (5%), south (50%), west (20%), and east (25%).
Analysis Scenarios Considered	16. **Scenario 1 – Future 2032 without Site:** Represents future 2032 traffic volumes on the existing road network, including the existing traffic control and lane configurations of the Study Intersections without the proposed development. 17. **Scenario 2 – Future 2032 with Site:** Represents future 2032 traffic volumes on the existing road network, including the existing traffic control and lane configurations of the Study Intersections with the proposed development.
Warrant Analysis Summary	18. Warrant reviews were completed for traffic signals for Scenario 2 to identify road network upgrades warranted with the proposed development. a. No left-turn lane warrants were completed, as there are existing left-turn lanes on First Lake Drive at the site accesses. b. It was determined that traffic signals are not warranted at any Study Intersection that is not yet signalized.
Summary – Intersection Capacity Analysis	19. Intersection performance analysis was completed using *Synchro 11* at the Study Intersections. 20. All study intersections are expected to operate within HRM acceptable limits during the AM and PM peak hours with the exception of the westbound through movement on Glendale Drive at Metropolitan Avenue during the PM peak hour, which is expected to operate with a volume to capacity ratio (v/c) of 0.89 without and with site generated trips. Minimal impacts in the operational performance of these intersections are expected with the addition of the proposed development trips and no geometric modifications are recommended.

6.2 CONCLUSIONS

Conclusion	21. Trips generated by the proposed additional development at 70 First Lake Drive are expected to have a minimal impact on the operational performance of the Study Intersections and the adjacent street network. No modifications to the study intersections are recommended.

APPENDIX

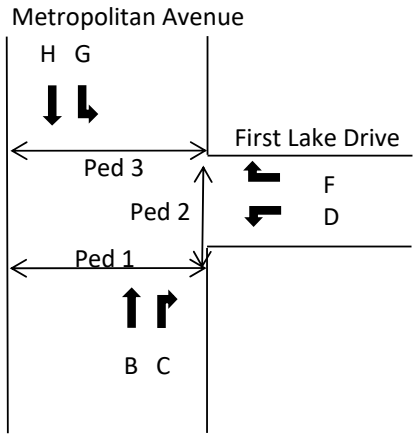
A TRAFFIC VOLUME DATA

Table A-1

Metropolitan Avenue @ First Lake Drive

Lower Sackville, NS

Wednesday, February 2, 2022



AM Peak Period Volume Data

Time		Metropolitan Avenue Northbound Approach		First Lake Drive Westbound Approach		Metropolitan Avenue Southbound Approach		Total Vehicles
		B	C	D	F	G	H	
07:00	07:15	4	22	23	1	12	32	94
07:15	07:30	14	31	33	6	12	28	124
07:30	07:45	17	48	28	8	13	43	157
07:45	08:00	21	36	51	12	5	45	170
08:00	08:15	17	43	54	10	16	36	176
08:15	08:30	14	27	28	10	6	18	103
08:30	08:45	36	43	42	7	15	57	200
08:45	09:00	55	47	48	19	20	82	271
AM Peak Hour		**122**	**160**	**172**	**46**	**57**	**193**	**750**
07:00	**08:00**	**56**	**137**	**135**	**27**	**42**	**148**	**545**
08:00	**09:00**	**122**	**160**	**172**	**46**	**57**	**193**	**750**
		Ped 1		**Ped 2**		**Ped 3**		**Total Peds**
07:00	**08:00**	**4**		**1**		**0**		**5**
08:00	**09:00**	**8**		**1**		**0**		**9**

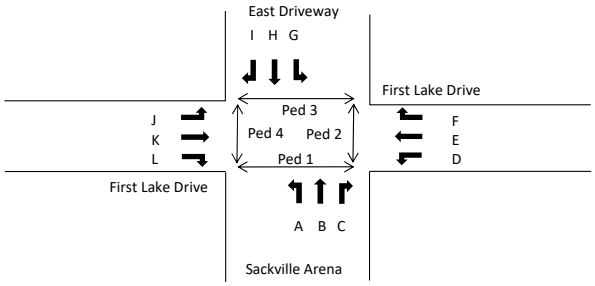
PM Peak Period Volume Data

Time		Metropolitan Avenue Northbound Approach		First Lake Drive Westbound Approach		Metropolitan Avenue Southbound Approach		Total Vehicles
		B	C	D	F	G	H	
16:00	16:15	43	70	44	17	8	26	208
16:15	16:30	50	65	50	17	8	21	211
16:30	16:45	47	63	61	18	4	29	222
16:45	17:00	49	61	58	23	8	35	234
17:00	17:15	40	68	59	29	8	21	225
17:15	17:30	54	63	59	12	6	17	211
17:30	17:45	42	52	57	17	6	15	189
17:45	18:00	33	58	58	13	7	28	197
PM Peak Hour		**190**	**255**	**237**	**82**	**26**	**102**	**892**
16:00	**17:00**	**189**	**259**	**213**	**75**	**28**	**111**	**875**
17:00	**18:00**	**169**	**241**	**233**	**71**	**27**	**81**	**822**
		Ped 1		**Ped 2**		**Ped 3**		**Total Peds**
16:00	**17:00**	**4**		**0**		**0**		**4**
17:00	**18:00**	**4**		**1**		**0**		**5**

Table A-2

First Lake Drive
@
East Driveway

Lower Sackville, NS
Wednesday, February 2, 2022



AM Peak Period Volume Data

Time		East Driveway Northbound Approach			First Lake Drive Westbound Approach			East Driveway Southbound Approach			First Lake Drive Eastbound Approach			Total Vehicles
		A	B	C	D	E	F	G	H	I	J	K	L	
07:00	07:15	0	0	0	1	14	2	3	0	1	2	14	0	37
07:15	07:30	0	0	0	0	23	1	6	1	0	0	16	0	47
07:30	07:45	0	0	0	0	21	3	11	0	2	3	29	0	69
07:45	08:00	0	0	0	0	51	8	6	0	2	1	22	0	90
08:00	08:15	0	0	0	1	38	5	10	0	2	2	22	0	80
08:15	08:30	2	0	0	0	19	3	6	0	2	0	16	0	48
08:30	08:45	0	0	0	0	24	1	8	0	1	1	22	0	57
08:45	09:00	0	0	0	0	32	5	6	0	3	4	20	1	71
AM Peak Hour		**2**	**0**	**0**	**1**	**129**	**19**	**33**	**0**	**8**	**6**	**89**	**0**	**287**
07:00	**08:00**	**0**	**0**	**0**	**1**	**109**	**14**	**26**	**1**	**5**	**6**	**81**	**0**	**243**
08:00	**09:00**	**2**	**0**	**0**	**1**	**113**	**14**	**30**	**0**	**8**	**7**	**80**	**1**	**256**
		Ped 1			**Ped 2**			**Ped 3**			**Ped 4**			**Total Peds**
07:00	**08:00**	**1**			**0**			**0**			**1**			**2**
08:00	**09:00**	**14**			**0**			**0**			**1**			**15**

Midday Volume Data

Time		East Driveway Northbound Approach			First Lake Drive Westbound Approach			East Driveway Southbound Approach			First Lake Drive Eastbound Approach			Total Vehicles
		A	B	C	D	E	F	G	H	I	J	K	L	
11:30	11:45	0	0	1	0	10	5	5	0	6	4	17	0	48
11:45	12:00	1	0	0	1	18	8	12	0	3	1	11	1	56
12:00	12:15	1	0	0	0	17	9	12	0	3	2	13	0	57
12:15	12:30	0	0	1	0	25	4	12	0	2	1	12	1	58
12:30	12:45	0	0	0	1	16	6	3	1	4	1	17	0	49
12:45	13:00	0	0	0	0	14	6	12	0	4	3	14	0	53
13:00	13:15	0	0	0	0	14	3	8	0	7	4	10	0	46
13:15	13:30	1	0	0	0	17	7	12	0	8	4	16	0	65
Midday Peak Hour		**2**	**0**	**1**	**2**	**76**	**27**	**39**	**1**	**12**	**5**	**53**	**2**	**220**
11:30	**12:30**	**2**	**0**	**2**	**1**	**70**	**26**	**41**	**0**	**14**	**8**	**53**	**2**	**219**
12:30	**13:30**	**1**	**0**	**0**	**1**	**61**	**22**	**35**	**1**	**23**	**12**	**57**	**0**	**213**
		Ped 1			**Ped 2**			**Ped 3**			**Ped 4**			**Total Peds**
11:30	**12:30**	**4**			**0**			**0**			**2**			**6**
12:30	**13:30**	**3**			**1**			**0**			**0**			**4**

