



February 24th, 2020

JDE Project 1672

JD Development 50 Lakeside Terrace Inc.

7100 Woodbine Avenue, Suite 301

Markham, ON L3R 5J2

**RE: Traffic Impact Study Addendum
Little Lake Senior Condominium, City of Barrie**

This letter was prepared by **JD Northcote Engineering Inc.** [JD Engineering] for the account of the **JD Development 50 Lakeside Terrace Inc.** [The Client].

1.0 BACKGROUND

The proposed development is located within Condominium Block 'B' of a larger multi-phase development, located east of J.C. Massie Way and Little Lake Drive, in the City of Barrie [City].

JD Engineering prepared a traffic impact study for the proposed senior's community (dated December 2016) [TIS]. The TIS was based on the development plan proposed at the time the study was completed. This letter is intended as an update to the TIS, to assess the impact of minor revisions to the development proposal.

2.0 SITE PLAN

The revised Site Plan is provided in the **Appendix**.

The previous development plan was proposed to include the following:

Senior Condominium	413 units
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The revised development plan will include the following:

Senior Condominium	479 units
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3.0 IMPACT OF THE REVISED TRAFFIC GENERATION

The Institute of Transportation Engineers [ITE] *Trip Generation* (9th Edition) data was used in the TIS to calculate the traffic generated from the previous development plan with the following ITE land uses:

- ITE land use 252 (Senior Adult Housing - Attached)

The ITE *Trip Generation* (10th Edition) was released after the completion of the TIS. For the purpose of this analysis, the ITE *Trip Generation* (10th Edition) data has been used to calculate the traffic generated from the revised development plan. The following ITE land uses have been applied:

- ITE land use 252 (Senior Adult Housing - Attached)



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The estimated trip generation of the proposed development is shown below in **Table 1**. The fitted curve equation for the peak hour of adjacent street traffic has been used in our calculation for the AM and PM peak hour. The previous traffic generation values have also been included in **Table 1** for comparative purposes.

Table 1 – Estimated Traffic Generation of Proposed Development

Land Use	Size	AM Peak Hour			PM Peak Hour		
		IN	OUT	TOTAL	IN	OUT	TOTAL
Previous Development Plan							
Senior Adult Housing - Attached ITE Land Use: 252	413 units	28	54	82	55	46	101
Revised Development Plan							
Senior Adult Housing - Attached ITE Land Use: 252	479 units	34	62	96	65	53	118
Net Increase Between Development Plans							
		+6	+8	+14	+10	+7	+17

As illustrated above, the revised development plan includes 66 more units than the previous development plan and will generate 14 AM and 17 PM peak hour trips.

4.0 TRAFFIC ASSIGNMENT

The traffic distribution pattern for the proposed development assumed to follow the distribution of the existing traffic volumes in the study area illustrated in **Figure 1** (obtained from the TIS excerpts provided in **Appendix**). Using the traffic distribution pattern noted above, the site traffic assignment was calculated for the AM and PM peak hour and has been illustrated in **Figure 2**.

Figure 1 – Proposed Development Traffic Distribution

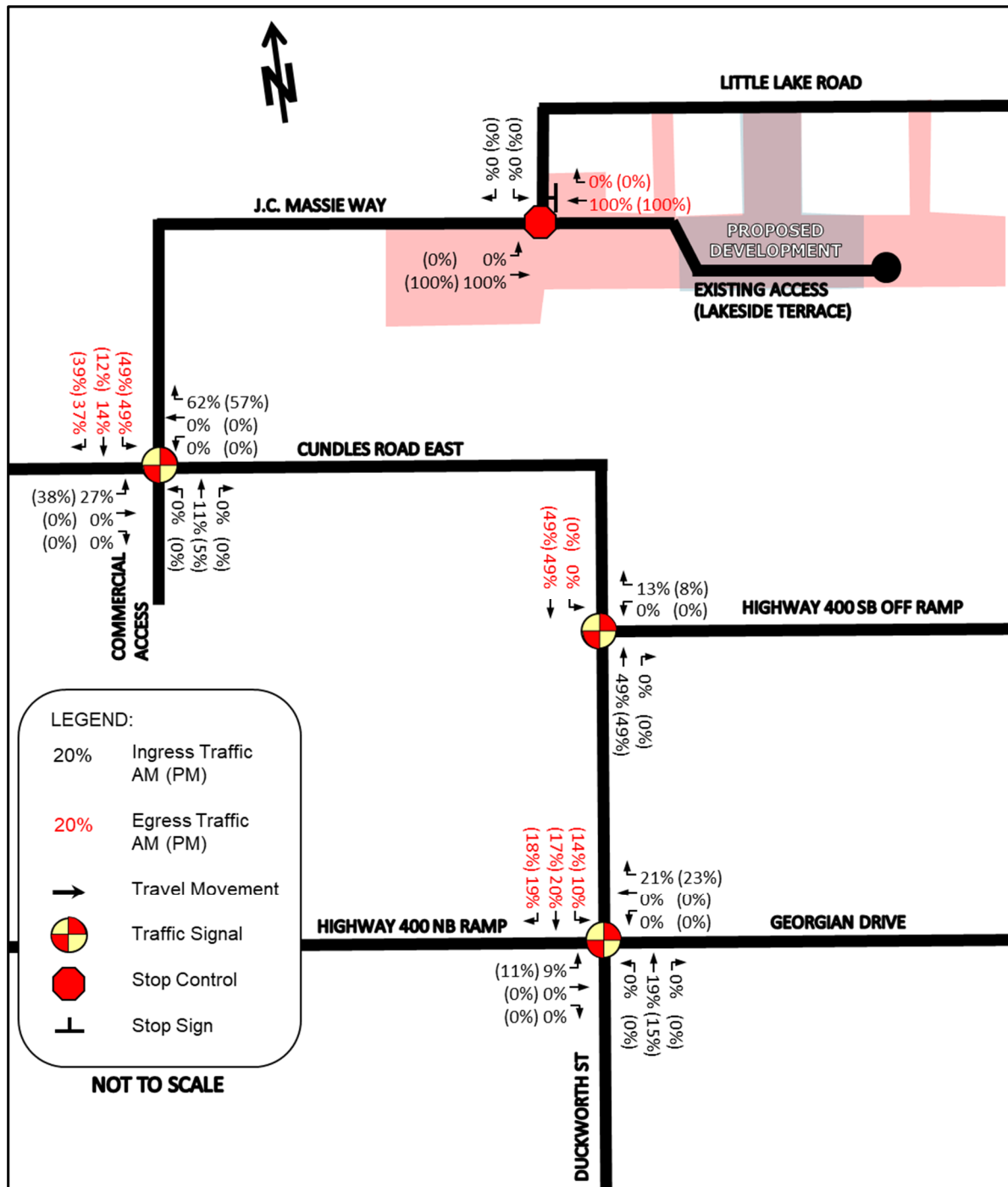
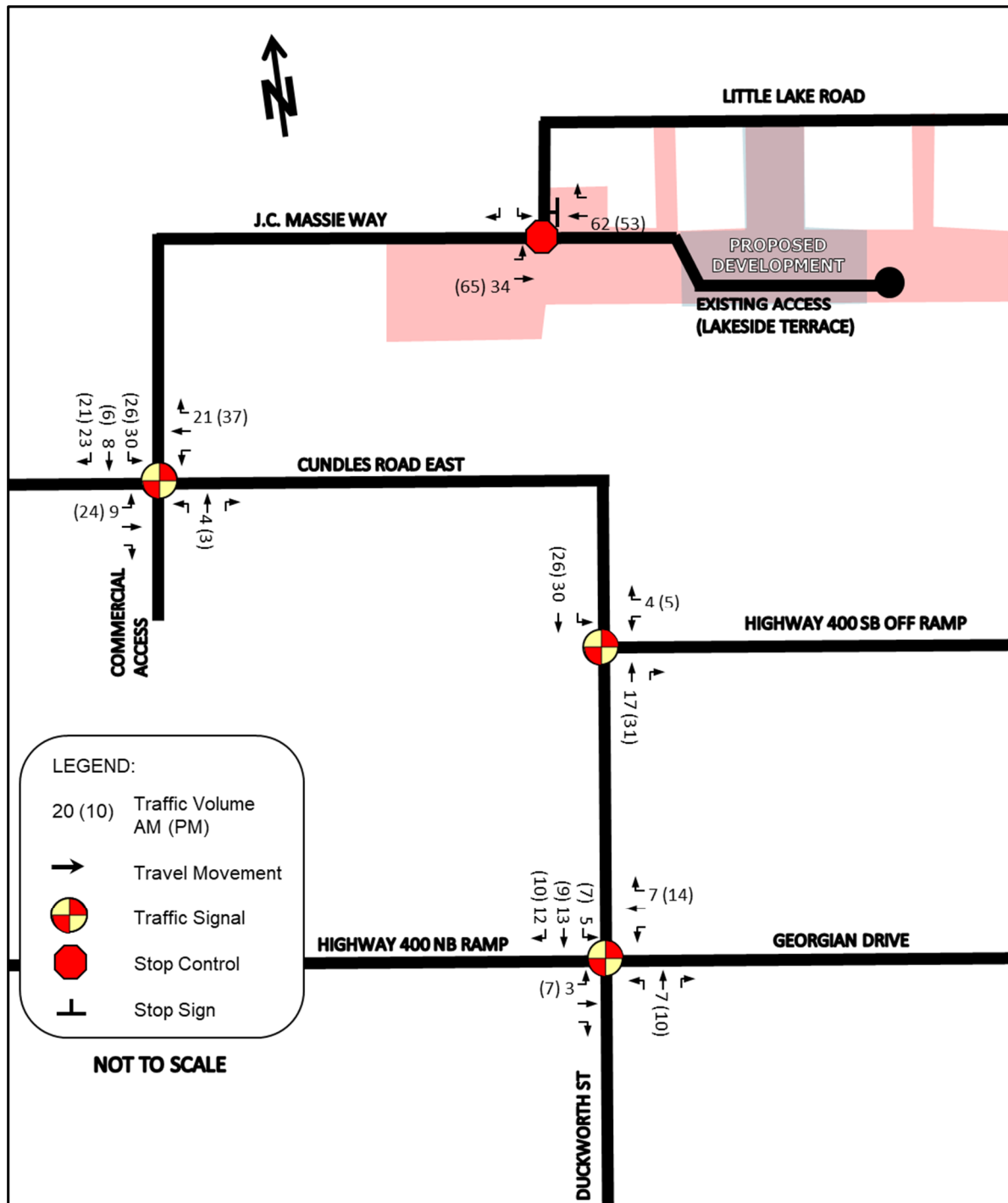


Figure 2 – Proposed Development Traffic Assignment



5.0 TOTAL HORIZON YEAR TRAFFIC VOLUMES WITH THE PROPOSED DEVELOPMENT

For the total (2026) horizon year traffic volume, the proposed development traffic was added to the background (2026) traffic volumes (obtained from the TIS and is illustrated in **Figure 3**). The resulting total (2026) horizon year total traffic volume for the AM and PM peak hours can be found in **Figure 4**.

