

# 70 FIRST LAKE DRIVE DEVELOPMENT REVISED TRAFFIC IMPACT STUDY FINAL REPORT

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PREPARED FOR:  
FIRST MUTUAL PROPERTIES

JANUARY 2024

Project No. CA0019009.4561





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PREPARED BY: BRIANNA RIETZEL, EIT  
PATRICK HATTON, P.ENG.





# 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), as shown in Figure 1.

Halifax Regional Municipality (HRM) has requested that a Traffic Impact Study be completed to review the impacts to the adjacent road network.

WSP Canada Inc. has been retained to complete a Traffic Impact Study (TIS) for the proposed 70 First Lake Drive Development.

## **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 2030 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 2030 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.

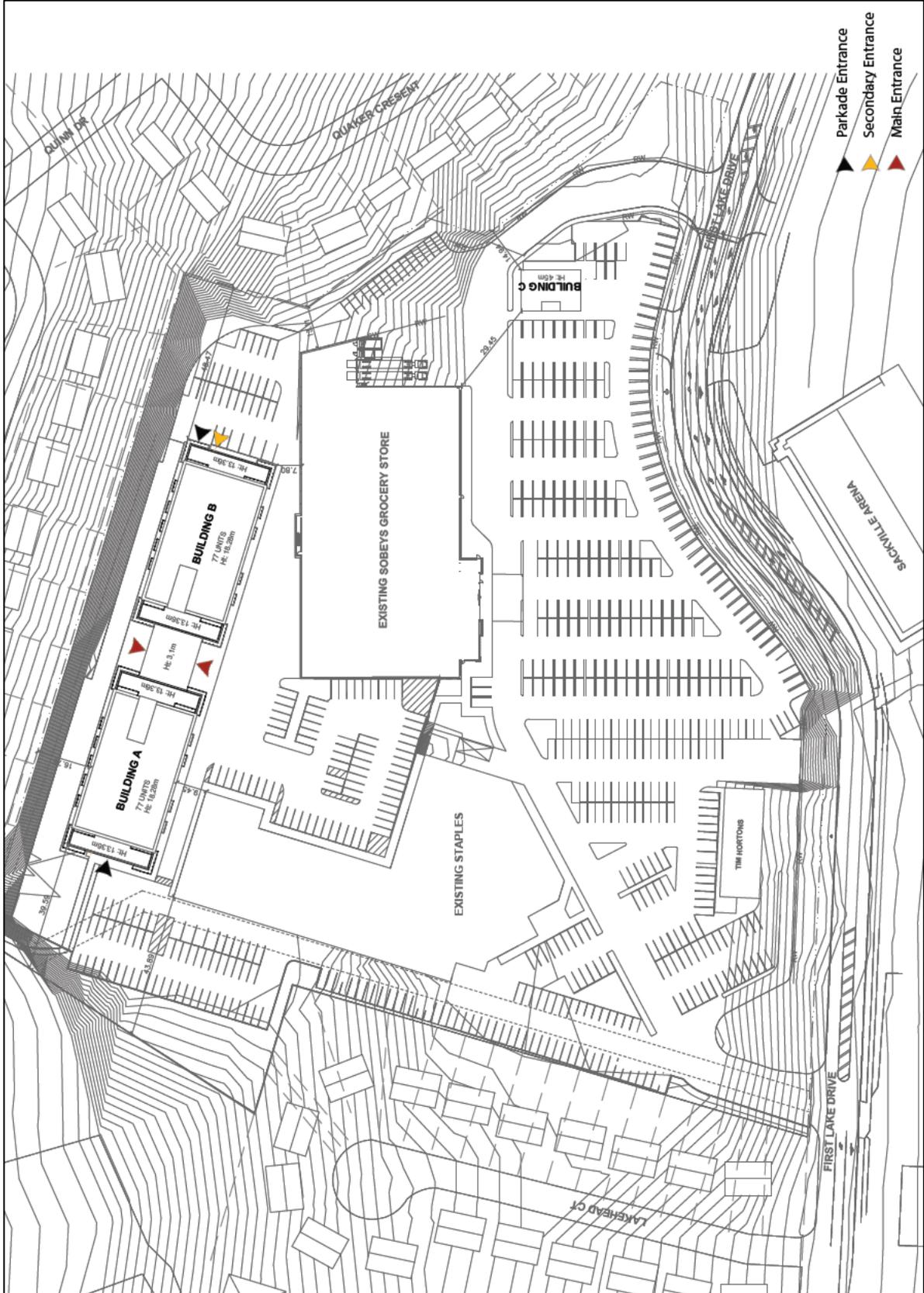


Figure 1 – Site Plan

## 2 STUDY AREA DESCRIPTIONS

### **Description of Existing Development**

70 First Lake Drive is currently occupied with a Sobey's store, Tim Hortons' with a drive-through, a Call Centre, Glass Repair Shop, Recreation Sport Centre with a batting cage and 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.

### **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 2025.



Figure 2 – Study Area with the Study Intersections

### **Existing Study Road Descriptions**

**First Lake Drive** is a 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 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 50 km/h. There is a multi-use path 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-leg signalized intersection with shared lane approaches and marked pedestrian crossings on all approaches.

**Intersection #2 – First Lake Drive at West Driveway** is a 3-leg 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. 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-leg 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. 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-leg 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.



### 3 BACKGROUND TRAFFIC

**Turning  
Movement  
Counts**

Turning movement counts were collected by WSP on Wednesday, February 2<sup>nd</sup>, 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.

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

**Traffic Growth  
Rate**

An annual growth rate of 1.0% was applied to the background volumes for this Traffic Impact Study to project 2030 future background volumes (buildout + five years).



# 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.

**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. Trip generation estimates for the proposed development were prepared using published rates from *Trip Generation Manual, 11<sup>th</sup> Edition* (Institute of Transportation Engineers, Washington, 2021).

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, 3<sup>rd</sup> Edition* (Institute of Transportation Engineers, Washington, 2017), estimates of the total person trips generated by the development were prepared (See Table 1).

**Appendix B of the ITE Trip Generation Handbook, 3<sup>rd</sup> 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.**

**Trips Generated by the Proposed Development – Total Trips Generated**

Trip generation estimates for the proposed development are summarized in Table 1. It is estimated that the development will generate:

- 59 two-way person trips (16 entering and 43 exiting) during the AM peak hour; and,
- 76 two-way person trips (46 entering and 30 exiting) during the PM peak hour.

**Table 1 – Trip Generation Estimates for the Proposed Development**

Land Use <sup>1</sup>	Units <sup>2</sup>	Trip Generation Rates <sup>3</sup>				Trip Generation Estimates <sup>3</sup>			
		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
<b>Baseline Vehicle Trips for the Proposed Development</b>					14	39	39	24	
<b>Estimated Person Trips for the Proposed Development</b>					16	43	46	30	

NOTES: 1. Rates and equations are from *Trip Generation, 11<sup>th</sup> 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. Within the site itself there are numerous existing amenities including a grocery store and a 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. The estimated person trips generated by the site development by modal share is included in Table 2.

It is estimated that the development will generate:

- 44 two-way vehicle trips (11 entering and 33 exiting) during the AM peak hour; and,
- 56 two-way vehicle trips (34 entering and 22 exiting) during the PM peak hour.

**Table 2 - Total Trip Generation Estimates for the Proposed Development**

Travel Mode	Modal Share	AM Peak		PM Peak	
		In	Out	In	Out
<b>External Person Trips</b>		<b>16</b>	<b>43</b>	<b>46</b>	<b>30</b>
Auto Driver	75%	11	33	34	22
Auto Passenger	10%	2	4	5	3
Transit	5%	1	2	2	2
Active Modes	10%	2	4	5	3

**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.

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 2030 without and with the proposed development and they are included in Appendix A.



## 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 2030 without Site:** Represents future 2030 traffic volumes on the existing road network, including the existing traffic control and lane configurations of the Study Intersections.

**Scenario 2 – Future 2030 with Site:** Represents future 2030 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 3 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 2030 without and with development trips.