PM Peak Period Volume Data

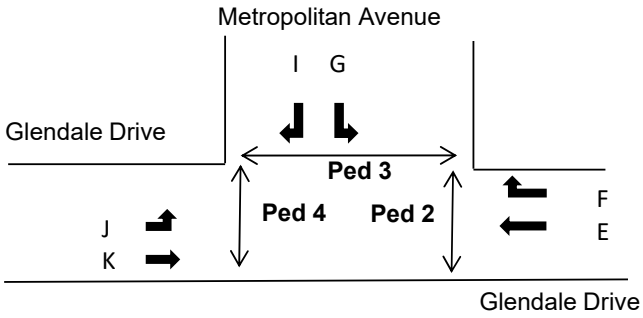
Time		East Driveway Northbound Approach			First Lake Drive Westbound Approach			East Driveway Southbound Approach			First Lake Drive Eastbound Approach			Total Vehicles
		A	B	C	D	E	F	G	H	I	J	K	L	
16:00	16:15	0	0	1	1	19	15	13	0	8	3	28	1	89
16:15	16:30	0	1	0	1	25	5	16	3	7	3	28	1	90
16:30	16:45	0	1	0	0	26	11	8	0	9	8	17	2	82
16:45	17:00	0	1	1	0	38	23	10	0	11	5	23	0	112
17:00	17:15	5	1	4	0	26	11	15	2	7	3	32	0	106
17:15	17:30	2	0	0	5	31	15	14	2	8	5	30	0	112
17:30	17:45	0	0	1	0	25	12	13	0	10	4	18	2	85
17:45	18:00	7	0	0	1	16	9	13	0	6	3	22	1	78
PM Peak Hour		**7**	**2**	**6**	**5**	**120**	**61**	**52**	**4**	**36**	**17**	**103**	**2**	**415**
16:00	**17:00**	**0**	**3**	**2**	**2**	**108**	**54**	**47**	**3**	**35**	**19**	**96**	**4**	**373**
17:00	**18:00**	**14**	**1**	**5**	**6**	**98**	**47**	**55**	**4**	**31**	**15**	**102**	**3**	**381**
		Ped 1			**Ped 2**			**Ped 3**			**Ped 4**			**Total Peds**
16:00	**17:00**	**13**			**0**			**0**			**0**			**13**
17:00	**18:00**	**6**			**0**			**0**			**2**			**8**

Table A-3

Glendale Drive @ Metropolitan Avenue

Lower Sackville, NS

Tuesday, January 09, 2023

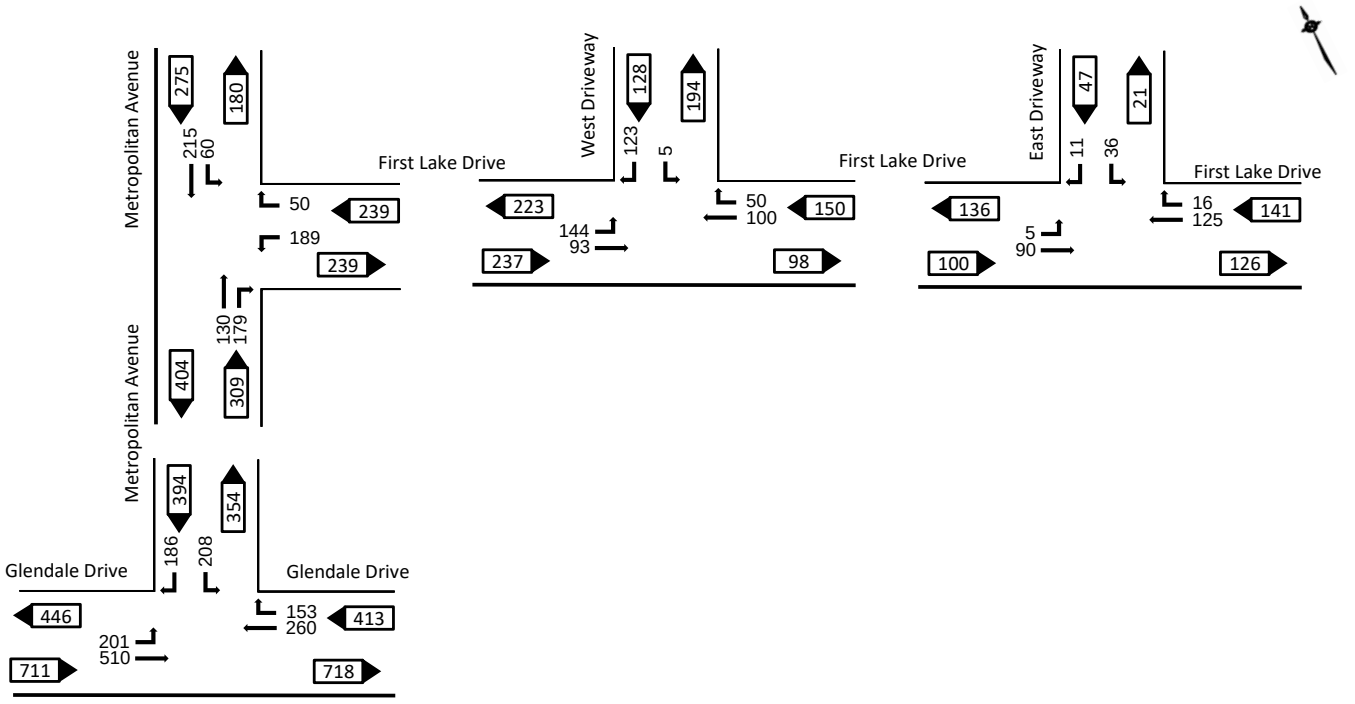


AM Peak Period Volume Data

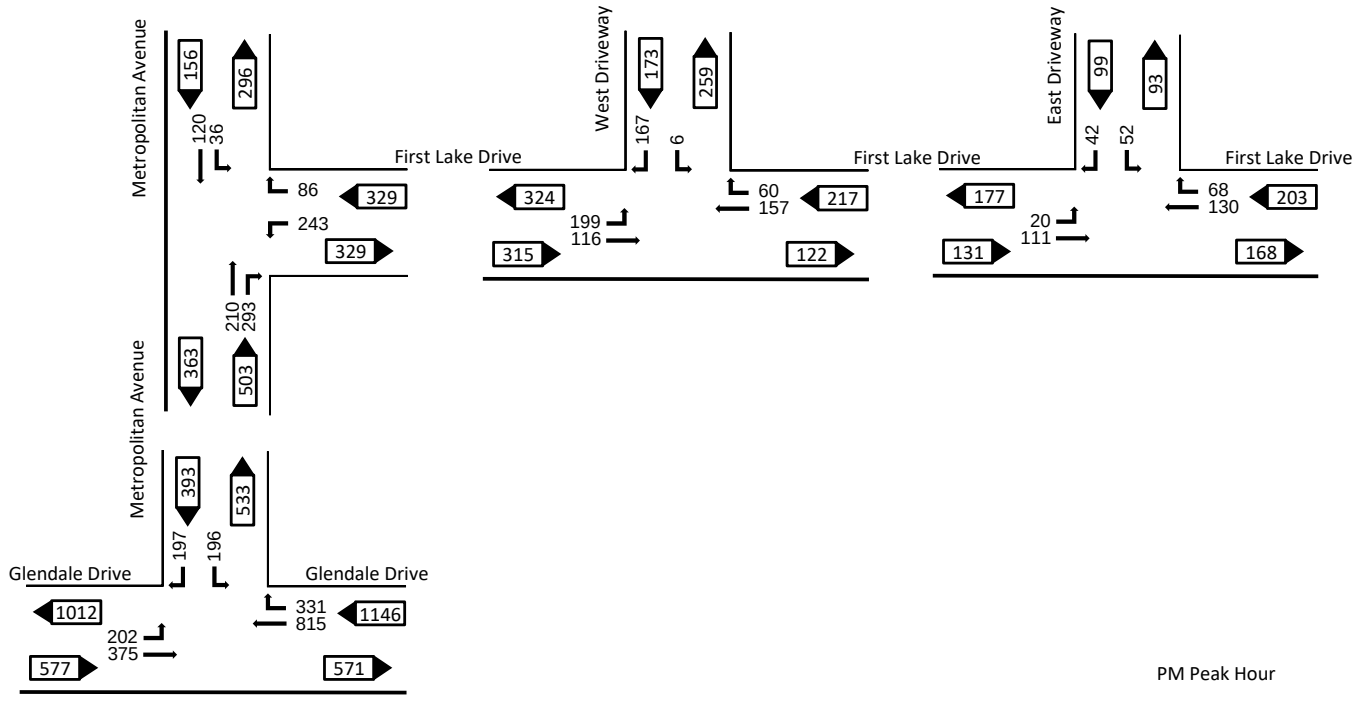
Time		Glendale Drive Westbound Approach		Metropolitan Avenue Southbound Approach		Glendale Drive Eastbound Approach		Total Vehicles
		E	F	G	I	J	K	
07:00	07:15	20	19	55	10	11	124	239
07:15	07:30	36	24	40	22	23	128	273
07:30	07:45	39	31	64	16	28	144	322
07:45	08:00	34	29	62	35	56	139	355
08:00	08:15	45	27	45	58	41	113	329
08:15	08:30	59	23	42	20	19	119	282
08:30	08:45	70	43	54	30	50	135	382
08:45	09:00	68	45	51	65	75	105	409
AM Peak Hour		**242**	**138**	**192**	**173**	**185**	**472**	**1402**
07:00	**08:00**	**129**	**103**	**221**	**83**	**118**	**535**	**1189**
08:00	**09:00**	**242**	**138**	**192**	**173**	**185**	**472**	**1402**
		Ped 2		**Ped 3**		**Ped 4**		**Total Peds**
07:00	**08:00**	**0**		**0**		**0**		**0**
08:00	**09:00**	**0**		**20**		**0**		**20**

