

ANNEX D - TRAFFIC IMPACT STUDY

70 FIRST LAKE DRIVE DEVELOPMENT TRAFFIC IMPACT STUDY FINAL REPORT

PREPARED FOR:
FIRST MUTUAL PROPERTIES

JULY 2022

Project No. 221-00147-01



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1 INTRODUCTION

Background

Plans are being prepared by First Mutual Properties for a mixed development including both commercial and residential units at 70 First Lake Drive in Lower Sackville, Nova Scotia. The proposed development is planned to include 25 townhomes, 125 low-rise apartment units, 680 high-rise apartment units and 10,000 ft² of commercial space, 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.

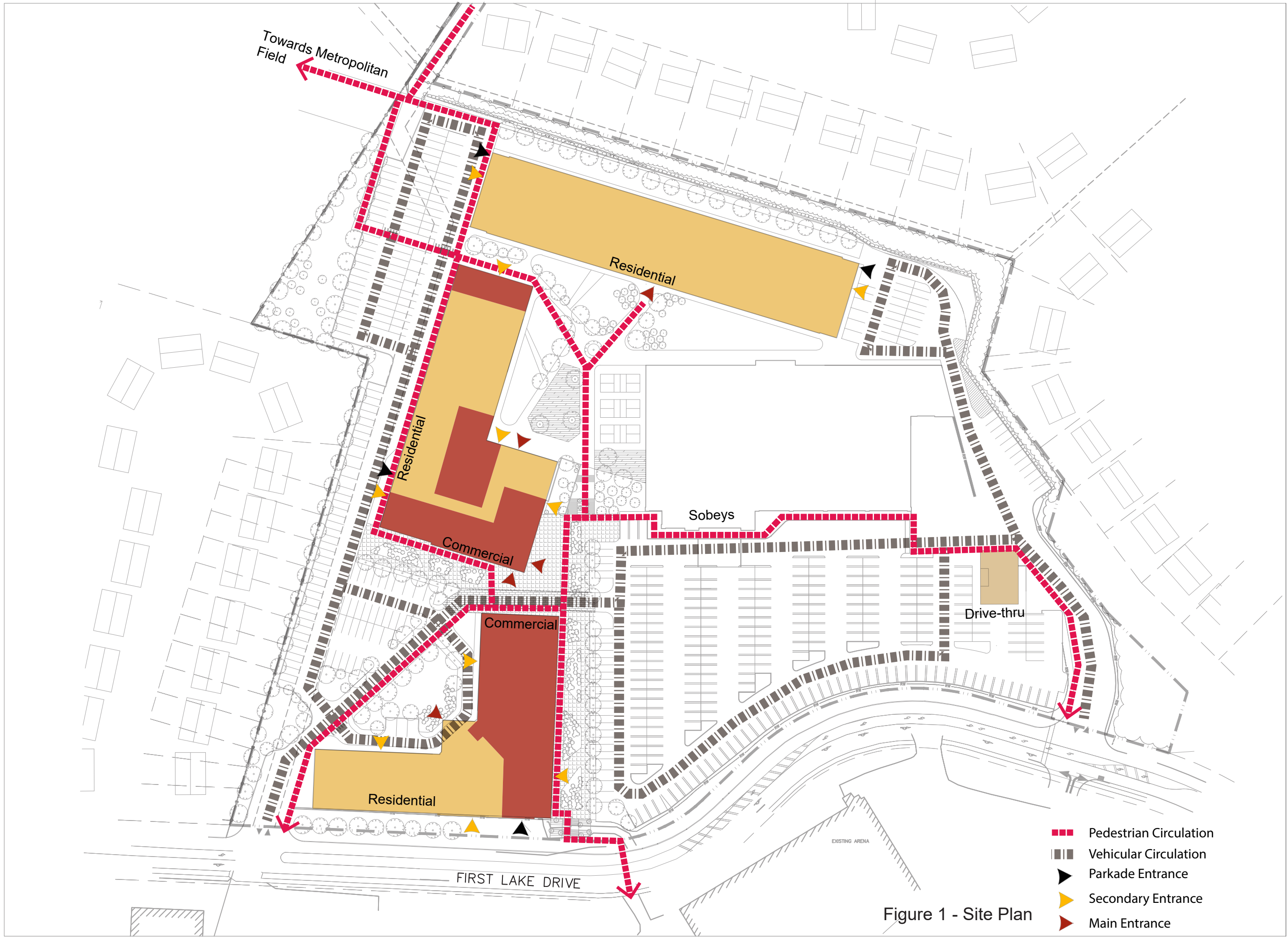


Figure 1 - Site Plan

- Pedestrian Circulation
- Vehicular Circulation
- ▲ Parkade Entrance
- ▲ Secondary Entrance
- ▲ Main Entrance

UPLAND

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STAMP

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT
70FIRSTLAKE DRIVE

DRAWING TITLE
CONCEPT PLAN

NORTH

SCALE
1:1200

DRAWING #
DRAWING#

2 STUDY AREA DESCRIPTIONS

Description of Existing Development

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 Driveway, 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 is moving to a new location (more to the east), however, remaining on the same site.

Description of Proposed Development

The proposed 70 First Lake Drive Development is planned to include 25 townhomes, 125 low-rise apartment units, 680 high-rise apartment units and 10,000ft² of commercial space. 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 2030.



Figure 2 – Study Area with the Study Intersections

Existing Study Road Descriptions

Metropolitan Avenue is a collector roadway with two lanes with one lane in each direction. The posted speed limit within the study area of 50 km/h. There are transit services for Route #82 and #182.

First Lake Drive is a collector road that has two lanes with one lane in each direction supplemented with left-turn lanes at roadways/driveways. The posted speed limit of 50 km/h. There are transit services for Route #82 and 182.

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 West Driveway approach. First Lake Drive has two lanes with one in each direction and an eastbound left-turn lane. No marked pedestrian crossings at this intersection.

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 two lanes with one in each direction and an eastbound and westbound left-turn lane. No marked pedestrian crossings at this intersection.



3 BACKGROUND TRAFFIC

***Turning
Movement
Counts***

Turning movement volumes 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.

***Covid-19
Adjustment
Factor***

It should be noted that a 5% Covid-19 factor was applied.

***Traffic Growth
Rate***

An annual growth rate of 0.5% was applied to the background volumes for this Traffic Impact Study.

***Network Re-
Distribution for
Tim Horton's***

With the Tim Horton's being re-located on the site, from the west more to the east, the trips from the west driveway have been re-distributed to the east driveway.



4 TRIP GENERATION, DISTRIBUTION, AND ASSIGNMENT

Prepared Trip Generation Estimates

When using the published trip generation rates 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 25 townhomes, 125 low-rise apartment units, 680 high-rise apartment units and 10,000ft² of commercial space. The commercial development is unknown at this time and therefore, was assumed to be a Strip Retail Plaza.

Estimation of Trips Generated by the Proposed Development

Trip generated by Strip Retail Plaza (Land Use 822) are estimated for the AM and PM peak hours of traffic by the leasable square footage. Single Family Attached Housing (Land Use 215), Multi-family Housing Low-Rise (Land Use 220) and Multi-family Housing High-Rise (Land Use 222) are estimated for the AM and PM peak hours of traffic by unit count. Trip generation estimates for the proposed development were prepared using published rates from *Trip Generation Manual, 11th Edition* (Institute of Transportation Engineers, Washington, 2021).

