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407-419 Maplevue Drive West

TRAFFIC STUDY

407-419 Maplevue Drive Inc.

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Document Contents

1	Introduction	1
2	Existing Conditions.....	2
2.1	Road Network	2
2.2	Existing Traffic Volumes.....	2
2.3	Existing Traffic Operations.....	2
3	Proposed Development	4
3.1	Site Location	4
3.2	Proposed Land-Use	4
3.3	Site Parking	4
3.4	Site Access & On-Site Circulation	5
3.5	Site Traffic.....	5
4	Transportation Impacts.....	7
4.1	Future Traffic Volumes.....	7
4.2	Future Traffic Operations.....	8
4.3	Turn Lane Requirements	9
4.4	Sight Line Assessment.....	10
5	Summary.....	11



Tables

Table 1: Road Section Operations – 2020 Conditions.....	3
Table 2: Trip Generation Rates – 407-419 Mapleview Drive West.....	5
Table 3: Road Section Operations – 2023 Total Conditions	8
Table 4: Road Section Operations – 2028 Total Conditions	8
Table 5: Intersection Operations – 2023 Total Conditions.....	9
Table 6: Intersection Operations – 2028 Total Conditions.....	9
Table 7: Sight Line Assessment.....	10

Figures

Figure 1: Site Location.....	12
Figure 2: Area Road Network.....	13
Figure 3: 2020 Traffic Volumes.....	14
Figure 4: Site Plan	15
Figure 5: Parking Plan	16
Figure 6: Site Generated Traffic.....	17
Figure 7: Background Development Traffic - 393-405 Mapleview Drive West.....	18
Figure 8: 2023 Total Traffic.....	19
Figure 9: 2028 Total Traffic.....	20

Appendices

- Appendix A: Traffic Counts
- Appendix B: Intersection Operations
- Appendix C: Turn Lane Warrants



1 Introduction

Tatham Engineering Limited was retained by 407-419 Maplevue Drive Inc. to address the traffic impacts associated with the proposed residential development to be located at 407-419 Maplevue Drive West in the City of Barrie. The location of the development site is illustrated in Figure 1.

The purpose of this study is to review the proposed development from a transportation perspective in consideration of the City of Barrie's requirements. The traffic study will consider the following:

- existing conditions, including a description of the study area road network, traffic volumes, operations and planned/proposed improvements;
- details of the proposed development and anticipated trip generation;
- on-site circulation and parking provision; and
- transportation impacts associated with the proposed development.



2 Existing Conditions

This chapter will describe the road network, traffic volumes and operations for the existing conditions.

2.1 ROAD NETWORK

The road network to be addressed by this study consists of Mapleview Drive West across the site frontage, which has the following characteristics:

- jurisdiction: City of Barrie;
- classification: arterial;
- orientation: east-west;
- cross-section: urban 4-lane (2 lanes per direction);
- posted speed limit: 60 km/h; and
- assumed planning capacity: 900 vehicles per hour per lane (vphpl).

Photographs of the road system are provided in Figure 2.

2.2 EXISTING TRAFFIC VOLUMES

To determine existing traffic volumes through the study area, traffic counts were obtained for the intersection of Mapleview Drive and Essa Road which is located approximately 400 metres to the east and thus considered reflective of traffic volumes across the site frontage. The counts were conducted on November 15, 2018, from 7:00 to 9:00 and 15:00 to 18:00; corresponding traffic count details are provided in Appendix A.

To further reflect 2020 conditions, an additional 1% increase was applied to consider annual growth (additional discussion regarding annual growth is provided in Section 4.1).

The resulting 2020 peak hour volumes are illustrated in Figure 3.

2.3 EXISTING TRAFFIC OPERATIONS

2.3.1 Road Section Operations

As previously noted, a lane capacity of 900 vphpl has been assumed for Mapleview Drive West. Given the 4-lane cross section, Mapleview Drive West has an ultimate capacity of 1,800 vehicles per hour per direction through the study area. The existing road section operations are summarized in Table 1, reflective of the peak directional peak hour volumes.



Table 1: Road Section Operations – 2020 Conditions

ROAD & LANES PER DIRECTION		CAPACITY ¹		TRAFFIC VOLUMES		VOLUME TO CAPACITY	
		EB	WB	EB	WB	NB	SB
Mapleview Drive West	2	1800	1800	805	933	0.45	0.52

¹capacity is in vehicles per hour per direction

As noted, the study area road network is operating at 52% of capacity or less (i.e. $v/c \leq 0.52$), thus indicating that the network is operating well within the available capacity. No improvements are recommended to address capacity under existing conditions.



3 Proposed Development

This section will provide additional details with respect to the proposed development, including its location, the projected site generated traffic volumes and the assignment of such to the adjacent road network.

3.1 SITE LOCATION

The subject site is located at 407-419 Mapleview Drive West in the City of Barrie (as per Figure 1). The property is bound by existing residential development to the east, west and south and Mapleview Drive West to the north.

3.2 PROPOSED LAND-USE

The proposed development will consist of 88 townhouse units with access provided via a single full-moves access on Mapleview Drive West. For the purpose of this study, full build-out is anticipated by 2023.

A site plan is provided in Figure 4.

3.3 SITE PARKING

As per the *City of Barrie Comprehensive Zoning By-Law 2009-141*¹, a residential building containing more than 3 dwelling units must provide 1.5 parking spaces per dwelling unit. In considering the City's parking standards, the proposed development requires 132 spaces for the development (1.5 spaces per unit x 88 units = 132 spaces).

As per the parking plan provided in Figure 5, the proposed development will provide 165 spaces as follow:

- 3 outdoor parallel parking spaces (visitor); and
- 162 covered spaces (44 of which are tandem spaces).

The provision of 162 spaces equates to 1.84 spaces per unit and thus the proposed parking supply meets the City's requirements. Without consideration for the tandem parking, 1.375 spaces per unit is provided.

¹ *City of Barrie Comprehensive Zoning Bylaw 2009-141*. Updated January 2020.



3.4 SITE ACCESS & ON-SITE CIRCULATION

As illustrated in Figure 4, access to the development will be provided via a single access to Mapleview Drive West, located approximately 400 metres west of Essa Road. The access will have a width of 9.0 metres, which will readily accommodate two-way operations as well as the turning requirements of large vehicles that may require access to the site (i.e. garbage truck, medium single unit truck, etc.).

The City's zoning by-law requires that an aisle providing access to a parking area or parking spaces have a minimum width of 6.4 metres where the parking spaces are at a 90° angle. As per the parking plan, a minimum aisle width of 6.4 metres will be maintained throughout the site, thus satisfying the City's requirements.

As per the above, the internal aisle layout as proposed is considered sufficient with respect to the circulation of site generated traffic and the typical vehicle type accessing the site (i.e. passenger vehicles).

3.5 SITE TRAFFIC

3.5.1 Trip Generation

The number of vehicle trips to be generated by the proposed development has been determined based on type of use, development size, and published ITE trip generation rates for land-uses consistent with those proposed for the site. Based on the proposed development, trip rates for the *multifamily housing - low rise* (ITE code 220) have been used. The associated trip rates and resulting trip estimates are provided in Table 2.