PM Peak Period Volume Data

Time		Glendale Drive Westbound Approach		Metropolitan Avenue Southbound Approach		Glendale Drive Eastbound Approach		Total Vehicles
		E	F	G	I	J	K	
16:00	16:15	162	60	52	46	43	76	439
16:15	16:30	206	68	48	38	41	84	485
16:30	16:45	172	77	48	42	38	96	473
16:45	17:00	205	66	48	55	54	80	508
17:00	17:15	189	73	39	45	46	78	470
17:15	17:30	187	84	39	39	48	93	490
17:30	17:45	141	55	41	37	38	76	388
17:45	18:00	129	80	37	56	62	95	459
PM Peak Hour		**753**	**300**	**174**	**181**	**186**	**347**	**1941**
16:00	**17:00**	**745**	**271**	**196**	**181**	**176**	**336**	**1905**
17:00	**18:00**	**646**	**292**	**156**	**177**	**194**	**342**	**1807**
		Ped 2		**Ped 3**		**Ped 4**		**Total Peds**
16:00	**17:00**	**2**		**4**		**0**		**6**
17:00	**18:00**	**4**		**3**		**0**		**7**

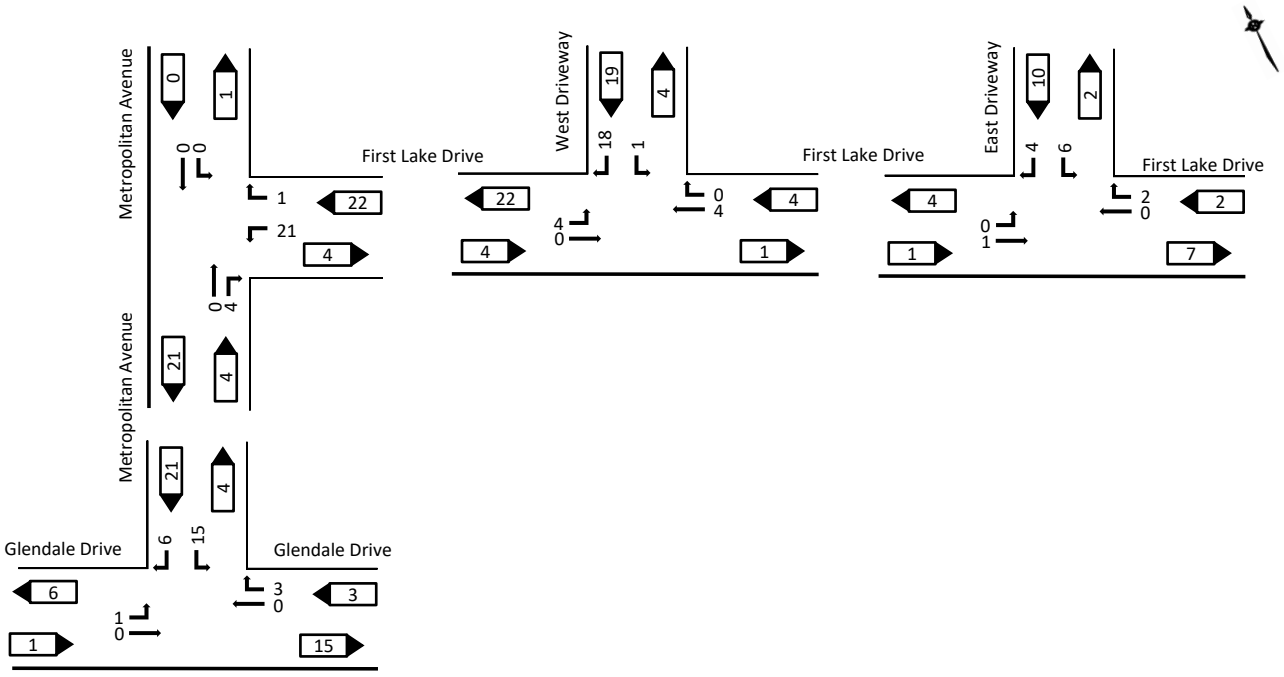


AM Peak Hour

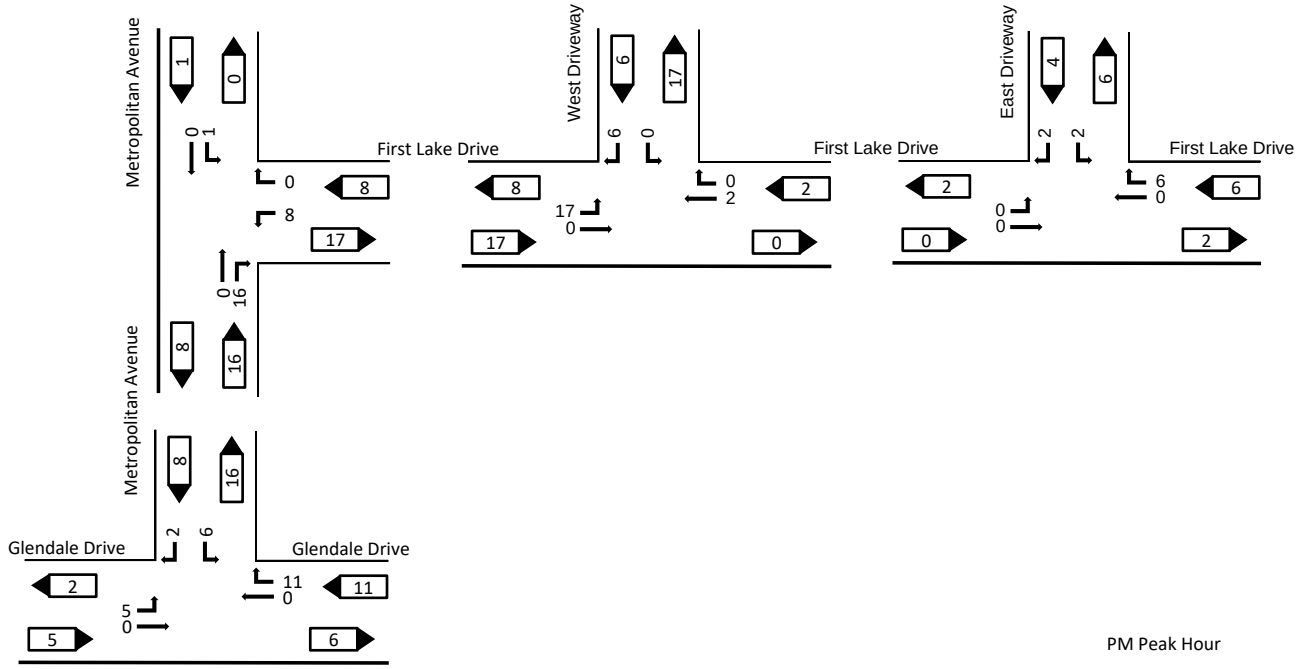


PM Peak Hour

wsp	70 First Lake Development - TIS Lower Sackville, NS	Figure A-1
	Weekday AM and PM Peak Hour 2032 Future Background Traffic Volumes	May 2024