**Table 3 - Intersection Capacity Analysis: Metropolitan Avenue at First Lake Drive**

LOS Criteria	Control Delay (sec/veh), v/c Ratio, and 95 <sup>th</sup> %ile Queue (m) by Intersection Movement			Overall Intersection
	First Lake Drive	Metropolitan Avenue		
	WB-LR	NB-TR	SB-LT	Delay
<b>Scenario 1 - Future 2030 without Site AM Peak Hour (Page C-1)</b>				
Delay	14.2	9.6	13.2	12.1
v/c	0.47	0.45	0.47	
Queue	33.7	36.5	42.3	
<b>Scenario 2 - Future 2030 with Site AM Peak Hour (Page C-9)</b>				
Delay	14.8	9.9	13.6	12.6
v/c	0.51	0.47	0.47	
Queue	37.8	37.7	42.4	
<b>Scenario 1 - Future 2030 without Site PM Peak Hour (Page C-5)</b>				
Delay	19.5	14.6	10.7	15.6
v/c	0.61	0.68	0.24	
Queue	59.0	70.5	23.4	
<b>Scenario 2 - Future 2030 with Site PM Peak Hour (Page C-13)</b>				
Delay	20.5	15.7	11.2	16.6
v/c	0.63	0.71	0.25	
Queue	65.8	79.7	25.0	

## 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 4 for both the AM and PM peak hours. A traffic signal warrant was completed for the 2030 Future with Site scenario, and it was determined that:

- 2030 Future with Site: Traffic signals are not warranted (**12 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 at with a v/c ratio of 0.21 or better.

**Table 4 - Intersection Capacity Analysis: First Lake Drive at West Driveway**

LOS Criteria	Control Delay (sec/veh), v/c Ratio, and 95 <sup>th</sup> %ile Queue (m) by Intersection Movement					Overall Intersection Delay
	First Lake Drive			West Driveway		
	EB-L	EB-T	WB-TR	SB-L	SB-R	
<b>Scenario 1 - Future 2030 without Site AM Peak Hour (Page C-3)</b>						
Delay	7.8	0.0	0.0	12.9	9.5	4.6
v/c	0.11	0.06	0.09	0.01	0.13	
Queue	2.8	0.0	0.0	0.3	3.7	
<b>Scenario 2 - Future 2030 with Site AM Peak Hour (Page C-11)</b>						
Delay	7.8	0.0	0.0	13.2	9.6	4.9
v/c	0.11	0.06	0.09	0.01	0.16	
Queue	3.0	0.0	0.0	0.3	4.6	
<b>Scenario 1 - Future 2030 without Site PM Peak Hour (Page C-7)</b>						
Delay	8.0	0.0	0.0	15.6	10.0	4.9
v/c	0.15	0.08	0.11	0.01	0.19	
Queue	4.2	0.0	0.0	0.4	5.5	
<b>Scenario 2 - Future 2030 with Site PM Peak Hour (Page C-15)</b>						
Delay	8.1	0.0	0.0	16.7	10.1	5.2
v/c	0.17	0.08	0.11	0.02	0.21	
Queue	4.8	0.0	0.0	0.4	6.3	



## 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 5 for both the AM and PM peak hours. A traffic signal warrant was completed for the 2030 Future with Site scenario, and it was determined that:

- 2030 Future with Site: Traffic signals are not warranted (**6 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 at with a v/c ratio of 0.13 or better.

**Table 5 - Intersection Capacity Analysis: First Lake Drive at East Driveway**

LOS Criteria	Control Delay (sec/veh), v/c Ratio, and 95 <sup>th</sup> %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
<b>Scenario 1 - Future 2030 without Site AM Peak Hour (Page C-4)</b>								
Delay	7.5	0.0	7.4	0.0	9.9	10.4	9.2	1.7
v/c	0.00	0.06	0.00	0.09	0.00	0.05	0.01	
Queue	0.1	0.0	0.0	0.0	0.1	1.2	0.3	
<b>Scenario 2 - Future 2030 with Site AM Peak Hour (Page C-12)</b>								
Delay	7.5	0.0	7.4	0.0	9.9	10.5	9.2	2.0
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	1.5	0.3	
<b>Scenario 1 - Future 2030 without Site PM Peak Hour (Page C-8)</b>								
Delay	7.7	0.0	7.5	0.0	10.8	11.8	9.7	3.1
v/c	0.02	0.07	0.00	0.12	0.02	0.09	0.06	
Queue	0.4	0.0	0.1	0.0	0.6	2.4	1.5	
<b>Scenario 2 - Future 2030 with Site PM Peak Hour (Page C-16)</b>								
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	0.11	0.06	
Queue	0.4	0.0	0.1	0.0	0.6	2.8	1.5	



## 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 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. Negligible 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 0.88 or better. There are heavy westbound through volumes at this intersection during the PM peak hour and the 95<sup>th</sup> percentile queues along Glendale Drive extend beyond Raymond Drive and the RA-5 crosswalk crossing Glendale Drive (approximately 170m). 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 6 - Intersection Capacity Analysis: Glendale Drive at Metropolitan Avenue**

LOS Criteria	Control Delay (sec/veh), v/c Ratio, and 95 <sup>th</sup> %ile Queue (m) by Intersection Movement						Overall Intersection Delay
	Glendale Drive				Metropolitan Avenue		
	EB-L	EB-T	WB-T	WB-R	SB-L	SB-R	
<b>Scenario 1 - Future 2030 without Site AM Peak Hour (Page C-2)</b>							
Delay	7.6	11.1	21.7	5.1	24.0	14.8	14.4
v/c	0.33	0.55	0.53	0.28	0.53	0.46	
Queue	21.9	67.5	51.6	11.9	44.5	29.1	
<b>Scenario 2 - Future 2030 with Site AM Peak Hour (Page C-10)</b>							
Delay	8.0	11.6	22.3	5.2	24.4	15.1	14.6
v/c	0.34	0.55	0.54	0.29	0.55	0.46	
Queue	23.1	70.1	53.0	12.4	48.2	31.0	
<b>Scenario 1 - Future 2030 without Site PM Peak Hour (Page C-6)</b>							
Delay	25.7	6.3	31.2	4.9	51.2	32.3	24.0
v/c	0.68	0.31	0.88	0.36	0.66	0.61	
Queue	45.1	43.9	236.8	27.2	73.5	54.6	
<b>Scenario 2 - Future 2030 with Site PM Peak Hour (Page C-14)</b>							
Delay	28.7	6.5	30.9	4.6	51.8	33.0	24.3
v/c	0.72	0.31	0.88	0.38	0.69	0.61	
Queue	48.2	43.9	226.6	25.5	77.8	57.0	



# 6 SUMMARY, CONCLUSION & RECOMMENDATIONS

## 6.1 SUMMARY

<b>Background</b>	1. Plans are being prepared to add residential units to an existing commercial site at 70 First Lake Drive in Lower Sackville, Nova Scotia.
<b>Description of Existing Development</b>	2. 70 First Lake Drive is currently occupied with a Sobeys store, Tim Hortons' with a Drive-through, a 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 with the proposed development include the Sobeys store and the Tim Horton's restaurant.
<b>Description of the Proposed Development</b>	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. It is anticipated that the development will be completed by 2025.
<b>Proposed Site Access</b>	5. The access to the proposed development will be via the existing driveways on First Lake Drive.
<b>Study Area Roads</b>	6. <b>First Lake Drive</b> is a 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. 7. <b>Metropolitan Avenue</b> is a 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. 8. <b>Glendale Drive</b> is an arterial road that has two lanes, one lane in each direction, and a posted speed limit of 50 km/h. There is a multi-use path on the north side of Glendale Drive and transit services for Route #84 in this area.
<b>Turning Movement Counts</b>	9. Turning movement counts were collected by WSP on Wednesday, February 2 <sup>nd</sup> , 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. 10. Additional turning movement counts were collected by WSP on Tuesday, January 9 <sup>th</sup> , 2024 at the Glendale Drive / Metropolitan Avenue intersection during the morning (7:00-9:00AM) and afternoon (4:00-6:00PM) peak periods.
<b>Background Traffic Volumes</b>	11. Projected 2030 peak hour future background volumes include: <ul style="list-style-type: none"><li>• 1.0% annual growth between 2022-2030.</li></ul>