Figure 3 – Background (2026) Traffic Volumes

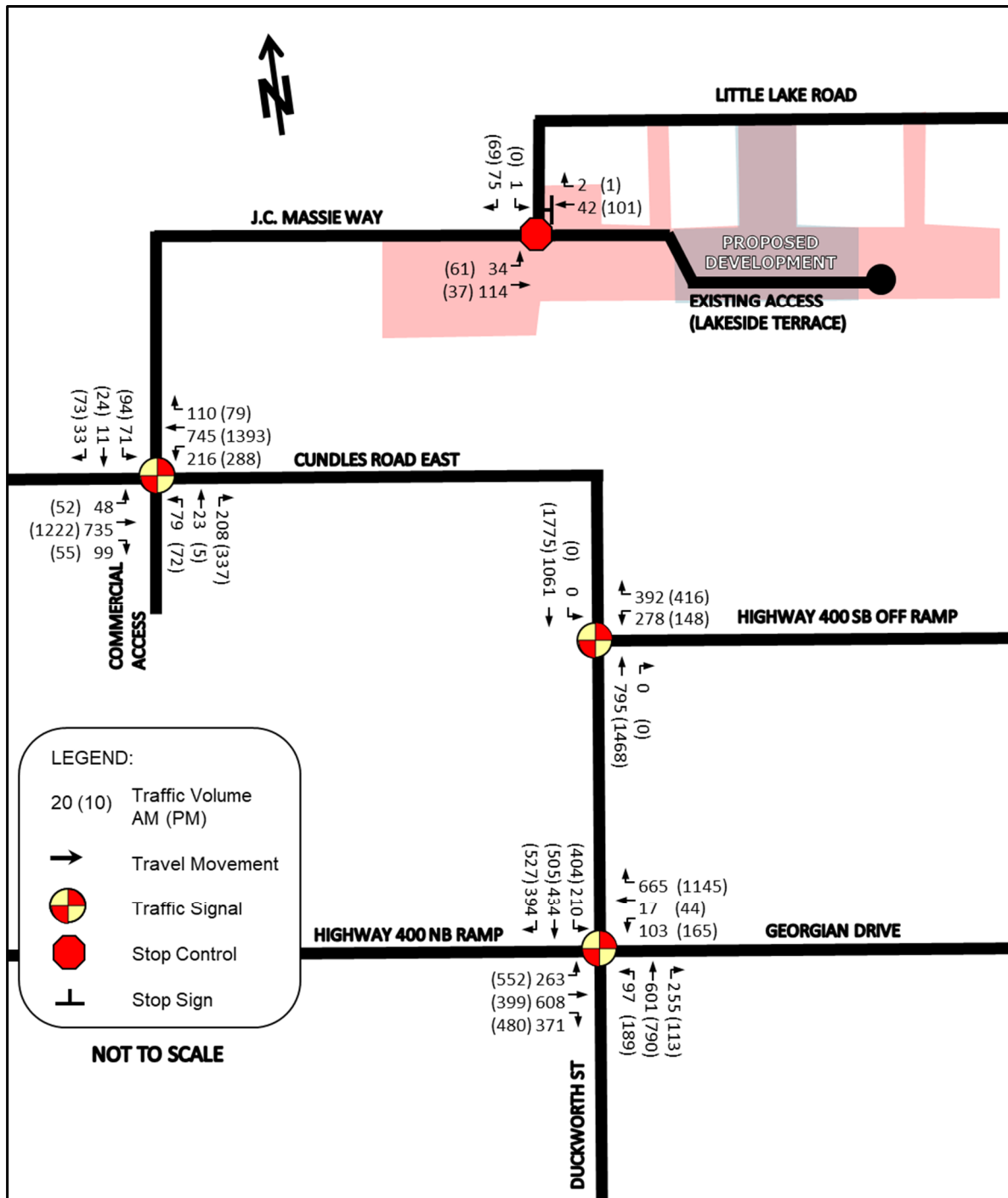
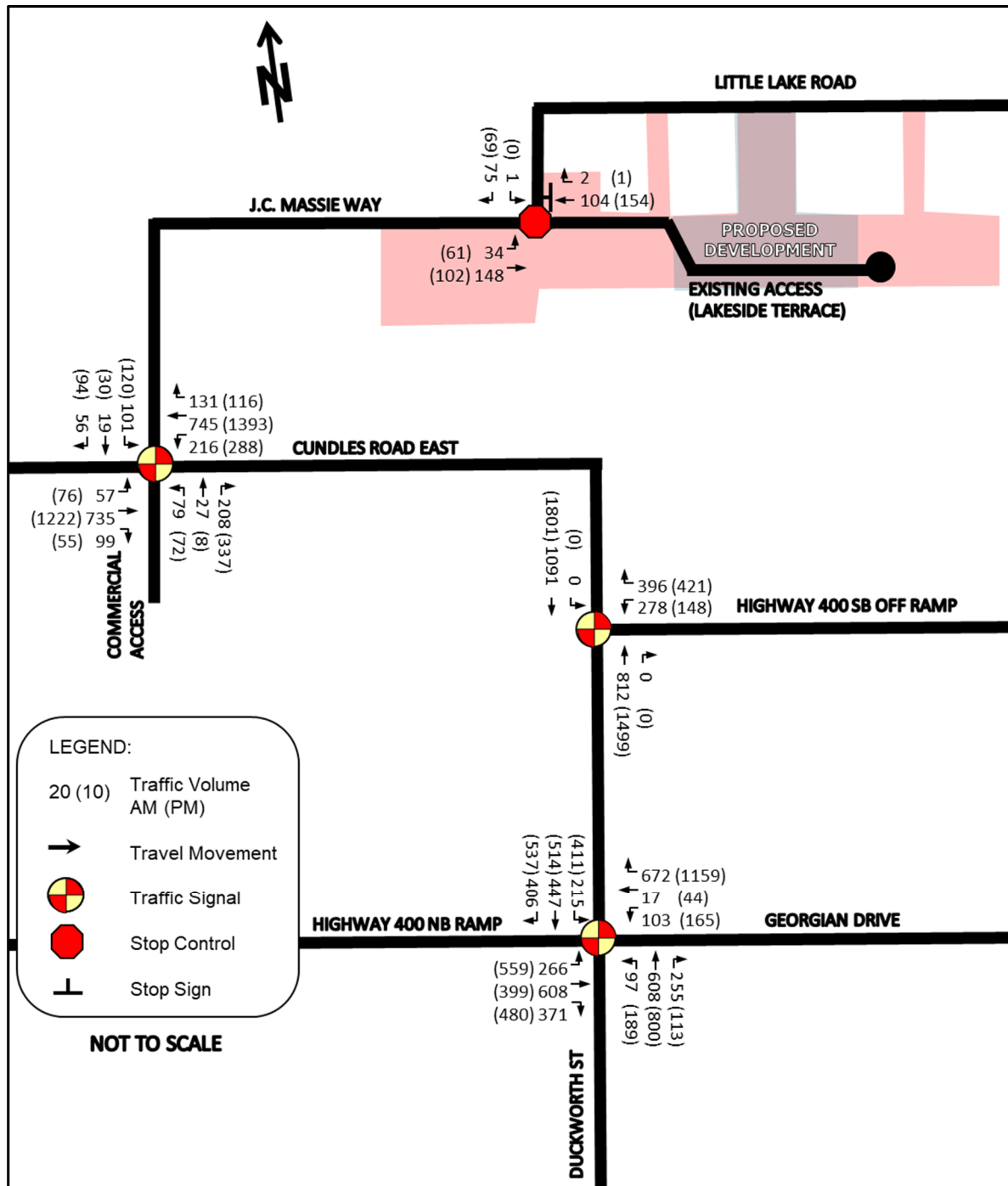


Figure 4 – Total (2026) Traffic Volumes



6.0 TOTAL TRAFFIC OPERATIONAL ANALYSIS

6.1 INTERSECTION CAPACITY ANALYSIS CRITERIA

The same analysis criteria illustrated in Section 3.1 of the TIS (excerpts provided in **Appendix**) were used to determine the intersection performance measured using the traffic analysis software. The TIS used Synchro 9 to assess the intersection performance in the study area. Synchro 10 was released after the completion of the TIS. For the purpose of this analysis, Synchro 10 has been used to assess the intersection performance in the study area.

6.2 TOTAL (2026) INTERSECTION OPERATION

The results of the LOS analysis under total (2026) traffic volumes during the AM and PM peak hours can be found below in **Table 6**. Existing intersection geometry and traffic control with signal timing improvements at all signalized intersections have been utilized for this scenario. Detailed output of the Synchro analysis can be found in the **Appendix**.

Table 2 – Total (2026) LOS

Location (N-S Street / E-W Street)	Weekday AM Peak Hour					Weekday PM Peak Hour				
	V/C	Delay (s)	LOS	95 th % Queue (m)		V/C	Delay (s)	LOS	95 th % Queue (m)	
				Model	Actual				Model	Actual
J.C. Massie Way / Cundles Road / Commercial Access (signalized)	0.54	21.8	C	-	-	0.84	32.9	C	-	-
EBL	0.17	14.9	B	11	50	0.43	21.9	C	13	50
EBT	0.50	22.6	C	-	-	0.83	36.1	D	-	-
EBR	0.07	17.8	B	12	50	0.04	21.0	C	8	50
WBL	0.57	14.7	B	34	160	0.83	52.2	D	85	160
WBT	0.44	18.1	B	-	-	0.76	24.2	C	-	-
WBR	0.09	14.6	B	-	-	0.10	14.1	B	-	-
NBL	0.22	32.3	C	-	-	0.21	35.7	D	-	-
NBT	0.20	31.7	C	-	-	0.24	35.9	D	-	-
SBL	0.45	39.4	D	40	35	0.80	75.4	E	69	35
SBT	0.08	29.9	C	-	-	0.13	34.1	C	-	-
Cundles Road / Highway 400 Southbound Off Ramp (signalized)	0.51	20.7	C	-	-	0.71	23.5	C	-	-
WBL	0.43	26.5	C	-	-	0.23	23.2	C	-	-
WBR	0.57	30.1	C	-	-	0.69	34.3	C	-	-
NBT	0.35	17.0	B	-	-	0.60	20.7	C	-	-
SBT	0.47	18.6	B	-	-	0.72	23.4	C	-	-
Highway 400 Northbound Ramp / Duckworth Street / Georgian Drive (signalized)	0.66	25.0	C	-	-	0.91	33.1	C	-	-
EBL	0.58	35.8	D	91	180	0.72	53.3	D	128	180
EBT	0.73	38.5	D	-	-	0.72	48.8	D	-	-
EBR	0.31	31.3	C	25	180	0.55	46.6	D	79	180
WBL	0.58	51.4	D	45	70	0.47	50.9	D	65	70
WBT	0.09	44.5	D	-	-	0.11	43.5	D	-	-
WBR	0.49	1.1	A	-	-	0.76	3.6	A	-	-
NBL	0.29	23.5	C	28	60	0.57	36.0	D	55	60
NBT	0.49	34.2	C	-	-	0.70	49.8	D	-	-
NBR	0.20	31.1	C	19	60	0.08	41.0	D	16	60
SBL	0.40	23.3	C	28	60	0.82	44.4	D	56	60
SBT	0.34	31.7	C	-	-	0.44	44.2	D	-	-
SBR	0.30	0.5	A	0	60	0.35	0.6	A	0	60
J.C. Massie Way / Little Lake Drive / Existing Site Access (unsignalized)	-	3.1	A	-	-	-	5.0	A	-	-
WB	0.16	10.5	B	-	-	0.33	12.5	B	-	-

The results of the LOS analysis indicate that the Highway 400 Northbound Ramp / Duckworth Street / Georgian Drive intersection is operating outside the typical design limits noted in Section 6.1 during the PM peak hour; however, no infrastructure improvements are recommended as all individual turning movements of the intersection are within the typical design limits noted in Section 6.1. Furthermore, it is noted that the intersection V/C ratio is only marginally outside the design limits and a conservative background growth rate was applied in our analysis. It is recommended that the intersection operation is monitored in the years approaching 2026 to assess if additional improvements are warranted.

The results of the LOS analysis indicate that all other intersections are operating within the typical design limits noted in Section 6.1.

For the J.C. Massie Way / Cundles Road / Commercial Access intersection, a 70-meter storage length is required for the auxiliary southbound left turn lane on J.C. Massie Way in order to accommodate the anticipated 95th percentile queue length. The existing road width can support an extended southbound left turn lane. It is recommended that the City monitor the queuing at this intersection and extend the left turn storage lane pavement marking to provide a 70 metre storage length. This can be arranged to be completed under future road repainting contracts, if required.

The existing storage length for all other auxiliary turn lanes can accommodate the anticipated 95th percentile queue length for the associated turning movement.

Based on the Ontario Traffic Manual Book 12 Signal Justification, traffic signals are not warranted at the J.C. Massie Way / Little Lake Drive / Existing Site Access intersection (results are provided in **Appendix**).

Consequently, no change to the recommendations and conclusions presented in the TIS are required as a result of the revised development plan.

7.0 PEDESTRIAN ACCESS

The recommendation in the TIS (repeated below for reference) related to pedestrian infrastructure at the intersection of Cundles Road / Highway 400 Southbound Off-Ramp intersection is still applicable.

"It is recommended that a pedestrian crossing head is provided on the pole at the southwest corner of the intersection to accommodate pedestrian trips travelling east to west across the south leg of this intersection. It is also recommended that the standard cross-walk pavement markings are installed across the south leg of this intersection along with curb depressions and sidewalk ramps to accommodate this pedestrian crossing.

It is noted that this signalized crosswalk will not only service the subject site, but also the adjacent Marina Bay development, existing development along Little Lake Drive and pedestrians traffic to and from the south travelling on the east side of Duckworth Street. Consequently, it is our

our expectation that the City would coordinate and install the above-noted improvements as part of their capital works budget.”

The signal timing for this intersection was reviewed and a pedestrian phase can be accommodated with minor adjustment to the signal timing phases. Based on the anticipated low volume of pedestrian movements at this crossing, the change to the signal timing would not impact the overall operation of this intersection. Detailed output of the Synchro analysis for the Total (2026) horizon year scenario with the above noted improvement can be found in the **Appendix**.

8.0 CONCLUSION

This chapter summarizes the conclusions and recommendations from the study.

- 1) The revised development plan includes 66 additional units and an additional 14 AM and 17 PM peak hour trips in the study area, compared to the previous development plan.
- 2) An intersection operational analysis was completed at the study area intersections, using the total (2026) traffic volumes, without the proposed development traffic. This enabled a review of existing and future traffic deficiencies that would be present without the influence of the proposed operations. No changes to the recommendations and conclusions presented in the TIS are required as a result of the revised development plan.
- 3) It is recommended that the City include the construction of the pedestrian crosswalk infrastructure on the south side of the intersection of Cundles Road / Highway 400 Southbound Off Ramp as a capital works project.
- 4) There is no change to the recommendations and conclusions presented in the TIS, as a result of the revised development plan.