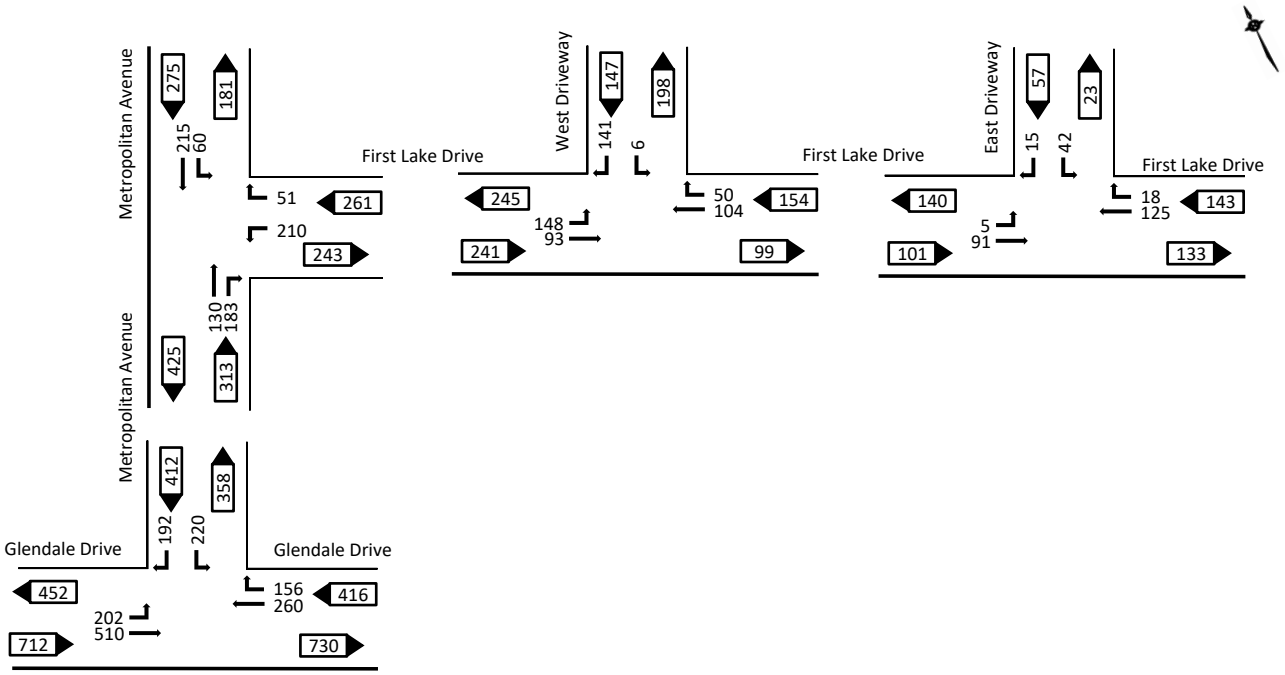


AM Peak Hour

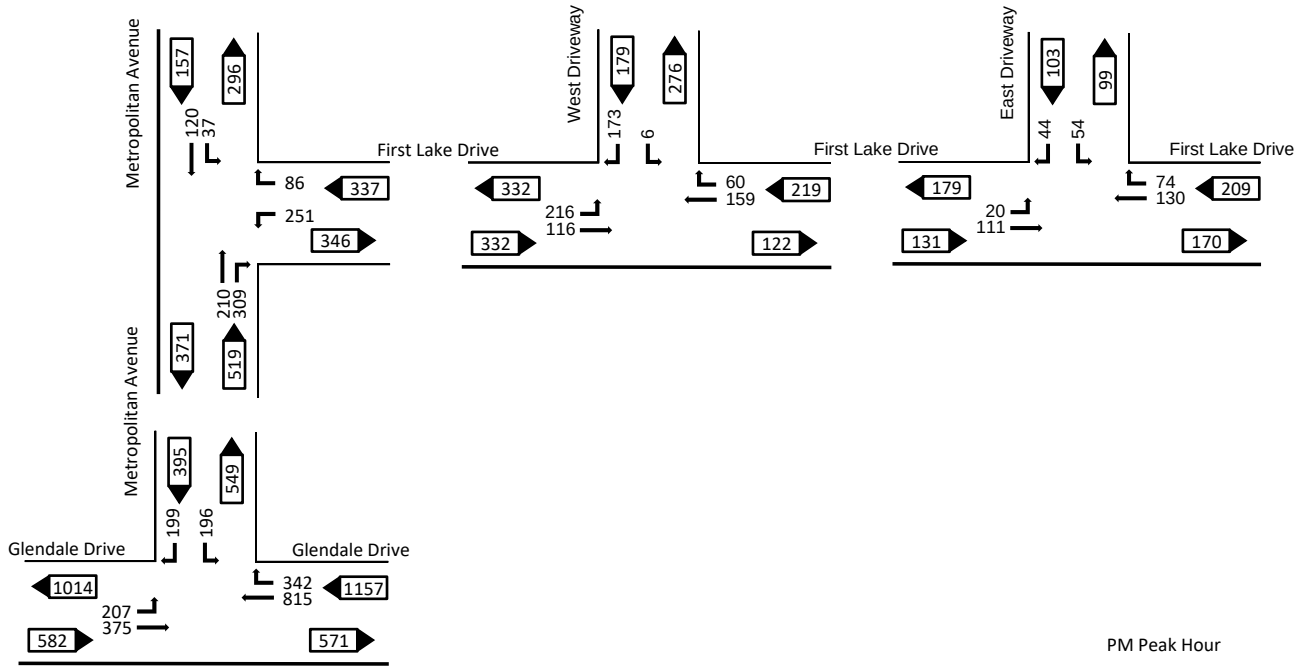


PM Peak Hour

wsp	70 First Lake Development - TIS Lower Sackville, NS	Figure A-2
	Weekday AM and PM Peak Hour Trip Assignment	May 2024



AM Peak Hour



PM Peak Hour

wsp	70 First Lake Development - TIS Lower Sackville, NS	Figure A-3
	Weekday AM and PM Peak Hour 2032 Total Traffic with Site Generated Trips	May 2024

APPENDIX

B WARRANT ANALYSIS

2005 Canadian Traffic Signal Warrant Matrix Analysis

Table: B-1 - First Lake Drive at West Driveway
2032 Future with Site

Main Street (name)	First Lake Drive	Direction (EW or NS)	EW	Date:	May 2024
Side Street (name)	West Driveway	Direction (EW or NS)	NS	City:	Lower Sackville, NS

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
First Lake Drive	WB				1		210	1	
First Lake Drive	EB	1		1			10,000	1	
	NB								
West Driveway	SB	1				1			

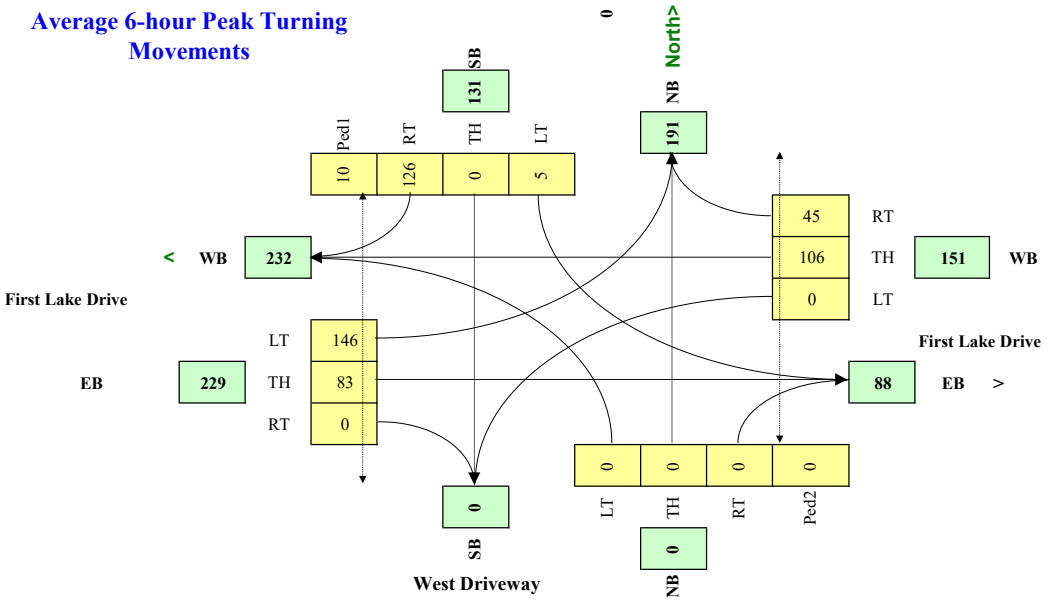
Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
First Lake Drive	EW	50	2.0%	y	0.0
West Driveway	NS	50	2.0%	n	