Reductions to Trip Generation Estimates

The total trip generation estimate for the proposed development were reduced by 10% to account for cycling and walking (non-auto) trips. Trips generated by the development were reduced by 5% to account for on-site synergies between residential and retail uses on the site.

Trips Generated by the Proposed Development – Full Build-Out

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

- 215 two-way primary vehicle trips (78 entering and 137 exiting) during the AM peak hour; and,
- 308 two-way pass-by vehicle trips (173 entering and 135 exiting) during the PM peak hour.

Table 1 – Trip Generation Estimates for the Proposed Development – 830 Units

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 Attached Housing (Land Use 215)	25.0 Units	0.15	0.33	0.32	0.25	4	8	8	6
Multi-family Housing (Low-Rise) (Land Use 220)	125.0 Units	0.10	0.18	0.32	0.19	12	23	40	24
Multi-family Housing (High-Rise) (Land Use 222)	680.0 Units	0.09	0.18	0.18	0.14	62	121	122	96
Strip Retail Plaza ⁴ (Land Use 822)	10.0 KGLA	1.42	0.94	3.30	3.30	14	9	33	33
Trip Generation Estimates for Proposed Development - Full Build-Out						92	161	203	159
10% Reduction for Non-Auto Trips⁵						9	16	20	16
5% Reduction for On-Site Synergies⁶						5	8	10	8
Primary Trip Estimate for the Proposed Development - Full Build-Out						78	137	173	135

NOTES: 1. Land Use Codes are from Trip Generation, 11th Edition, (Institute of Transportation Engineers, Washington, 2021).
 2. 'Residential Units' for Single-Family Attached Housing and Multi-family and 'Gross Leasable Area x 1000 SF' for Strip Retail Plaza.
 3. Rates are 'vehicles per hour per unit'; trips generated are 'vehicles per hour for peak hours'.
 4. Commercial uses associated with the development have yet to be identified, therefore, the commercial space was assumed to be Strip Retail Plaza.
 5. A 10% reduction for non-auto trips generated by the residential units and strip retail plaza have been used to account for cycling and walking trips.
 6. A 5% reduction has been used for trips generated by the residential development and retail plaza to account for on-site synergies within the development.



**Trip
Distribution
and
Assignment**

Background traffic and the 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. 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 Level of Service (LOS) 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 a left-turn lane 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 are included in Appendix B.

Intersection Capacity Analysis Results

Synchro 11.0 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.

Intersection Level of Service Analysis

The level or quality of performance of an intersection in terms of traffic movement is determined by a level of service (LOS) analysis. LOS for intersections is defined in terms of delay, which is a measure of driver discomfort and frustration, fuel consumption, and increased travel time.

LOS criteria, as shown in Table 2, are stated in terms of average control delay per vehicle which includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay.

Table 2 – Level of Service Criteria

Signalized Intersections Control Delay (Seconds per Vehicle)	LOS Description	Roundabouts and Two Way Stop Controlled (TWSC) Intersections Control Delay (Seconds per Vehicle)
Less than 10.0	Very low delay; most vehicles do not stop (Excellent)	Less than 10.0
Between 10.0 and 20.0	Higher delay; most vehicles stop (Very Good)	Between 10.0 and 15.0
Between 20.0 and 35.0	Higher level of congestion; number of vehicles stopping is significant, although many still pass through intersection without stopping (Good)	Between 15.0 and 25.0
Between 35.0 and 55.0	Congestion becomes noticeable; vehicles must sometimes wait through more than one red light; many vehicles stop (Satisfactory)	Between 25.0 and 35.0
Between 55.0 and 80.0	Vehicles must often wait through more than one red light; considered by many agencies to be the limit of acceptable delay	Between 35.0 and 50.0
Greater than 80.0	This level is considered to be unacceptable to most drivers; occurs when arrival flow rates exceed the capacity of the intersection (Unacceptable)	Greater than 50.0

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 0.80 or better.

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

LOS Criteria	Control Delay (sec/veh), v/c Ratio, and 95 th %ile Queue (m) by Intersection Movement			Overall Intersection
	First Lake Drive	Metropolitan Avenue		
	WB-LR	NB-TR	SB-LT	Delay
Scenario 1 - Future 2030 without Site AM Peak Hour (Page C-1)				
Delay	14.1	9.6	13.4	12.2
v/c	0.47	0.46	0.48	
Queue	33.7	36.5	43.2	
Scenario 2 - Future 2030 with Site AM Peak Hour (Page C-7)				
Delay	17.5	11.1	15.0	14.4
v/c	0.62	0.54	0.51	
Queue	52.8	43.1	44.4	
Scenario 1 - Future 2030 without Site PM Peak Hour (Page C-4)				
Delay	19.8	14.8	10.9	15.8
v/c	0.61	0.69	0.26	
Queue	60.9	72.4	24.3	
Scenario 2 - Future 2030 with Site PM Peak Hour (Page C-10)				
Delay	28.5	20.9	14.8	22.7
v/c	0.75	0.80	0.35	
Queue	112.3	125.7	35.4	

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 (**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 proposed development. All movements are expected to operate at with a v/c ratio of 0.20 or better.

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

LOS Criteria	Control Delay (sec/veh), v/c Ratio, and 95 th %ile Queue (m) by Intersection Movement					Overall Intersecti on
	First Lake Drive			West Driveway		
	EB-L	EB-T	WB-TR	SB-L	SB-R	Delay
Scenario 1 - Future 2030 without Site AM Peak Hour (Page C-2)						
Delay	7.8	0.0	0.0	13.0	9.5	4.6
v/c	0.11	0.06	0.09	0.01	0.14	
Queue	2.9	0.0	0.0	0.3	3.9	
Scenario 2 - Future 2030 with Site AM Peak Hour (Page C-8)						
Delay	7.9	0.0	0.0	14.2	10.2	3.0
v/c	0.05	0.15	0.15	0.09	0.14	
Queue	1.2	0.0	0.0	2.2	3.9	
Scenario 1 - Future 2030 without Site PM Peak Hour (Page C-5)						
Delay	8.1	0.0	0.0	15.7	10.0	4.9
v/c	0.15	0.08	0.11	0.01	0.20	
Queue	4.2	0.0	0.0	0.4	5.8	
Scenario 2 - Future 2030 with Site PM Peak Hour (Page C-11)						
Delay	8.4	0.0	0.0	21.4	10.9	3.2
v/c	0.12	0.20	0.20	0.14	0.15	
Queue	3.1	0.0	0.0	4.0	4.3	

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 (**19 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 0.27 or better.