Table 2: Trip Generation Rates – 407-419 Mapleview Drive West

LAND USE	RATE/ ESTIMATE	VARIABLE/ SIZE	AM PEAK HOUR			PM PEAK HOUR		
			in	out	total	in	out	total
<i>multifamily housing - low rise</i>	rate	units	0.11	0.35	0.46	0.35	0.21	0.56
(ITE code 220)	estimate	88	9	31	40	31	18	49

As indicated, the proposed development is expected to generate 40 trips during the weekday AM peak hour and 49 trips during the weekday PM peak hour (total of inbound and outbound trips).



3.5.2 Trip Distribution & Assignment

The distribution of the new trips generated by the site has been developed based on the location of the site in relation to surrounding developments, existing traffic patterns observed along Maplevue Drive West intersection and distribution data as per the 2016 *Transportation Tomorrow Survey*. The following distribution has been assumed:

- to/from the west - 20%; and
- to/from the east - 80%.

The assignment of the trips generated by the development to the area road network and site access is based on the trip distribution noted above with consideration given to the expected travel routes. The resulting site generated traffic volumes assigned to the road network is illustrated in Figure 6.



4 Transportation Impacts

This chapter will address the resulting impacts of the proposed development on the adjacent road system. The following areas are to be addressed:

- access operations;
- road section operations;
- available sight lines along Mapleview Drive West at the proposed access point; and
- potential improvements to the study area road network, if necessary.

4.1 FUTURE TRAFFIC VOLUMES

For the purpose of this study, 2023 and 2028 horizons have been considered to assess the impact of the development on the road network. The 2023 horizon reflects full build-out of the subject development, whereas 2028 reflects a 5-year horizon beyond build-out.

4.1.1 Background Growth

Based on traffic projections from the City's Transportation Model, City staff have indicated a growth rate of 1% per annum be applied to Mapleview Drive West, west of Essa Road.

4.1.2 Background Development

The City has requested that consideration be given to the future development of the lands immediately east of the subject development (i.e. 393-405 Mapleview Drive West). While no development plans have been submitted for the noted block of properties, it is expected that these lands will be developed with similar use and density as the subject development (i.e. townhouses). It is noted that 393-405 Mapleview Drive West is nearly identical in size when compared to the subject site. As such, it has been assumed that it will yield the same number units, and hence trips, as 407-419 Mapleview Drive West (i.e. 40 AM trips and 49 PM trips). The trip generation for the background development, as illustrated in Figure 7, has been assigned to the road network based on the previously noted trip distribution. Full build-out of the background development has also been assumed by 2023.

4.1.3 Future Traffic Volumes

The future traffic volumes for the 2023 and 2028 horizon years are illustrated in Figure 8 and Figure 9. The volumes are based on the 2020 volumes, adjusted to reflect annual background growth of 1.0%, background development volumes and the volumes generated by the subject development.



4.2 FUTURE TRAFFIC OPERATIONS

4.2.1 Road Section Operations

The road section capacity operations have been reviewed for the 2023 and 2028 horizon periods based on the projected background volumes and the existing road network. As previously noted, Maplevue Drive West has an assumed directional capacity of 1,800 vph. The projected road section operations are summarized in Table 3 and Table 4, reflective of the peak directional peak hour volumes.

Table 3: Road Section Operations – 2023 Total Conditions

ROAD & LANES PER DIRECTION		CAPACITY ¹		TRAFFIC VOLUMES		VOLUME TO CAPACITY	
		EB	WB	EB	WB	NB	SB
Maplevue Drive West	2	1800	1800	856	990	0.48	0.55

¹ capacity is in vehicles per hour per direction

Table 4: Road Section Operations – 2028 Total Conditions

ROAD & LANES PER DIRECTION		CAPACITY ¹		TRAFFIC VOLUMES		VOLUME TO CAPACITY	
		EB	WB	EB	WB	NB	SB
Maplevue Drive West	2	1800	1800	898	1039	0.50	0.58

¹ capacity is in vehicles per hour per direction

As noted, the study area road network will operate at 58% of capacity or less (i.e. $v/c \leq 0.58$), thus indicating that the network will operate well within the available capacity through the 2028 horizon. No improvements are recommended to address capacity under future conditions.

4.2.2 Access Operations

The operations of the site access on Maplevue Drive West were investigated to consider the total traffic volumes for the 2023 and 2028 horizon years. The operations at the proposed access point have been reviewed, assuming a shared left/right turn lane configuration, operating under stop control. The results of the operational review are provided in Table 5 and Table 6, whereas detailed worksheets are provided in Appendix B.

Based on the projected traffic volumes and intersection control, the site access will provide good operations (LOS C or better) with average delays during both peak hours through the 2028 horizon. As such, the access configuration and control as proposed is appropriate.



Table 5: Intersection Operations – 2023 Total Conditions

INTERSECTION, MOVEMENT & CONTROL			AM PEAK HOUR			PM PEAK HOUR		
			DELAY	LOS	V/C	DELAY	LOS	V/C
Mapleview Drive West	NB	stop	14	B	0.08	14	B	0.05
& Site Access								

Table 6: Intersection Operations – 2028 Total Conditions

INTERSECTION, MOVEMENT & CONTROL			AM PEAK HOUR			PM PEAK HOUR		
			DELAY	LOS	V/C	DELAY	LOS	V/C
Mapleview Drive West	NB	stop	15	C	0.09	14	B	0.05
& Site Access								

In addition to the access operations, the queue lengths for traffic exiting the site was also reviewed to ensure there is sufficient on-site storage to accommodate potential queueing. Based on the 2028 conditions (the critical horizon where traffic volumes are greatest), the 95th percentile queue length at the site access was approximately 14 metres during the AM peak hour and 11 metres during the PM peak hour. This equates to approximately two vehicles. As such, the internal site layout can accommodate on-site queueing.

4.3 TURN LANE REQUIREMENTS

Despite the otherwise good operations provided at the site access, the need for exclusive turn lanes on Mapleview Drive West at the proposed access to serve site traffic has been reviewed based on MTO warrants.

4.3.1 Right Turn Lane

At unsignalized intersections, MTO guidelines suggest that an exclusive right turn lane be considered where right turn volumes exceed 60 vehicles per hour and/or impede the operations of through traffic. Based on the limited volume of right turning traffic entering the site (approximately 6 vehicles), a right turn lane is not required.

4.3.2 Left Turn Lane

With respect to left turn lane requirements on a 4-lane undivided road, the warrants are based on the volume of left turn traffic and the volume of opposing traffic. Based on the 2028 projected volumes, a westbound left turn lane with 15 metres of storage is warranted during the PM peak hour (the left turn warrants are provided in Appendix C). While the left turn warrant is satisfied,



a left turn lane is not considered necessary due to the relatively low volume of left turning traffic accessing the site (25 left turns during the PM peak hour) and the available capacity on Mapleview Drive West. It is noted that there are several municipal side streets in the immediate vicinity (Nakiska Court, Redfern Avenue and Twiss Drive) that experience similar or greater left turn volumes yet are not served by an exclusive left turn lane. Due to the relatively close proximity of the various intersections and the typical design requirements of a left turn lane (i.e. storage, parallel lane and taper), providing individual left turn lanes would not be feasible. Rather, a continuous centre turn lane through the area would benefit all development with access to Mapleview Drive West. This improvement would not be considered a responsibility of the developer, but rather a development charge improvement with local benefit. Regardless, a left turn lane to serve the subject development is not considered necessary.