	Ped1	Ped2	Ped3	Ped4
	NS	NS	EW	EW
	W Side	E Side	N Side	S side
7:00 - 8:00	10	0	5	0
8:00 - 9:00	10	0	5	0
11:30 - 12:30	10	0	5	0
12:30 - 13:30	10	0	5	0
15:30 - 16:30	10	0	5	0
16:30 - 17:30	10	0	5	0
Total (6-hour peak)	**60**	**0**	**30**	**0**
Average (6-hour peak)	**10**	**0**	**5**	**0**

Demographics		
Elementary School	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	400,000
Central Business District	(y/n)	n

Traffic Input	NB			SB			WB			EB		
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT
7:00 - 8:00	0	0	0	5	0	140	0	105	50	150	95	0
8:00 - 9:00	0	0	0	5	0	125	0	95	45	135	85	0
11:30 - 12:30	0	0	0	5	0	80	0	65	30	90	50	0
12:30 - 13:30	0	0	0	5	0	80	0	65	30	90	50	0
15:30 - 16:30	0	0	0	5	0	155	0	145	55	195	105	0
16:30 - 17:30	0	0	0	5	0	175	0	160	60	215	115	0
Total (6-hour peak)	**0**	**0**	**0**	**30**	**0**	**755**	**0**	**635**	**270**	**875**	**500**	**0**
Average (6-hour peak)	**0**	**0**	**0**	**5**	**0**	**126**	**0**	**106**	**45**	**146**	**83**	**0**

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\,(X_{v\text{-}p})\,L) / K_2] \times C_i$$

W =	17	12	5
		Veh	*Ped*

NOT Warranted

2005 Canadian Traffic Signal Warrant Matrix Analysis

Table: B-2 - First Lake Drive at East Driveway
2032 Future with Site

Main Street (name)	First Lake Drive	Direction (EW or NS)	EW	Date:	March 2024
Side Street (name)	East Driveway	Direction (EW or NS)	NS	City:	Lower Sackville, NS

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
First Lake Drive	WB	1			1		500	1	
First Lake Drive	EB	1			1		10,000	1	
Sackville Arena	NB			1					
East Driveway	SB	1			1				

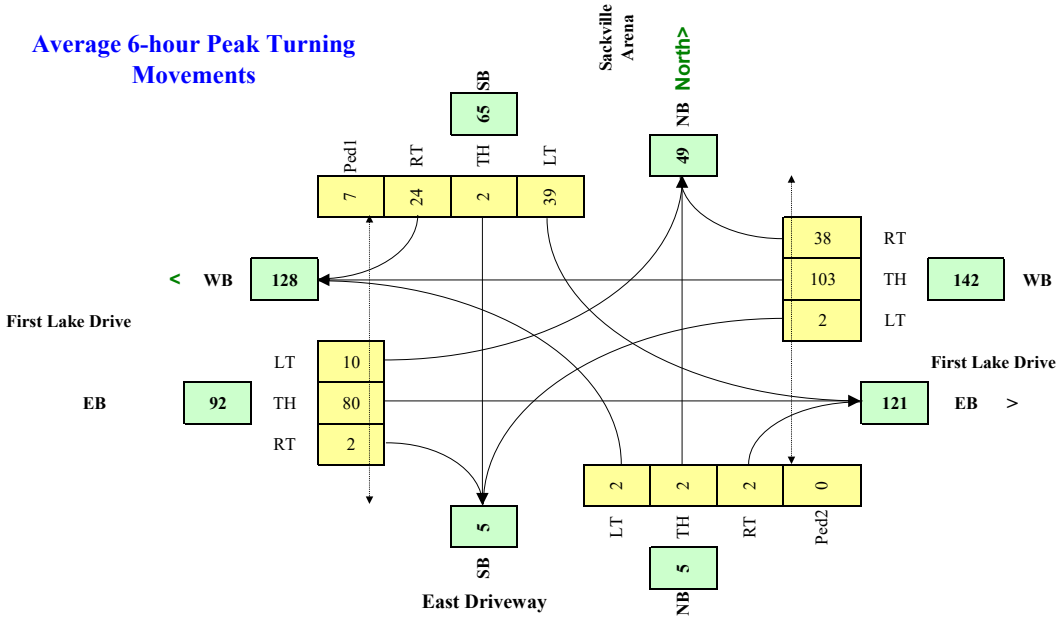
Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
First Lake Drive	EW	50	2.0%	y	0.0
East Driveway	NS	50	2.0%	n	

	Ped1 NS W Side	Ped2 NS E Side	Ped3 EW N Side	Ped4 EW S side
7:00 - 8:00	1	0	0	1
8:00 - 9:00	14	0	0	1
11:30 - 12:30	4	0	0	2
12:30 - 13:30	3	1	0	0
15:30 - 16:30	13	0	0	0
16:30 - 17:30	6	0	0	2
Total (6-hour peak)	**41**	**1**	**0**	**6**
Average (6-hour peak)	**7**	**0**	**0**	**1**

Demographics		
Elementary School	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	400,000
Central Business District	(y/n)	n

Traffic Input	NB			SB			WB			EB		
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT
7:00 - 8:00	0	0	0	40	0	15	0	125	20	5	90	5
8:00 - 9:00	0	0	0	40	0	15	0	115	15	5	80	5
11:30 - 12:30	0	0	0	25	0	15	0	65	25	5	50	0
12:30 - 13:30	0	0	0	25	0	15	0	65	25	5	50	0
15:30 - 16:30	5	5	5	50	5	40	5	115	65	20	100	0
16:30 - 17:30	5	5	5	55	5	45	5	130	75	20	110	0
Total (6-hour peak)	**10**	**10**	**10**	**235**	**10**	**145**	**10**	**615**	**225**	**60**	**480**	**10**
Average (6-hour peak)	**2**	**2**	**2**	**39**	**2**	**24**	**2**	**103**	**38**	**10**	**80**	**2**

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\,(X_{v\text{-}p})\,L) / K_2] \times C_i$$

W =	7	6	1
		Veh	*Ped*

Not Warranted - Vs<75

APPENDIX

C

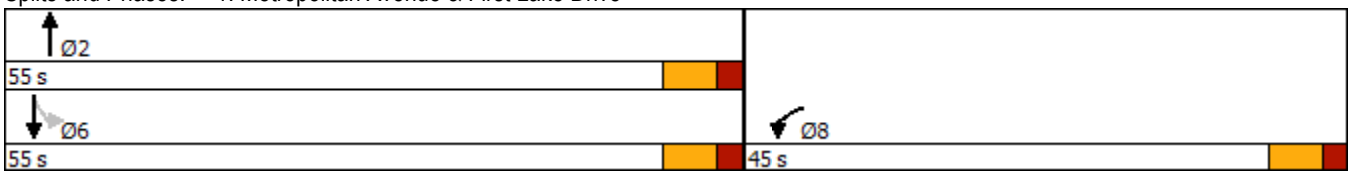
INTERSECTION PERFORMANCE ANALYSIS

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	189	50	130	179	60	215
Future Volume (vph)	189	50	130	179	60	215
Satd. Flow (prot)	1731	0	1687	0	0	1842
Flt Permitted	0.962					0.850
Satd. Flow (perm)	1716	0	1687	0	0	1581
Satd. Flow (RTOR)	16		98			
Lane Group Flow (vph)	259	0	336	0	0	299
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Total Split (s)	45.0		55.0		55.0	55.0
Total Lost Time (s)	6.0		6.0			6.0
Act Effct Green (s)	12.9		16.6			16.6
Actuated g/C Ratio	0.31		0.40			0.40
v/c Ratio	0.48		0.46			0.48
Control Delay	14.2		9.6			13.4
Queue Delay	0.0		0.0			0.0
Total Delay	14.2		9.6			13.4
LOS	B		A			B
Approach Delay	14.2		9.6			13.4
Approach LOS	B		A			B
Queue Length 50th (m)	13.2		10.4			13.8
Queue Length 95th (m)	34.3		37.1			43.3
Internal Link Dist (m)	194.9		85.0			233.3
Turn Bay Length (m)						
Base Capacity (vph)	1612		1638			1532
Starvation Cap Reductn	0		0			0
Spillback Cap Reductn	0		0			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	0.16		0.21			0.20