We trust you will find this submission acceptable. Should you have any questions or concerns or require any additional information in this regard, please contact our office.

Yours truly,
JD Northcote Engineering Inc.

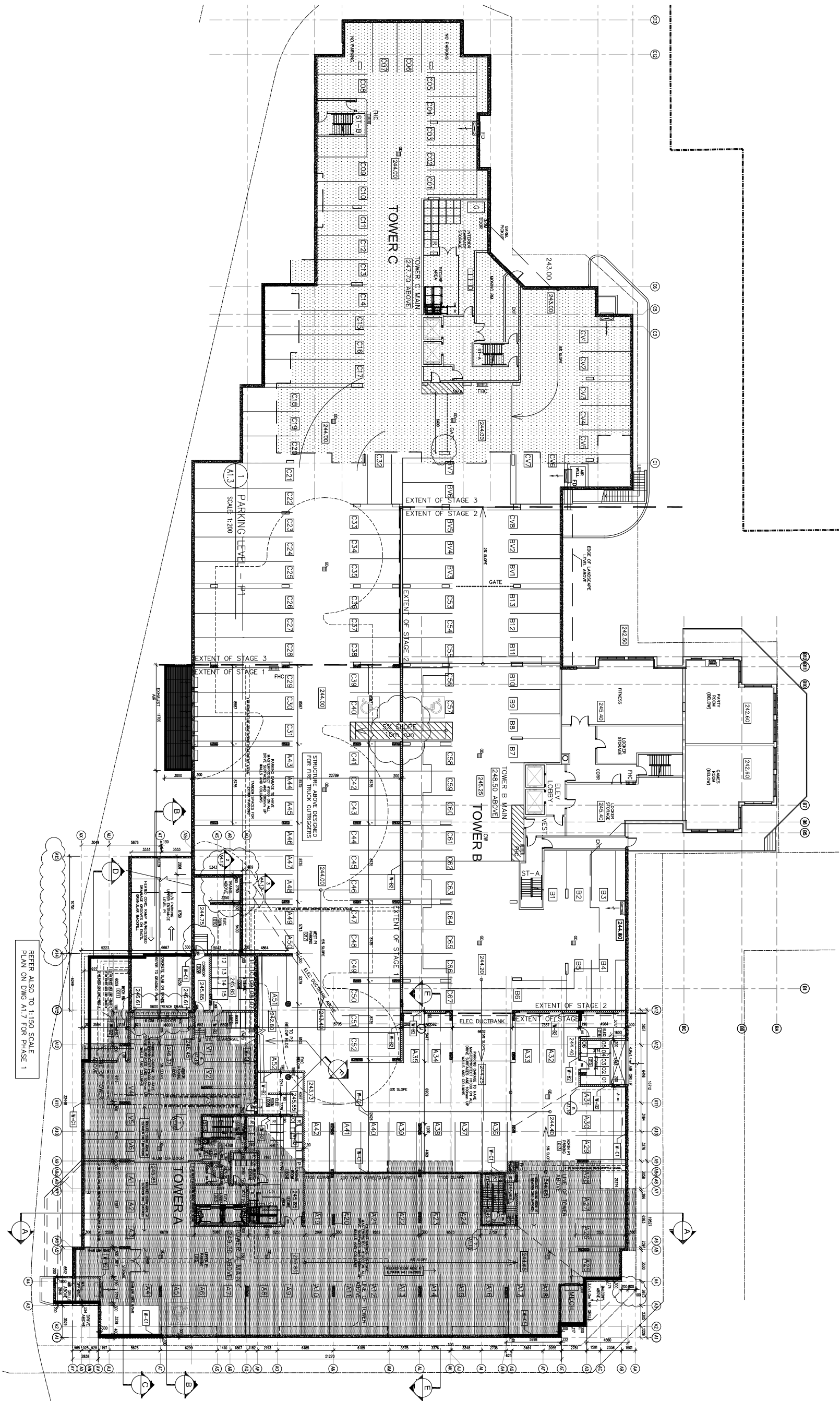


John Northcote, P.Eng.
President

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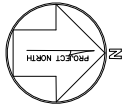
Appendix

Site Plan



REFER ALSO TO 1:150 SCALE
PLAN ON DWG A1.7 FOR PHASE 1

No.	REVISION	DATE
1.	ISSUED FOR PARKING REVIEW	FEB 4, 2020
REVISIONS		
ALL DIMENSIONS TO BE CHECKED & VERIFIED ON SITE. DISCREPANCIES TO BE REPORTED TO THE ARCHITECT. DIMENSIONS ONLY TO BE USED FOR CONSTRUCTION.		



MCLARCHITECTS
MCKNIGHT CHARLTON LIMITED

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1 705 722 6729
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DRAWING NAME:
PARKING LEVEL P1
LARGE SCALE PLAN

PROJECT NAME:
LITTLE LAKE CONDOMINIUMS
50 LAKESIDE TERRACE
BARRIE, ON

OWNER:
LAKESIDE TERRACE LTD.
7100 WOODBINE AVE. SUITE 301, MARKHAM, ON L3R 5Z2

DATE: JULY, 2017
JOB NO. SHEET NO.
DRAWN BY: KC/SC 17-000
SCALE: AS NOTED A1.3

TIS Excerpts

Little Lake Senior Condominium

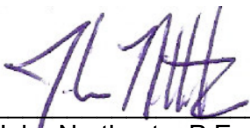
City of Barrie, County of Simcoe

Traffic Impact Study for: Lakeside Terrace Limited

Type of Document:
Final Report

Project Number:
JDE – 1672

Date Submitted:
December 30th, 2016



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1 Introduction

1.1 Background

Lakeside Terrace Ltd. [The Developer] is proposing to develop a senior's community east of J.C. Massie Way and south of Little Lake Drive, in the City of Barrie [City]. The proposed development includes the construction of three senior condominium buildings with a total of 413 residential units.

The proposed development is located within Condominium Block 'B', of a larger multi-phase development. The larger development currently includes a medical office building (Condominium Block 'A') and a retirement home (Condominium Block 'C'). The proposed development will be the final phase of this multi-phase development, which includes:

- **Phase 1** – Construction of a medical office building (Condominium Block 'A') and temporary parking lot (Condominium Block 'B');
- **Phase 2** – Construction of a 140 unit retirement home (Condominium Block 'C');
- **Phase 3** – Construction of permanent parking lot within surplus lands located west of Condominium Block 'A', which became available as a result of the reconstruction of the Duckworth Street interchange with Highway 400; and
- **Phase 4 – Proposed development** – construction of a 413 unit senior condominium development (Condominium Block 'B').

Phases 1 and 2 are complete. Phase 3 has been approved; however, construction will not be complete until fall of 2017. It is anticipated that the proposed development (Phase 4) will be completed in 2018.

The Developer has retained **JD Northcote Engineering Inc.** [JD Engineering] to prepare this traffic impact study in support of the proposed senior's condominium development.

1.2 Study Area

The purpose of this study is to identify the potential impacts to traffic flow at the site access and on the surrounding roadway network. The study analysis includes the following tasks:

- Consult with the City and MTO to address any traffic-related issues or concerns they have with the proposed development;
- Determine existing traffic volumes and circulation patterns;
- Estimate future traffic volumes if the proposed development was not constructed, including the impact of additional proposed developments in the area;
- Complete level-of-service [LOS] analysis of horizon year (without the proposed development) traffic conditions and identify operational deficiencies;
- Estimate the amount of traffic that would be generated by the proposed development and assign to the roadway network;
- Complete LOS analysis of horizon year (with the proposed development) traffic conditions and identify additional operational deficiencies;
- Identify improvement options to address operational deficiencies;
- Review the sight distance available at the site access driveways on Lakeside Terrace;
- Review pedestrian infrastructure within the study area; and
- Document findings and recommendations in a final report.

3 Background Traffic Operational Analysis

3.1 Intersection Capacity Analysis Criteria

Intersection performance was measured using the traffic analysis software, Synchro 9, a deterministic model that employs Highway Capacity Manual and Intersection Capacity Utilization methodologies for analyzing intersection operations. These procedures are accepted by provincial and municipal agencies throughout North America.

Synchro 9 enables the study area to be graphically defined in terms of streets and intersections, along with their geometric and traffic control characteristics. The user is able to evaluate both signalized and unsignalized intersections in relation to each other, thus not only providing level of service for the individual intersections, but also enabling an assessment of the impact the various intersections in a network have on each other in terms of spacing, traffic congestion, delay, and queuing.

For the purpose of our analysis, turning movements with a volume-to-capacity [V/C] ratio of 0.85 or greater are considered to be critical movements. For Highway 400-series, ramp approaches with a value greater than 0.75 are considered to be critical movements. Values approaching this threshold have been highlighted in the LOS tables.

The intersection operations were also evaluated in terms of the LOS. LOS is a common measure of the quality of performance at an intersection and is defined in terms of vehicular delay. This delay includes deceleration delay, queue move-up time, stopped delay, and acceleration delay. LOS is expressed on a scale of A through F, where LOS A represents very little delay (i.e. less than 10 seconds per vehicle) and LOS F represents very high delay (i.e. greater than 50 seconds per vehicle for a stop sign controlled intersection and greater than 80 seconds per vehicle for a signalized intersection).

The LOS criteria for signalized and stop sign controlled intersections are shown in **Table 2**. A description of traffic performance characteristics is included for each LOS.

Table 2 – Level of Service Criteria for Intersections

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

background growth rate was applied in our analysis. It is recommended that the intersection operation is monitored in the years approaching 2026 to assess if additional improvements are warranted.

All other intersections are operating within the typical design limits noted in Section 3.1.

For the J.C. Massie Way / Cundles Road / Commercial Access intersection, a 55-meter storage length is required for the auxiliary southbound left turn lane on J.C. Massie Way in order to accommodate the anticipated 95th percentile queue length. The existing road width can support an extended southbound left turn lane. It is recommended that the City monitor the queuing at this intersection and extend the left turn storage lane pavement marking to provide a 55 metre storage length. This can be arranged to be completed under future road repainting contracts, if required.

The existing storage length for all other auxiliary turn lanes can accommodate the anticipated 95th percentile queue length for the associated turning movement.

Based on the Ontario Traffic Manual Book 12 *Signal Justification*, traffic signals are not warranted at the J.C. Massie Way / Little Lake Drive / Existing Site Access intersection (results are provided in **Appendix F**).

No additional improvements are recommended within the study area.

4 Proposed Development Traffic Generation and Assignment

4.1 Traffic Generation

The traffic generation for the subject site has been based on the ITE *Trip Generation* data. The following ITE land uses have been applied to estimate the traffic from the proposed development:

- ITE land use 252 (Senior Adult Housing - Attached)

The estimated trip generation of the proposed development is illustrated below in **Table 5**. The AM and PM peak traffic generation for the subject site generally align with the AM and PM peak hour in the traffic counts.

Table 5 – Estimated Traffic Generation of Proposed Development

Land Use	Size	AM Peak Hour			PM Peak Hour		
		IN	OUT	TOTAL	IN	OUT	TOTAL
Senior Adult Housing – Attached ITE Land Use: 252	413 units	28	54	82	55	46	101

In order to be conservative, no transportation modal split has been applied to the above-noted traffic generation calculation.

4.2 Traffic Assignment

The distribution of traffic for the Senior Adult Housing is assumed to follow the distribution of the existing traffic volumes within the study area. The traffic distribution pattern for the Senior Adult Housing for the AM and PM peak hours is illustrated in **Figure 7**.

Using the traffic distribution patterns noted above, the site traffic assignment was calculated for the AM and PM peak hours and has been illustrated in **Figure 8**.

4.3 Total Horizon Year Traffic Volumes with the Proposed Development

For the total (2026) horizon year traffic volumes, the proposed development traffic was added to the background (2026) traffic volumes. The resulting total (2026) horizon year total traffic volume for the AM and PM peak hours can be found in **Figure 9**.

