7302 Kalar Road Traffic Impact Study Report

Niagara Falls, Ontario

Project Number: PTRAN2023024

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1.0 Introduction

TraffMobility Engineering Inc. ("TraffMobility") was retained to undertake a Traffic Impact Study as part of the development application for the proposed development at 7302 Kalar Road in the City of Niagara of Falls ("City"), Ontario. The study scope was discussed and confirmed with City staff.

1.1 Study Area

The subject site is located on the east side of Kalar Road approximately 65 metres south of McLeod Road. The site location is shown in **Figure 1**.

Figure 1: Site Location and Study Intersection

The study area for the analysis includes the following key intersections:

- Kalar Road at McLeod Road; and,
- Kalar Road at Site Access

1.2 Study Methodology

The study assessed traffic operations under existing (2023) conditions and the following future horizon years:

- Future (2025) Background Conditions (Opening Year)
- Future (2030) Background Conditions (5 Years Post Opening)
- Future (2025) Total Conditions (Opening Year)
- Future (2030) Total Conditions (5 Years Post Opening)

Intersection operations were assessed using the Synchro 11 software which utilizes the Highway Capacity Manual (HCM) methodology published by the Transportation Research Board National Research Council. Synchro 11 can analyze both signalized and unsignalized intersections in a road corridor or network considering the spacing, interaction, queues, and operations between intersections.

Intersection operations performance metrics are reported in terms of Level of Service (LOS), volume to capacity (v/c) ratios, and 95th percentile queues. Level of Service is based on the average control delay per vehicle for a given movement. Delay is an indicator of how long a vehicle must wait to complete a movement and is represented by a letter between 'A' and 'F', with 'F' being the longest delay. **Table 1** summarizes the LOS criteria for signalized and unsignalized intersections.

Table 1: Intersection Level of Service Criteria

	Average Control Delay per Vehicle (second / vehicle)	
Level of Service	**Signalized Intersection**	**Unsignalized Intersection**
A	≤ 10	≤ 10
B	>10 and ≤ 20	>10 and ≤ 15
C	> 20 and ≤ 35	> 15 and ≤ 25
D	> 35 and ≤ 55	> 25 and ≤ 35
E	> 55 and ≤ 80	> 35 and ≤ 50
F	> 80	> 50

The following Synchro parameter used in the analysis is based on "*City of Niagara Falls Guidelines for the Preparation of Transportation Impact Studies and Site Plan Review*":

- Ideal Saturated Flow: 1750 vphpl

A compound growth rate of 2% per annum was used in the analysis to estimate future traffic volumes. The growth rate was confirmed with City staff.

For the purposes of the traffic analysis, critical movements were identified based on the following criteria as outlined in the City's TIS guidelines:

- *Signalized intersections:*
  - *"Volume to capacity (v/c) ratios for overall intersection operations, through movements, shared through/turning movements increased to 0.85 or above"*
  - *"v/c ratios for exclusive left turn or right turn movements increased to 0.95 or above.*
  - *95th percentile queues for an individual movement are projected to exceed available turning lane storage."*
- *Unsignalized intersections:*
  - *"Level of service (LOS), based on average delay per vehicle, on individual movements exceeds LOS 'E'".*

- *"The estimated 95th percentile queue length for an individual movement exceeds the available queue storage."*

1.3 Data Collection

The existing turning movement count for the intersection of Kalar Road / McLeod Road was provided by the City and the signal timing plan for this intersection was obtained from Niagara Region ("Region"). The existing turning movement count and signal timing plan are provided in **Appendix A**.

2.0 Existing Conditions

Traffic operations under existing conditions were analyzed for the weekday AM and weekday PM peak hours using the Synchro 11 software.

2.1 Existing Intersection Operations

Existing intersection operations were analyzed using the lane configurations illustrated in **Figure 2** and the existing (2023) traffic volumes shown in **Figure 3**. A peak hour factor of 0.92 was used in analysis for the weekday AM and weekday PM peak hours based on the Region's "*Guidelines for Transportation Impact Studies*". The analysis results are provided in **Table 2** and detailed calculations are provided in **Appendix B**.