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

LOS Criteria	Control Delay (sec/veh), v/c Ratio, and 95 th %ile Queue (m) by Intersection Movement							Overall Intersection n
	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 2030 without Site AM Peak Hour (Page C-3)								
Delay	7.5	0.0	7.4	0.0	9.9	10.4	9.2	1.9
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	1.4	0.3	
Scenario 2 - Future 2030 with Site AM Peak Hour (Page C-9)								
Delay	7.9	0.0	7.5	0.0	14.0	15.5	9.7	5.1
v/c	0.11	0.08	0.00	0.10	0.01	0.11	0.16	
Queue	3.0	0.0	0.0	0.0	0.2	3.0	4.5	
Scenario 1 - Future 2030 without Site PM Peak Hour (Page C-6)								
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	
Scenario 2 - Future 2030 with Site PM Peak Hour (Page C-12)								
Delay	8.3	0.0	7.5	0.0	20.4	23.9	11.1	6.5
v/c	0.17	0.09	0.00	0.15	0.06	0.24	0.27	
Queue	5.1	0.0	0.1	0.0	1.5	7.3	8.9	

6 SUMMARY, CONCLUSION & RECOMMENDATIONS

6.1 SUMMARY

Background	1. Plans are being prepared by First Mutual Properties for a mixed development including both commercial and residential units at 70 First Lake Drive in Lower Sackville, Nova Scotia.
Description of Existing Development	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 Driveway, 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 is moving to a new location (more to the east), however, remaining on the same site.
Description of the Proposed Development	<p>3. The proposed development is planned to include 25 townhomes, 125 low-rise apartment units, 680 high-rise apartment units and 10,000ft² of commercial space. Halifax Regional Municipality (HRM) has requested that a Traffic Impact Study be completed to review the impacts to the adjacent road network.</p> <p>4. It is anticipated that the development will be completed by 2030.</p>
Proposed Site Access	5. The access to the proposed development will be via the existing driveways on First Lake Drive.
Study Area Roads	<p>6. Metropolitan Avenue is a collector roadway with two lanes with one lane in each direction. The posted speed limit within the study area is 50 km/h. There are transit services for Route #82 and #182.</p> <p>7. First Lake Drive is a collector road that has two lanes with one lane in each direction supplemented with left-turn lanes at roadways/driveways. The posted speed limit is 50 km/h. There are transit services for Route #82 and 182.</p>
Turning Movement Counts	8. Turning movement volumes were collected by WSP on Wednesday, February 2 nd , 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.
Background Traffic Volumes & Re-distribution of Tim Horton's Trips	<p>9. Projected 2030 peak hour future background volumes include:</p> <ul style="list-style-type: none"> • 5% Covid-19 Adjustment Factor; and, • 0.5% annual growth between 2021-2030. <p>10. With the Tim Horton's being re-located on the site, from the west more to the east, the trips from the west driveway have been re-distributed to the east driveway.</p>

Estimation of Proposed Development Trips	<p>11. Trip generation estimates for the proposed Exhibition Expansion were prepared using rates published in <i>Trip Generation, 11th Edition</i> (Institute of Transportation Engineers, Washington, 2021).</p> <p>12. It is estimated that the development will generate:</p> <ul style="list-style-type: none"> • 215 two-way primary vehicle trips (78 entering and 137 exiting) during the AM peak hour; and, • 308 two-way pass-by vehicle trips (173 entering and 135 exiting) during the PM peak hour.
Trip Distribution and Assignment	<p>13. 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>
Analysis Scenarios Considered	<p>14. 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.</p> <p>15. 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.</p>
Warrant Analysis Summary	<p>16. 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.</p> <p>17. It was determined that traffic signals are not warranted at any Study Intersection.</p>
Summary – Intersection Capacity Analysis	<p>18. Intersection performance analysis was completed using <i>Synchro 11</i> at the Study Intersections.</p> <p>19. All study intersections are expected to operate within HRM acceptable limits during the AM and PM peak hours. Negligible or 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 0.80 or better.</p>

6.2 CONCLUSIONS

Conclusion	<p>20. Trips generated by 70 First Lake Drive Development are expected to have a minimal or negligible impact on the operational performance of the Study Intersections and the adjacent street network.</p>
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APPENDIX

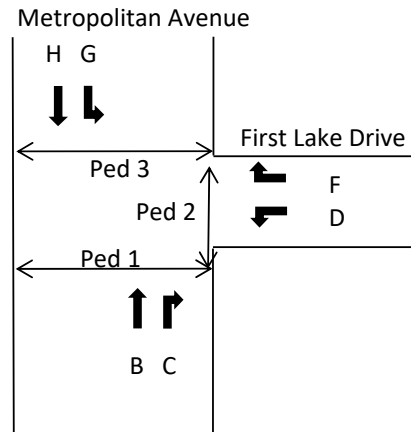
A

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
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

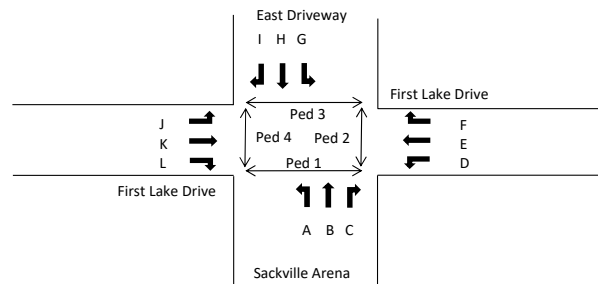
PM Peak Period Volume Data

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													
07:00 08:00	1			0			0			1			2
08:00 09:00	14			0			0			1			15

Midday Volume Data

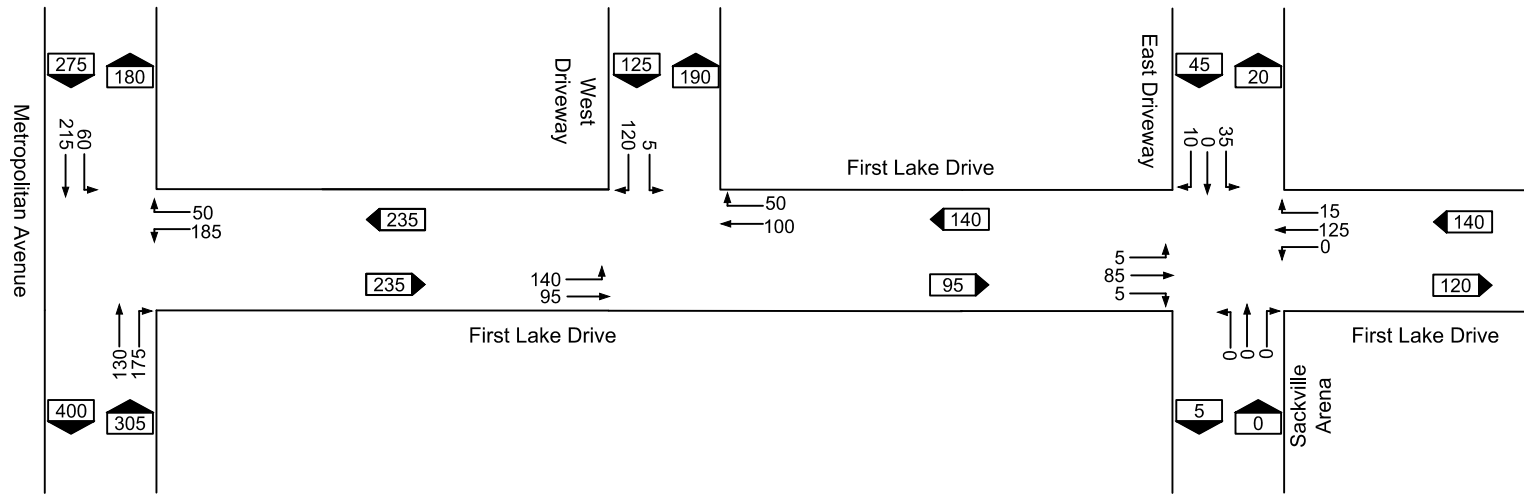
Time	East Driveway Northbound Approach			First Lake Drive Westbound Approach			East Driveway Southbound Approach			First Lake Drive Eastbound Approach			Total Vehicles
	A	B	C	D	E	F	G	H	I	J	K	L	
11:30 11:45	0	0	1	0	10	5	5	0	6	4	17	0	48
11:45 12:00	1	0	0	1	18	8	12	0	3	1	11	1	56
12:00 12:15	1	0	0	0	17	9	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													
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													
16:00 17:00	13			0			0			0			13
17:00 18:00	6			0			0			2			8