Figure 7 – Site Traffic Distribution

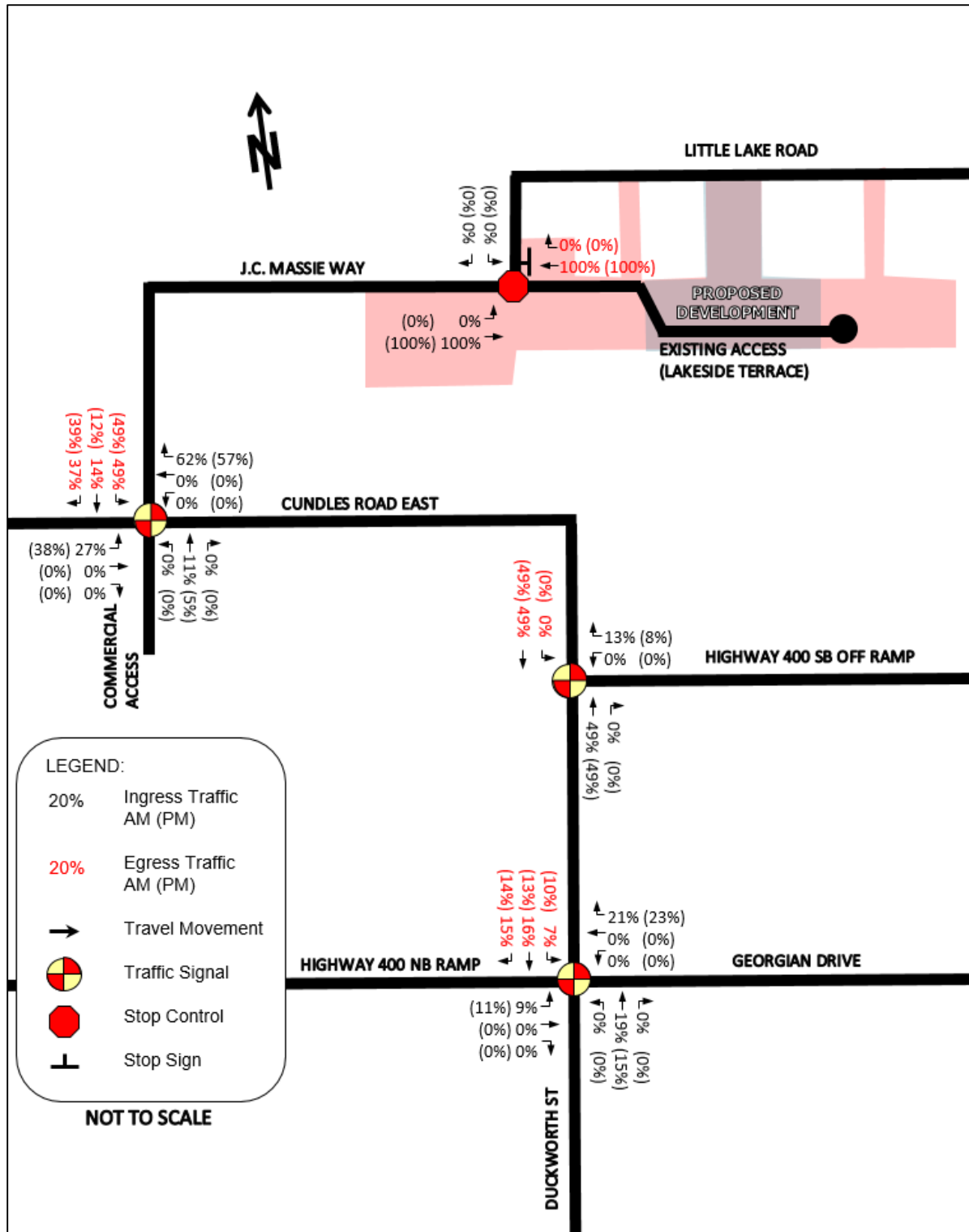


Figure 8 – Site Traffic Assignment

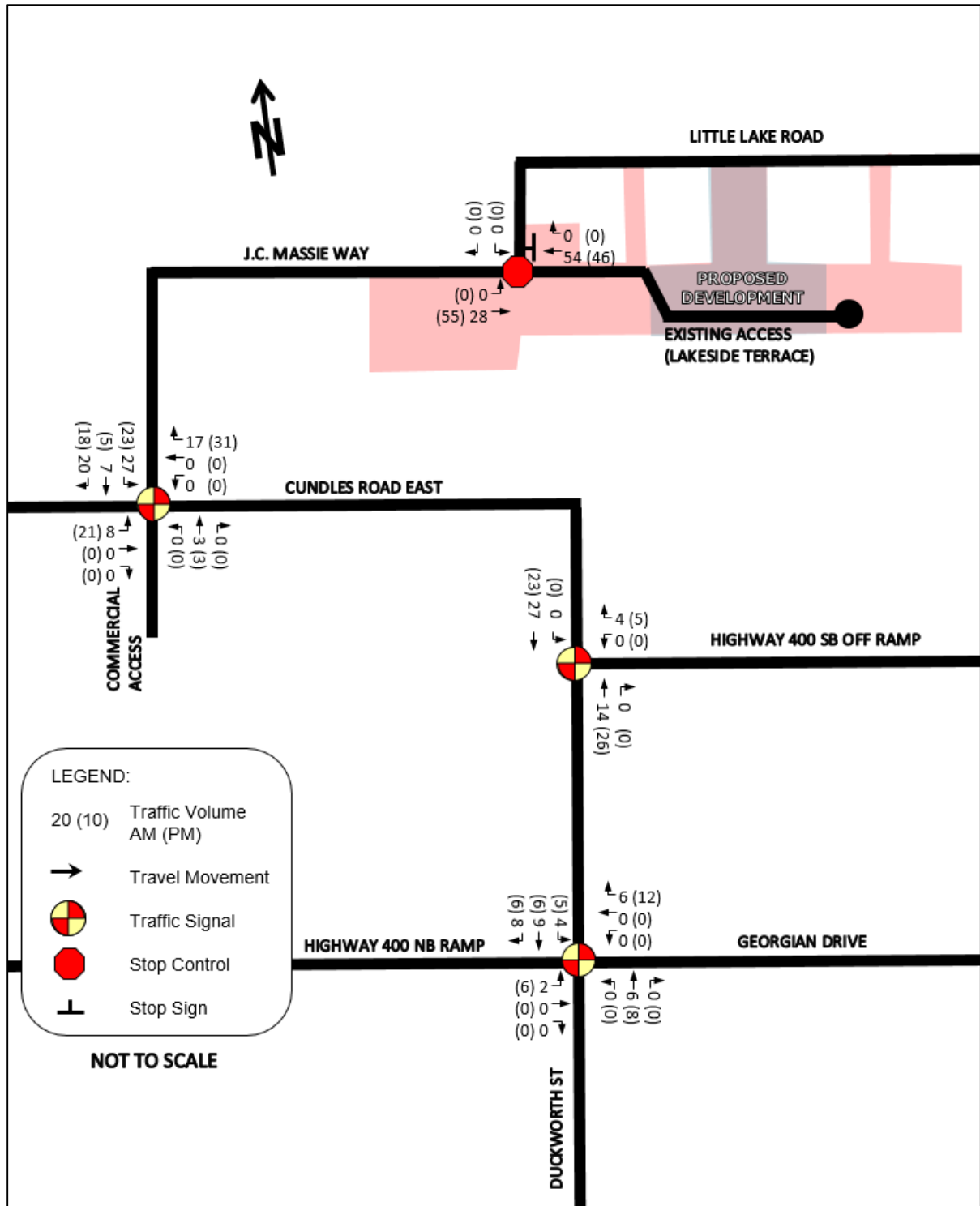
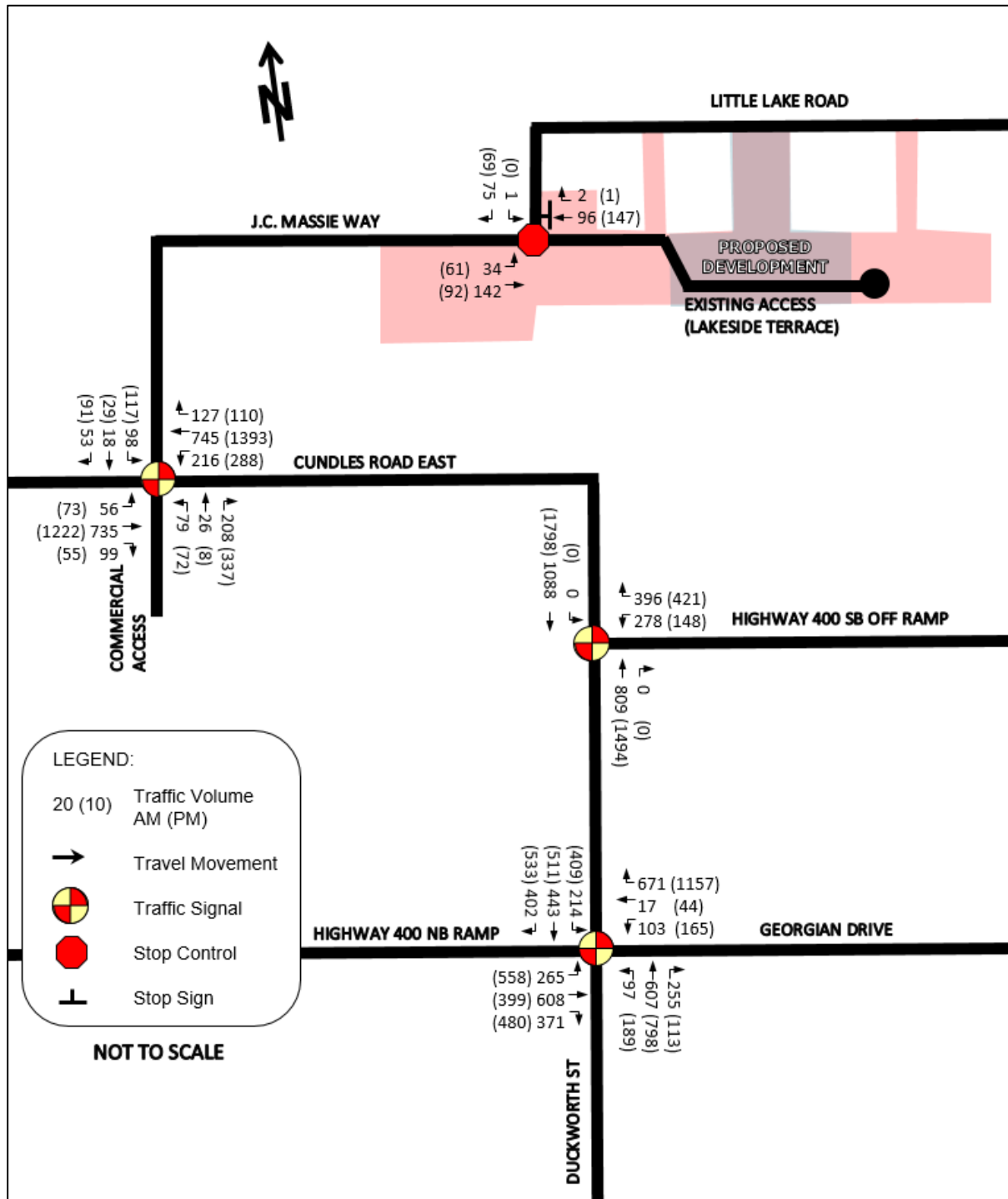


Figure 9 – Total (2026) Traffic Volumes



5 Total Traffic Operational Analysis

5.1 Total (2026) Intersection Operation

The results of the LOS analysis under total (2026) traffic volumes during the AM and PM peak hours can be found below in **Table 6**. Existing intersection geometry and traffic control with signal timing improvements at all signalized intersections have been utilized for this scenario. Detailed output of the Synchro analysis can be found in **Appendix E**.

Table 6 – Total (2026) LOS

Location (N-S Street / E-W Street)	Weekday AM Peak Hour					Weekday PM Peak Hour				
	V/C	Delay (s)	LOS	95 th % Queue (m)		V/C	Delay (s)	LOS	95 th % Queue (m)	
				Model	Actual				Model	Actual
J.C. Massie Way / Cundles Road / Commercial Access (signalized)	0.54	21.8	C	-	-	0.84	32.8	C	-	-
EBL	0.17	14.9	B	10.3	50.0	0.41	21.6	C	11.9	50.0
EBT	0.50	22.6	C	-	-	0.82	35.6	D	-	-
EBR	0.07	17.8	B	11.2	50.0	0.04	20.9	C	8.0	50.0
WBL	0.57	14.7	B	33.8	160.0	0.83	52.9	D	85.5	160.0
WBT	0.44	18.1	B	-	-	0.75	23.8	C	-	-
WBR	0.09	14.6	B	-	-	0.09	13.9	B	-	-
NBL	0.22	32.2	C	-	-	0.21	36.2	D	-	-
NBT	0.20	31.6	C	-	-	0.24	36.3	D	-	-
SBL	0.43	38.7	D	37.9	35.0	0.80	75.9	E	67.6	35.0
SBT	0.08	29.9	C	-	-	0.12	34.5	C	-	-
Cundles Road / Highway 400 Southbound Off Ramp (signalized)	0.51	20.7	C	-	-	0.71	23.5	C	-	-
WBL	0.43	26.5	C	-	-	0.23	23.2	C	-	-
WBR	0.57	30.1	C	-	-	0.69	34.3	C	-	-
NBT	0.35	17.0	B	-	-	0.60	20.7	C	-	-
SBT	0.46	18.5	B	-	-	0.72	23.3	C	-	-
Highway 400 Northbound Ramp / Duckworth Street / Georgian Drive (signalized)	0.66	25.0	C	-	-	0.91	33.0	C	-	-
EBL	0.58	35.7	D	90.1	180.0	0.71	53.1	D	126.7	180.0
EBT	0.73	38.5	D	-	-	0.72	48.8	D	-	-
EBR	0.31	31.2	C	24.8	180.0	0.55	46.6	D	78.5	180.0
WBL	0.58	51.4	D	44.7	70.0	0.47	50.9	D	64.9	70.0
WBT	0.09	44.4	D	-	-	0.11	43.5	D	-	-
WBR	0.49	1.1	A	-	-	0.76	3.5	A	-	-
NBL	0.29	23.5	C	27.8	60.0	0.57	35.9	D	55.0	60.0
NBT	0.49	34.2	C	-	-	0.70	49.8	D	-	-
NBR	0.20	31.1	C	18.2	60.0	0.08	41.0	D	15.4	60.0
SBL	0.40	23.3	C	27.0	60.0	0.82	43.8	D	54.5	60.0
SBT	0.34	31.7	C	-	-	0.44	44.2	D	-	-
SBR	0.30	0.5	A	0.0	60.0	0.35	0.6	A	0.0	60.0
J.C. Massie Way / Little Lake Drive / Existing Site Access (unsignalized)	-	2.9	A	-	-	-	4.9	A	-	-
WB	0.15	10.4	B	-	-	0.31	12.2	B	-	-

The results of the LOS analysis indicate that the Highway 400 Northbound Ramp / Duckworth Street / Georgian Drive intersection is operating outside the typical design limits noted in Section 3.1 during the PM peak hour; however, no infrastructure improvements are recommended as all individual turning movements of the intersection are within the typical design limits noted in Section 3.1. Furthermore, it is noted that the intersection V/C ratio is only marginally outside the design limits and a conservative

background growth rate was applied in our analysis. It is recommended that the intersection operation is monitored in the years approaching 2026 to assess if additional improvements are warranted.