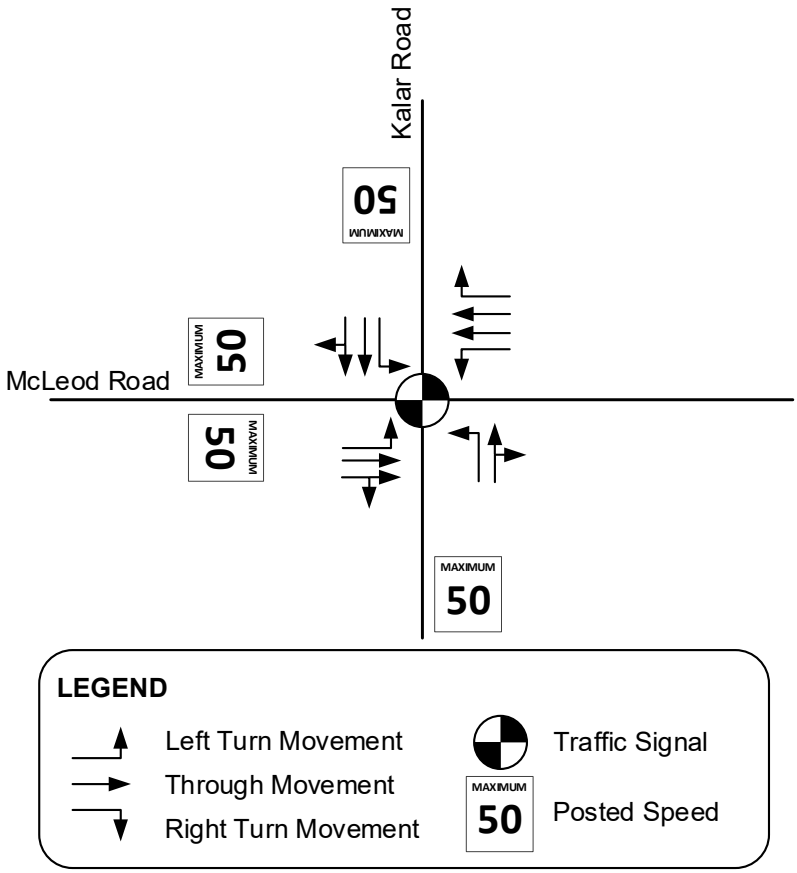


Figure 2: Existing Intersection Lane Configuration

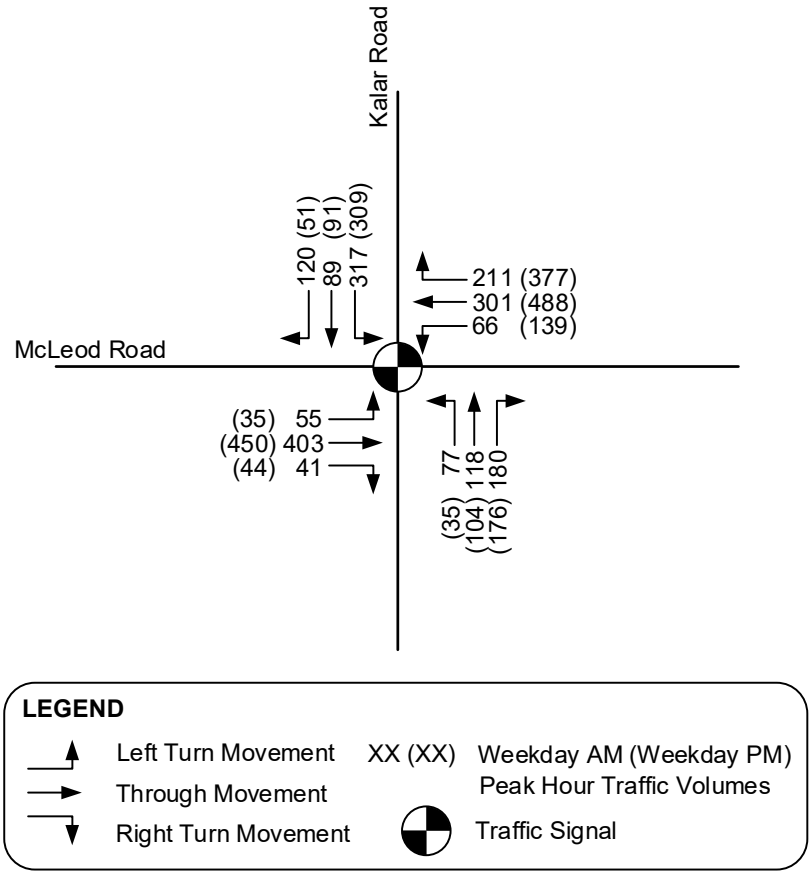


Figure 3: Existing (2023) Traffic Volumes

Table 2: Existing Conditions Intersection Operations

Intersection / Movement	AM Peak Hour				PM Peak Hour				Available Storage (m)
	LOS	Delay (s)	v/c ratio	95th Percentile Queue (m)	LOS	Delay (s)	v/c ratio	95th Percentile Queue (m)	
Kalar Road at McLeod Road (Signalized)									
Overall	C	20	0.69	-	C	22	0.74	-	-
EBL	B	17	0.20	15	B	15	0.14	10	70
EBTR	B	19	0.48	48	B	17	0.44	50	>300
WBL	C	25	0.46	26	C	32	0.69	50	90
WBT	C	24	0.50	42	C	23	0.58	62	>300
WBR	C	22	0.16	19	C	21	0.28	23	50
NBL	C	21	0.31	25	C	22	0.16	14	60
NBTR	C	28	0.71	71	C	30	0.67	68	>200
SBL	B	16	0.71	71	B	20	0.73	82	190
SBTR	A	9	0.11	12	B	11	0.09	12	>300

Note: LOS – level of service, v/c ratio – volume to capacity ratio

The analysis results in **Table 2** indicate that all movements at the study intersections are operating with acceptable level of service and residual capacity during the weekday AM, and weekday PM peak hours under existing conditions. Moreover, the analysis results indicate that the 95th percentile queues can be accommodated within the available storage under existing conditions.

2.2 Pedestrian and Cyclist Infrastructure

Currently, continuous sidewalks are provided on both sides of Kalar Road and on the north side of McLeod Road. Also, sidewalks are provided on one side of the local roads in the vicinity of the subject site. Moreover, dedicated bike lanes are provided on both sides along Kalar Road north of McLeod Road as shown in **Figure 4**.