A

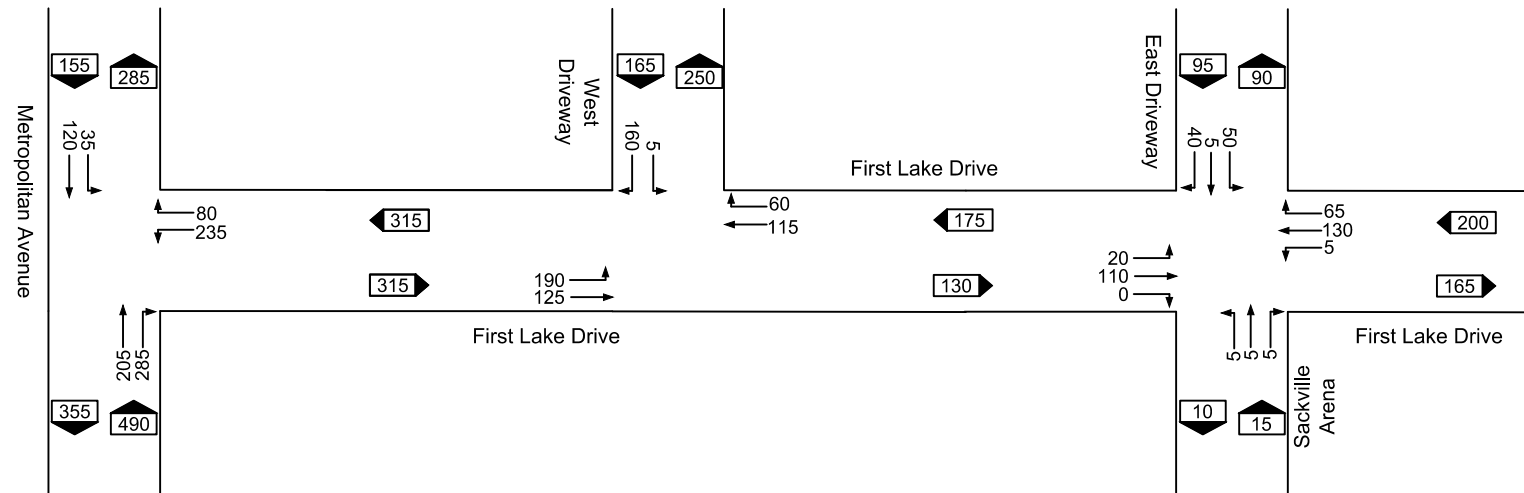
AM Peak Hour



NOT TO SCALE

B

PM Peak Hour



NOT TO SCALE



Traffic Impact Study - First Lake Drive
Lower Sackville, Nova Scotia

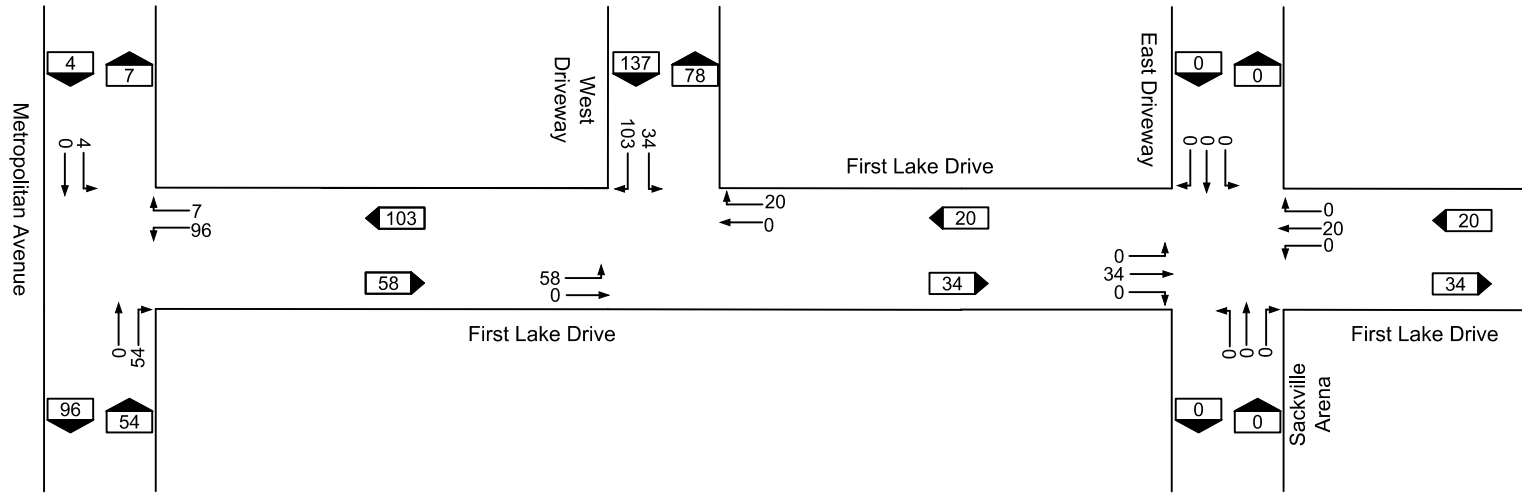
2030 Future Background Without Site Development
Weekday AM and PM Peak Hour