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<b>Estimation of Proposed Development Trips</b>	<p>12. Trip generation estimates for the proposed Exhibition Expansion were prepared using rates published in <i>Trip Generation, 11<sup>th</sup> Edition</i> (Institute of Transportation Engineers, Washington, 2021), and methodology provided in <i>Trip Generation Handbook, 3<sup>rd</sup> Edition</i> (Institute of Transportation Engineers, Washington, 2017).</p> <p>13. It is estimated that the development will generate:</p> <ul style="list-style-type: none"><li>• 44 two-way vehicle trips (11 entering and 33 exiting) during the AM peak hour; and,</li><li>• 56 two-way vehicle trips (34 entering and 22 exiting) during the PM peak hour.</li></ul>
<b>Trip Distribution and Assignment</b>	<p>14. 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%).</p>
<b>Analysis Scenarios Considered</b>	<p>15. <b>Scenario 1 – Future 2030 without Site:</b> Represents future 2030 traffic volumes on the existing road network, including the existing traffic control and lane configurations of the Study Intersections.</p> <p>16. <b>Scenario 2 – Future 2030 with Site:</b> Represents future 2030 traffic volumes on the existing road network, including the existing traffic control and lane configurations of the Study Intersections with the proposed development.</p>
<b>Warrant Analysis Summary</b>	<p>17. Warrant reviews were completed for traffic signals for Scenario 2 to identify road network upgrades warranted with the proposed development. No left-turn lane warrants were completed, as there are existing left-turn lanes on First Lake Drive at the site accesses.</p> <p>18. It was determined that traffic signals are not warranted at any Study Intersection that is not yet signalized.</p>
<b>Summary – Intersection Capacity Analysis</b>	<p>19. Intersection performance analysis was completed using <i>Synchro 11</i> at the Study Intersections.</p> <p>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 volume on Glendale Drive at Metropolitan Avenue which is expected to operate with a volume to capacity ratio (v/c) of 0.88 without and with site generated trips. Minimal impacts in the operational performance of these intersections are expected with the addition of the proposed development.</p>

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## 6.2 CONCLUSIONS

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<b>Conclusion</b>	<p>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.</p>
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# APPENDIX

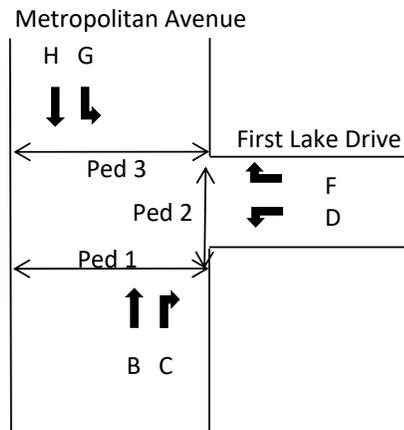
# A

## TRAFFIC VOLUME DATA



**Table A-1**  
**Metropolitan Avenue**  
**@**  
**First Lake Drive**

*Lower Sackville, NS*  
Wednesday, February 2, 2022

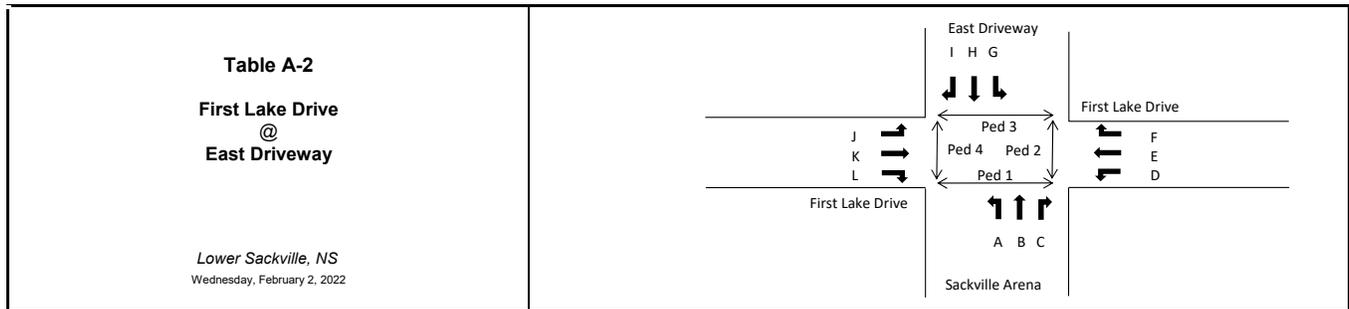


**AM Peak Period Volume Data**

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
<b>AM Peak Hour</b>	<b>122</b>	<b>160</b>	<b>172</b>	<b>46</b>	<b>57</b>	<b>193</b>	<b>750</b>
<b>07:00 - 08:00</b>	<b>56</b>	<b>137</b>	<b>135</b>	<b>27</b>	<b>42</b>	<b>148</b>	<b>545</b>
<b>08:00 - 09:00</b>	<b>122</b>	<b>160</b>	<b>172</b>	<b>46</b>	<b>57</b>	<b>193</b>	<b>750</b>
	<b>Ped 1</b>		<b>Ped 2</b>		<b>Ped 3</b>		<b>Total Peds</b>
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
<b>PM Peak Hour</b>	<b>190</b>	<b>255</b>	<b>237</b>	<b>82</b>	<b>26</b>	<b>102</b>	<b>892</b>
<b>16:00 - 17:00</b>	<b>189</b>	<b>259</b>	<b>213</b>	<b>75</b>	<b>28</b>	<b>111</b>	<b>875</b>
<b>17:00 - 18:00</b>	<b>169</b>	<b>241</b>	<b>233</b>	<b>71</b>	<b>27</b>	<b>81</b>	<b>822</b>
	<b>Ped 1</b>		<b>Ped 2</b>		<b>Ped 3</b>		<b>Total Peds</b>
16:00 - 17:00	4		0		0		4
17:00 - 18:00	4		1		0		5



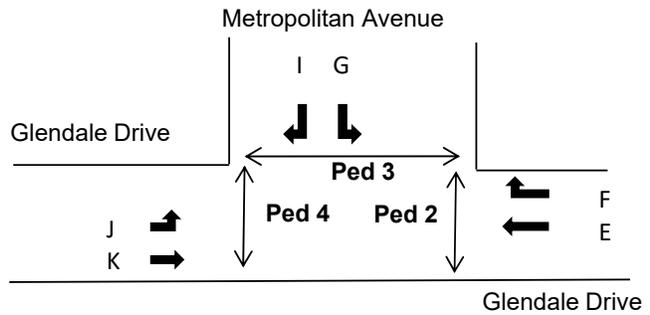
<b>AM Peak Period Volume Data</b>														
Time	East Driveway Northbound Approach			First Lake Drive Westbound Approach			East Driveway Southbound Approach			First Lake Drive Eastbound Approach			Total Vehicles	
	A	B	C	D	E	F	G	H	I	J	K	L		
07:00 - 07:15	0	0	0	1	14	2	3	0	1	2	14	0	37	
07:15 - 07:30	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	
<b>AM Peak Hour</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>129</b>	<b>19</b>	<b>33</b>	<b>0</b>	<b>8</b>	<b>6</b>	<b>89</b>	<b>0</b>	<b>287</b>	
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	
	<b>Ped 1</b>			<b>Ped 2</b>			<b>Ped 3</b>			<b>Ped 4</b>			<b>Total Peds</b>	
07:00 - 08:00	1			0			0			1			2	
08:00 - 09:00	14			0			0			1			15	

<b>Midday Volume Data</b>														
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	0	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	
<b>Midday Peak Hour</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>76</b>	<b>27</b>	<b>39</b>	<b>1</b>	<b>12</b>	<b>5</b>	<b>53</b>	<b>2</b>	<b>220</b>	
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	
	<b>Ped 1</b>			<b>Ped 2</b>			<b>Ped 3</b>			<b>Ped 4</b>			<b>Total Peds</b>	
11:30 - 12:30	4			0			0			2			6	
12:30 - 13:30	3			1			0			0			4	

<b>PM Peak Period Volume Data</b>														
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	
<b>PM Peak Hour</b>	<b>7</b>	<b>2</b>	<b>6</b>	<b>5</b>	<b>120</b>	<b>61</b>	<b>52</b>	<b>4</b>	<b>36</b>	<b>17</b>	<b>103</b>	<b>2</b>	<b>415</b>	
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	
	<b>Ped 1</b>			<b>Ped 2</b>			<b>Ped 3</b>			<b>Ped 4</b>			<b>Total Peds</b>	
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