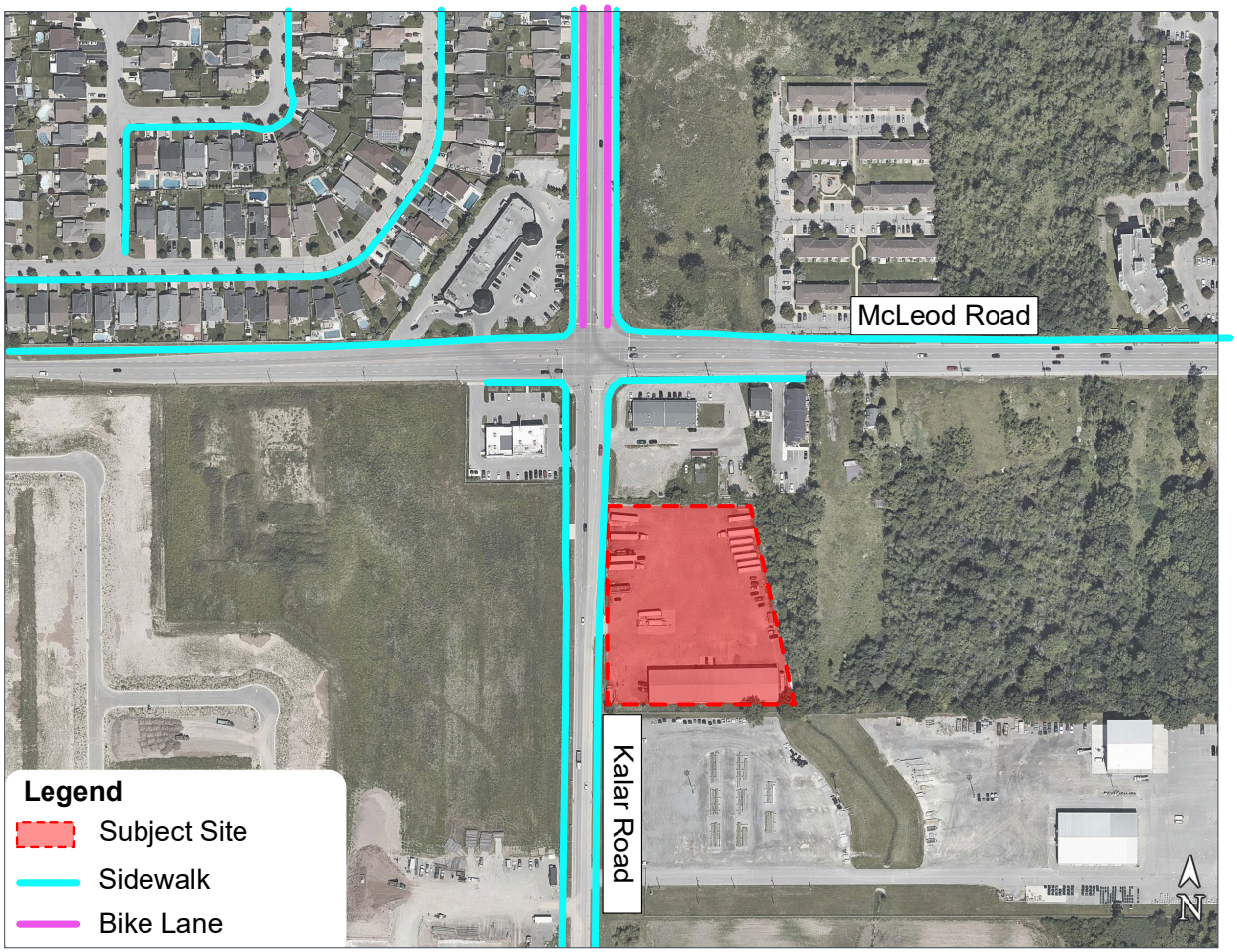


Figure 4: Existing Active Transportation Facilities

2.3 Transit Services

The subject site is well-served by public transit provided by Niagara Region Transit. The nearest bus stops are located on Kalar Road and McLeod Road close to the intersection within 250 metres from the subject site. The bus routes within the study area as shown in **Figure 5** are:

- Route 105 which operates with a service headway of thirty (30) minutes during the morning and afternoon peak periods.
- Route 113 which operates with a service headway of sixty (60) minutes during the morning and afternoon peak periods.