Figure A-1

March 2022

A

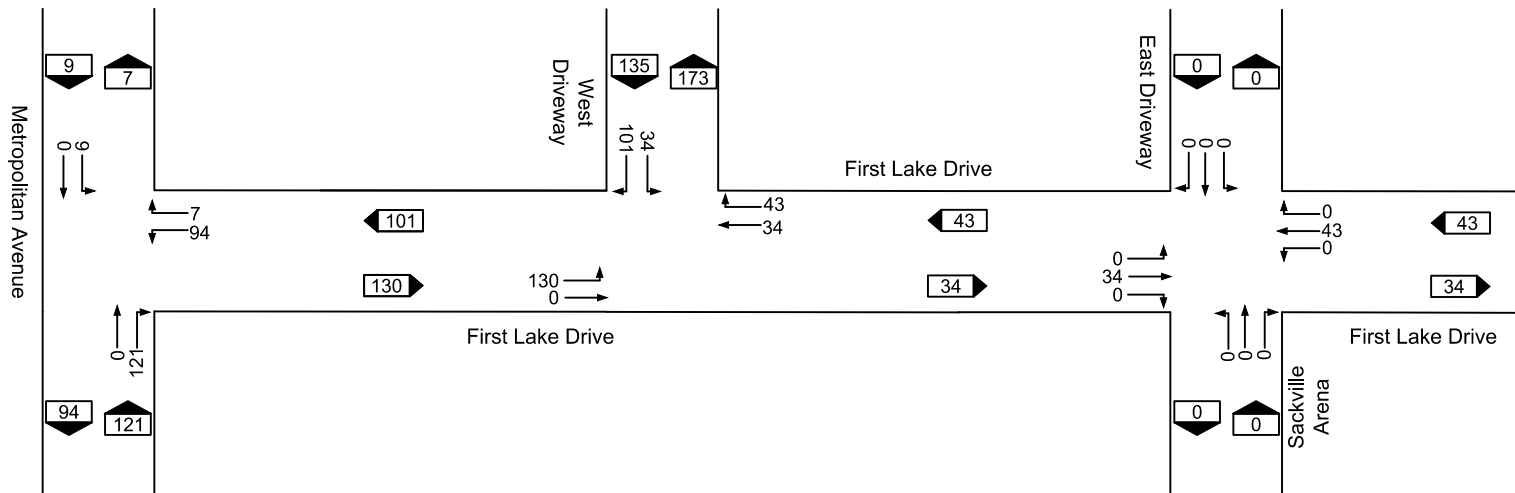
AM Peak Hour



NOT TO SCALE

B

PM Peak Hour



NOT TO SCALE



Traffic Impact Study - First Lake Drive
Lower Sackville, Nova Scotia

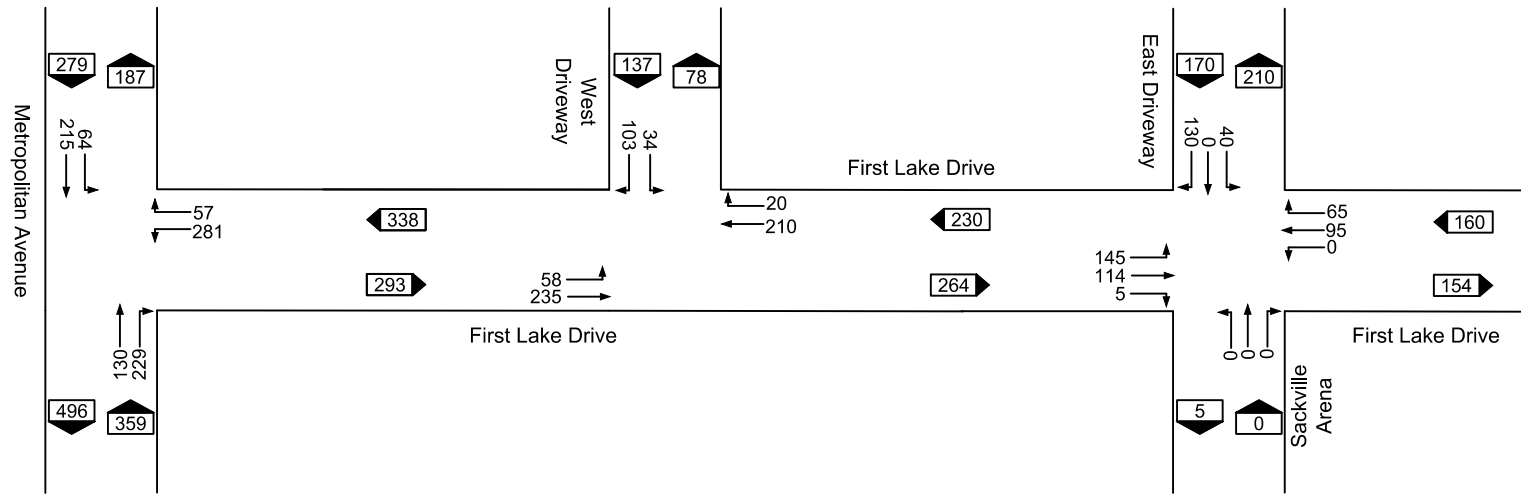
2030 Site Generated Trips
Weekday AM and PM Peak Hour