4.4 SIGHT LINE ASSESSMENT

The sight line assessment has considered both minimum stopping sight distance and intersection sight distance, as per Transportation Association of Canada (TAC) standards. The minimum stopping sight distance provides sufficient distance for an approaching motorist to observe a stationary hazard in the road and bring their vehicle to a complete stop prior to the hazard; whereas the intersection sight distance allows a vehicle to enter a main road from a side street (or site access) and attain the appropriate operating speed without significantly impacting the operating speed of an approaching vehicle. The minimum stopping sight and intersection sight distance requirements are provided in Table 7 for a design speed of 70 km/h (reflective of the 60 km/h speed limit). The available sight lines along Mapleview Drive West at the site access point are also provided in Table 7.

Table 7: Sight Line Assessment

LOCATION	DESIGN SPEED	STOPPING SIGHT DISTANCE	INTERSECTION SIGHT DISTANCE		AVAILABLE SIGHTLINES TO/FROM	
			Left Turn	Right Turn	North	South
site access	70 km/h	105 m	150 m	130 m	>200m	>200 m

As indicated, the available sight distances satisfy the minimum stopping and intersection sight distance requirements for the noted design speed. Thus, the available sight distances are considered appropriate.



5 Summary

Proposed Development

This study has addressed the transportation impacts associated with the proposed residential townhouse development located at 407-419 Mapleview Drive West in the City of Barrie. The development will consist of 88 townhouses. Upon completion, the development is expected to generate an additional 40 trips during the AM peak hour and 49 trips during the PM peak hour.

Transportation Impacts

The capacity of Mapleview Dr was reviewed under both existing and future traffic conditions. The street is currently operating below capacity and is expected to continue to operate below capacity through the 2028 horizon. As such, no improvements to the road network are required to accommodate the future traffic volumes.

The results of the operational analyses indicate that the site access point will provide good operations (LOS C or better) through the 2028 horizon under the future total conditions. Thus, no improvements are required to support the proposed development.

Overall, the subject site is not expected to have any material impact on the operations of the existing road network. This is not unexpected given the minimal volumes generated by the site.

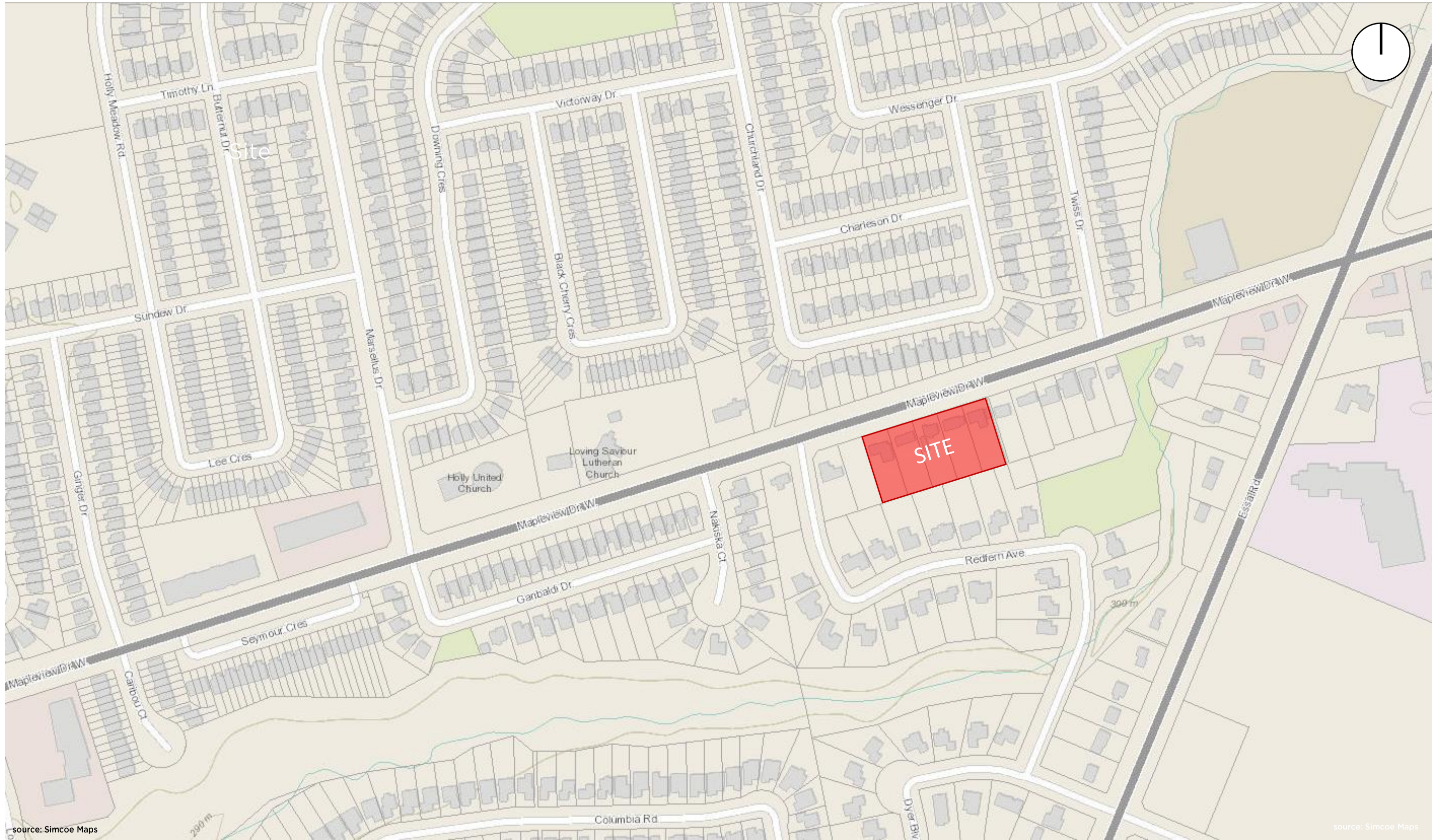
Turn Lane Requirements

Based on a review of the right and left turn volumes accessing the site, and in context of the projected volumes on Mapleview Drive West and MTO warrant criteria, exclusive right and left turn lanes on Mapleview Drive West to serve the site are not considered necessary.

Sight Line Assessment

The sight lines along Mapleview Drive West at the proposed access location were reviewed and determined to satisfy the TAC recommended guidelines for minimum stopping sight and intersection sight distances for a design speed of 70 km/h.