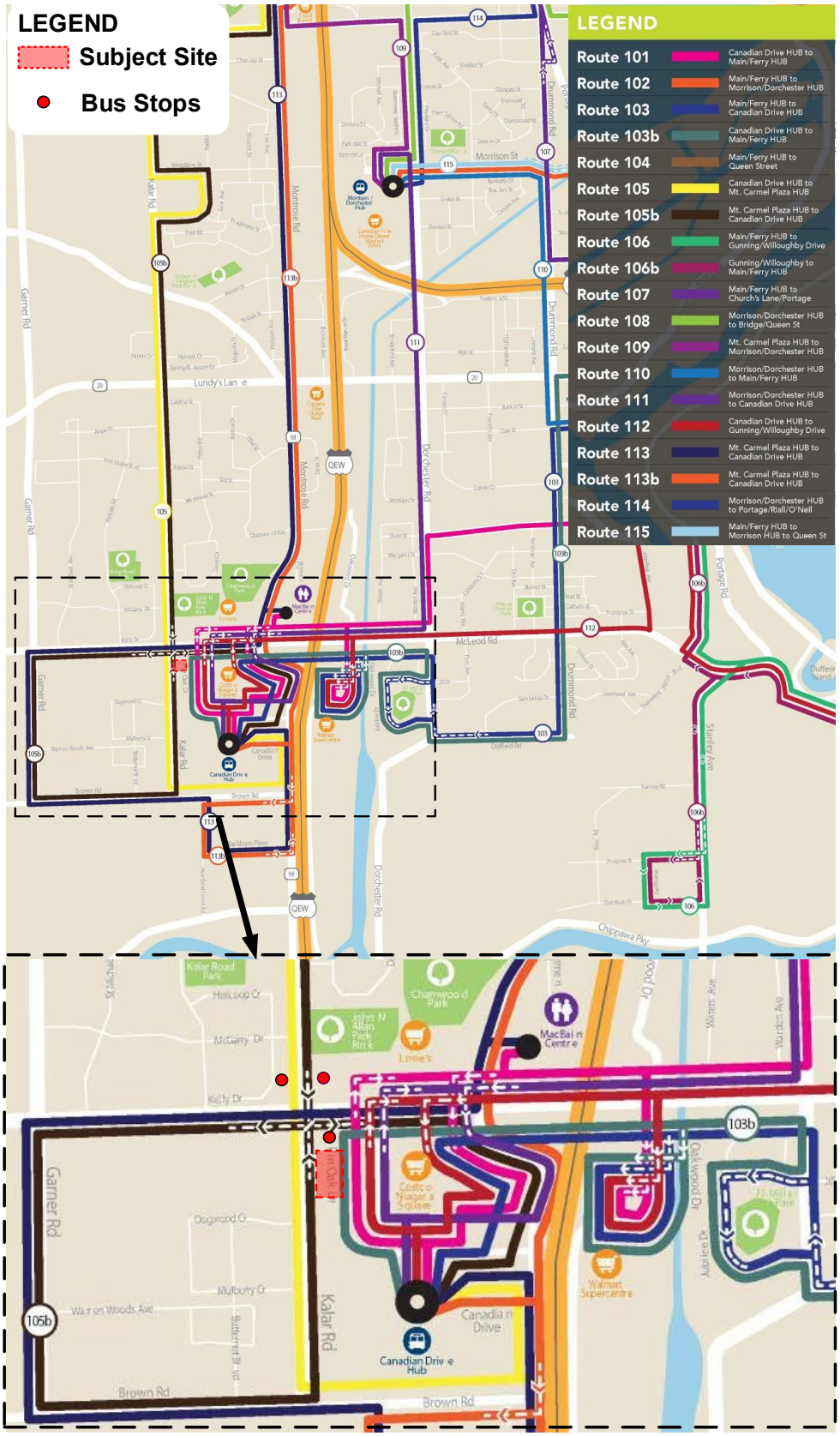


Figure 5: Existing Transit Service

3.0 Future Background Conditions

The future 2025 and 2030 horizon years were selected and confirmed with City staff. The future background conditions assessment is based on projected background growth and transportation improvements planned for the study area corresponding to the horizon year, if applicable. Traffic operations under future background conditions were analyzed for the weekday AM and weekday PM peak hours using the Synchro 11 software.

3.1 Future Planned Transportation Improvements

It is noted that no roadway and/or intersection improvements are planned on Kalar Road and/or McLeod Road in the vicinity of the study area by the horizon year of 2030. However, it is noted that the City will be embarking on an Environmental Assessment (EA) Study for the segment of McLeod Road from Kalar Road to Thorold Townline.

3.2 Future Traffic Growth

Future background traffic through the study area consists of two components: traffic growth outside the study area and other development site traffic within the study area. A compound growth rate of 2% per annum was used in the analysis to estimate future traffic volumes. This growth rate was confirmed with City staff.

3.3 Future Background Developments

Based on consultations with City staff, the following background developments were identified and considered in the study:

- Splendour Subdivision
- 2 apartment buildings on the northeast corner of Kalar/McLeod
- Proposed townhouse development on the east side of Kalar Road, south of Mulberry Drive
- Proposed subdivision extending east from Kalar Road, opposite Elderberry Drive

The information regarding site generated trips from the background developments above were provided by City staff and the total site generated trips are shown in **Figure 6**.