All other intersections are operating within the typical design limits noted in Section 3.1.

For the J.C. Massie Way / Cundles Road / Commercial Access intersection, a 70-meter storage length is required for the auxiliary southbound left turn lane on J.C. Massie Way in order to accommodate the anticipated 95th percentile queue length. The existing road width can support an extended southbound left turn lane. It is recommended that the City monitor the queuing at this intersection and extend the left turn storage lane pavement marking to provide a 70 metre storage length. This can be arranged to be completed under future road repainting contracts, if required.

The existing storage length for all other auxiliary turn lanes can accommodate the anticipated 95th percentile queue length for the associated turning movement.

Based on the Ontario Traffic Manual Book 12 *Signal Justification*, traffic signals are not warranted at the J.C. Massie Way / Little Lake Drive / Existing Site Access intersection (results are provided in **Appendix F**).

No additional improvements are recommended within the study area.

5.2 Site Access Driveways

Based on our review of the volume of traffic on Lakeside Terrace at the two site access driveways, it is recommended that each site access driveway provide a single lane for ingress and a single lane for egress traffic movements. It is recommended that southbound one-way stop control is provided at both site access driveways. No additional lane improvements are required on Lakeside Terrace at the site access driveways.

6 Sight Distance Review

There is currently no posted speed limit on Lakeside Terrace. However, based on our observation of the existing travel speeds, our driver assessment of the design speed (performed during a site inspection) and our desktop review of the vertical and horizontal profile of the road, it is our opinion that a reasonable design speed on Lakeside Terrace would be 30 km/h past the western site access driveway, as a result of the existing back-to-back corners on Lakeside Terrace on either side of the western site access driveway and 50 km/h past the eastern site access driveway.

The available sight distance for approaching and departing vehicles at the site access driveways on Lakeside Terrace is based on our review of the vertical and horizontal sight line constraints through site measurements and our review of the proposed retaining walls, signage, building location and boulevard grading proposed in the Site Plan for the subject site.

The sight distance east and west from the eastern driveway on Lakeside Terrace is in excess of 70 metres in both directions, which is in excess of the minimum stopping sight distance requirements as identified in the TAC Guidelines for a design speed of 50km/h (65 metres).

The sight distance southeast from the western site access driveway on Lakeside Terrace is limited by the proposed retaining / signage wall. The available sight distance in this direction is 33 metres, which is in excess of the minimum stopping sight distance requirements as identified in the TAC Guidelines for a design speed of 30km/h (30 metres). The sight distance west from the western driveway on Lakeside Terrace is technically limited by the existing parking stall on the south side of Lakeside Terrace within Condominium Block 'A'. Assuming a high cube van is parked at the limits of this parking

stall, the available sight distance in this direction is 38 metres, which is in excess of the minimum stopping sight distance requirements as identified in the TAC Guidelines for a design speed of 30km/h (30 metres). It is noted that the sight distance in this direction is typically greater than 42 metres when a smaller vehicle is parked in this stall or when taking into consideration the sight lines between the parked cars in this area.

In order to increase safety, it is recommended that a hidden driveway sign is installed on Lakeside Terrace, 85 metres east of the western site access driveway.

7 Pedestrian Access

Based on our review of the study area, it is anticipated that there will be pedestrian traffic between the subject site and the Mady retail development on the south side of Cundles Road. The majority of the pedestrian traffic is anticipated to travel via the J.C. Massie Way / Cundles Road / Commercial Access intersection; however, the length of travel for pedestrian trips from the subject site to the east side of the commercial development would be shortened with the installation of a pedestrian crossing on the south side of the Cundles Road / Highway 400 Southbound Off Ramp intersection. During our site visit, we observed a pedestrian crossing head on the pole at the southeast corner of this intersection; however, no other pedestrian crossing infrastructure is provided for the south leg of this intersection.

It is recommended that a pedestrian crossing head is provided on the pole at the southwest corner of the intersection to accommodate pedestrian trips travelling east to west across the south leg of this intersection. It is also recommended that the standard cross-walk pavement markings are installed across the south leg of this intersection along with curb depressions and sidewalk ramps to accommodate this pedestrian crossing.

It is noted that this signalized crosswalk will not only service the subject site, but also the adjacent Marina Bay development, existing development along Little Lake Drive and pedestrians traffic to and from the south travelling on the east side of Duckworth Street. Consequently, it is our expectation that the City would coordinate and install the above-noted improvements as part of their capital works budget.

The signal timing for this intersection was reviewed and a pedestrian phase can be accommodated with a minor adjustment to the signal timing phases. Based on the anticipated low volume of pedestrian movements at this crossing, the change to the signal timing would not impact the overall operation of this intersection. Detailed output of the Synchro analysis for the Total (2026) horizon year scenario with the above noted improvement can be found in **Appendix E**.

8 Summary

Lakeside Terrace Ltd. retained **JD Engineering** to prepare this traffic impact study in support of the proposed senior's community development in the City of Barrie. The site plan is shown in **Appendix A**. This chapter summarizes the conclusions and recommendations from the study.

1. Lakeside Terrace Ltd. is proposing to construct a 413 unit senior's residential condominium.
2. The proposed development is anticipated to generate a total of 82 AM and 101 PM peak hour external trips when built-out and fully occupied.
3. Background traffic and pedestrian counts were obtained from a previous JD Engineering report for the existing J.C. Massie Way / Little Lake Drive / Existing Access intersection. Additional background traffic and pedestrian counts were completed for the existing intersections in the study area on Tuesday, December 20th, 2016.

4. An intersection operation analysis was completed at the study area intersections, using the existing (2016), and background (2026) traffic volumes, without the proposed development traffic. This enabled a review of existing and future traffic deficiencies that would be present without the influence of the proposed development. The following improvements are recommended:

Background (2026) Traffic Volume

J.C. Massie Way / Cundles Road / Commercial Access intersection

- It is recommended that the City monitor the queuing at this intersection and extend the southbound left turn storage lane pavement marking to provide a 55-metre storage length, as part of future road repainting contracts, if required.

Highway 400 Northbound Ramp / Duckworth Street / Georgian Drive intersection

- It is our expectation that this intersection will operate in a safe and efficient manner in 2026; however, it is recommended that the City monitor operations at this intersection in the years approaching 2026, to confirm the traffic volume assumptions used in this report and ensure that the intersection is operating as anticipated.

5. An estimate of the amount of traffic that would be generated by the Subject Site was prepared and assigned to the study area streets and intersections.
6. An intersection operation analysis was completed under total (2026) traffic volumes with the proposed development operational at the study area intersections. The following summarizes the results and recommendations from this analysis:

Total (2026) Traffic Volume

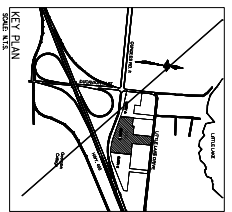
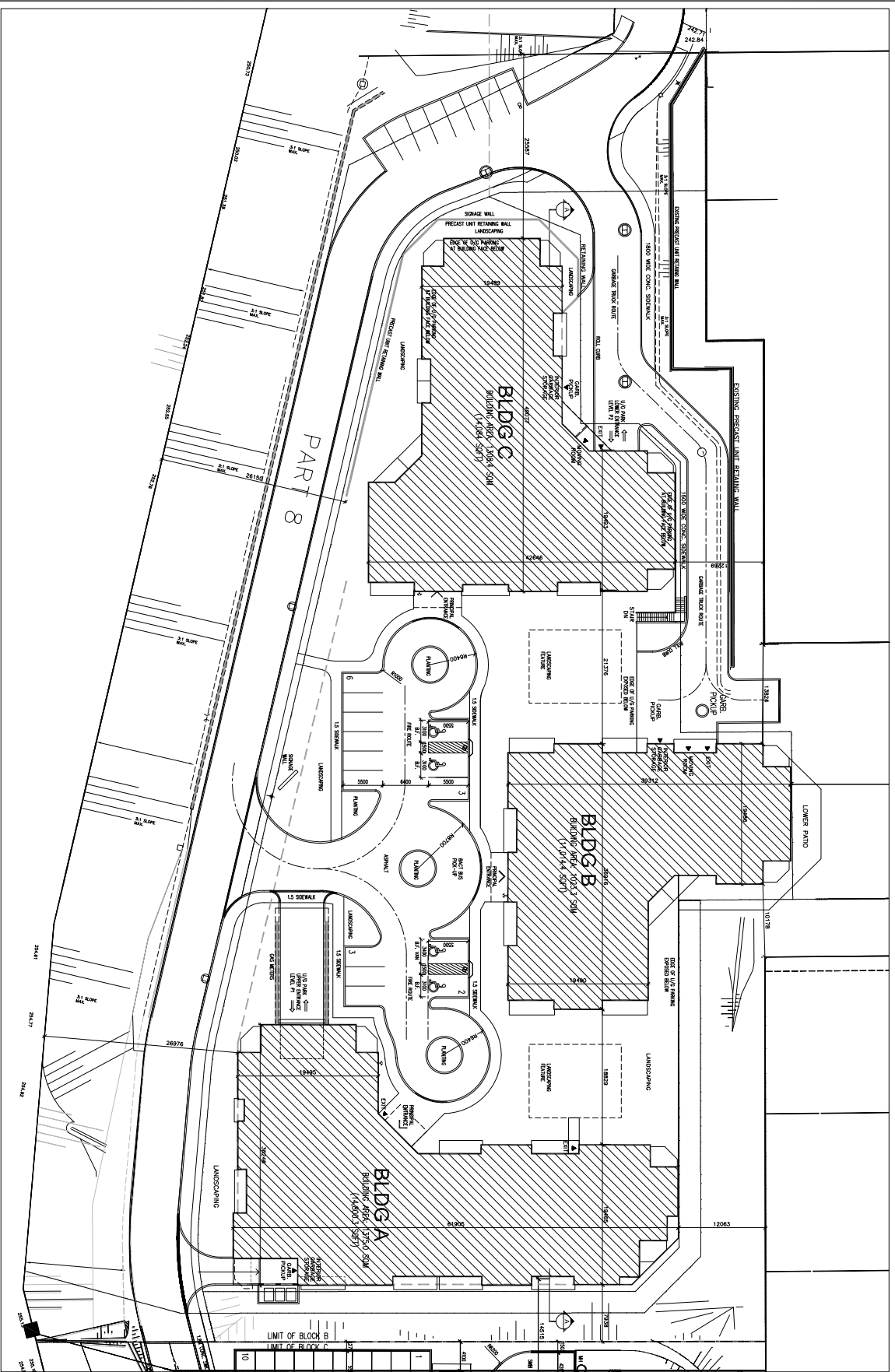
J.C. Massie Way / Cundles Road / Commercial Access intersection

- It is recommended that the City monitor the queuing at this intersection and extend the southbound left turn storage lane pavement marking to provide a 70-metre storage length, as part of future road repainting contracts, if required.

Highway 400 Northbound Ramp / Duckworth Street / Georgian Drive intersection

- It is our expectation that this intersection will operate in a safe and efficient manner in 2026; however, it is recommended that the City monitor operations at this intersection in the years approaching 2026, to confirm the traffic volume assumptions used in this report and ensure that the intersection is operating as anticipated.
7. The site access driveways onto Lakeside Terrace with operate efficiently with a single ingress and single egress lane. Southbound one-way stop control is recommended for both site access driveways onto Lakeside Terrace.
 8. Hidden driveway signage is recommended on Lakeside Terrace, 85 metres east of the western site access driveway.
 9. The existing site access onto J.C. Massie Way / Little Lake Drive will operate efficiently in the existing configuration.
 10. It is recommended that the City include the construction of the pedestrian crosswalk infrastructure on the south side of the intersection of Cundles Road / Highway 400 Southbound Off Ramp as a capital works project.
 11. In summary, with the above-noted improvements, the proposed development will not cause any operational issues to the local roadway network.