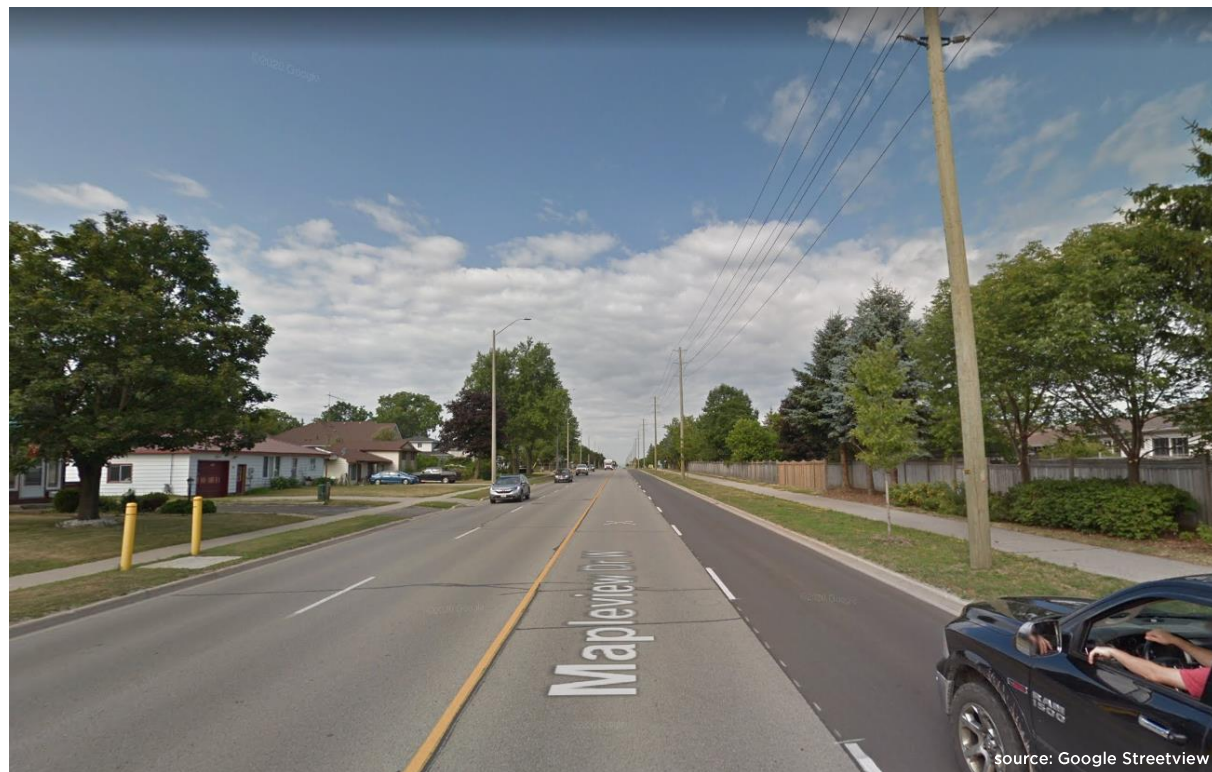
407-419 Maplevue Drive West

Figure 1: Site Location





Looking east along Maplevue Drive West from proposed access point



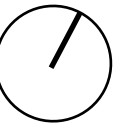
Looking west along Maplevue Drive West from proposed access point