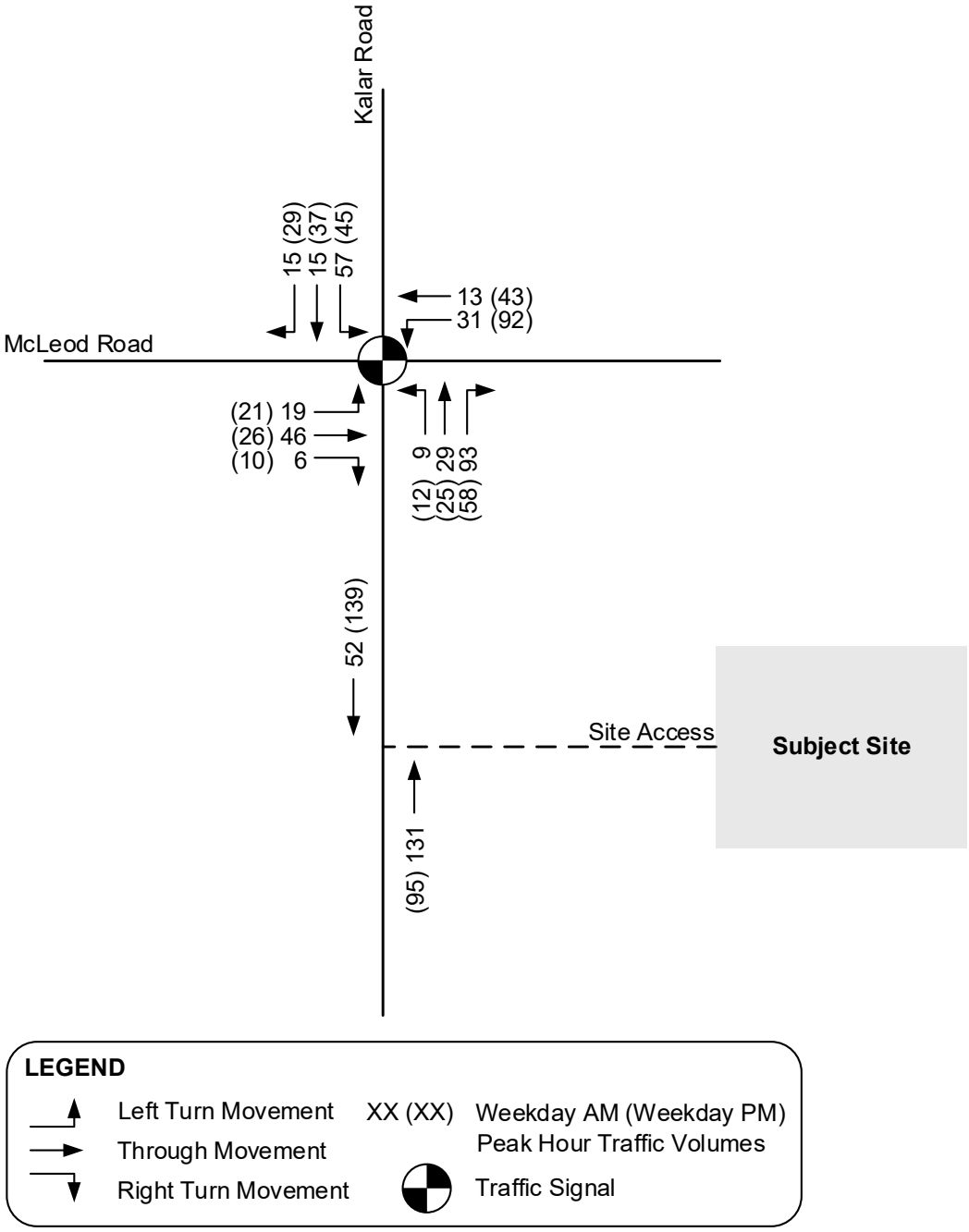


Figure 6: Total Background Developments Site Traffic

3.4 Future (2025) Background Intersection Operations

Future (2025) background traffic volumes were estimated using a compound growth rate of 2% per annum applied to the existing traffic volumes (**Figure 3**) plus the total site traffic from the other planned developments within the study area (**Figure 6**). The resulting future (2025) background traffic volumes are illustrated in **Figure 7**.

Future (2025) background intersection operations were analyzed using the existing lane configurations illustrated in **Figure 2** and the future (2025) background traffic volumes shown in **Figure 7**. The analysis results are provided in **Table 3** and detailed calculations are provided in **Appendix C**.