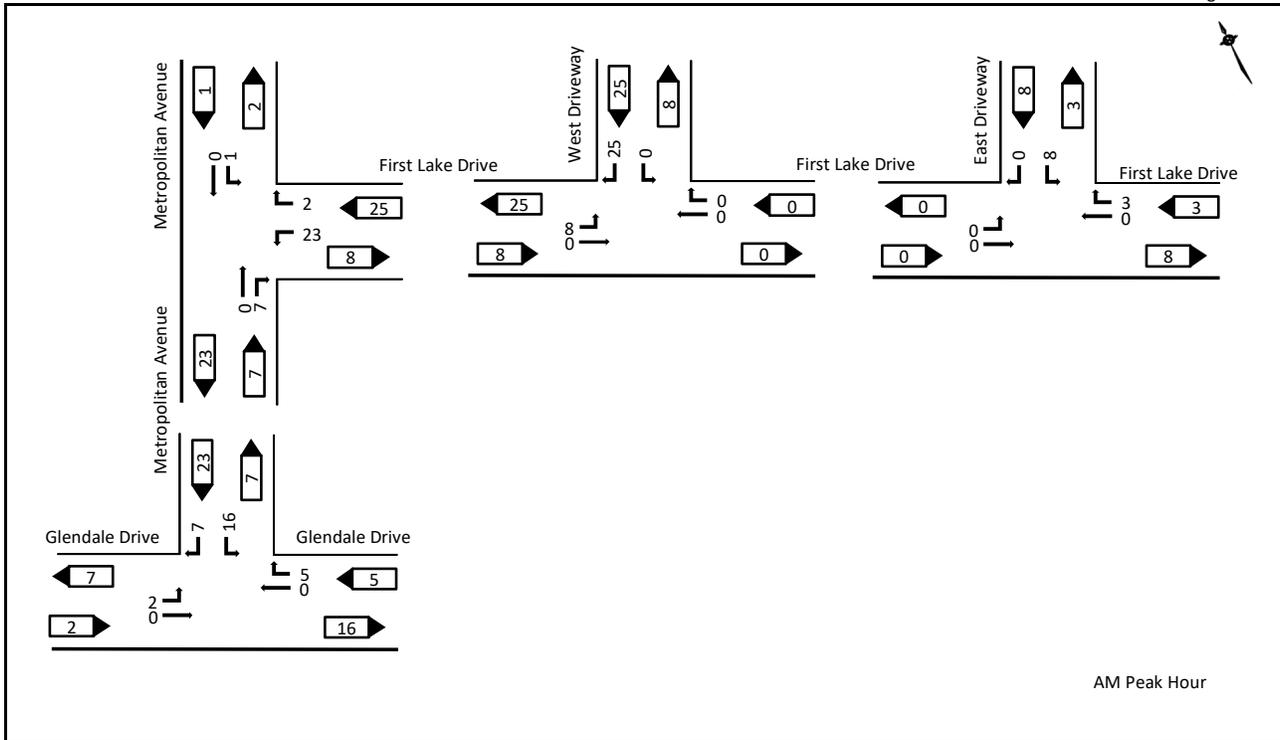
**AM Peak Period Volume Data**

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
<b>AM Peak Hour</b>		<b>242</b>	<b>138</b>	<b>192</b>	<b>173</b>	<b>185</b>	<b>472</b>	<b>1402</b>
07:00	08:00	129	103	221	83	118	535	1189
08:00	09:00	242	138	192	173	185	472	1402
		<b>Ped 2</b>		<b>Ped 3</b>		<b>Ped 4</b>		<b>Total Peds</b>
07:00	08:00	0		0		0		0
08:00	09:00	0		20		0		20

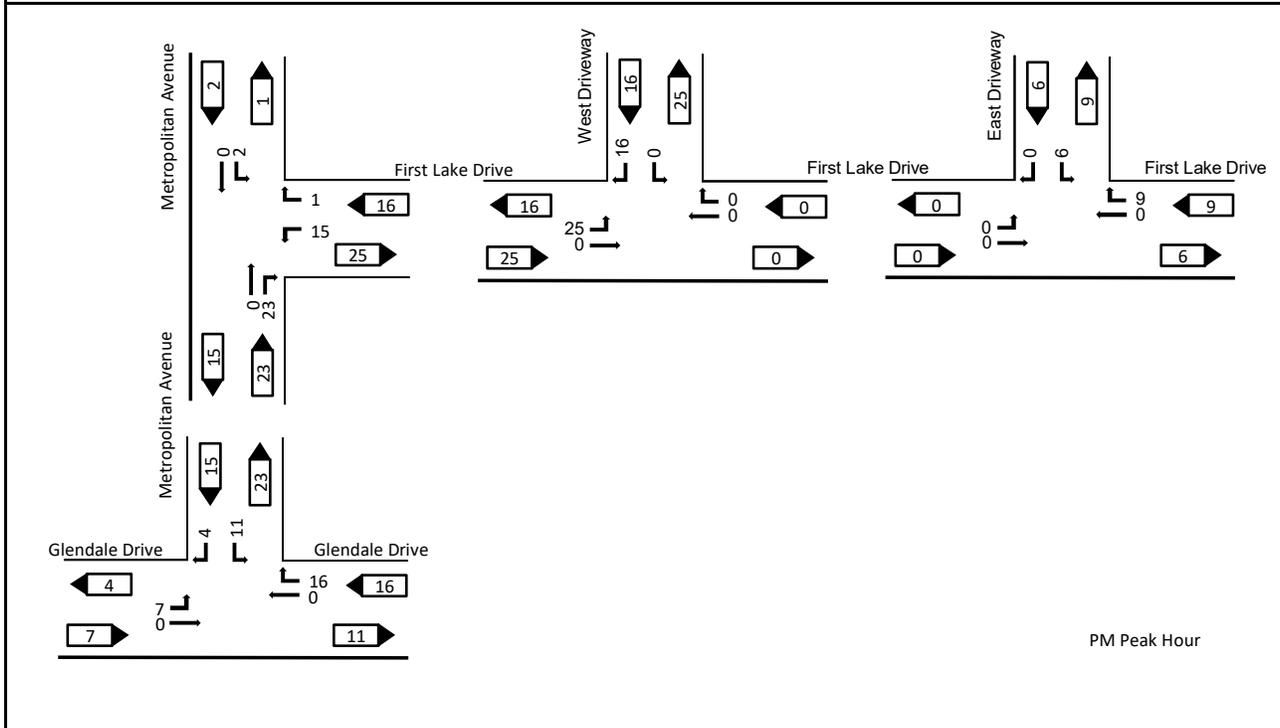
**PM Peak Period Volume Data**

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
<b>PM Peak Hour</b>		<b>753</b>	<b>300</b>	<b>174</b>	<b>181</b>	<b>186</b>	<b>347</b>	<b>1941</b>
16:00	17:00	745	271	196	181	176	336	1905
17:00	18:00	646	292	156	177	194	342	1807
		<b>Ped 2</b>		<b>Ped 3</b>		<b>Ped 4</b>		<b>Total Peds</b>
16:00	17:00	2		4		0		6
17:00	18:00	4		3		0		7





AM Peak Hour



PM Peak Hour

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



# APPENDIX

# B

## WARRANT ANALYSIS



### 2005 Canadian Traffic Signal Warrant Matrix Analysis

Table: B-1 - First Lake Drive at West Driveway  
2030 Future with Site

Main Street (name)	First Lake Drive	Direction (EW or NS)	EW	Date:	January 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
First Lake Drive	NB							
West Driveway	SB	1				1		