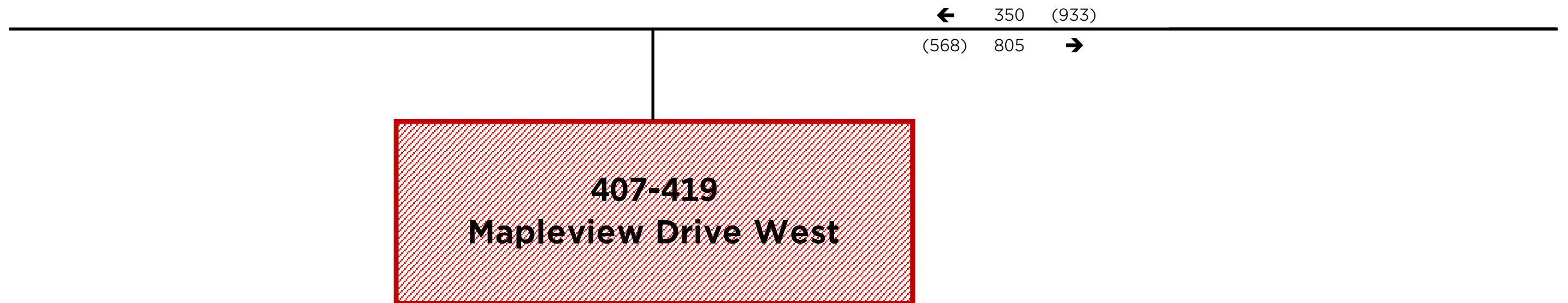
407-419 Maplevue Drive West

Figure 2: Area Road Network



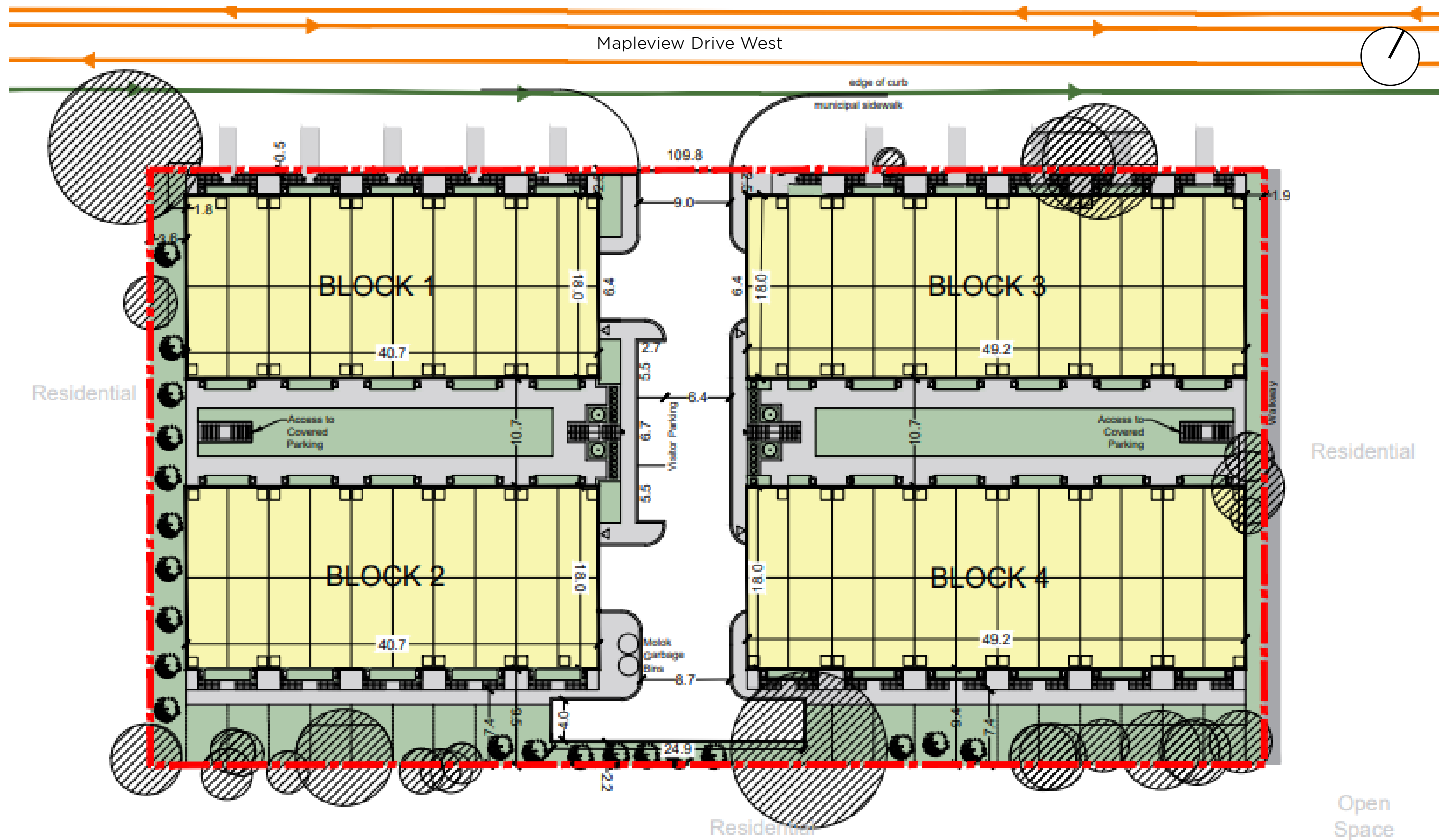


100 Weekday AM Peak Hour
(100) Weekday PM Peak Hour



407-419 Mapleview Drive West
Figure 3: 2020 Traffic Volumes

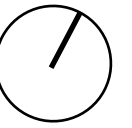




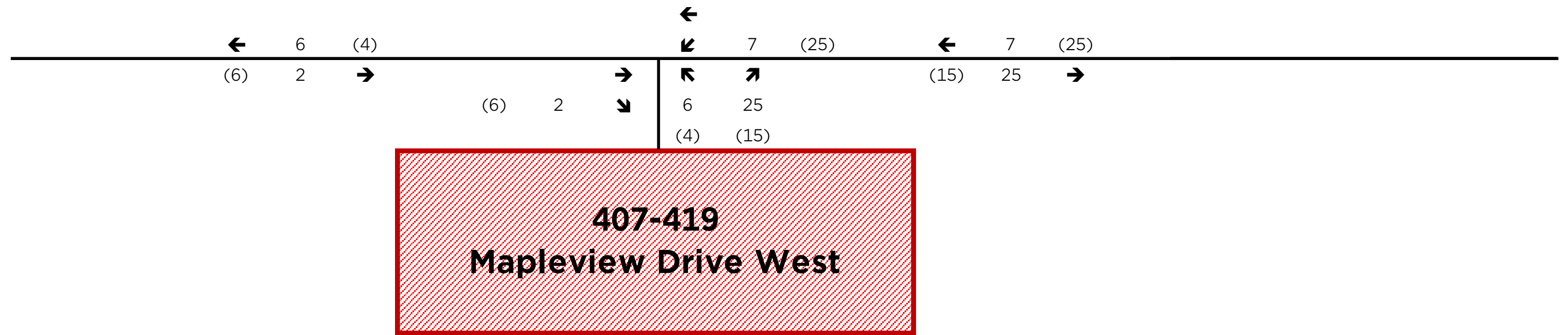
407-419 Maplevue Drive West

Figure 4: Site Plan



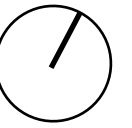


100 Weekday AM Peak Hour
(100) Weekday PM Peak Hour

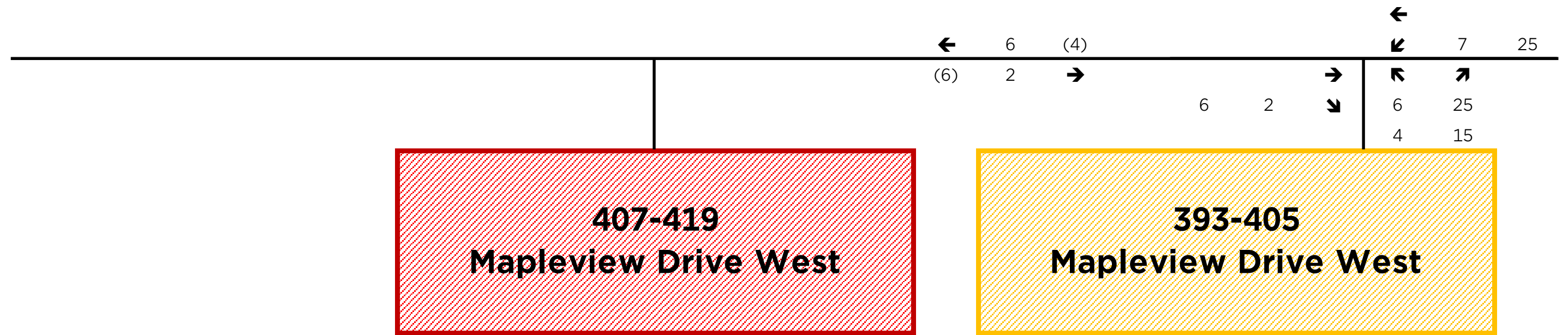


407-419 Maplevue Drive West
Figure 6: Site Traffic – 407-419 Maplevue Drive West



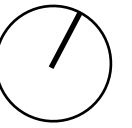


100 Weekday AM Peak Hour
(100) Weekday PM Peak Hour

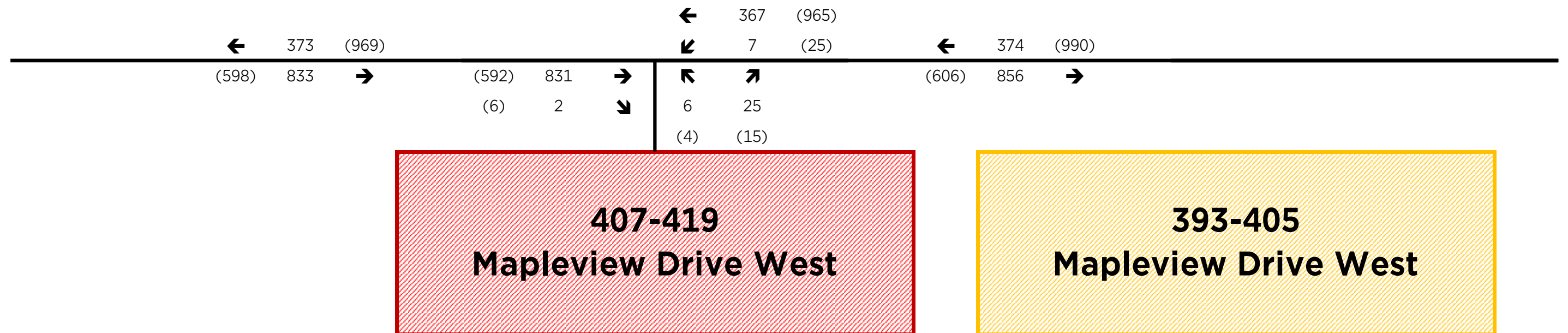


407-419 Maplevue Drive West
Figure 7: Background Development Traffic – 393-405 Maplevue Drive West



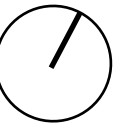


100 Weekday AM Peak Hour
(100) Weekday PM Peak Hour

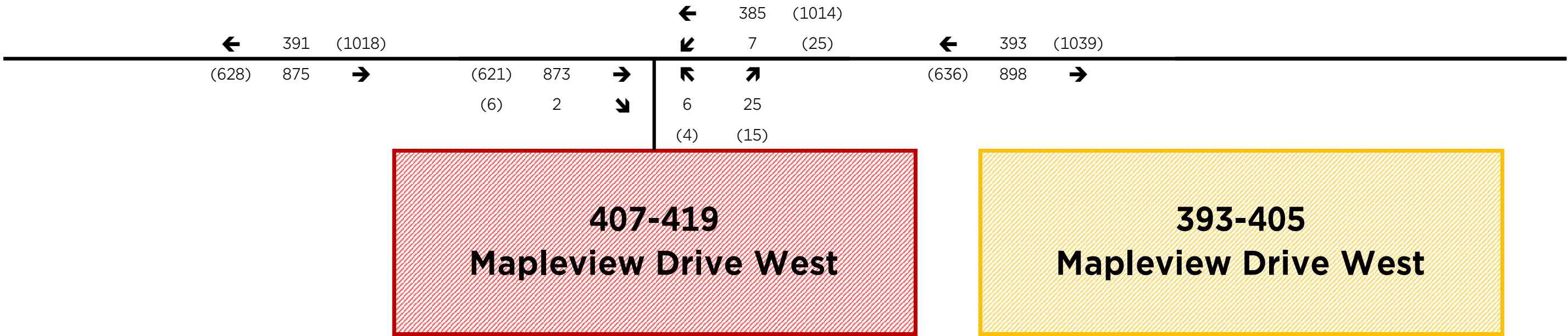


407-419 Maplevue Drive West
Figure 8: 2023 Total Traffic





100 Weekday AM Peak Hour
(100) Weekday PM Peak Hour



407-419 Mapleview Drive West
Figure 9: 2028 Total Traffic



Appendix A: Traffic Counts

Site ID Code:	
Intersection Location:	Mapleview Drive at Essa Road
Municipality:	Barrie, Ontario
Count Date:	Thursday, November 15, 2018
Weather and Temperature:	Partly Sunny, -4 Degrees
Surveyor:	TP