Figure A-2

March 2022

A

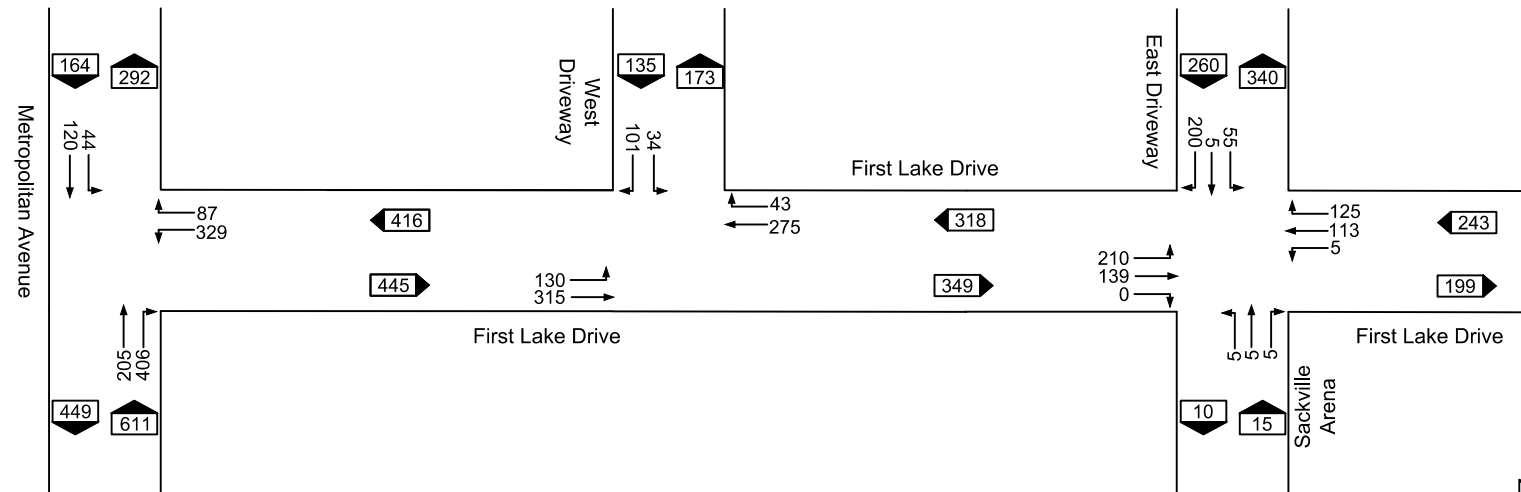
AM Peak Hour



NOT TO SCALE

B

PM Peak Hour



NOT TO SCALE



Traffic Impact Study - First Lake Drive
Lower Sackville, Nova Scotia

Figure A-3

2030 Future Background with Site Development
Weekday AM and PM Peak Hour

March 2022

APPENDIX

B

INTERSECTION PERFORMANCE ANALYSIS



2005 Canadian Traffic Signal Warrant Matrix Analysis

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

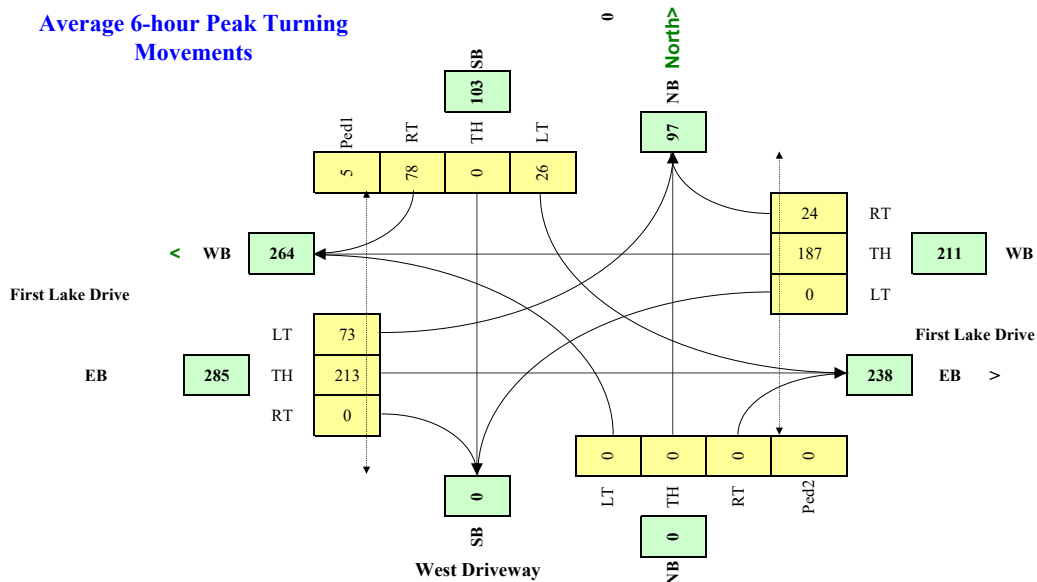
Main Street (name)	First Lake Drive			Direction (EW or NS)		EW	Date:	March 2022	
Side Street (name)	West Driveway			Direction (EW or NS)		NS		City:	Lower Sackville, NS
Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)		# of Thru Lanes
First Lake Drive	WB				1		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 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	1	0	0	14
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)	28	1	0	19
Average (6-hour peak)	5	0	0	3

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	35	0	105	0	210	20	60	235	0
8:00 - 9:00	0	0	0	25	0	75	0	160	15	45	175	0
11:30 - 12:30	0	0	0	15	0	50	0	120	15	45	140	0
12:30 - 13:30	0	0	0	15	0	50	0	120	15	45	140	0
15:30 - 16:30	0	0	0	30	0	85	0	235	35	110	270	0
16:30 - 17:30	0	0	0	35	0	100	0	275	45	130	315	0
Total (6-hour peak)	0	0	0	155	0	465	0	1,120	145	435	1,275	0
Average (6-hour peak)	0	0	0	26	0	78	0	187	24	73	213	0

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 = 17 14 3
 Veh Ped
NOT Warranted

2005 Canadian Traffic Signal Warrant Matrix Analysis

**Table: B-2 - First Lake Drive at East Driveway
2030 Future w Site**

Main Street (name)	First Lake Drive	Direction (EW or NS)	EW	Date:	March 2022
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				

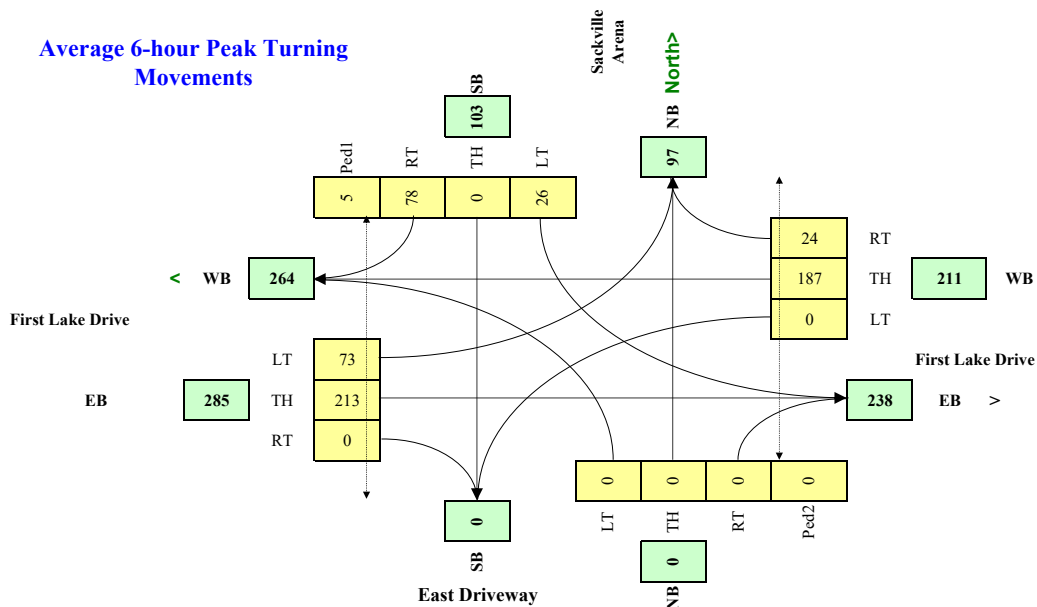
Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
First Lake Drive	EW	50	2.0%	y	0.0
East Driveway	NS	50	2.0%	n	

	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	1	0	0	14
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)	28	1	0	19
Average (6-hour peak)	5	0	0	3

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	35	0	105	0	210	20	60	235	0
8:00 - 9:00	0	0	0	25	0	75	0	160	15	45	175	0
11:30 - 12:30	0	0	0	15	0	50	0	120	15	45	140	0
12:30 - 13:30	0	0	0	15	0	50	0	120	15	45	140	0
15:30 - 16:30	0	0	0	30	0	85	0	235	35	110	270	0
16:30 - 17:30	0	0	0	35	0	100	0	275	45	130	315	0
Total (6-hour peak)	0	0	0	155	0	465	0	1,120	145	435	1,275	0
Average (6-hour peak)	0	0	0	26	0	78	0	187	24	73	213	0

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 = 19 16 3
 Veh Ped
NOT Warranted

APPENDIX

C

WARRANT ANALYSIS



70 First Lake Drive TIS
1: Metropolitan Avenue & First Lake Drive

Page C-1
2030 AM Future without Site

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	185	50	130	175	60	215
Future Volume (vph)	185	50	130	175	60	215
Satd. Flow (prot)	1729	0	1689	0	0	1842
Flt Permitted	0.962					0.852
Satd. Flow (perm)	1714	0	1689	0	0	1585
Satd. Flow (RTOR)	16		95			
Lane Group Flow (vph)	255	0	331	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	0.47		0.46			0.48
Control Delay	14.1		9.6			13.4
Queue Delay	0.0		0.0			0.0
Total Delay	14.1		9.6			13.4
LOS	B		A			B
Approach Delay	14.1		9.6			13.4
Approach LOS	B		A			B
Queue Length 50th (m)	13.0		10.2			13.7
Queue Length 95th (m)	33.7		36.5			43.2
Internal Link Dist (m)	194.9		85.0			233.3
Turn Bay Length (m)						
Base Capacity (vph)	1611		1639			1536
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: 41.9