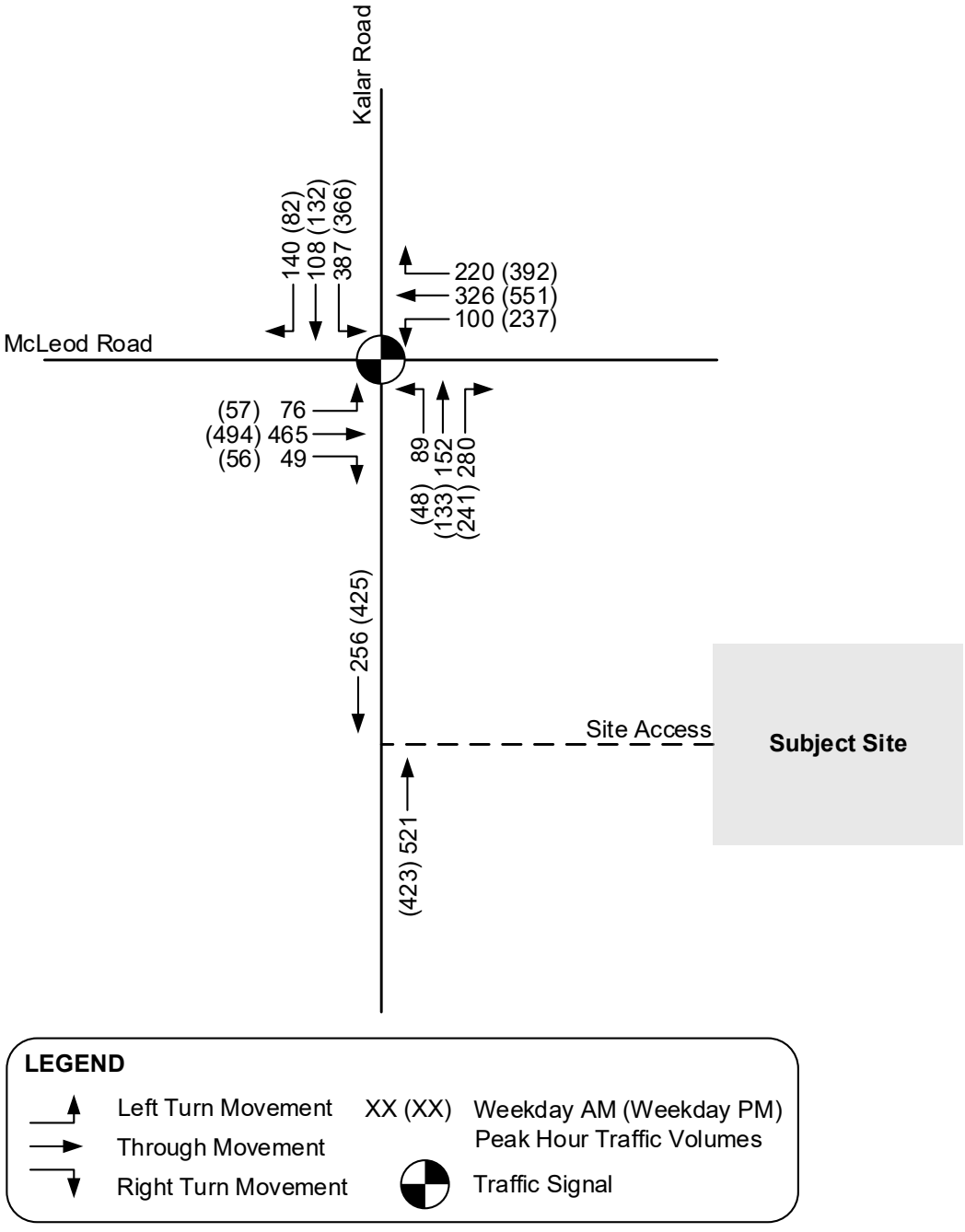


Figure 7: Future (2025) Background Traffic Volumes

Table 3: Future (2025) Background Conditions Intersection Operations

Intersection / Movement	AM Peak Hour				PM Peak Hour				Available Storage (m)
	LOS	Delay (s)	v/c ratio	95th Percentile Queue (m)	LOS	Delay (s)	v/c ratio	95th Percentile Queue (m)	
Kalar Road at McLeod Road (Signalized)									
Overall	D	39	**0.97**	-	D	49	**1.13**	-	-
EBL	C	20	0.26	20	B	16	0.20	16	70
EBTR	C	23	0.52	59	B	18	0.42	63	>300
WBL	D	42	0.69	41	**F**	99	**1.04**	**122**	90
WBT	C	30	0.50	47	C	25	0.54	80	>300
WBR	C	27	0.17	19	C	23	0.29	26	50
NBL	C	22	0.30	31	C	27	0.21	19	60
NBTR	D	41	**0.86**	143	D	49	**0.86**	101	>200
SBL	**F**	96	**1.11**	163	**F**	155	**1.24**	140	190
SBTR	B	11	0.13	16	B	16	0.14	17	>300

Note: LOS – level of service, v/c ratio – volume to capacity ratio

The analysis results in **Table 3** indicate that all movements at the Kalar Road at McLeod Road intersection are expected to operate with acceptable level of service and residual capacity during the weekday AM and weekday PM peak hours under future (2025) background conditions except for the following movements:

- Westbound left movement during the weekday PM peak hour.
- Northbound through-right and southbound left movements during both the weekday AM and weekday PM peak hours.

3.4.1 Proposed Mitigation Measures

Based on the analysis results provided in **Table 3**, the following mitigation measures are proposed under future (2025) background conditions at the Kalar Road at McLeod Road intersection:

- Increase the cycle length from 107.1 seconds to 140 seconds during the weekday AM and weekday PM peak hours.
- Add a dedicated northbound right turn lane from Kalar Road onto McLeod Road with a storage length of 60 metres.

The analysis results with mitigation are provided in **Table 4** and detailed calculations are provided in **Appendix C**.

Table 4: Future (2025) Background Conditions Intersection Operations with Mitigation

Intersection / Movement	AM Peak Hour				PM Peak Hour				Available Storage (m)
	LOS	Delay (s)	v/c ratio	95th Percentile Queue (m)	LOS	Delay (s)	v/c ratio	95th Percentile Queue (m)	
Kalar Road at McLeod Road (Signalized)									
Overall	C	25	0.65	-	C	26	0.84	-	-
EBL	C	21	0.29	25	B	13	0.18	13	70
EBTR	C	24	0.55	72	B	15	0.37	53	>300
WBL	D	39	0.67	44	D	41	0.83	90	90
WBT	C	28	0.49	52	B	20	0.43	64	>300
WBR	C	26	0.17	20	B	18	0.29	17	50
NBL	C	34	0.54	39	D	37	0.35	25	60
NBT	C	34	0.58	59	D	39	0.56	56	>200
NBR	C	35	0.59	59	D	38	0.48	48	60
SBL	B	14	0.60	91	D	40	0.85	157	190
SBTR	B	10	0.13	15	C	20	0.16	24	>300

Note: LOS – level of service, v/c ratio – volume to capacity ratio

3.5 Future (2030) Background Intersection Operations

Future (2030) background traffic volumes were estimated using a compound growth rate of 2% per annum applied to the existing traffic volumes (**Figure 3**) plus the total site traffic from the other planned developments within the study area (**Figure 6**). The resulting future (2030) background traffic volumes are illustrated in **Figure 8**.

Future (2030) background intersection operations were analyzed using the existing lane configurations illustrated in **Figure 2** and the future (2030) background traffic volumes shown in **Figure 8**. The analysis results are provided in **Table 5** and detailed calculations are provided in **Appendix D**.