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 41.9
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.48
Intersection Signal Delay: 12.2
Intersection LOS: B
Intersection Capacity Utilization 62.4%
ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 1: Metropolitan Avenue & First Lake Drive

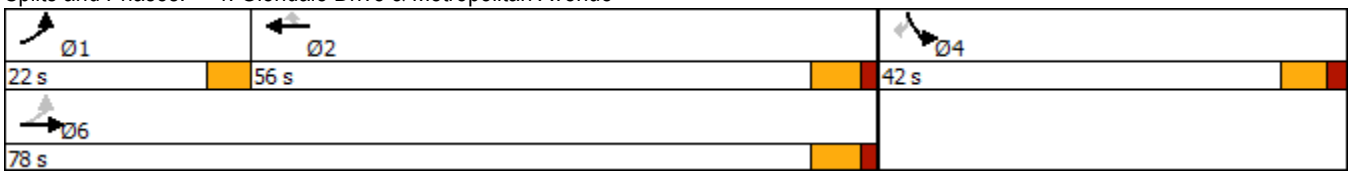


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	201	510	260	153	208	186
Future Volume (vph)	201	510	260	153	208	186
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.428				0.950	
Satd. Flow (perm)	797	1863	1863	1583	1770	1583
Satd. Flow (RTOR)				166		86
Lane Group Flow (vph)	218	554	283	166	226	202
Turn Type	pm+pt	NA	NA	Perm	Prot	Perm
Protected Phases	1	6	2		4	
Permitted Phases	6			2		4
Total Split (s)	22.0	78.0	56.0	56.0	42.0	42.0
Total Lost Time (s)	4.0	6.0	6.0	6.0	6.0	6.0
Act Effct Green (s)	31.0	29.0	15.2	15.2	12.9	12.9
Actuated g/C Ratio	0.57	0.54	0.28	0.28	0.24	0.24
v/c Ratio	0.35	0.56	0.54	0.29	0.54	0.46
Control Delay	7.8	11.3	22.1	5.1	24.3	15.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.8	11.3	22.1	5.1	24.3	15.1
LOS	A	B	C	A	C	B
Approach Delay		10.3	15.8		20.0	
Approach LOS		B	B		B	
Queue Length 50th (m)	9.2	32.7	23.8	0.0	19.3	9.3
Queue Length 95th (m)	22.7	70.1	53.3	12.3	45.8	29.8
Internal Link Dist (m)		161.1	209.3		132.8	
Turn Bay Length (m)	70.0			65.0		10.0
Base Capacity (vph)	789	1863	1685	1448	1209	1108
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	0.28	0.30	0.17	0.11	0.19	0.18

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 54.2
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.56
Intersection Signal Delay: 14.3
Intersection LOS: B
Intersection Capacity Utilization 49.7%
ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 4: Glendale Drive & Metropolitan Avenue



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	144	93	100	50	5	123
Future Volume (Veh/h)	144	93	100	50	5	123
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	157	101	109	54	5	134
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		219				
pX, platoon unblocked						
vC, conflicting volume	163				551	136
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	163				551	136
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	89				99	85
cM capacity (veh/h)	1416				440	913

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	157	101	163	5	134
Volume Left	157	0	0	5	0
Volume Right	0	0	54	0	134
cSH	1416	1700	1700	440	913
Volume to Capacity	0.11	0.06	0.10	0.01	0.15
Queue Length 95th (m)	3.0	0.0	0.0	0.3	4.1
Control Delay (s)	7.9	0.0	0.0	13.3	9.6
Lane LOS	A			B	A
Approach Delay (s)	4.8		0.0	9.8	
Approach LOS				A	

Intersection Summary			
Average Delay	4.6		
Intersection Capacity Utilization	29.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	90	5	1	125	16	1	1	1	36	1	11
Future Volume (Veh/h)	5	90	5	1	125	16	1	1	1	36	1	11
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	98	5	1	136	17	1	1	1	39	1	12
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	153			103			261	266	100	256	260	144
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	153			103			261	266	100	256	260	144
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	94	100	99
cM capacity (veh/h)	1428			1489			680	637	955	693	642	903

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	5	103	1	153	3	39	13
Volume Left	5	0	1	0	1	39	0
Volume Right	0	5	0	17	1	0	12
cSH	1428	1700	1489	1700	734	693	875
Volume to Capacity	0.00	0.06	0.00	0.09	0.00	0.06	0.01
Queue Length 95th (m)	0.1	0.0	0.0	0.0	0.1	1.4	0.4
Control Delay (s)	7.5	0.0	7.4	0.0	9.9	10.5	9.2
Lane LOS	A		A		A	B	A
Approach Delay (s)	0.3		0.0		9.9	10.2	
Approach LOS					A	B	

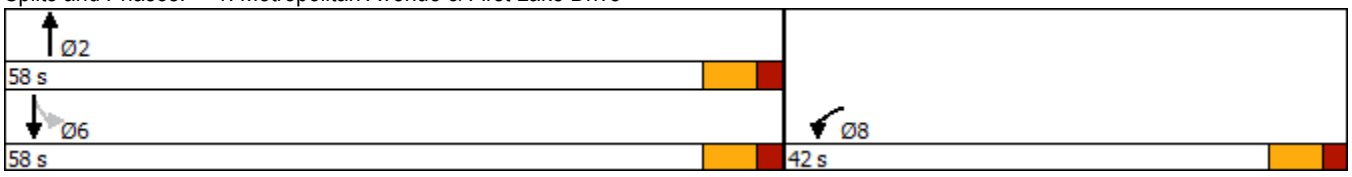
Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	19.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	243	86	210	293	36	120
Future Volume (vph)	243	86	210	293	36	120
Satd. Flow (prot)	1719	0	1685	0	0	1842
Flt Permitted	0.964					0.818
Satd. Flow (perm)	1705	0	1685	0	0	1523
Satd. Flow (RTOR)	20		105			
Lane Group Flow (vph)	357	0	546	0	0	169
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Total Split (s)	42.0		58.0		58.0	58.0
Total Lost Time (s)	6.0		6.0			6.0
Act Effct Green (s)	16.3		21.8			21.8
Actuated g/C Ratio	0.32		0.43			0.43
v/c Ratio	0.63		0.70			0.26
Control Delay	20.7		15.4			11.2
Queue Delay	0.0		0.0			0.0
Total Delay	20.7		15.4			11.2
LOS	C		B			B
Approach Delay	20.7		15.4			11.2
Approach LOS	C		B			B
Queue Length 50th (m)	23.8		28.8			9.0
Queue Length 95th (m)	66.1		78.0			25.5
Internal Link Dist (m)	194.9		85.0			233.3
Turn Bay Length (m)						
Base Capacity (vph)	1302		1566			1408
Starvation Cap Reductn	0		0			0
Spillback Cap Reductn	0		0			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	0.27		0.35			0.12

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 50.9
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.70
Intersection Signal Delay: 16.5
Intersection LOS: B
Intersection Capacity Utilization 66.5%
ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 1: Metropolitan Avenue & First Lake Drive

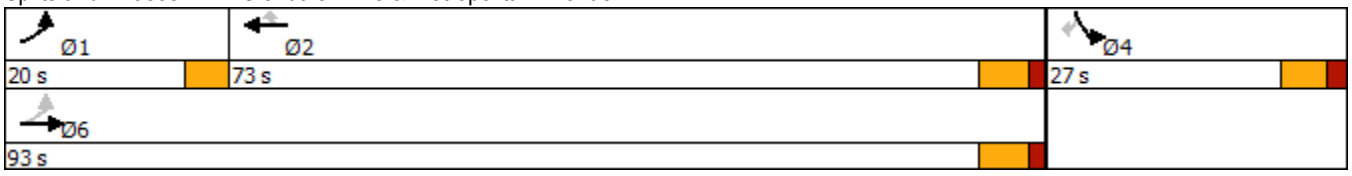


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	202	375	815	331	196	197
Future Volume (vph)	202	375	815	331	196	197
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.092				0.950	
Satd. Flow (perm)	171	1863	1863	1583	1770	1583
Satd. Flow (RTOR)				252		82
Lane Group Flow (vph)	220	408	886	360	213	214
Turn Type	pm+pt	NA	NA	Perm	Prot	Perm
Protected Phases	1	6	2		4	
Permitted Phases	6			2		4
Total Split (s)	20.0	93.0	73.0	73.0	27.0	27.0
Total Lost Time (s)	4.0	6.0	6.0	6.0	6.0	6.0
Act Effct Green (s)	69.0	66.9	51.4	51.4	16.6	16.6
Actuated g/C Ratio	0.72	0.70	0.53	0.53	0.17	0.17
v/c Ratio	0.71	0.32	0.89	0.37	0.70	0.63
Control Delay	30.5	6.4	32.7	5.2	54.1	34.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.5	6.4	32.7	5.2	54.1	34.4
LOS	C	A	C	A	D	C
Approach Delay		14.8	24.8		44.2	
Approach LOS		B	C		D	
Queue Length 50th (m)	19.8	27.7	146.2	10.0	40.8	24.5
Queue Length 95th (m)	50.9	44.6	245.6	29.0	#77.8	57.5
Internal Link Dist (m)		161.1	209.3		132.8	
Turn Bay Length (m)	70.0			65.0		10.0
Base Capacity (vph)	405	1614	1352	1218	410	430
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.25	0.66	0.30	0.52	0.50