Appendix A – Site Plan



- KEY KITS
- 1. FIRE ALARM SIGNAL & APPROPRIATIONS
 - 2. FIRE ALARM SIGNAL AT MAX 150M PHASE
 - 3. FIRE ALARM SIGNAL CROSS SIGNAL
 - 4. FIRE ALARM SIGNAL CONNECTION
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MCA ARCHITECTS
44 LAUREL BLVD, UNIT 110
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TEL: 705.632.8448
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DRAWING NAME: SITE PLAN

PROJECT NAME: LITTLE LAKE CONDOMINIUM PROJECT
PROJECT ADDRESS: 50 LAUREL TERRACE
BARRIE, ON

DATE: NOV 2 2014
DRAWN BY: SCZ
SCALE: AS NOTED

SHEET NO. 100-000
A1.1

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NO.	REVISION	DATE
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Synchro Analysis Output – Total (2026)

										
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	57	735	99	216	745	131	79	27	101	19
Future Volume (vph)	57	735	99	216	745	131	79	27	101	19
Lane Group Flow (vph)	61	790	106	232	801	141	85	253	109	80
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm	NA
Protected Phases	7	4		3	8			2		6
Permitted Phases	4		4	8		8	2		6	
Detector Phase	7	4	4	3	8	8	2	2	6	6
Switch Phase										
Minimum Initial (s)	7.0	53.0	53.0	7.0	53.0	53.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.0	59.0	59.0	11.0	59.0	59.0	16.0	16.0	16.0	16.0
Total Split (s)	35.0	59.0	59.0	35.0	59.0	59.0	31.0	31.0	31.0	31.0
Total Split (%)	28.0%	47.2%	47.2%	28.0%	47.2%	47.2%	24.8%	24.8%	24.8%	24.8%
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag				
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes				
Recall Mode	None	None	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.16	0.51	0.14	0.56	0.44	0.17	0.22	0.40	0.45	0.16
Control Delay	10.4	24.2	5.1	15.5	19.0	3.0	33.2	8.1	40.8	12.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.4	24.2	5.1	15.5	19.0	3.0	33.2	8.1	40.8	12.2
Queue Length 50th (m)	5.2	65.4	1.1	22.1	59.9	0.0	14.5	4.7	20.1	3.2
Queue Length 95th (m)	10.4	88.1	11.2	33.8	77.4	9.8	28.7	24.8	39.6	14.9
Internal Link Dist (m)		158.5			240.9			93.5		47.8
Turn Bay Length (m)	50.0		50.0	160.0					35.0	
Base Capacity (vph)	668	1562	763	619	1829	844	386	638	243	510
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.51	0.14	0.37	0.44	0.17	0.22	0.40	0.45	0.16

Intersection Summary

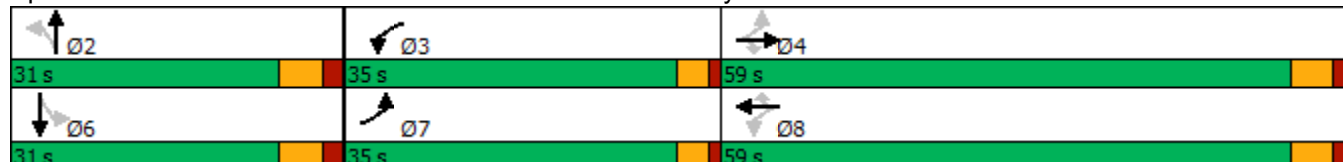
Cycle Length: 125

Actuated Cycle Length: 116.5

Natural Cycle: 90

Control Type: Semi Act-Uncoord

Splits and Phases: 1: Commercial Access/J.C. Massie Way & Cundles Rd. E.



												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	57	735	99	216	745	131	79	27	208	101	19	56
Future Volume (vph)	57	735	99	216	745	131	79	27	208	101	19	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.87		1.00	0.89	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1750	3433	1562	1733	3535	1502	1733	1604		1623	1562	
Flt Permitted	0.32	1.00	1.00	0.25	1.00	1.00	0.70	1.00		0.47	1.00	
Satd. Flow (perm)	584	3433	1562	453	3535	1502	1286	1604		810	1562	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	61	790	106	232	801	141	85	29	224	109	20	60
RTOR Reduction (vph)	0	0	53	0	0	69	0	157	0	0	42	0
Lane Group Flow (vph)	61	790	53	232	801	72	85	96	0	109	38	0
Confl. Peds. (#/hr)	3		3	3		3						
Heavy Vehicles (%)	2%	4%	0%	3%	1%	4%	3%	6%	1%	10%	0%	9%
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	59.8	53.8	53.8	70.3	60.3	60.3	35.0	35.0		35.0	35.0	
Effective Green, g (s)	59.8	53.8	53.8	70.3	60.3	60.3	35.0	35.0		35.0	35.0	
Actuated g/C Ratio	0.51	0.46	0.46	0.60	0.51	0.51	0.30	0.30		0.30	0.30	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	357	1574	716	407	1817	772	383	478		241	466	
v/s Ratio Prot	0.01	0.23		c0.06	0.23			0.06			0.02	
v/s Ratio Perm	0.08		0.03	c0.28		0.05	0.07			c0.13		
v/c Ratio	0.17	0.50	0.07	0.57	0.44	0.09	0.22	0.20		0.45	0.08	
Uniform Delay, d1	14.7	22.3	17.8	12.8	17.9	14.6	30.9	30.7		33.4	29.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	0.3	0.0	1.9	0.2	0.1	1.3	0.9		6.0	0.3	
Delay (s)	14.9	22.6	17.8	14.7	18.1	14.6	32.3	31.7		39.4	29.9	
Level of Service	B	C	B	B	B	B	C	C		D	C	
Approach Delay (s)		21.6			17.0			31.8			35.4	
Approach LOS		C			B			C			D	
Intersection Summary												
HCM 2000 Control Delay			21.8			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.54									
Actuated Cycle Length (s)			117.3			Sum of lost time (s)				16.0		
Intersection Capacity Utilization			99.2%			ICU Level of Service				F		
Analysis Period (min)			15									
c Critical Lane Group												

Little Lake Seniors Community
2: Duckworth St & Hwy 400 SB Off Ramp

Queues
Total (2026) AM Peak Hour

				
Lane Group	WBL	WBR	NBT	SBT
Lane Configurations			  	  
Traffic Volume (vph)	278	396	812	1091
Future Volume (vph)	278	396	812	1091
Lane Group Flow (vph)	296	421	864	1161
Turn Type	Prot	Prot	NA	NA
Protected Phases	8	8	2	6
Permitted Phases				
Detector Phase	8	8	2	6
Switch Phase				
Minimum Initial (s)	10.0	10.0	55.0	55.0
Minimum Split (s)	22.0	22.0	61.0	61.0
Total Split (s)	49.0	49.0	61.0	61.0
Total Split (%)	44.5%	44.5%	55.5%	55.5%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	Max	Max
v/c Ratio	0.43	0.61	0.35	0.47
Control Delay	26.9	23.8	17.1	18.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	26.9	23.8	17.1	18.7
Queue Length 50th (m)	45.8	52.5	39.6	57.4
Queue Length 95th (m)	69.2	85.5	49.0	69.0
Internal Link Dist (m)	73.9		391.5	20.4
Turn Bay Length (m)				
Base Capacity (vph)	690	685	2490	2490
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.43	0.61	0.35	0.47

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 110

Natural Cycle: 85

Control Type: Semi Act-Uncoord

Splits and Phases: 2: Duckworth St & Hwy 400 SB Off Ramp



Little Lake Seniors Community
2: Duckworth St & Hwy 400 SB Off Ramp

HCM Signalized Intersection Capacity Analysis
Total (2026) AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	278	396	812	0	0	1091
Future Volume (vph)	278	396	812	0	0	1091
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0			6.0
Lane Util. Factor	1.00	1.00	0.91			0.91
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	1767	1581	4980			4980
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	1767	1581	4980			4980
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	296	421	864	0	0	1161
RTOR Reduction (vph)	0	68	0	0	0	0
Lane Group Flow (vph)	296	353	864	0	0	1161
Heavy Vehicles (%)	1%	1%	3%	0%	0%	3%
Turn Type	Prot	Prot	NA			NA
Protected Phases	8	8	2			6
Permitted Phases						
Actuated Green, G (s)	43.0	43.0	55.0			55.0
Effective Green, g (s)	43.0	43.0	55.0			55.0
Actuated g/C Ratio	0.39	0.39	0.50			0.50
Clearance Time (s)	6.0	6.0	6.0			6.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	690	618	2490			2490
v/s Ratio Prot	0.17	c0.22	0.17			c0.23
v/s Ratio Perm						
v/c Ratio	0.43	0.57	0.35			0.47
Uniform Delay, d1	24.5	26.3	16.6			17.9
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	1.9	3.8	0.4			0.6
Delay (s)	26.5	30.1	17.0			18.6
Level of Service	C	C	B			B
Approach Delay (s)	28.6		17.0			18.6
Approach LOS	C		B			B
Intersection Summary						
HCM 2000 Control Delay			20.7		HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.51			
Actuated Cycle Length (s)			110.0		Sum of lost time (s)	12.0
Intersection Capacity Utilization			80.4%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

Little Lake Seniors Community
3: Duckworth St & Hwy 400 NB Ramp/Georgian Dr

Queues
Total (2026) AM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 						  		 	  	
Traffic Volume (vph)	266	608	371	103	17	672	97	608	255	215	447	406
Future Volume (vph)	266	608	371	103	17	672	97	608	255	215	447	406
Lane Group Flow (vph)	275	730	426	118	20	772	111	699	293	247	514	467
Turn Type	Split	NA	Perm	Split	NA	Free	pm+pt	NA	Perm	pm+pt	NA	Free
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			Free	2		2	6		Free
Detector Phase	4	4	4	8	8		5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0		7.0	30.0	30.0	7.0	30.0	
Minimum Split (s)	16.0	16.0	16.0	16.0	16.0		11.0	36.0	36.0	11.0	36.0	
Total Split (s)	44.0	44.0	44.0	25.0	25.0		20.0	39.0	39.0	20.0	39.0	
Total Split (%)	34.4%	34.4%	34.4%	19.5%	19.5%		15.6%	30.5%	30.5%	15.6%	30.5%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		3.0	4.0	4.0	3.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		1.0	2.0	2.0	1.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0		4.0	6.0	6.0	4.0	6.0	
Lead/Lag							Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	None	None	None	None		None	Max	Max	None	Max	
v/c Ratio	0.58	0.73	0.57	0.58	0.09	0.49	0.28	0.49	0.46	0.39	0.34	0.30
Control Delay	40.3	41.1	7.4	60.9	47.1	1.1	22.9	36.0	6.6	22.5	33.5	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.3	41.1	7.4	60.9	47.1	1.1	22.9	36.0	6.6	22.5	33.5	0.5
Queue Length 50th (m)	56.5	79.2	3.6	26.3	4.2	0.0	15.4	49.4	0.0	17.8	34.3	0.0
Queue Length 95th (m)	90.4	106.7	25.0	44.7	11.2	0.0	27.8	65.3	18.2	27.1	47.5	0.0
Internal Link Dist (m)		215.7			125.2			283.6			391.5	
Turn Bay Length (m)	180.0		180.0	70.0			60.0		60.0	60.0		60.0
Base Capacity (vph)	536	1138	795	281	316	1581	479	1430	640	776	1503	1551
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.51	0.64	0.54	0.42	0.06	0.49	0.23	0.49	0.46	0.32	0.34	0.30