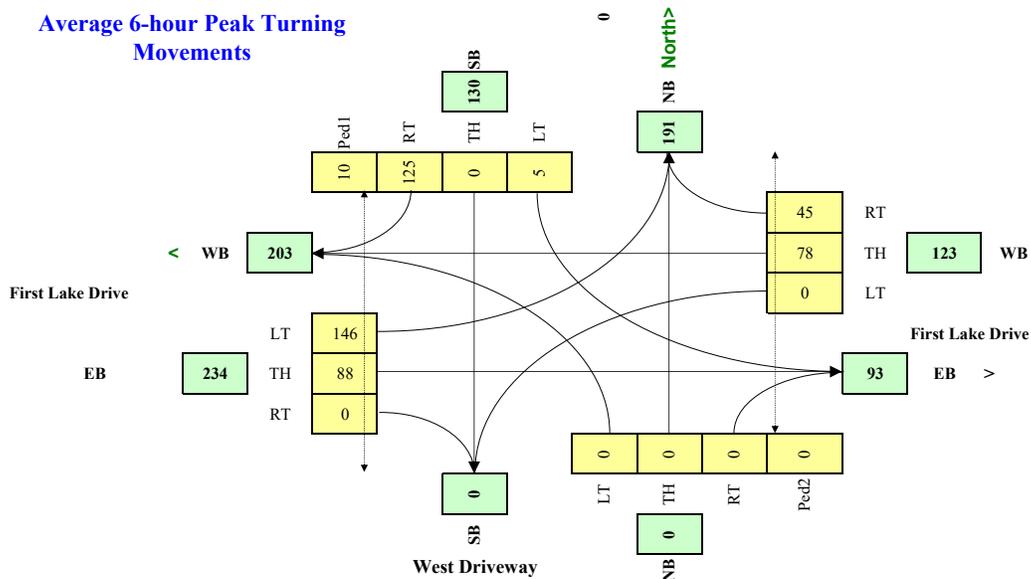
Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
First Lake Drive	EW	50	2.0%	y	0.0
West Driveway	NS	50	2.0%	n	

	Ped1 NS W Side	Ped2 NS E Side	Ped3 EW N Side	Ped4 EW 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
<b>Total (6-hour peak)</b>	<b>60</b>	<b>0</b>	<b>30</b>	<b>0</b>
<b>Average (6-hour peak)</b>	<b>10</b>	<b>0</b>	<b>5</b>	<b>0</b>

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	85	50	150	95	0
8:00 - 9:00	0	0	0	5	0	125	0	75	45	135	85	0
11:30 - 12:30	0	0	0	5	0	80	0	50	30	90	55	0
12:30 - 13:30	0	0	0	5	0	80	0	50	30	90	55	0
15:30 - 16:30	0	0	0	5	0	155	0	100	55	195	115	0
16:30 - 17:30	0	0	0	5	0	170	0	110	60	215	125	0
<b>Total (6-hour peak)</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>30</b>	<b>0</b>	<b>750</b>	<b>0</b>	<b>470</b>	<b>270</b>	<b>875</b>	<b>530</b>	<b>0</b>
<b>Average (6-hour peak)</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>125</b>	<b>0</b>	<b>78</b>	<b>45</b>	<b>146</b>	<b>88</b>	<b>0</b>

#### Average 6-hour Peak Turning Movements



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

W =	14	10	4
		Veh	Ped
<b>NOT Warranted</b>			

### 2005 Canadian Traffic Signal Warrant Matrix Analysis

Table: B-1 - First Lake Drive at East Driveway  
2030 Future with Site

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

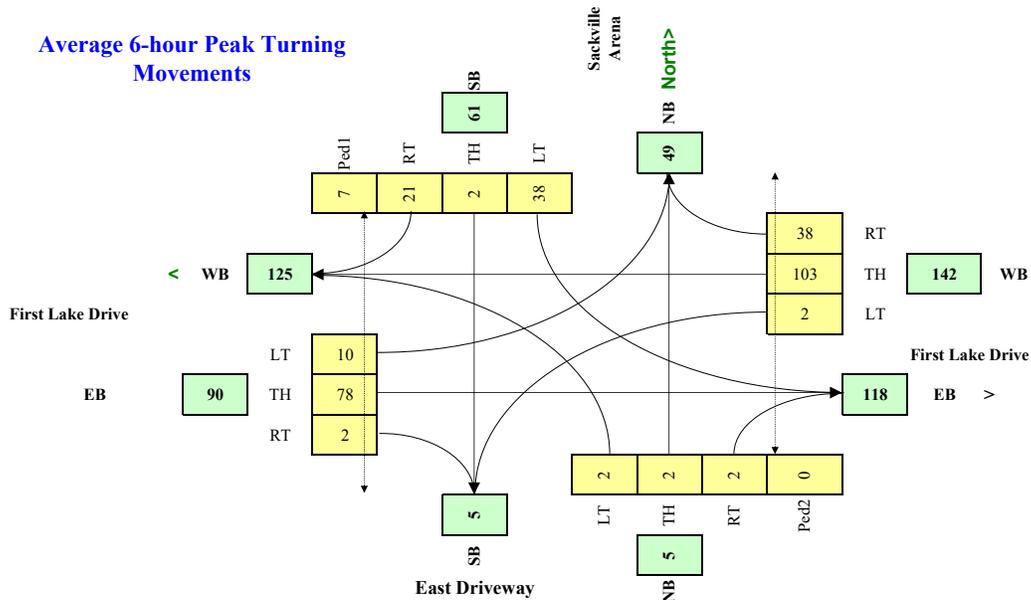
Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
First Lake Drive	WB	1			1		500	1
First Lake Drive	EB	1			1		10,000	1
Sackville Arena	NB			1				
East Driveway	SB	1			1			

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	Ped2	Ped3	Ped4
	NS W Side	NS E Side	EW N Side	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
<b>Total (6-hour peak)</b>	<b>41</b>	<b>1</b>	<b>0</b>	<b>6</b>
<b>Average (6-hour peak)</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>1</b>

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	10	0	125	20	5	85	5
8:00 - 9:00	0	0	0	35	0	10	0	115	15	5	75	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	35	5	115	65	20	100	0
16:30 - 17:30	5	5	5	55	5	40	5	130	75	20	110	0
<b>Total (6-hour peak)</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>230</b>	<b>10</b>	<b>125</b>	<b>10</b>	<b>615</b>	<b>225</b>	<b>60</b>	<b>470</b>	<b>10</b>
<b>Average (6-hour peak)</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>38</b>	<b>2</b>	<b>21</b>	<b>2</b>	<b>103</b>	<b>38</b>	<b>10</b>	<b>78</b>	<b>2</b>



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

W =	7	5	2
		Veh	Ped
<b>Not Warranted - Vs &lt; 75</b>			

# APPENDIX

## C

### INTERSECTION PERFORMANCE ANALYSIS



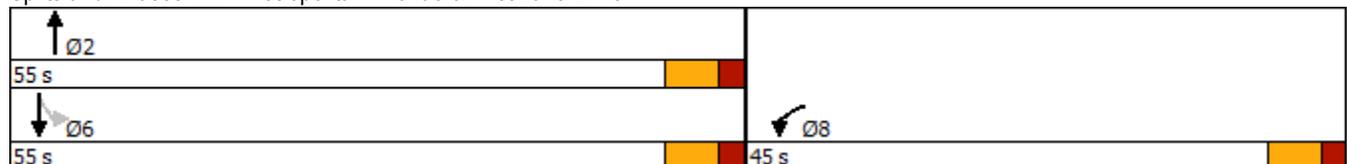
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	185	50	130	175	60	210
Future Volume (vph)	185	50	130	175	60	210
Satd. Flow (prot)	1729	0	1689	0	0	1842
Flt Permitted	0.962					0.849
Satd. Flow (perm)	1714	0	1689	0	0	1579
Satd. Flow (RTOR)	16		95			
Lane Group Flow (vph)	255	0	331	0	0	293
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)	12.8		16.6			16.6
Actuated g/C Ratio	0.31		0.40			0.40
v/c Ratio	0.47		0.45			0.47
Control Delay	14.2		9.6			13.2
Queue Delay	0.0		0.0			0.0
Total Delay	14.2		9.6			13.2
LOS	B		A			B
Approach Delay	14.2		9.6			13.2
Approach LOS	B		A			B
Queue Length 50th (m)	13.0		10.2			13.3
Queue Length 95th (m)	33.7		36.5			42.3
Internal Link Dist (m)	194.9		85.0			233.3
Turn Bay Length (m)						
Base Capacity (vph)	1612		1639			1530
Starvation Cap Reductn	0		0			0
Spillback Cap Reductn	0		0			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	0.16		0.20			0.19

Intersection Summary

Cycle Length: 100  
 Actuated Cycle Length: 41.8  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.47  
 Intersection Signal Delay: 12.1  
 Intersection Capacity Utilization 61.7%  
 Analysis Period (min) 15