AM	NORTH APPROACH										Total	EAST APPROACH										Total	SOUTH APPROACH										Total	WEST APPROACH										Total	Grand Total
	CAR			TRUCKS			CYCLISTS			Peds		CAR			TRUCKS			CYCLISTS			Peds		CAR			TRUCKS			CYCLISTS			Peds													
	L	T	R	L	T	R	L	T	R			L	T	R	L	T	R	L	T	R			L	T	R	L	T	R	L	T	R														
7:00	22	39	22	1	1	1	0	0	0	1	87	6	37	5	2	1	0	0	0	1	52	13	24	33	0	0	0	0	0	0	0	70	5	123	9	1	2	0	0	0	0	0	140	349	
7:15	27	27	18	0	0	0	0	0	0	1	73	9	44	5	1	1	1	0	0	0	61	6	17	26	0	0	2	0	0	0	51	23	123	4	2	1	0	0	1	0	0	154	339		
7:30	31	44	27	1	1	2	0	0	0	0	106	15	52	11	2	4	0	0	0	0	84	9	30	33	0	0	0	0	0	0	73	21	169	2	0	1	0	0	0	0	0	193	456		
7:45	54	43	24	1	4	0	0	0	0	0	126	16	57	13	2	1	1	0	0	1	91	7	42	35	0	2	1	0	0	0	87	21	163	7	1	0	0	0	0	0	0	192	496		
8:00	25	46	17	2	2	2	0	0	0	1	95	26	52	7	3	2	2	0	0	0	92	11	34	31	1	4	4	0	0	0	85	21	165	11	0	2	1	0	0	0	0	200	472		
8:15	31	34	21	2	1	1	0	0	0	0	90	15	48	15	1	3	2	0	0	0	84	7	32	26	0	0	2	0	0	0	67	29	174	9	0	0	1	0	0	0	0	213	454		
8:30	26	41	18	0	4	0	0	0	0	0	89	10	72	14	1	0	0	0	0	0	98	9	42	37	0	3	2	0	0	0	93	33	144	12	0	6	1	0	0	0	0	196	476		
8:45	26	33	17	1	1	1	0	0	0	0	79	15	48	16	3	3	3	0	0	0	89	13	26	39	0	0	3	0	0	0	82	22	165	5	1	5	0	0	0	0	0	198	448		
MD																																													
11:00	29	22	13	0	0	0	0	0	0	0	64	24	75	25	2	3	0	0	0	0	129	9	28	19	0	0	1	0	0	0	57	17	103	5	3	1	0	0	0	0	0	129	379		
11:15	38	30	26	0	1	0	0	0	0	0	95	10	79	21	1	4	2	0	0	0	117	5	23	21	0	1	3	0	0	0	53	16	93	1	3	2	0	0	0	0	0	115	380		
11:30	39	26	27	1	1	0	0	0	0	0	94	18	97	21	4	1	0	0	0	0	141	11	26	20	0	3	2	0	0	0	63	14	111	4	0	4	0	0	0	0	0	133	431		
11:45	25	23	22	0	2	0	0	0	0	0	72	25	88	22	1	1	2	0	0	0	139	8	19	17	0	0	2	0	0	0	46	18	109	4	3	3	0	0	0	0	0	137	394		
12:00	22	36	25	1	1	0	0	0	0	2	87	22	78	39	2	1	1	0	0	0	143	7	32	28	0	4	1	0	0	0	72	17	96	4	2	1	0	0	0	0	0	120	422		
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12:30	28	25	27	2	1	0	0	0	0	0	83	17	95	21	2	2	1	0	0	0	138	9	20	20	1	0	2	0	0	0	52	15	96	3	2	1	0	0	0	0	0	117	390		
12:45	39	29	24	0	0	0	0	0	0	0	92	13	91	32	3	1	0	0	0	0	141	9	24	18	1	0	2	0	0	0	55	20	85	5	2	0	0	0	0	0	0	112	400		
13:00	30	27	16	1	0	1	0	0	0	0	75	27	107	34	0	4	0	0	0	0	172	6	19	26	0	1	1	0	0	0	54	15	95	0	0	2	0	0	0	0	0	112	413		
13:15	45	22	19	1	2	0	0	0	0	0	89	22	97	32	6	2	1	0	0	0	160	11	15	21	0	0	4	0	0	0	51	22	92	3	3	1	0	0	0	0	0	121	421		
13:30	27	32	22	1	0	0	0	0	0	1	83	25	117	36	3	2	1	0	0	0	184	3	16	21	0	2	0	0	0	0	43	13	100	3	0	3	0	0	0	0	0	119	429		
13:45	28	43	26	1	0	0	0	0	0	0	98	17	94	20	1	2	0	0	0	0	134	6	27	21	0	2	3	0	0	0	59	10	98	7	2	5	0	0	0	0	0	122	413		
PM																																													
15:00	24	39	23	1	0	0	0	0	0	0	87	24	140	47	2	4	0	0	0	0	217	7	29	25	0	2	3	0	0	0	67	22	89	6	0	3	0	0	0	0	0	120	491		
15:15	23	57	28	0	3	0	0	0	0	2	113	28	118	37	4	0	1	0	0	0	189	10	36	23	0	1	3	0	0	0	75	19	105	20	0	0	1	0	0	0	0	145	522		
15:30	28	58	24	1	0	0	0	0	0	2	113	25	145	31	0	0	1	0	0	0	202	15	50	32	1	4	1	0	0	0	103	24	124	4	0	3	1	0	0	0	0	156	574		
15:45	33	44	35	0	2	2	0	0	0	1	117	28	137	36	2	3	0	0	0	0	207	14	40	31	0	0	4	0	0	0	89	18	116	10	1	1	0	0	0	0	7	153	566		
16:00	24	37	44	2	0	3	0	0	0	2	112	22	116	73	0	4	0	0	0	0	215	14	45	30	0	0	0	0	0	0	89	25	103	6	0	3	0	0	0	0	4	141	557		
16:15	29	51	27	1	2	0	0	0	0	1	111	33	172	45	3	1	2	0	0	0	256	8	40	32	0	0	3	0	0	0	83	23	115	6	0	4	0	0	0	0	0	148	598		
16:30	25	39	37	0	1	0	0	0	0	0	102	34	165	54	0	2	1	0	0	0	256	22	66	24	0	0	3	0	0	0	116	26	133	10	0	1	0	0	0	0	0	170	644		
16:45	35	44	29	2	0	1	0	0	0	0	111	40	169	63	1	2	1	0	0	0	276	11	68	28	0	1	5	0	0	0	114	25	111	8	0	2	0	0	0	0	0	146	647		
17:00	34	49	35	0	0	0	0	0	0	0	118	37	190	63	1	0	0	0	0	0	291	19	74	29	0	0	2	0	0	0	125	22	108	6	0	1	0	0	0	0	0	137	671		
17:15	19	52	26	1	1	0	0	0	0	1	100	35	193	45	0	1	0	0	0	0	274	19	67	27	0	0	0	0	0	0	115	17	84	7	0	0	1	0	0	0	2	111	600		
17:30	25	54	44	0	0	0	0	0	0	0	123	31	197	55	1	0	0	0	0	0	285	20	55	26	0	3	2	0	0	0	106	22	101	5	0	0	0	0	0	0	0	128	642		
17:45	18	44	36	2	1	0	0	0	0	1	102	29	156	46	0	2	1	0	0	0	234	15	34	16	0	0	2	0	0	0	67	21	105	7	0	1	0	0	0	0	1	135	538		