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 96.2
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 25.7 Intersection LOS: C
Intersection Capacity Utilization 78.3% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 4: Glendale Drive & Metropolitan Avenue



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	199	116	157	60	6	167
Future Volume (Veh/h)	199	116	157	60	6	167
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	216	126	171	65	7	182
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		219				
pX, platoon unblocked						
vC, conflicting volume	236				762	204
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	236				762	204
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	84				98	78
cM capacity (veh/h)	1331				313	837

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	216	126	236	7	182
Volume Left	216	0	0	7	0
Volume Right	0	0	65	0	182
cSH	1331	1700	1700	313	837
Volume to Capacity	0.16	0.07	0.14	0.02	0.22
Queue Length 95th (m)	4.6	0.0	0.0	0.5	6.6
Control Delay (s)	8.2	0.0	0.0	16.8	10.5
Lane LOS	A			C	B
Approach Delay (s)	5.2		0.0	10.7	
Approach LOS				B	

Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	36.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	111	1	5	130	68	5	5	5	52	5	42
Future Volume (Veh/h)	20	111	1	5	130	68	5	5	5	52	5	42
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	121	1	5	141	74	5	5	5	57	5	46
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	215			122			365	390	122	360	354	178
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	215			122			365	390	122	360	354	178
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			100			99	99	99	90	99	95
cM capacity (veh/h)	1355			1465			548	534	930	579	560	865

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	22	122	5	215	15	57	51
Volume Left	22	0	5	0	5	57	0
Volume Right	0	1	0	74	5	0	46
cSH	1355	1700	1465	1700	628	579	821
Volume to Capacity	0.02	0.07	0.00	0.13	0.02	0.10	0.06
Queue Length 95th (m)	0.4	0.0	0.1	0.0	0.6	2.6	1.6
Control Delay (s)	7.7	0.0	7.5	0.0	10.9	11.9	9.7
Lane LOS	A		A		B	B	A
Approach Delay (s)	1.2		0.2		10.9	10.8	
Approach LOS					B	B	

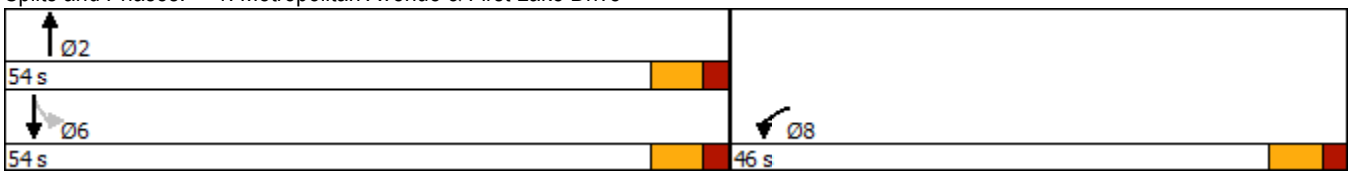
Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	30.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	210	51	130	183	60	215
Future Volume (vph)	210	51	130	183	60	215
Satd. Flow (prot)	1733	0	1685	0	0	1842
Flt Permitted	0.961					0.849
Satd. Flow (perm)	1718	0	1685	0	0	1579
Satd. Flow (RTOR)	14		98			
Lane Group Flow (vph)	283	0	340	0	0	299
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Total Split (s)	46.0		54.0		54.0	54.0
Total Lost Time (s)	6.0		6.0			6.0
Act Effct Green (s)	13.3		16.7			16.7
Actuated g/C Ratio	0.31		0.39			0.39
v/c Ratio	0.51		0.47			0.48
Control Delay	14.9		9.9			13.7
Queue Delay	0.0		0.0			0.0
Total Delay	14.9		9.9			13.7
LOS	B		A			B
Approach Delay	14.9		9.9			13.7
Approach LOS	B		A			B
Queue Length 50th (m)	14.9		11.0			14.3
Queue Length 95th (m)	37.9		37.6			43.3
Internal Link Dist (m)	194.9		85.0			233.3
Turn Bay Length (m)						
Base Capacity (vph)	1619		1630			1524
Starvation Cap Reductn	0		0			0
Spillback Cap Reductn	0		0			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	0.17		0.21			0.20

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 42.3
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.51
Intersection Signal Delay: 12.7
Intersection LOS: B
Intersection Capacity Utilization 63.6%
ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 1: Metropolitan Avenue & First Lake Drive

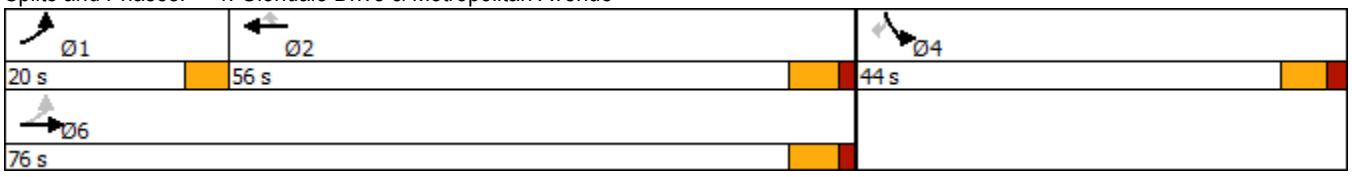


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	202	510	260	156	220	192
Future Volume (vph)	202	510	260	156	220	192
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.426				0.950	
Satd. Flow (perm)	794	1863	1863	1583	1770	1583
Satd. Flow (RTOR)				170		86
Lane Group Flow (vph)	220	554	283	170	239	209
Turn Type	pm+pt	NA	NA	Perm	Prot	Perm
Protected Phases	1	6	2		4	
Permitted Phases	6			2		4
Total Split (s)	20.0	76.0	56.0	56.0	44.0	44.0
Total Lost Time (s)	4.0	6.0	6.0	6.0	6.0	6.0
Act Effct Green (s)	31.3	29.2	15.3	15.3	13.4	13.4
Actuated g/C Ratio	0.57	0.53	0.28	0.28	0.24	0.24
v/c Ratio	0.35	0.56	0.55	0.30	0.55	0.46
Control Delay	8.1	11.7	22.5	5.1	24.6	15.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.1	11.7	22.5	5.1	24.6	15.3
LOS	A	B	C	A	C	B
Approach Delay		10.6	16.0		20.3	
Approach LOS		B	B		C	
Queue Length 50th (m)	9.6	33.5	24.2	0.0	20.8	10.0
Queue Length 95th (m)	23.7	71.9	54.4	12.6	48.6	31.4
Internal Link Dist (m)		161.1	209.3		132.8	
Turn Bay Length (m)	70.0			65.0		10.0
Base Capacity (vph)	744	1854	1669	1436	1260	1152
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	0.30	0.30	0.17	0.12	0.19	0.18

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 55
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.56
Intersection Signal Delay: 14.7
Intersection LOS: B
Intersection Capacity Utilization 50.4%
ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 4: Glendale Drive & Metropolitan Avenue



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	148	93	104	50	6	141
Future Volume (Veh/h)	148	93	104	50	6	141
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	161	101	113	54	7	153
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		219				
pX, platoon unblocked						
vC, conflicting volume	167				563	140
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	167				563	140
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	89				98	83
cM capacity (veh/h)	1411				432	908