Intersection LOS: B  
 ICU Level of Service B

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



Appendix C - Intersection Capacity Analysis  
 4: Glendale Drive & Metropolitan Avenue

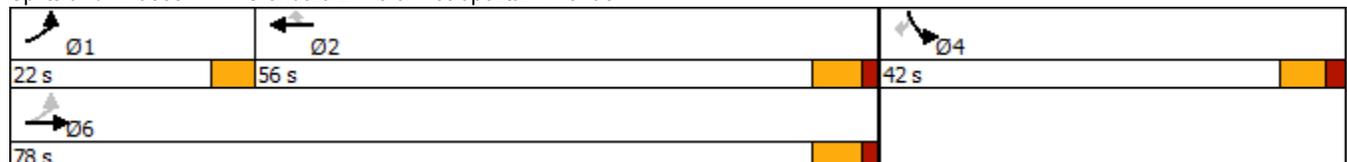
						
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	195	500	255	145	205	185
Future Volume (vph)	195	500	255	145	205	185
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.437				0.950	
Satd. Flow (perm)	814	1863	1863	1583	1770	1583
Satd. Flow (RTOR)				158		87
Lane Group Flow (vph)	212	543	277	158	223	201
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)	30.7	28.6	15.0	15.0	12.7	12.7
Actuated g/C Ratio	0.57	0.53	0.28	0.28	0.24	0.24
v/c Ratio	0.33	0.55	0.53	0.28	0.53	0.46
Control Delay	7.6	11.1	21.7	5.1	24.0	14.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.6	11.1	21.7	5.1	24.0	14.8
LOS	A	B	C	A	C	B
Approach Delay		10.2	15.7		19.6	
Approach LOS		B	B		B	
Queue Length 50th (m)	8.8	31.4	22.9	0.0	18.8	9.1
Queue Length 95th (m)	21.9	67.5	51.6	11.9	44.5	29.1
Internal Link Dist (m)		161.1	209.3		132.8	
Turn Bay Length (m)	70.0			65.0		10.0
Base Capacity (vph)	794	1863	1699	1457	1220	1118
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	0.27	0.29	0.16	0.11	0.18	0.18

Intersection Summary

Cycle Length: 120  
 Actuated Cycle Length: 53.7  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.55  
 Intersection Signal Delay: 14.1  
 Intersection Capacity Utilization 48.9%  
 Analysis Period (min) 15

Intersection LOS: B  
 ICU Level of Service A

Splits and Phases: 4: Glendale Drive & Metropolitan Avenue



Appendix C - Intersection Capacity Analysis  
 2: First Lake Drive & West Driveway

						
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	140	95	85	50	5	115
Future Volume (Veh/h)	140	95	85	50	5	115
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)	152	103	92	54	5	125
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	146				526	119
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	146				526	119
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	87
cM capacity (veh/h)	1436				458	933
Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2	
Volume Total	152	103	146	5	125	
Volume Left	152	0	0	5	0	
Volume Right	0	0	54	0	125	
cSH	1436	1700	1700	458	933	
Volume to Capacity	0.11	0.06	0.09	0.01	0.13	
Queue Length 95th (m)	2.8	0.0	0.0	0.3	3.7	
Control Delay (s)	7.8	0.0	0.0	12.9	9.5	
Lane LOS	A			B	A	
Approach Delay (s)	4.7		0.0	9.6		
Approach LOS				A		
Intersection Summary						
Average Delay			4.6			
Intersection Capacity Utilization			28.6%		ICU Level of Service	A
Analysis Period (min)			15			

Appendix C - Intersection Capacity Analysis  
 3: First Lake Drive & East Driveway

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	85	5	1	125	15	1	1	1	30	1	10
Future Volume (Veh/h)	5	85	5	1	125	15	1	1	1	30	1	10
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	92	5	1	136	16	1	1	1	33	1	11
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	152			97			254	258	94	250	253	144
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	152			97			254	258	94	250	253	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	95	100	99
cM capacity (veh/h)	1429			1496			688	643	962	700	648	903
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2					
Volume Total	5	97	1	152	3	33	12					
Volume Left	5	0	1	0	1	33	0					
Volume Right	0	5	0	16	1	0	11					
cSH	1429	1700	1496	1700	741	700	875					
Volume to Capacity	0.00	0.06	0.00	0.09	0.00	0.05	0.01					
Queue Length 95th (m)	0.1	0.0	0.0	0.0	0.1	1.2	0.3					
Control Delay (s)	7.5	0.0	7.4	0.0	9.9	10.4	9.2					
Lane LOS	A		A		A	B	A					
Approach Delay (s)	0.4		0.0		9.9	10.1						
Approach LOS					A	B						
Intersection Summary												
Average Delay			1.7									
Intersection Capacity Utilization			18.3%		ICU Level of Service				A			
Analysis Period (min)			15									

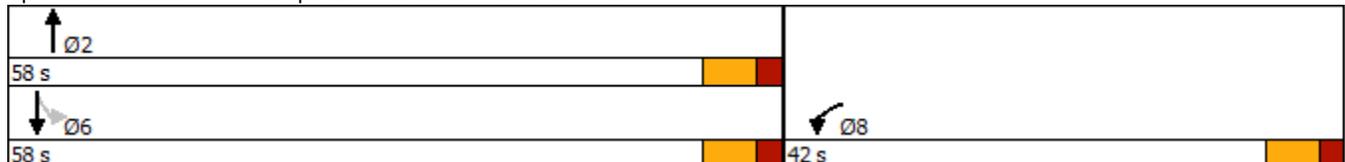
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	230	80	205	280	30	120
Future Volume (vph)	230	80	205	280	30	120
Satd. Flow (prot)	1719	0	1687	0	0	1844
Flt Permitted	0.964					0.851
Satd. Flow (perm)	1705	0	1687	0	0	1584
Satd. Flow (RTOR)	20		102			
Lane Group Flow (vph)	337	0	527	0	0	163
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)	15.3		20.7			20.7
Actuated g/C Ratio	0.31		0.43			0.43
v/c Ratio	0.61		0.68			0.24
Control Delay	19.5		14.6			10.7
Queue Delay	0.0		0.0			0.0
Total Delay	19.5		14.6			10.7
LOS	B		B			B
Approach Delay	19.5		14.6			10.7
Approach LOS	B		B			B
Queue Length 50th (m)	21.0		26.0			8.2
Queue Length 95th (m)	59.0		70.5			23.4
Internal Link Dist (m)	194.9		85.0			233.3
Turn Bay Length (m)						
Base Capacity (vph)	1347		1599			1497
Starvation Cap Reductn	0		0			0
Spillback Cap Reductn	0		0			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	0.25		0.33			0.11

Intersection Summary

Cycle Length: 100  
 Actuated Cycle Length: 48.7  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.68  
 Intersection Signal Delay: 15.6  
 Intersection Capacity Utilization 60.2%  
 Analysis Period (min) 15

Intersection LOS: B  
 ICU Level of Service B

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



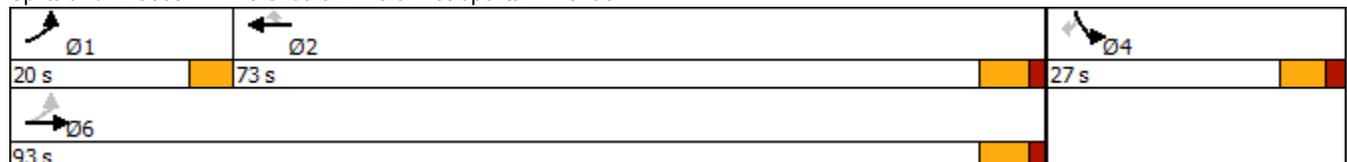
Appendix C - Intersection Capacity Analysis  
4: Glendale Drive & Metropolitan Avenue