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.48

Intersection Signal Delay: 12.2

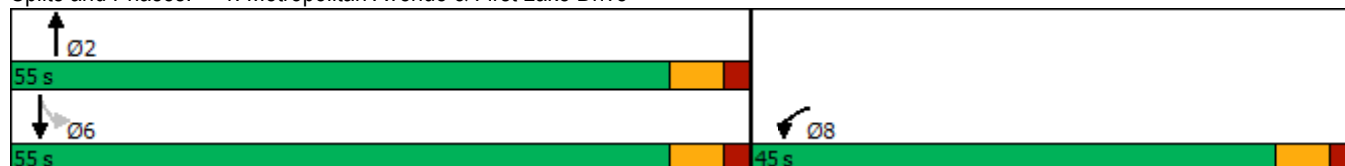
Intersection LOS: B

Intersection Capacity Utilization 62.0%

ICU Level of Service B












Analysis Period (min) 15

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






















70 First Lake Drive TIS
2: First Lake Drive & West Driveway

Page C-2
2030 AM Future without Site

						
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	140	95	90	50	5	120
Future Volume (Veh/h)	140	95	90	50	5	120
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	98	54	5	130
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	152				532	125
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	152				532	125
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	86
cM capacity (veh/h)	1429				454	926
Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2	
Volume Total	152	103	152	5	130	
Volume Left	152	0	0	5	0	
Volume Right	0	0	54	0	130	
cSH	1429	1700	1700	454	926	
Volume to Capacity	0.11	0.06	0.09	0.01	0.14	
Queue Length 95th (m)	2.9	0.0	0.0	0.3	3.9	
Control Delay (s)	7.8	0.0	0.0	13.0	9.5	
Lane LOS	A			B	A	
Approach Delay (s)	4.7		0.0	9.7		
Approach LOS				A		
Intersection Summary						
Average Delay			4.6			
Intersection Capacity Utilization			28.9%		ICU Level of Service	A
Analysis Period (min)			15			

70 First Lake Drive TIS
3: First Lake Drive & East Driveway

Page C-3
2030 AM Future without Site

												
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	35	1	10
Future Volume (Veh/h)	5	85	5	1	125	15	1	1	1	35	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	38	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	38	12					
Volume Left	5	0	1	0	1	38	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	1.4	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			1.9									
Intersection Capacity Utilization			19.0%		ICU Level of Service			A				
Analysis Period (min)			15									

70 First Lake Drive TIS
1: Metropolitan Avenue & First Lake Drive

Page C-4
2030 PM Future without Site

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	235	80	205	285	35	120
Future Volume (vph)	235	80	205	285	35	120
Satd. Flow (prot)	1721	0	1685	0	0	1842
Flt Permitted	0.964					0.830
Satd. Flow (perm)	1707	0	1685	0	0	1545
Satd. Flow (RTOR)	19		104			
Lane Group Flow (vph)	342	0	533	0	0	168
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)	15.6		20.9			20.9
Actuated g/C Ratio	0.32		0.42			0.42
v/c Ratio	0.61		0.69			0.26
Control Delay	19.8		14.8			10.9
Queue Delay	0.0		0.0			0.0
Total Delay	19.8		14.8			10.9
LOS	B		B			B
Approach Delay	19.8		14.8			10.9
Approach LOS	B		B			B
Queue Length 50th (m)	21.9		26.6			8.6
Queue Length 95th (m)	60.9		72.4			24.3
Internal Link Dist (m)	194.9		85.0			233.3
Turn Bay Length (m)						
Base Capacity (vph)	1337		1589			1451
Starvation Cap Reductn	0		0			0
Spillback Cap Reductn	0		0			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	0.26		0.34			0.12

Intersection Summary

Cycle Length: 100

Actuated Cycle Length: 49.2

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.69

Intersection Signal Delay: 15.8

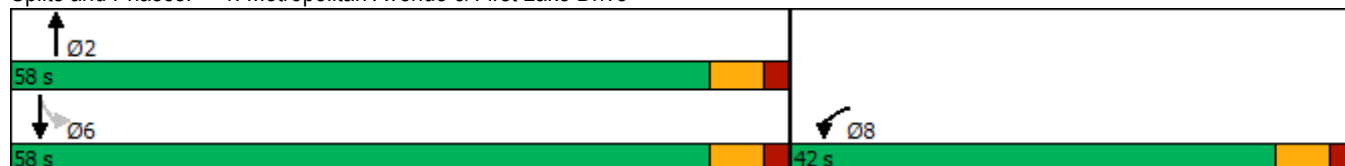
Intersection LOS: B

Intersection Capacity Utilization 64.9%

ICU Level of Service C












Analysis Period (min) 15

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






















70 First Lake Drive TIS
2: First Lake Drive & West Driveway

Page C-5
2030 PM Future without Site

						
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	190	125	115	60	5	160
Future Volume (Veh/h)	190	125	115	60	5	160
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	125	65	5	174
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	190				708	158
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	190				708	158
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	80
cM capacity (veh/h)	1384				341	888
Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2	
Volume Total	207	136	190	5	174	
Volume Left	207	0	0	5	0	
Volume Right	0	0	65	0	174	
cSH	1384	1700	1700	341	888	
Volume to Capacity	0.15	0.08	0.11	0.01	0.20	
Queue Length 95th (m)	4.2	0.0	0.0	0.4	5.8	
Control Delay (s)	8.1	0.0	0.0	15.7	10.0	
Lane LOS	A			C	B	
Approach Delay (s)	4.9		0.0	10.2		
Approach LOS				B		
Intersection Summary						
Average Delay			4.9			
Intersection Capacity Utilization			33.6%		ICU Level of Service	A
Analysis Period (min)			15			

70 First Lake Drive TIS
3: First Lake Drive & East Driveway

Page C-6
2030 PM Future without Site

												
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								

70 First Lake Drive TIS
1: Metropolitan Avenue & First Lake Drive

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2030 AM Future with Site

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	281	57	130	229	64	215
Future Volume (vph)	281	57	130	229	64	215
Satd. Flow (prot)	1738	0	1669	0	0	1842
Flt Permitted	0.960					0.826
Satd. Flow (perm)	1722	0	1669	0	0	1537
Satd. Flow (RTOR)	12		120			
Lane Group Flow (vph)	367	0	390	0	0	304
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Total Split (s)	47.0		53.0		53.0	53.0
Total Lost Time (s)	6.0		6.0			6.0
Act Effct Green (s)	15.0		17.4			17.4
Actuated g/C Ratio	0.33		0.39			0.39
v/c Ratio	0.62		0.54			0.51
Control Delay	17.5		11.1			15.0
Queue Delay	0.0		0.0			0.0
Total Delay	17.5		11.1			15.0
LOS	B		B			B
Approach Delay	17.5		11.1			15.0
Approach LOS	B		B			B
Queue Length 50th (m)	20.8		14.6			17.1
Queue Length 95th (m)	52.8		43.1			44.4
Internal Link Dist (m)	194.9		85.0			233.3
Turn Bay Length (m)						
Base Capacity (vph)	1582		1601			1470
Starvation Cap Reductn	0		0			0
Spillback Cap Reductn	0		0			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	0.23		0.24			0.21