Turning Movement Count Diagram

Intersection: Mapleview Drive at Essa Road

Municipality: Barrie, Ontario

Intersection ID:

Date: Thursday, November 15, 2018

AM Peak Hour: 7:45 to 8:45

MD Peak Hour: 13:00 to 14:00

Essa Road									
North Total 718						East Total 1297			
North Entering 399	Cyclists	0	0	0		East Entering 364			
North Receiving 319	Truck	3	11	5		East Receiving 933			
North Peds 1	Cars	80	164	136		East Peds 1			
Mapleview Drive		↙	↓	↘					
	0	1	104	↗		↗	49	5	1
	0	8	646	→		←	229	6	0
	0	3	39	↘		↘	67	7	0
			↙	↑	↘				
West Total 1154			34	150	129	South Total 623			
West Entering 801		1	9	9		South Entering 332			
West Receiving 353		0	0	0		South Receiving 291			
West Peds 0						South Peds 0			

Essa Road													
North Total 615							East Total 1277						
North Entering 344		Cyclists	0	0	0	East Entering 650							
North Receiving 271		Truck	1	2	4	East Receiving 627							
North Peds 1		Cars	83	124	130	East Peds 0							
			⬅	⬇	➡								
Mapleview Drive	0	5	60	↗						↖	122	2	0
	0	11	385	➡						⬅	415	10	0
	0	0	13	⬇						↘	91	10	0
			⬅	⬆	➡								
West Total 1009				26	77	89	South Total 445						
West Entering 474				0	5	8	South Entering 205						
West Receiving 535				0	0	0	South Receiving 240						
West Peds 0				South Peds 2									

PM Peak Hour: 16:30 to 17:30

Total 8-Hour Count

Essa Road									
North Total 1023							East Total 1771		
North Entering 430	Cyclists	0	0	0				East Entering 1097	
North Receiving 593	Truck	1	2	3				East Receiving 674	
North Peds 1	Cars	127	184	113				East Peds 0	
Mapleview Drive		↙	↓	↘					
	0	0	90	↗				↖	225 2 0
	0	4	436	→				←	717 5 0
	0	1	31	↘				↙	146 2 0
				↙	↑	↘			
West Total 1483				71	275	108	South Total 831		
West Entering 562				0	1	10	South Entering 465		
West Receiving 921				0	0	0	South Receiving 366		
West Peds 2							South Peds 5		

Essa Road									
North Total 5901							East Total 10901		
North Entering 3036		Cyclists	0	0	0	East Entering 5286			
North Receiving 2865		Truck	14	33	27	East Receiving 5615			
North Peds 16		Cars	817	1216	929	East Peds 7			
Mapleview Drive	0	28	635	↙		↗	1007	25	1
	1	59	3706	→		←	3417	57	0
	0	6	194	↘		↖	723	56	0
West Total 9278				340	1134	827	South Total 4634		
West Entering 4629			4	35	66	South Entering 2406			
West Receiving 4649			0	0	0	South Receiving 2228			
West Peds 14						South Peds 14			

Appendix B: Intersection Operations

HCM Unsignalized Intersection Capacity Analysis

4: Site Access & Mapleview Drive West

2023 Total Conditions

AM peak

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	831	2	7	367	6	25
Future Volume (Veh/h)	831	2	7	367	6	25
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)	903	2	8	399	7	27
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	905			1120	452	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	905			1120	452	
tC, single (s)	4.1			6.8	6.9	
tC, 2 stage (s)						
tF (s)	2.2			3.5	3.3	
p0 queue free %	99			96	95	
cM capacity (veh/h)	747			198	554	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	
Volume Total	602	303	141	266	34	
Volume Left	0	0	8	0	7	
Volume Right	0	2	0	0	27	
cSH	1700	1700	747	1700	405	
Volume to Capacity	0.35	0.18	0.01	0.16	0.08	
Queue Length 95th (m)	0.0	0.0	0.3	0.0	2.2	
Control Delay (s)	0.0	0.0	0.7	0.0	14.7	
Lane LOS	A			B		
Approach Delay (s)	0.0	0.2			14.7	
Approach LOS	B					
Intersection Summary						
Average Delay	0.4					
Intersection Capacity Utilization	33.0%			ICU Level of Service		A
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis

4: Site Access & Mapleview Drive West

2023 Total Conditions

PM peak

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	592	6	25	965	4	15
Future Volume (Veh/h)	592	6	25	965	4	15
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)	643	7	27	1049	4	16
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume				650	1225	325
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol				650	1225	325
tC, single (s)				4.1	6.8	6.9
tC, 2 stage (s)						
tF (s)				2.2	3.5	3.3
p0 queue free %				97	98	98
cM capacity (veh/h)				932	166	671
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	
Volume Total	429	221	377	699	20	
Volume Left	0	0	27	0	4	
Volume Right	0	7	0	0	16	
cSH	1700	1700	932	1700	417	
Volume to Capacity	0.25	0.13	0.03	0.41	0.05	
Queue Length 95th (m)	0.0	0.0	0.7	0.0	1.2	
Control Delay (s)	0.0	0.0	0.9	0.0	14.1	
Lane LOS				A	B	
Approach Delay (s)	0.0	0.3		14.1		
Approach LOS				B		
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization			54.6%		ICU Level of Service	
Analysis Period (min)			15			
			A			

HCM Unsignalized Intersection Capacity Analysis

4: Site Access & Mapleview Drive West

2028 Total Conditions

AM peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑			↑↑	↘	↗
Traffic Volume (veh/h)	873	2	7	385	6	25
Future Volume (Veh/h)	873	2	7	385	6	25
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)	949	2	8	418	7	27
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			951		1175	476
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			951		1175	476
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		96	95
cM capacity (veh/h)			718		182	536
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	
Volume Total	633	318	147	279	34	
Volume Left	0	0	8	0	7	
Volume Right	0	2	0	0	27	
cSH	1700	1700	718	1700	383	
Volume to Capacity	0.37	0.19	0.01	0.16	0.09	
Queue Length 95th (m)	0.0	0.0	0.3	0.0	2.3	
Control Delay (s)	0.0	0.0	0.7	0.0	15.3	
Lane LOS			A		C	
Approach Delay (s)	0.0		0.2		15.3	
Approach LOS					C	
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization			34.2%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