						
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	195	370	800	320	185	190
Future Volume (vph)	195	370	800	320	185	190
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.100				0.950	
Satd. Flow (perm)	186	1863	1863	1583	1770	1583
Satd. Flow (RTOR)				248		84
Lane Group Flow (vph)	212	402	870	348	201	207
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)	66.4	64.3	49.4	49.4	16.0	16.0
Actuated g/C Ratio	0.71	0.69	0.53	0.53	0.17	0.17
v/c Ratio	0.68	0.31	0.88	0.36	0.66	0.61
Control Delay	25.7	6.3	31.2	4.9	51.2	32.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.7	6.3	31.2	4.9	51.2	32.3
LOS	C	A	C	A	D	C
Approach Delay		13.0	23.7		41.6	
Approach LOS		B	C		D	
Queue Length 50th (m)	14.7	25.7	130.6	8.6	35.3	20.8
Queue Length 95th (m)	45.1	43.9	236.8	27.2	73.5	54.6
Internal Link Dist (m)		161.1	209.3		132.8	
Turn Bay Length (m)	70.0			65.0		10.0
Base Capacity (vph)	423	1645	1391	1244	426	445
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	0.50	0.24	0.63	0.28	0.47	0.47

Intersection Summary

Cycle Length: 120  
 Actuated Cycle Length: 93.1  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.88  
 Intersection Signal Delay: 24.0  
 Intersection Capacity Utilization 76.5%  
 Analysis Period (min) 15  
 Intersection LOS: C  
 ICU Level of Service D

Splits and Phases: 4: Glendale Drive & Metropolitan Avenue



Appendix C - Intersection Capacity Analysis  
 2: First Lake Drive & West Driveway

						
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	190	125	110	60	5	155
Future Volume (Veh/h)	190	125	110	60	5	155
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	207	136	120	65	5	168
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	185				702	152
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	185				702	152
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	85				99	81
cM capacity (veh/h)	1390				344	894
Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2	
Volume Total	207	136	185	5	168	
Volume Left	207	0	0	5	0	
Volume Right	0	0	65	0	168	
cSH	1390	1700	1700	344	894	
Volume to Capacity	0.15	0.08	0.11	0.01	0.19	
Queue Length 95th (m)	4.2	0.0	0.0	0.4	5.5	
Control Delay (s)	8.0	0.0	0.0	15.6	10.0	
Lane LOS	A			C	A	
Approach Delay (s)	4.9		0.0	10.1		
Approach LOS				B		
Intersection Summary						
Average Delay			4.9			
Intersection Capacity Utilization			33.3%		ICU Level of Service	A
Analysis Period (min)			15			

Appendix C - Intersection Capacity Analysis  
 3: First Lake Drive & East Driveway

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	110	1	5	130	65	5	5	5	50	5	40
Future Volume (Veh/h)	20	110	1	5	130	65	5	5	5	50	5	40
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	120	1	5	141	71	5	5	5	54	5	43
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	212			121			361	386	120	358	352	176
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	212			121			361	386	120	358	352	176
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	91	99	95
cM capacity (veh/h)	1358			1467			553	537	931	581	562	867
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2					
Volume Total	22	121	5	212	15	54	48					
Volume Left	22	0	5	0	5	54	0					
Volume Right	0	1	0	71	5	0	43					
cSH	1358	1700	1467	1700	632	581	820					
Volume to Capacity	0.02	0.07	0.00	0.12	0.02	0.09	0.06					
Queue Length 95th (m)	0.4	0.0	0.1	0.0	0.6	2.4	1.5					
Control Delay (s)	7.7	0.0	7.5	0.0	10.8	11.8	9.7					
Lane LOS	A		A		B	B	A					
Approach Delay (s)	1.2		0.2		10.8	10.8						
Approach LOS					B	B						
Intersection Summary												
Average Delay			3.1									
Intersection Capacity Utilization			30.2%		ICU Level of Service				A			
Analysis Period (min)			15									

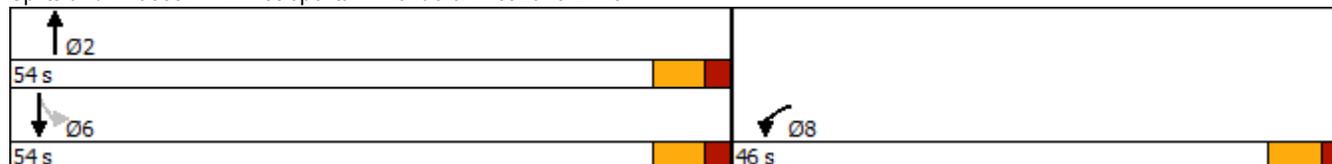
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	208	52	130	182	61	210
Future Volume (vph)	208	52	130	182	61	210
Satd. Flow (prot)	1733	0	1685	0	0	1842
Flt Permitted	0.962					0.845
Satd. Flow (perm)	1718	0	1685	0	0	1572
Satd. Flow (RTOR)	15		97			
Lane Group Flow (vph)	283	0	339	0	0	294
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)	13.2		16.6			16.6
Actuated g/C Ratio	0.31		0.39			0.39
v/c Ratio	0.51		0.47			0.47
Control Delay	14.8		9.9			13.6
Queue Delay	0.0		0.0			0.0
Total Delay	14.8		9.9			13.6
LOS	B		A			B
Approach Delay	14.8		9.9			13.6
Approach LOS	B		A			B
Queue Length 50th (m)	14.8		10.9			13.9
Queue Length 95th (m)	37.8		37.7			42.4
Internal Link Dist (m)	194.9		85.0			233.3
Turn Bay Length (m)						
Base Capacity (vph)	1620		1630			1518
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			0.19

Intersection Summary

Cycle Length: 100  
 Actuated Cycle Length: 42.2  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.51  
 Intersection Signal Delay: 12.6  
 Intersection Capacity Utilization 63.3%  
 Analysis Period (min) 15

Intersection LOS: B  
 ICU Level of Service B

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



Appendix C - Intersection Capacity Analysis  
4: Glendale Drive & Metropolitan Avenue

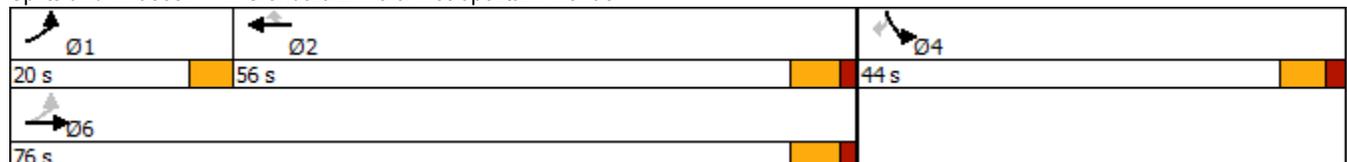
						
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	197	500	255	150	221	192
Future Volume (vph)	197	500	255	150	221	192
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.433				0.950	
Satd. Flow (perm)	807	1863	1863	1583	1770	1583
Satd. Flow (RTOR)				163		86
Lane Group Flow (vph)	214	543	277	163	240	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 Effect Green (s)	31.0	28.9	15.2	15.2	13.4	13.4
Actuated g/C Ratio	0.57	0.53	0.28	0.28	0.24	0.24
v/c Ratio	0.34	0.55	0.54	0.29	0.55	0.46
Control Delay	8.0	11.6	22.3	5.2	24.4	15.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.0	11.6	22.3	5.2	24.4	15.1
LOS	A	B	C	A	C	B
Approach Delay		10.6	16.0		20.1	
Approach LOS		B	B		C	
Queue Length 50th (m)	9.3	32.6	23.6	0.0	20.7	10.0
Queue Length 95th (m)	23.1	70.1	53.0	12.4	48.2	31.0
Internal Link Dist (m)		161.1	209.3		132.8	
Turn Bay Length (m)	70.0			65.0		10.0
Base Capacity (vph)	747	1858	1676	1441	1266	1156
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	0.29	0.29	0.17	0.11	0.19	0.18

Intersection Summary

Cycle Length: 120  
 Actuated Cycle Length: 54.7  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.55  
 Intersection Signal Delay: 14.6  
 Intersection Capacity Utilization 49.9%  
 Analysis Period (min) 15

Intersection LOS: B  
 ICU Level of Service A

Splits and Phases: 4: Glendale Drive & Metropolitan Avenue



Appendix C - Intersection Capacity Analysis  
 2: First Lake Drive & West Driveway