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	161	101	167	7	153
Volume Left	161	0	0	7	0
Volume Right	0	0	54	0	153
cSH	1411	1700	1700	432	908
Volume to Capacity	0.11	0.06	0.10	0.02	0.17
Queue Length 95th (m)	3.1	0.0	0.0	0.4	4.8
Control Delay (s)	7.9	0.0	0.0	13.5	9.8
Lane LOS	A			B	A
Approach Delay (s)	4.8		0.0	9.9	
Approach LOS				A	

Intersection Summary			
Average Delay	4.9		
Intersection Capacity Utilization	30.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	91	5	1	125	18	1	1	1	42	1	15
Future Volume (Veh/h)	5	91	5	1	125	18	1	1	1	42	1	15
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	99	5	1	136	20	1	1	1	46	1	16
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	156			104			266	270	102	258	262	146
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	156			104			266	270	102	258	262	146
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	93	100	98
cM capacity (veh/h)	1424			1488			672	634	954	691	640	901

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	5	104	1	156	3	46	17
Volume Left	5	0	1	0	1	46	0
Volume Right	0	5	0	20	1	0	16
cSH	1424	1700	1488	1700	729	691	880
Volume to Capacity	0.00	0.06	0.00	0.09	0.00	0.07	0.02
Queue Length 95th (m)	0.1	0.0	0.0	0.0	0.1	1.7	0.5
Control Delay (s)	7.5	0.0	7.4	0.0	10.0	10.6	9.2
Lane LOS	A		A		A	B	A
Approach Delay (s)	0.3		0.0		10.0	10.2	
Approach LOS					A	B	

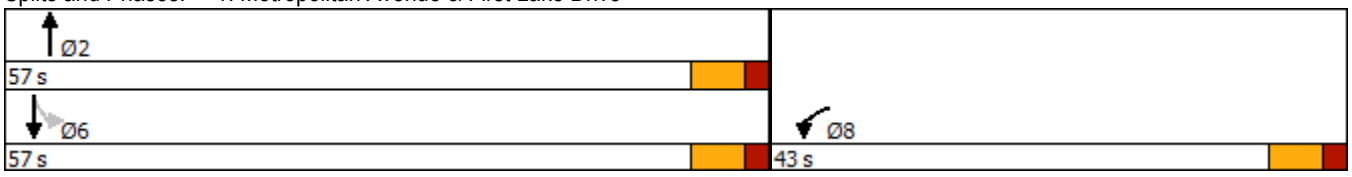
Intersection Summary				
Average Delay	2.2			
Intersection Capacity Utilization	20.2%	ICU Level of Service		A
Analysis Period (min)	15			

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	251	86	210	309	37	120
Future Volume (vph)	251	86	210	309	37	120
Satd. Flow (prot)	1721	0	1682	0	0	1840
Flt Permitted	0.964					0.789
Satd. Flow (perm)	1707	0	1682	0	0	1469
Satd. Flow (RTOR)	19		108			
Lane Group Flow (vph)	366	0	564	0	0	170
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Total Split (s)	43.0		57.0		57.0	57.0
Total Lost Time (s)	6.0		6.0			6.0
Act Effct Green (s)	17.0		22.7			22.7
Actuated g/C Ratio	0.32		0.43			0.43
v/c Ratio	0.64		0.72			0.27
Control Delay	21.4		16.2			11.7
Queue Delay	0.0		0.0			0.0
Total Delay	21.4		16.2			11.7
LOS	C		B			B
Approach Delay	21.4		16.2			11.7
Approach LOS	C		B			B
Queue Length 50th (m)	25.5		31.2			9.4
Queue Length 95th (m)	70.6		84.8			26.9
Internal Link Dist (m)	194.9		85.0			233.3
Turn Bay Length (m)						
Base Capacity (vph)	1304		1532			1329
Starvation Cap Reductn	0		0			0
Spillback Cap Reductn	0		0			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	0.28		0.37			0.13

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 52.6
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.72
Intersection Signal Delay: 17.2
Intersection LOS: B
Intersection Capacity Utilization 67.8%
ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 1: Metropolitan Avenue & First Lake Drive

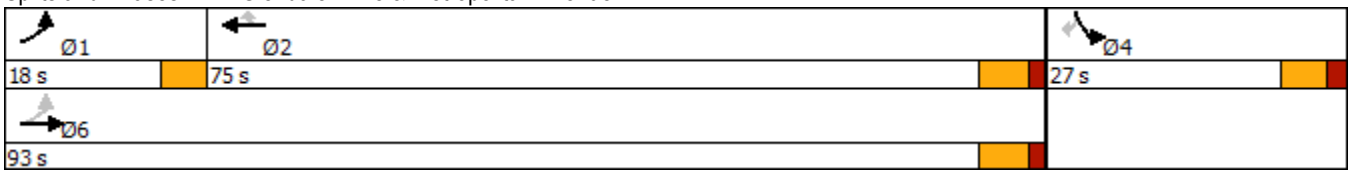


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	207	375	815	342	196	199
Future Volume (vph)	207	375	815	342	196	199
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.095				0.950	
Satd. Flow (perm)	177	1863	1863	1583	1770	1583
Satd. Flow (RTOR)				270		83
Lane Group Flow (vph)	225	408	886	372	213	216
Turn Type	pm+pt	NA	NA	Perm	Prot	Perm
Protected Phases	1	6	2		4	
Permitted Phases	6			2		4
Total Split (s)	18.0	93.0	75.0	75.0	27.0	27.0
Total Lost Time (s)	4.0	6.0	6.0	6.0	6.0	6.0
Act Effct Green (s)	68.2	66.1	51.2	51.2	16.5	16.5
Actuated g/C Ratio	0.72	0.69	0.54	0.54	0.17	0.17
v/c Ratio	0.74	0.32	0.89	0.38	0.70	0.63
Control Delay	32.4	6.4	31.5	4.7	53.8	34.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.4	6.4	31.5	4.7	53.8	34.3
LOS	C	A	C	A	D	C
Approach Delay		15.6	23.6		44.0	
Approach LOS		B	C		D	
Queue Length 50th (m)	19.5	27.2	140.5	9.1	39.3	23.7
Queue Length 95th (m)	#55.9	44.6	235.2	27.0	#77.8	57.9
Internal Link Dist (m)		161.1	209.3		132.8	
Turn Bay Length (m)	70.0			65.0		10.0
Base Capacity (vph)	376	1624	1393	1252	415	434
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	0.60	0.25	0.64	0.30	0.51	0.50

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 95.3
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 25.2 Intersection LOS: C
Intersection Capacity Utilization 78.6% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 4: Glendale Drive & Metropolitan Avenue



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	216	116	159	60	6	173
Future Volume (Veh/h)	216	116	159	60	6	173
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	235	126	173	65	7	188
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		219				
pX, platoon unblocked						
vC, conflicting volume	238				802	206
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	238				802	206
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	82				98	77
cM capacity (veh/h)	1329				291	835

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	235	126	238	7	188
Volume Left	235	0	0	7	0
Volume Right	0	0	65	0	188
cSH	1329	1700	1700	291	835
Volume to Capacity	0.18	0.07	0.14	0.02	0.23
Queue Length 95th (m)	5.1	0.0	0.0	0.6	6.9
Control Delay (s)	8.3	0.0	0.0	17.7	10.6
Lane LOS	A			C	B
Approach Delay (s)	5.4		0.0	10.8	
Approach LOS				B	

Intersection Summary			
Average Delay	5.1		
Intersection Capacity Utilization	37.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	111	1	5	130	74	5	5	5	54	5	44
Future Volume (Veh/h)	20	111	1	5	130	74	5	5	5	54	5	44
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	121	1	5	141	80	5	5	5	59	5	48
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	221			122			367	396	122	364	357	181
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	221			122			367	396	122	364	357	181
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			100			99	99	99	90	99	94
cM capacity (veh/h)	1348			1465			544	530	930	576	558	862

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	22	122	5	221	15	59	53
Volume Left	22	0	5	0	5	59	0
Volume Right	0	1	0	80	5	0	48
cSH	1348	1700	1465	1700	625	576	820
Volume to Capacity	0.02	0.07	0.00	0.13	0.02	0.10	0.06
Queue Length 95th (m)	0.4	0.0	0.1	0.0	0.6	2.7	1.7
Control Delay (s)	7.7	0.0	7.5	0.0	10.9	12.0	9.7
Lane LOS	A		A		B	B	A
Approach Delay (s)	1.2		0.2		10.9	10.9	
Approach LOS					B	B	

Intersection Summary				
Average Delay	3.2			
Intersection Capacity Utilization	30.8%	ICU Level of Service	A	
Analysis Period (min)	15			