Intersection Summary

Cycle Length: 128

Actuated Cycle Length: 113.7

Natural Cycle: 90

Control Type: Semi Act-Uncoord

Splits and Phases: 3: Duckworth St & Hwy 400 NB Ramp/Georgian Dr

 Ø1	 Ø2	 Ø4	 Ø8
20 s	39 s	44 s	25 s
 Ø5	 Ø6		
20 s	39 s		

Little Lake Seniors Community
3: Duckworth St & Hwy 400 NB Ramp/Georgian Dr

HCM Signalized Intersection Capacity Analysis
Total (2026) AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 						  		 	 	
Traffic Volume (vph)	266	608	371	103	17	672	97	608	255	215	447	406
Future Volume (vph)	266	608	371	103	17	672	97	608	255	215	447	406
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	4.0	4.0	6.0	6.0	4.0	6.0	4.0
Lane Util. Factor	0.91	0.91	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1592	3377	1566	1668	1879	1581	1767	4885	1482	3360	5029	1551
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.42	1.00	1.00	0.29	1.00	1.00
Satd. Flow (perm)	1592	3377	1566	1668	1879	1581	773	4885	1482	1016	5029	1551
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	306	699	426	118	20	772	111	699	293	247	514	467
RTOR Reduction (vph)	0	0	283	0	0	0	0	0	207	0	0	0
Lane Group Flow (vph)	275	730	143	118	20	772	111	699	86	247	514	467
Confl. Peds. (#/hr)									4	4		
Heavy Vehicles (%)	2%	1%	2%	7%	0%	1%	1%	5%	6%	3%	2%	3%
Turn Type	Split	NA	Perm	Split	NA	Free	pm+pt	NA	Perm	pm+pt	NA	Free
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			Free	2		2	6		Free
Actuated Green, G (s)	33.7	33.7	33.7	13.8	13.8	113.6	43.5	33.4	33.4	44.7	34.0	113.6
Effective Green, g (s)	33.7	33.7	33.7	13.8	13.8	113.6	43.5	33.4	33.4	44.7	34.0	113.6
Actuated g/C Ratio	0.30	0.30	0.30	0.12	0.12	1.00	0.38	0.29	0.29	0.39	0.30	1.00
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		4.0	6.0	6.0	4.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	472	1001	464	202	228	1581	384	1436	435	620	1505	1551
v/s Ratio Prot	0.17	c0.22		0.07	0.01		0.03	0.14		0.04	0.10	
v/s Ratio Perm			0.09			c0.49	0.08		0.06	0.12		0.30
v/c Ratio	0.58	0.73	0.31	0.58	0.09	0.49	0.29	0.49	0.20	0.40	0.34	0.30
Uniform Delay, d1	34.0	35.9	30.9	47.2	44.3	0.0	23.1	33.0	30.1	22.9	31.1	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.8	2.7	0.4	4.3	0.2	1.1	0.4	1.2	1.0	0.4	0.6	0.5
Delay (s)	35.8	38.5	31.3	51.4	44.5	1.1	23.5	34.2	31.1	23.3	31.7	0.5
Level of Service	D	D	C	D	D	A	C	C	C	C	C	A
Approach Delay (s)		35.9			8.6			32.3			18.1	
Approach LOS		D			A			C			B	
Intersection Summary												
HCM 2000 Control Delay			25.0	HCM 2000 Level of Service			C					
HCM 2000 Volume to Capacity ratio			0.66									
Actuated Cycle Length (s)			113.6	Sum of lost time (s)			22.0					
Intersection Capacity Utilization			74.6%	ICU Level of Service			D					
Analysis Period (min)			15									
c Critical Lane Group												

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	34	148	1	75	104	2
Future Volume (Veh/h)	34	148	1	75	104	2
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	40	174	1	88	122	2
Pedestrians				3		
Lane Width (m)				3.5		
Walking Speed (m/s)				1.2		
Percent Blockage				0		
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	310					
pX, platoon unblocked						
vC, conflicting volume			214		217	130
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			214		217	130
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		84	100
cM capacity (veh/h)			1368		775	923
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	214	89	124			
Volume Left	0	1	122			
Volume Right	174	0	2			
cSH	1700	1368	777			
Volume to Capacity	0.13	0.00	0.16			
Queue Length 95th (m)	0.0	0.0	4.3			
Control Delay (s)	0.0	0.1	10.5			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.1	10.5			
Approach LOS			B			
Intersection Summary						
Average Delay			3.1			
Intersection Capacity Utilization			24.2%	ICU Level of Service	A	
Analysis Period (min)			15			

Little Lake Seniors Community

1: Commercial Access/J.C. Massie Way & Cundles Rd. E.

Queues

Total (2026) PM Peak Hour

										
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	76	1222	55	288	1393	116	72	8	120	30
Future Volume (vph)	76	1222	55	288	1393	116	72	8	120	30
Lane Group Flow (vph)	78	1260	57	297	1436	120	74	355	124	128
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm	NA
Protected Phases	7	4		3	8			2		6
Permitted Phases	4		4	8		8	2		6	
Detector Phase	7	4	4	3	8	8	2	2	6	6
Switch Phase										
Minimum Initial (s)	7.0	53.0	53.0	7.0	53.0	53.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.0	59.0	59.0	11.0	59.0	59.0	16.0	16.0	16.0	16.0
Total Split (s)	35.0	58.0	58.0	36.0	59.0	59.0	31.0	31.0	31.0	31.0
Total Split (%)	28.0%	46.4%	46.4%	28.8%	47.2%	47.2%	24.8%	24.8%	24.8%	24.8%
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag				
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes				
Recall Mode	None	None	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.38	0.84	0.08	0.82	0.75	0.14	0.21	0.51	0.79	0.24
Control Delay	17.2	39.4	5.9	50.7	25.7	5.5	38.0	7.1	77.6	12.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.2	39.4	5.9	50.7	25.7	5.5	38.0	7.1	77.6	12.8
Queue Length 50th (m)	6.7	142.4	0.0	53.6	141.1	3.7	13.8	1.4	28.0	5.5
Queue Length 95th (m)	12.3	#207.0	8.0	84.8	179.5	13.4	29.1	26.4	#68.7	22.3
Internal Link Dist (m)		158.5			240.9			93.5		47.8
Turn Bay Length (m)	50.0		50.0	160.0					35.0	
Base Capacity (vph)	525	1499	692	511	1914	869	349	695	156	529
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.84	0.08	0.58	0.75	0.14	0.21	0.51	0.79	0.24

Intersection Summary

Cycle Length: 125

Actuated Cycle Length: 124.1

Natural Cycle: 90

Control Type: Semi Act-Uncoord

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Commercial Access/J.C. Massie Way & Cundles Rd. E.

		
Ø2	Ø3	Ø4
31 s	36 s	58 s
		
Ø6	Ø7	Ø8
31 s	35 s	59 s

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	76	1222	55	288	1393	116	72	8	337	120	30	94
Future Volume (vph)	76	1222	55	288	1393	116	72	8	337	120	30	94
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.98	1.00	0.99		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.89	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1785	3570	1564	1785	3535	1533	1785	1580		1765	1628	
Flt Permitted	0.11	1.00	1.00	0.07	1.00	1.00	0.66	1.00		0.30	1.00	
Satd. Flow (perm)	206	3570	1564	132	3535	1533	1237	1580		553	1628	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	78	1260	57	297	1436	120	74	8	347	124	31	97
RTOR Reduction (vph)	0	0	33	0	0	40	0	249	0	0	70	0
Lane Group Flow (vph)	78	1260	24	297	1436	80	74	106	0	124	58	0
Confl. Peds. (#/hr)	1		1	1		1			3	3		
Heavy Vehicles (%)	0%	0%	0%	0%	1%	2%	0%	0%	0%	1%	0%	3%
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	59.6	53.0	53.0	77.8	67.2	67.2	35.1	35.1		35.1	35.1	
Effective Green, g (s)	59.6	53.0	53.0	77.8	67.2	67.2	35.1	35.1		35.1	35.1	
Actuated g/C Ratio	0.48	0.42	0.42	0.62	0.54	0.54	0.28	0.28		0.28	0.28	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	181	1514	663	357	1901	824	347	444		155	457	
v/s Ratio Prot	0.02	0.35		c0.14	0.41			0.07			0.04	
v/s Ratio Perm	0.18		0.02	c0.38		0.05	0.06			c0.22		
v/c Ratio	0.43	0.83	0.04	0.83	0.76	0.10	0.21	0.24		0.80	0.13	
Uniform Delay, d1	20.2	32.0	21.0	37.1	22.5	14.1	34.3	34.6		41.6	33.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.6	4.1	0.0	15.1	1.8	0.1	1.4	1.3		33.8	0.6	
Delay (s)	21.9	36.1	21.0	52.2	24.2	14.1	35.7	35.9		75.4	34.1	
Level of Service	C	D	C	D	C	B	D	D		E	C	
Approach Delay (s)		34.7			28.0			35.8			54.4	
Approach LOS		C			C			D			D	
Intersection Summary												
HCM 2000 Control Delay			32.9									
HCM 2000 Level of Service											C	
HCM 2000 Volume to Capacity ratio			0.84									
Actuated Cycle Length (s)			124.9							16.0		
Intersection Capacity Utilization			116.3%									
ICU Level of Service										H		
Analysis Period (min)			15									
c Critical Lane Group												

Little Lake Seniors Community
2: Duckworth St & Hwy 400 SB Off Ramp

Queues
Total (2026) PM Peak Hour

				
Lane Group	WBL	WBR	NBT	SBT
Lane Configurations				
Traffic Volume (vph)	148	421	1499	1801
Future Volume (vph)	148	421	1499	1801
Lane Group Flow (vph)	153	434	1545	1857
Turn Type	Prot	Prot	NA	NA
Protected Phases	8	8	2	6
Permitted Phases				
Detector Phase	8	8	2	6
Switch Phase				
Minimum Initial (s)	10.0	10.0	55.0	55.0
Minimum Split (s)	22.0	22.0	61.0	61.0
Total Split (s)	49.0	49.0	61.0	61.0
Total Split (%)	44.5%	44.5%	55.5%	55.5%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	Max	Max
v/c Ratio	0.23	0.70	0.60	0.72
Control Delay	23.5	34.2	20.9	23.6
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	23.5	34.2	20.9	23.6
Queue Length 50th (m)	21.6	74.2	83.8	110.3
Queue Length 95th (m)	36.2	111.0	98.4	128.1
Internal Link Dist (m)	73.9		391.5	20.4
Turn Bay Length (m)				
Base Capacity (vph)	677	621	2564	2564
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.23	0.70	0.60	0.72

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 110

Natural Cycle: 85

Control Type: Semi Act-Uncoord

Splits and Phases: 2: Duckworth St & Hwy 400 SB Off Ramp



Little Lake Seniors Community
2: Duckworth St & Hwy 400 SB Off Ramp

HCM Signalized Intersection Capacity Analysis
Total (2026) PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	148	421	1499	0	0	1801
Future Volume (vph)	148	421	1499	0	0	1801
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0			6.0
Lane Util. Factor	1.00	1.00	0.91			0.91
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	1733	1566	5129			5129
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	1733	1566	5129			5129
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	153	434	1545	0	0	1857
RTOR Reduction (vph)	0	10	0	0	0	0
Lane Group Flow (vph)	153	424	1545	0	0	1857
Heavy Vehicles (%)	3%	2%	0%	0%	0%	0%
Turn Type	Prot	Prot	NA			NA
Protected Phases	8	8	2			6
Permitted Phases						
Actuated Green, G (s)	43.0	43.0	55.0			55.0
Effective Green, g (s)	43.0	43.0	55.0			55.0
Actuated g/C Ratio	0.39	0.39	0.50			0.50
Clearance Time (s)	6.0	6.0	6.0			6.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	677	612	2564			2564
v/s Ratio Prot	0.09	c0.27	0.30			c0.36
v/s Ratio Perm						
v/c Ratio	0.23	0.69	0.60			0.72
Uniform Delay, d1	22.4	28.0	19.7			21.6
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	0.8	6.4	1.1			1.8
Delay (s)	23.2	34.3	20.7			23.4
Level of Service	C	C	C			C
Approach Delay (s)	31.4		20.7			23.4
Approach LOS	C		C			C
Intersection Summary						
HCM 2000 Control Delay			23.5		HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.71			
Actuated Cycle Length (s)			110.0		Sum of lost time (s)	12.0
Intersection Capacity Utilization			81.9%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

Little Lake Seniors Community
3: Duckworth St & Hwy 400 NB Ramp/Georgian Dr

Queues
Total (2026) PM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	559	399	480	165	44	1159	189	800	113	411	514	537
Future Volume (vph)	559	399	480	165	44	1159	189	800	113	411	514	537
Lane Group Flow (vph)	326	672	500	172	46	1207	197	833	118	428	535	559
Turn Type	Split	NA	Perm	Split	NA	Free	pm+pt	NA	Perm	pm+pt	NA	Free
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			Free	2		2	6		Free
Detector Phase	4	4	4	8	8		5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0		7.0	30.0	30.0	7.0	30.0	
Minimum Split (s)	16.0	16.0	16.0	16.0	16.0		11.0	36.0	36.0	11.0	36.0	
Total Split (s)	44.0	44.0	44.0	25.0	25.0		20.0	39.0	39.0	20.0	39.0	
Total Split (%)	34.4%	34.4%	34.4%	19.5%	19.5%		15.6%	30.5%	30.5%	15.6%	30.5%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		3.0	4.0	4.0	3.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		1.0	2.0	2.0	1.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0		4.0	6.0	6.0	4.0	6.0	
Lead/Lag							Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	
Recall Mode	Max	Max	Max	Max	Max		Min	Min	Min	Min	Min	
v/c Ratio	0.72	0.72	0.72	0.47	0.11	0.76	0.56	0.71	0.28	0.81	0.44	0.35
Control Delay	54.5	49.4	18.9	51.9	44.7	3.6	35.1	51.7	8.7	42.6	45.6	0.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	54.5	49.4	18.9	51.9	44.7	3.6	35.1	51.7	8.7	42.6	45.6	0.6
Queue Length 50th (m)	86.3	89.1	33.9	40.5	10.0	0.0	36.0	76.1	0.0	41.0	45.6	0.0
Queue Length 95th (m)	127.5	115.0	78.5	64.9	21.3	0.0	55.0	91.3	15.4	#55.5	57.6	0.0
Internal Link Dist (m)		215.7			125.2			283.6			391.5	
Turn Bay Length (m)	180.0		180.0	70.0			60.0		60.0	60.0		60.0
Base Capacity (vph)	455	934	695	366	401	1581	377	1248	442	545	1236	1597
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.72	0.72	0.72	0.47	0.11	0.76	0.52	0.67	0.27	0.79	0.43	0.35