Intersection Summary

Cycle Length: 100

Actuated Cycle Length: 44.8

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.62

Intersection Signal Delay: 14.4

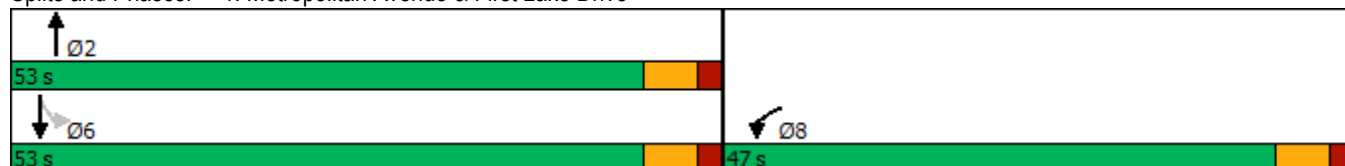
Intersection LOS: B

Intersection Capacity Utilization 70.2%

ICU Level of Service C












Analysis Period (min) 15

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






















70 First Lake Drive TIS
2: First Lake Drive & West Driveway

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2030 AM Future with Site

						
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	58	235	210	20	34	103
Future Volume (Veh/h)	58	235	210	20	34	103
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)	63	255	228	22	37	112
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	250				620	239
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	250				620	239
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				91	86
cM capacity (veh/h)	1316				430	800
Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2	
Volume Total	63	255	250	37	112	
Volume Left	63	0	0	37	0	
Volume Right	0	0	22	0	112	
cSH	1316	1700	1700	430	800	
Volume to Capacity	0.05	0.15	0.15	0.09	0.14	
Queue Length 95th (m)	1.2	0.0	0.0	2.2	3.9	
Control Delay (s)	7.9	0.0	0.0	14.2	10.2	
Lane LOS	A			B	B	
Approach Delay (s)	1.6		0.0	11.2		
Approach LOS				B		
Intersection Summary						
Average Delay			3.0			
Intersection Capacity Utilization			28.9%		ICU Level of Service	A
Analysis Period (min)			15			

70 First Lake Drive TIS
3: First Lake Drive & East Driveway

Page C-9
2030 AM Future with Site

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	145	114	5	1	95	65	1	1	1	40	1	130
Future Volume (Veh/h)	145	114	5	1	95	65	1	1	1	40	1	130
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)	158	124	5	1	103	71	1	1	1	43	1	141
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	174			129			689	618	126	582	586	138
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	174			129			689	618	126	582	586	138
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 %	89			100			100	100	100	89	100	85
cM capacity (veh/h)	1403			1457			277	359	924	386	375	910
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2					
Volume Total	158	129	1	174	3	43	142					
Volume Left	158	0	1	0	1	43	0					
Volume Right	0	5	0	71	1	0	141					
cSH	1403	1700	1457	1700	401	386	901					
Volume to Capacity	0.11	0.08	0.00	0.10	0.01	0.11	0.16					
Queue Length 95th (m)	3.0	0.0	0.0	0.0	0.2	3.0	4.5					
Control Delay (s)	7.9	0.0	7.5	0.0	14.0	15.5	9.7					
Lane LOS	A		A		B	C	A					
Approach Delay (s)	4.3		0.0		14.0	11.1						
Approach LOS					B	B						
Intersection Summary												
Average Delay			5.1									
Intersection Capacity Utilization			35.1%	ICU Level of Service				A				
Analysis Period (min)			15									

70 First Lake Drive TIS
1: Metropolitan Avenue & First Lake Drive

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2030 PM Future with Site

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	LT	TH	TH	TH	LT	TH
Traffic Volume (vph)	329	87	205	406	44	120
Future Volume (vph)	329	87	205	406	44	120
Satd. Flow (prot)	1731	0	1661	0	0	1839
Flt Permitted	0.962					0.609
Satd. Flow (perm)	1716	0	1661	0	0	1134
Satd. Flow (RTOR)	15		145			
Lane Group Flow (vph)	453	0	664	0	0	178
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)	22.6		29.4			29.4
Actuated g/C Ratio	0.35		0.45			0.45
v/c Ratio	0.75		0.80			0.35
Control Delay	28.5		20.9			14.8
Queue Delay	0.0		0.0			0.0
Total Delay	28.5		20.9			14.8
LOS	C		C			B
Approach Delay	28.5		20.9			14.8
Approach LOS	C		C			B
Queue Length 50th (m)	43.9		49.6			12.9
Queue Length 95th (m)	112.3		125.7			35.4
Internal Link Dist (m)	194.9		85.0			233.3
Turn Bay Length (m)						
Base Capacity (vph)	1096		1358			908
Starvation Cap Reductn	0		0			0
Spillback Cap Reductn	0		0			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	0.41		0.49			0.20

Intersection Summary

Cycle Length: 100

Actuated Cycle Length: 65.4

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.80

Intersection Signal Delay: 22.7

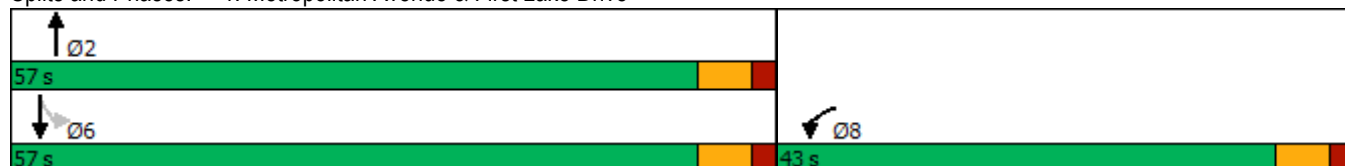
Intersection LOS: C

Intersection Capacity Utilization 78.5%

ICU Level of Service D

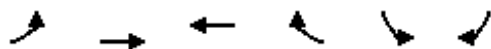
Analysis Period (min) 15






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



70 First Lake Drive TIS
2: First Lake Drive & West Driveway




















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2030 PM Future with Site



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	130	315	275	43	34	101
Future Volume (Veh/h)	130	315	275	43	34	101
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)	141	342	299	47	37	110
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	346				946	322
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	346				946	322
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	88				86	85
cM capacity (veh/h)	1213				256	718
Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2	
Volume Total	141	342	346	37	110	
Volume Left	141	0	0	37	0	
Volume Right	0	0	47	0	110	
cSH	1213	1700	1700	256	718	
Volume to Capacity	0.12	0.20	0.20	0.14	0.15	
Queue Length 95th (m)	3.1	0.0	0.0	4.0	4.3	
Control Delay (s)	8.4	0.0	0.0	21.4	10.9	
Lane LOS	A			C	B	
Approach Delay (s)	2.4		0.0	13.6		
Approach LOS				B		
Intersection Summary						
Average Delay			3.2			
Intersection Capacity Utilization			37.6%		ICU Level of Service	
Analysis Period (min)			15			
			A			

70 First Lake Drive TIS
3: First Lake Drive & East Driveway

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2030 PM Future with Site

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	210	139	1	5	113	125	5	5	5	55	5	200
Future Volume (Veh/h)	210	139	1	5	113	125	5	5	5	55	5	200
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)	228	151	1	5	123	136	5	5	5	60	5	217
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage veh												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	259			152			960	876	152	816	809	191
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	259			152			960	876	152	816	809	191
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 %	83			100			97	98	99	76	98	74
cM capacity (veh/h)	1306			1429			150	236	895	250	259	851
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2					
Volume Total	228	152	5	259	15	60	222					
Volume Left	228	0	5	0	5	60	0					
Volume Right	0	1	0	136	5	0	217					
cSH	1306	1700	1429	1700	249	250	809					
Volume to Capacity	0.17	0.09	0.00	0.15	0.06	0.24	0.27					
Queue Length 95th (m)	5.1	0.0	0.1	0.0	1.5	7.3	8.9					
Control Delay (s)	8.3	0.0	7.5	0.0	20.4	23.9	11.1					
Lane LOS	A		A		C	C	B					
Approach Delay (s)	5.0		0.1		20.4	13.8						
Approach LOS					C	B						
Intersection Summary												
Average Delay			6.5									
Intersection Capacity Utilization			47.9%		ICU Level of Service			A				
Analysis Period (min)			15									