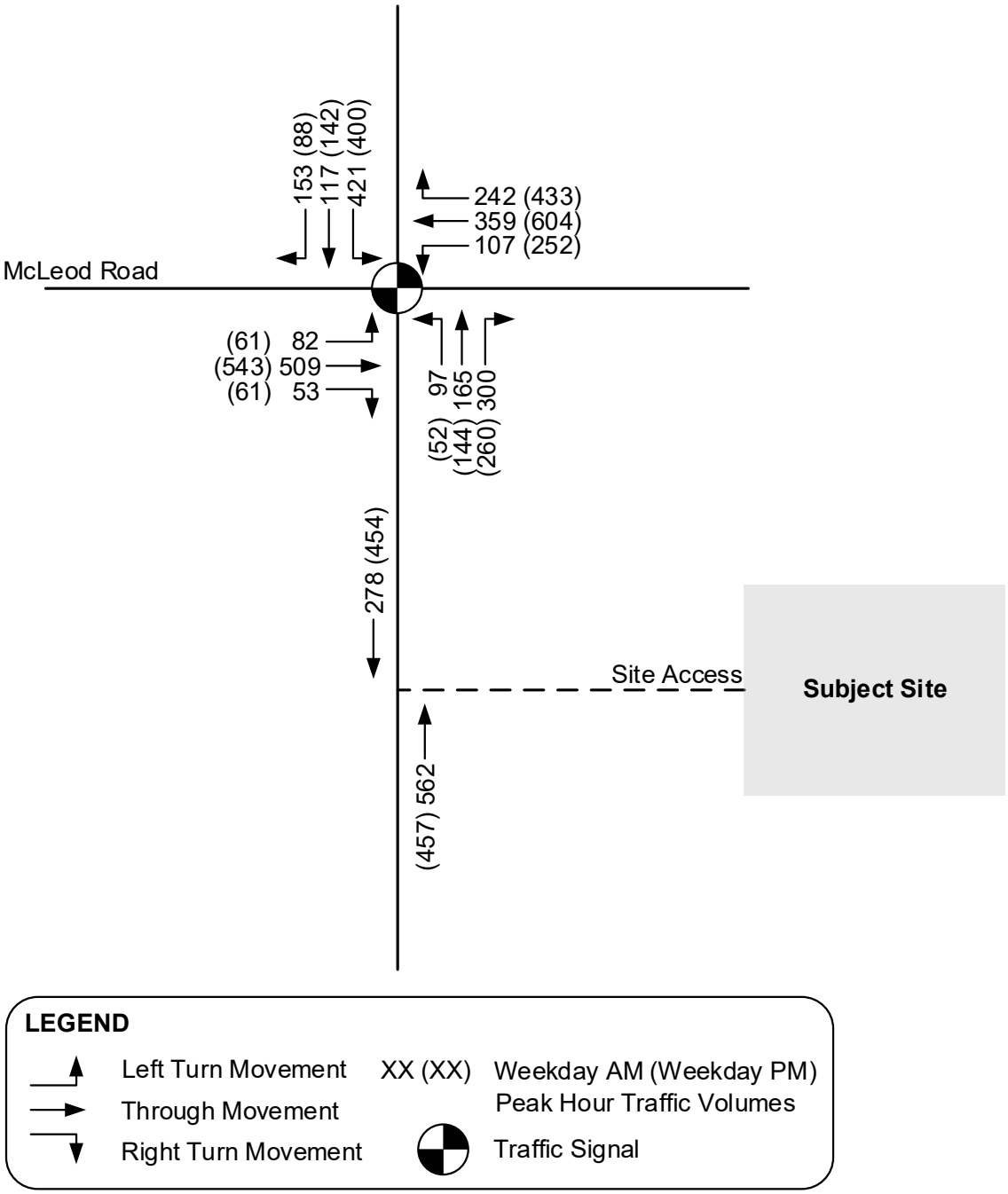


Figure 8: Future (2030) Background Traffic Volumes

Table 5: Future (2030) Background Conditions Intersection Operations

Intersection / Movement	AM Peak Hour				PM Peak Hour				Available Storage (m)
	LOS	Delay (s)	v/c ratio	95th Percentile Queue (m)	LOS	Delay (s)	v/c ratio	95th Percentile Queue (m)	
Kalar Road at McLeod Road (Signalized)									
Overall	D	53	**1.11**	-	E	64	**1.28**	-	-
EBL	C	21	0.29	22	B	18	0.24	17	70
EBTR	C	25	0.56	66	B	20	0.47	71	>300
WBL	D	49	0.74	48	F	159	**1.21**	**133**	90
WBT	C	31	0.53	52	C	28	0.61	89	>300
WBR	C	28	0.19	20	C	25	0.33	29	50
NBL	C	22	0.31	34	C	27	0.21	20	60
NBTR	D	45	**0.88**	162	D	50	**0.87**	122	>200
SBL	**F**	174	**1.30**	172	**F**	**218**	**1.39**	164	190
SBTR	B	12	0.14	16	B	16	0.15	18	>300

Note: LOS – level of service, v/c ratio – volume to capacity ratio

The analysis results in **Table 5** indicate that all movements at the Kalar Road and McLeod Road intersection are expected to operate with acceptable level of service and residual capacity during the weekday AM and weekday PM peak hours under future (2030) background conditions except for the following movements, similar to future (2025) background conditions:

- Westbound left movement during the weekday PM peak hour.
- Northbound through-right and southbound left movements during the weekday AM and weekday PM peak hours.

3.5.1 Proposed Mitigation Measures

Based on the analysis results provided in **Table 5**, in addition to the mitigation measures proposed under future (2025) background conditions, the following additional mitigation measures are proposed under future (2030) background conditions at the Kalar Road at McLeod Road intersection:

- Modify the westbound left turn phase from permissive to protected/permissive during the weekday PM peak hour.
- Increase the storage length for the dedicated northbound right turn lane from 60 metres to 70 metres.

The analysis results with mitigation are provided in **Table 6** and detailed calculations are provided in **Appendix D**.