						
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	148	95	85	50	5	140
Future Volume (Veh/h)	148	95	85	50	5	140
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	103	92	54	5	152
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	146				544	119
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	146				544	119
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	84
cM capacity (veh/h)	1436				444	933
Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2	
Volume Total	161	103	146	5	152	
Volume Left	161	0	0	5	0	
Volume Right	0	0	54	0	152	
cSH	1436	1700	1700	444	933	
Volume to Capacity	0.11	0.06	0.09	0.01	0.16	
Queue Length 95th (m)	3.0	0.0	0.0	0.3	4.6	
Control Delay (s)	7.8	0.0	0.0	13.2	9.6	
Lane LOS	A			B	A	
Approach Delay (s)	4.8		0.0	9.7		
Approach LOS				A		
Intersection Summary						
Average Delay			4.9			
Intersection Capacity Utilization			29.1%		ICU Level of Service	A
Analysis Period (min)			15			

Appendix C - Intersection Capacity Analysis  
 3: First Lake Drive & East Driveway

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	85	5	1	125	18	1	1	1	38	1	10
Future Volume (Veh/h)	5	85	5	1	125	18	1	1	1	38	1	10
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	92	5	1	136	20	1	1	1	41	1	11
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			97			254	262	94	252	255	146
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	156			97			254	262	94	252	255	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	94	100	99
cM capacity (veh/h)	1424			1496			688	640	962	698	646	901
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2					
Volume Total	5	97	1	156	3	41	12					
Volume Left	5	0	1	0	1	41	0					
Volume Right	0	5	0	20	1	0	11					
cSH	1424	1700	1496	1700	740	698	872					
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	1.5	0.3					
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)	0.4		0.0		9.9	10.2						
Approach LOS					A	B						
Intersection Summary												
Average Delay			2.0									
Intersection Capacity Utilization			19.6%		ICU Level of Service				A			
Analysis Period (min)			15									

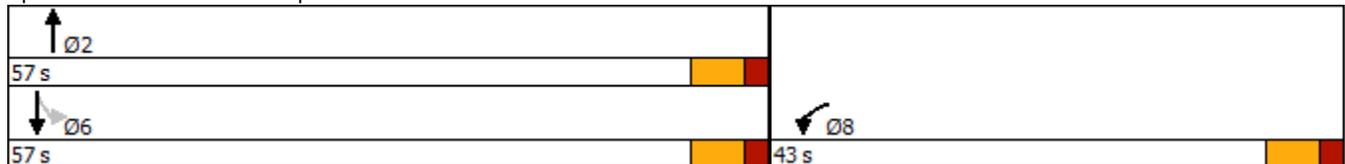
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	245	81	205	303	32	120
Future Volume (vph)	245	81	205	303	32	120
Satd. Flow (prot)	1721	0	1682	0	0	1844
Flt Permitted	0.964					0.839
Satd. Flow (perm)	1707	0	1682	0	0	1562
Satd. Flow (RTOR)	19		108			
Lane Group Flow (vph)	354	0	552	0	0	165
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)	16.4		21.9			21.9
Actuated g/C Ratio	0.32		0.43			0.43
v/c Ratio	0.63		0.71			0.25
Control Delay	20.5		15.7			11.2
Queue Delay	0.0		0.0			0.0
Total Delay	20.5		15.7			11.2
LOS	C		B			B
Approach Delay	20.5		15.7			11.2
Approach LOS	C		B			B
Queue Length 50th (m)	23.7		29.2			8.8
Queue Length 95th (m)	65.8		79.7			25.0
Internal Link Dist (m)	194.9		85.0			233.3
Turn Bay Length (m)						
Base Capacity (vph)	1335		1552			1433
Starvation Cap Reductn	0		0			0
Spillback Cap Reductn	0		0			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	0.27		0.36			0.12

Intersection Summary

Cycle Length: 100  
 Actuated Cycle Length: 51.1  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.71  
 Intersection Signal Delay: 16.6  
 Intersection Capacity Utilization 62.7%  
 Analysis Period (min) 15

Intersection LOS: B  
 ICU Level of Service B

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



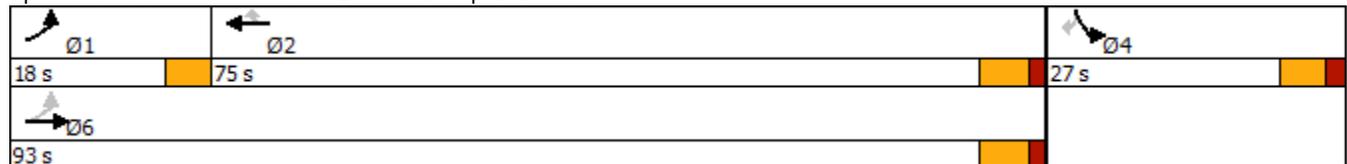
Appendix C - Intersection Capacity Analysis  
 4: Glendale Drive & Metropolitan Avenue

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	202	370	800	336	196	194
Future Volume (vph)	202	370	800	336	196	194
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.101				0.950	
Satd. Flow (perm)	188	1863	1863	1583	1770	1583
Satd. Flow (RTOR)				270		81
Lane Group Flow (vph)	220	402	870	365	213	211
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)	65.9	63.7	49.3	49.3	16.3	16.3
Actuated g/C Ratio	0.71	0.69	0.53	0.53	0.18	0.18
v/c Ratio	0.72	0.31	0.88	0.38	0.69	0.61
Control Delay	28.7	6.5	30.9	4.6	51.8	33.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.7	6.5	30.9	4.6	51.8	33.0
LOS	C	A	C	A	D	C
Approach Delay		14.3	23.1		42.4	
Approach LOS		B	C		D	
Queue Length 50th (m)	16.4	26.2	132.9	8.2	37.8	22.2
Queue Length 95th (m)	48.2	43.9	226.6	25.5	#77.8	57.0
Internal Link Dist (m)		161.1	209.3		132.8	
Turn Bay Length (m)	70.0			65.0		10.0
Base Capacity (vph)	387	1650	1422	1272	426	442
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	0.57	0.24	0.61	0.29	0.50	0.48

Intersection Summary

Cycle Length: 120  
 Actuated Cycle Length: 92.8  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.88  
 Intersection Signal Delay: 24.3  
 Intersection Capacity Utilization 77.5%  
 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



Appendix C - Intersection Capacity Analysis  
 2: First Lake Drive & West Driveway

						
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	215	125	110	60	5	171
Future Volume (Veh/h)	215	125	110	60	5	171
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)	234	136	120	65	5	186
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	185				756	152
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	185				756	152
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	83				98	79
cM capacity (veh/h)	1390				312	894
Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2	
Volume Total	234	136	185	5	186	
Volume Left	234	0	0	5	0	
Volume Right	0	0	65	0	186	
cSH	1390	1700	1700	312	894	
Volume to Capacity	0.17	0.08	0.11	0.02	0.21	
Queue Length 95th (m)	4.8	0.0	0.0	0.4	6.3	
Control Delay (s)	8.1	0.0	0.0	16.7	10.1	
Lane LOS	A			C	B	
Approach Delay (s)	5.1		0.0	10.3		
Approach LOS				B		
Intersection Summary						
Average Delay			5.2			
Intersection Capacity Utilization			34.7%		ICU Level of Service	A
Analysis Period (min)			15			

Appendix C - Intersection Capacity Analysis  
3: First Lake Drive & East Driveway

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	110	1	5	130	74	5	5	5	56	5	40
Future Volume (Veh/h)	20	110	1	5	130	74	5	5	5	56	5	40
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	120	1	5	141	80	5	5	5	61	5	43
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			121			361	396	120	362	356	181
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	221			121			361	396	120	362	356	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	89	99	95
cM capacity (veh/h)	1348			1467			553	531	931	577	559	862
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2					
Volume Total	22	121	5	221	15	61	48					
Volume Left	22	0	5	0	5	61	0					
Volume Right	0	1	0	80	5	0	43					
cSH	1348	1700	1467	1700	629	577	816					
Volume to Capacity	0.02	0.07	0.00	0.13	0.02	0.11	0.06					
Queue Length 95th (m)	0.4	0.0	0.1	0.0	0.6	2.8	1.5					
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	11.0						
Approach LOS					B	B						
Intersection Summary												
Average Delay			3.2									
Intersection Capacity Utilization			31.0%		ICU Level of Service				A			
Analysis Period (min)			15									