4: Site Access & Mapleview Drive West

2028 Total Conditions

PM peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑			↑↑	↘	↗
Traffic Volume (veh/h)	621	6	25	1014	4	15
Future Volume (Veh/h)	621	6	25	1014	4	15
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)	675	7	27	1102	4	16
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			682		1284	341
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			682		1284	341
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		97	98
cM capacity (veh/h)			907		152	655
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	
Volume Total	450	232	394	735	20	
Volume Left	0	0	27	0	4	
Volume Right	0	7	0	0	16	
cSH	1700	1700	907	1700	394	
Volume to Capacity	0.26	0.14	0.03	0.43	0.05	
Queue Length 95th (m)	0.0	0.0	0.7	0.0	1.3	
Control Delay (s)	0.0	0.0	0.9	0.0	14.6	
Lane LOS			A		B	
Approach Delay (s)	0.0		0.3		14.6	
Approach LOS					B	
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization			56.0%		ICU Level of Service	B
Analysis Period (min)			15			

Intersection: 4: Site Access & Mapleview Drive West

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (m)	6.7	14.8
Average Queue (m)	0.4	6.3
95th Queue (m)	3.3	13.7
Link Distance (m)	615.2	46.7
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 0

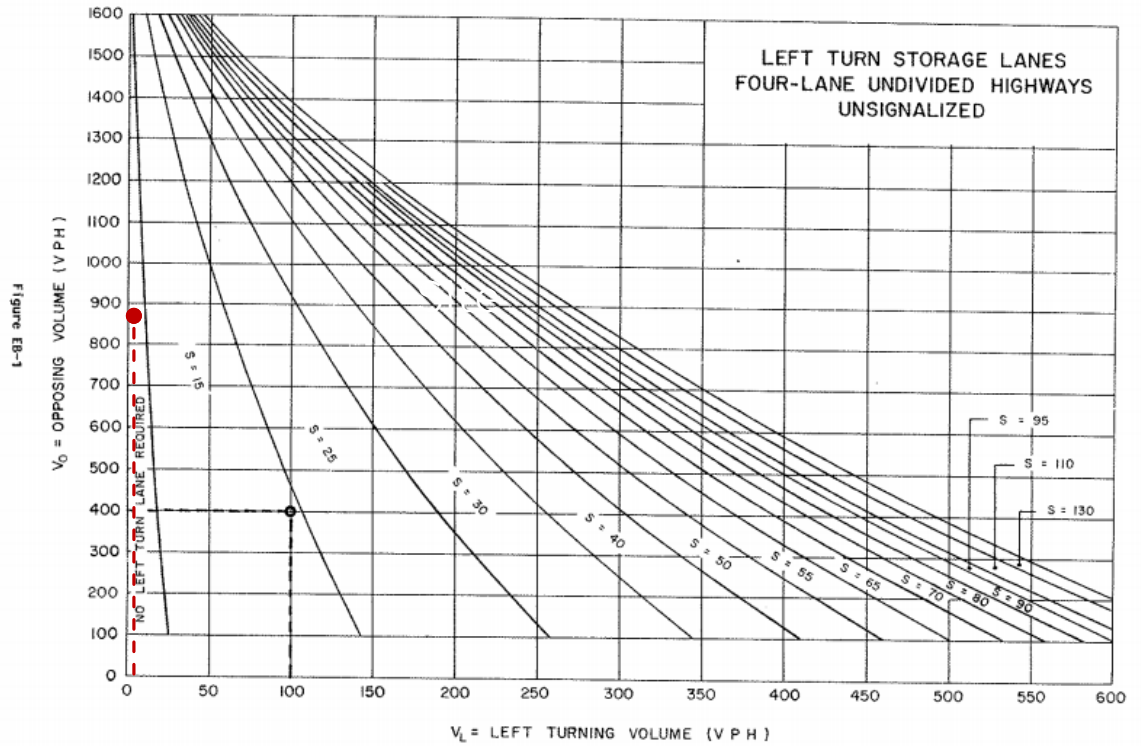
Intersection: 4: Site Access & Mapleview Drive West

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (m)	21.9	13.7
Average Queue (m)	3.6	3.6
95th Queue (m)	13.4	11.0
Link Distance (m)	621.0	46.7
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

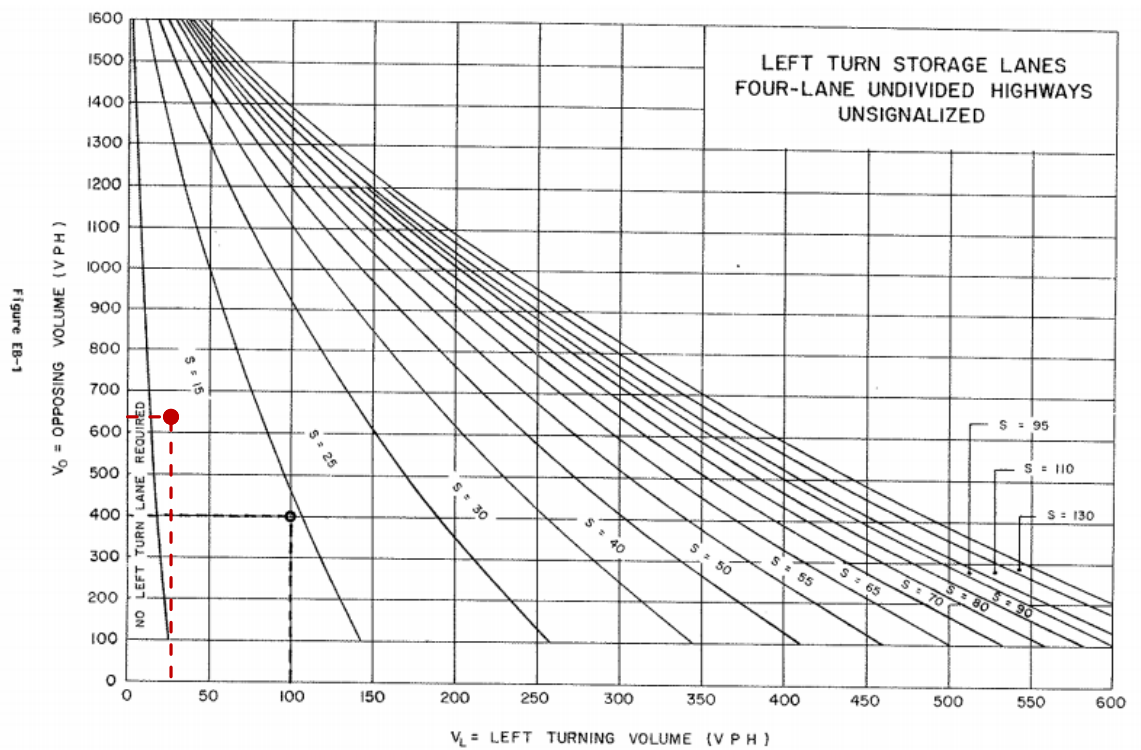
Network Summary

Network wide Queuing Penalty: 0

Appendix C: Turn Lane Warrants



Left Turn Lane Warrant: 2028 AM Peak Hour



Left Turn Lane Warrant: 2028 PM Peak Hour

407-419 Mapleview Drive West
Appendix C: Left Turn Warrant - 2028 Horizon