Intersection Summary

Cycle Length: 128

Actuated Cycle Length: 135.6

Natural Cycle: 90

Control Type: Semi Act-Uncoord

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 3: Duckworth St & Hwy 400 NB Ramp/Georgian Dr

			
Ø1	Ø2	Ø4	Ø8
20 s	39 s	44 s	25 s
			
Ø5	Ø6		
20 s	39 s		

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 						  		 	  	
Traffic Volume (vph)	559	399	480	165	44	1159	189	800	113	411	514	537
Future Volume (vph)	559	399	480	165	44	1159	189	800	113	411	514	537
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	4.0	4.0	6.0	6.0	4.0	6.0	4.0
Lane Util. Factor	0.91	0.91	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.98	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1624	3335	1565	1716	1879	1581	1785	5129	1449	3394	5079	1597
Flt Permitted	0.95	0.98	1.00	0.95	1.00	1.00	0.36	1.00	1.00	0.16	1.00	1.00
Satd. Flow (perm)	1624	3335	1565	1716	1879	1581	682	5129	1449	578	5079	1597
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	582	416	500	172	46	1207	197	833	118	428	535	559
RTOR Reduction (vph)	0	0	257	0	0	0	0	0	91	0	0	0
Lane Group Flow (vph)	326	672	243	172	46	1207	197	833	27	428	535	559
Confl. Peds. (#/hr)			6	6					6	6		
Heavy Vehicles (%)	0%	1%	0%	4%	0%	1%	0%	0%	8%	2%	1%	0%
Turn Type	Split	NA	Perm	Split	NA	Free	pm+pt	NA	Perm	pm+pt	NA	Free
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			Free	2		2	6		Free
Actuated Green, G (s)	38.0	38.0	38.0	29.0	29.0	135.6	45.6	31.3	31.3	47.6	32.3	135.6
Effective Green, g (s)	38.0	38.0	38.0	29.0	29.0	135.6	45.6	31.3	31.3	47.6	32.3	135.6
Actuated g/C Ratio	0.28	0.28	0.28	0.21	0.21	1.00	0.34	0.23	0.23	0.35	0.24	1.00
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		4.0	6.0	6.0	4.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	455	934	438	366	401	1581	345	1183	334	520	1209	1597
v/s Ratio Prot	0.20	0.20		0.10	0.02		0.06	0.16		0.09	0.11	
v/s Ratio Perm			0.16			c0.76	0.13		0.02	0.20		0.35
v/c Ratio	0.72	0.72	0.55	0.47	0.11	0.76	0.57	0.70	0.08	0.82	0.44	0.35
Uniform Delay, d1	43.9	44.0	41.6	46.6	43.0	0.0	33.7	47.9	40.9	34.2	44.0	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.3	4.8	5.0	4.3	0.6	3.6	2.3	1.9	0.1	10.2	0.3	0.6
Delay (s)	53.3	48.8	46.6	50.9	43.5	3.6	36.0	49.8	41.0	44.4	44.2	0.6
Level of Service	D	D	D	D	D	A	D	D	D	D	D	A
Approach Delay (s)		49.0			10.6			46.5			28.3	
Approach LOS		D			B			D			C	

Intersection Summary

HCM 2000 Control Delay	33.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	135.6	Sum of lost time (s)	22.0
Intersection Capacity Utilization	88.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Little Lake Seniors Community
4: Existing Access & JC Massie Way/Little Lake Rd

HCM Unsignalized Intersection Capacity Analysis
Total (2026) PM Peak Hour

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	61	102	0	69	154	1
Future Volume (Veh/h)	61	102	0	69	154	1
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.65	0.65	0.65	0.65	0.65	0.65
Hourly flow rate (vph)	94	157	0	106	237	2
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	310					
pX, platoon unblocked						
vC, conflicting volume			251		278	172
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			251		278	172
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		67	100
cM capacity (veh/h)			1326		716	876
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	251	106	239			
Volume Left	0	0	237			
Volume Right	157	0	2			
cSH	1700	1326	717			
Volume to Capacity	0.15	0.00	0.33			
Queue Length 95th (m)	0.0	0.0	11.1			
Control Delay (s)	0.0	0.0	12.5			
Lane LOS			B			
Approach Delay (s)	0.0	0.0	12.5			
Approach LOS			B			
Intersection Summary						
Average Delay			5.0			
Intersection Capacity Utilization			24.7%	ICU Level of Service	A	
Analysis Period (min)			15			

Little Lake Seniors Community
2: Duckworth St & Hwy 400 SB Off Ramp

Queues
Total (2026) AM Peak Hour with South Ped Walkway

	↖	↗	↑	↓
Lane Group	WBL	WBR	NBT	SBT
Lane Configurations	↖	↗	↑↑↑	↑↑↑
Traffic Volume (vph)	278	396	812	1091
Future Volume (vph)	278	396	812	1091
Lane Group Flow (vph)	296	421	864	1161
Turn Type	Perm	Perm	NA	NA
Protected Phases			2	6
Permitted Phases	8	8		
Detector Phase	8	8	2	6
Switch Phase				
Minimum Initial (s)	10.0	10.0	55.0	55.0
Minimum Split (s)	36.0	36.0	61.0	61.0
Total Split (s)	49.0	49.0	61.0	61.0
Total Split (%)	44.5%	44.5%	55.5%	55.5%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	Max	Max
v/c Ratio	0.44	0.61	0.35	0.47
Control Delay	27.2	23.8	17.1	18.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	27.2	23.8	17.1	18.7
Queue Length 50th (m)	46.0	52.5	39.6	57.4
Queue Length 95th (m)	69.7	85.5	49.0	69.0
Internal Link Dist (m)	73.9		391.5	20.4
Turn Bay Length (m)				
Base Capacity (vph)	675	685	2490	2490
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.44	0.61	0.35	0.47

Intersection Summary

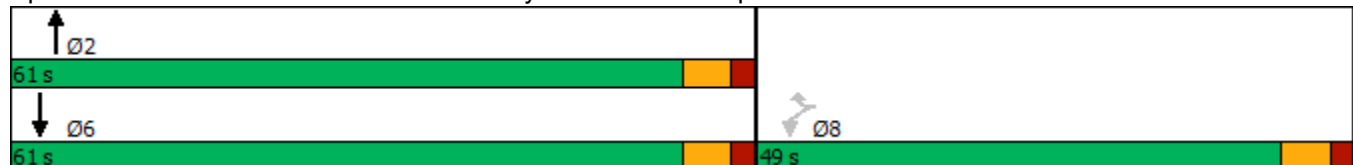
Cycle Length: 110

Actuated Cycle Length: 110

Natural Cycle: 100

Control Type: Semi Act-Uncoord

Splits and Phases: 2: Duckworth St & Hwy 400 SB Off Ramp



Little Lake Seniors Community
2: Duckworth St & Hwy 400 SB Off Ramp

HCM Signalized Intersection Capacity Analysis
Total (2026) AM Peak Hour with South Ped Walkway

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			  			  
Traffic Volume (vph)	278	396	812	0	0	1091
Future Volume (vph)	278	396	812	0	0	1091
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0			6.0
Lane Util. Factor	1.00	1.00	0.91			0.91
Frpb, ped/bikes	1.00	1.00	1.00			1.00
Flpb, ped/bikes	0.98	1.00	1.00			1.00
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	1728	1581	4980			4980
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	1728	1581	4980			4980
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	296	421	864	0	0	1161
RTOR Reduction (vph)	0	68	0	0	0	0
Lane Group Flow (vph)	296	353	864	0	0	1161
Confl. Peds. (#/hr)	20					
Heavy Vehicles (%)	1%	1%	3%	0%	0%	3%
Turn Type	Perm	Perm	NA			NA
Protected Phases			2			6
Permitted Phases	8	8				
Actuated Green, G (s)	43.0	43.0	55.0			55.0
Effective Green, g (s)	43.0	43.0	55.0			55.0
Actuated g/C Ratio	0.39	0.39	0.50			0.50
Clearance Time (s)	6.0	6.0	6.0			6.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	675	618	2490			2490
v/s Ratio Prot			0.17			c0.23
v/s Ratio Perm	0.17	c0.22				
v/c Ratio	0.44	0.57	0.35			0.47
Uniform Delay, d1	24.6	26.3	16.6			17.9
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	2.1	3.8	0.4			0.6
Delay (s)	26.7	30.1	17.0			18.6
Level of Service	C	C	B			B
Approach Delay (s)	28.7		17.0			18.6
Approach LOS	C		B			B
Intersection Summary						
HCM 2000 Control Delay			20.7		HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.51			
Actuated Cycle Length (s)			110.0		Sum of lost time (s)	12.0
Intersection Capacity Utilization			80.4%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

Little Lake Seniors Community
2: Duckworth St & Hwy 400 SB Off Ramp

Queues
Total (2026) PM Peak Hour with South Ped Walkway

	↖	↗	↑	↓
Lane Group	WBL	WBR	NBT	SBT
Lane Configurations	↖	↗	↑↑↑	↑↑↑
Traffic Volume (vph)	148	421	1499	1801
Future Volume (vph)	148	421	1499	1801
Lane Group Flow (vph)	153	434	1545	1857
Turn Type	Perm	Perm	NA	NA
Protected Phases			2	6
Permitted Phases	8	8		
Detector Phase	8	8	2	6
Switch Phase				
Minimum Initial (s)	10.0	10.0	55.0	55.0
Minimum Split (s)	36.0	36.0	61.0	61.0
Total Split (s)	49.0	49.0	61.0	61.0
Total Split (%)	44.5%	44.5%	55.5%	55.5%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	Max	Max
v/c Ratio	0.23	0.70	0.60	0.72
Control Delay	23.6	34.2	20.9	23.6
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	23.6	34.2	20.9	23.6
Queue Length 50th (m)	21.7	74.2	83.8	110.3
Queue Length 95th (m)	36.4	111.0	98.4	128.1
Internal Link Dist (m)	73.9		391.5	20.4
Turn Bay Length (m)				
Base Capacity (vph)	662	621	2564	2564
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.23	0.70	0.60	0.72

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 110

Natural Cycle: 100

Control Type: Semi Act-Uncoord

Splits and Phases: 2: Duckworth St & Hwy 400 SB Off Ramp



Little Lake Seniors Community
2: Duckworth St & Hwy 400 SB Off Ramp

HCM Signalized Intersection Capacity Analysis
Total (2026) PM Peak Hour with South Ped Walkway

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	148	421	1499	0	0	1801
Future Volume (vph)	148	421	1499	0	0	1801
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0			6.0
Lane Util. Factor	1.00	1.00	0.91			0.91
Frpb, ped/bikes	1.00	1.00	1.00			1.00
Flpb, ped/bikes	0.98	1.00	1.00			1.00
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	1695	1566	5129			5129
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	1695	1566	5129			5129
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	153	434	1545	0	0	1857
RTOR Reduction (vph)	0	10	0	0	0	0
Lane Group Flow (vph)	153	424	1545	0	0	1857
Confl. Peds. (#/hr)	20					
Heavy Vehicles (%)	3%	2%	0%	0%	0%	0%
Turn Type	Perm	Perm	NA			NA
Protected Phases			2			6
Permitted Phases	8	8				
Actuated Green, G (s)	43.0	43.0	55.0			55.0
Effective Green, g (s)	43.0	43.0	55.0			55.0
Actuated g/C Ratio	0.39	0.39	0.50			0.50
Clearance Time (s)	6.0	6.0	6.0			6.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	662	612	2564			2564
v/s Ratio Prot			0.30			c0.36
v/s Ratio Perm	0.09	c0.27				
v/c Ratio	0.23	0.69	0.60			0.72
Uniform Delay, d1	22.4	28.0	19.7			21.6
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	0.8	6.4	1.1			1.8
Delay (s)	23.2	34.3	20.7			23.4
Level of Service	C	C	C			C
Approach Delay (s)	31.5		20.7			23.4
Approach LOS	C		C			C
Intersection Summary						
HCM 2000 Control Delay			23.5		HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.71			
Actuated Cycle Length (s)			110.0		Sum of lost time (s)	12.0
Intersection Capacity Utilization			81.9%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

OTM Signal Justification Sheets

Justification No. 7 - 2026 Total Traffic (Critical Case)

Yonge St / Glenn Ave

Justification	Description		Compliance			Signal Warrant	Underground Provisions Warrant
			Sectional		Entire %		
			Rest. Flow	Numerical			
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	720	176	24%	3%	NO	NO
	B. Vehicle volume, along minor streets (average hour)	255	12	5%		NO	NO
2. Delay to cross traffic	A. Vehicle volume, major street (average hour)	720	160	22%	5%	NO	NO
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	75	6	8%		NO	NO