Table 6: Future (2030) Background Conditions Intersection Operations with Mitigation

Intersection / Movement	AM Peak Hour				PM Peak Hour				Available Storage (m)
	LOS	Delay (s)	v/c ratio	95th Percentile Queue (m)	LOS	Delay (s)	v/c ratio	95th Percentile Queue (m)	
Kalar Road at McLeod Road (Signalized)									
Overall	C	26	0.72	-	C	30	0.82	-	-
EBL	C	21	0.31	25	C	24	0.26	17	70
EBTR	C	24	0.57	77	D	37	0.77	99	>300
WBL	D	38	0.68	46	C	26	0.73	61	90
WBT	C	28	0.48	55	C	24	0.53	82	>300
WBR	C	25	0.19	19	C	22	0.39	38	50
NBL	C	35	0.56	42	D	38	0.39	26	60
NBT	C	35	0.59	62	D	41	0.59	57	>200
NBR	D	38	0.66	68	D	41	0.57	54	70
SBL	B	18	0.70	111	C	32	0.81	132	190
SBTR	B	11	0.14	18	B	18	0.15	22	>300

Note: LOS – level of service, v/c ratio – volume to capacity ratio

4.0 Proposed Development

The proposed development will consist of two residential condominiums with a total of 412 units. A total of 518 parking spaces will be provided.

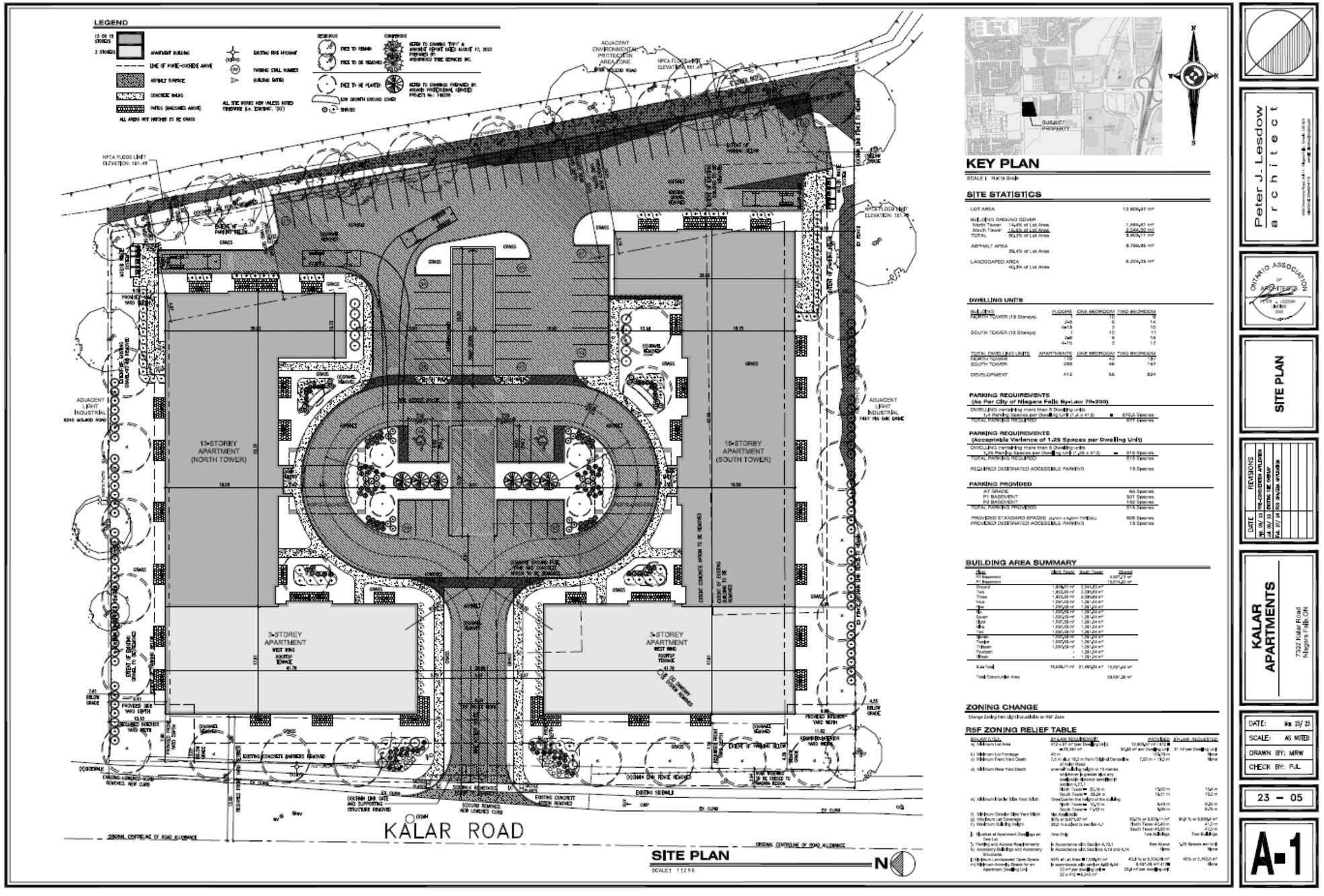


Figure 9: Site Concept Plan

4.1 Trip Generation

The estimates of trip generated by the proposed development are based on the Multifamily Housing (High-Rise) Land Use (LU Code 222) from the Institute of Transportation Engineers (ITE) publication, Trip Generation Manual, 11th Edition. The projected trip generation for the proposed development during the weekday AM and weekday PM peak hours are summarized in **Table 7**.

Table 7: Trip Generation Summary

ITE Land Use	Units	Parameter	AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Multifamily Housing (High-Rise) (LU 222)	412	Equation	T = 0.22(X) + 18.85			T = 0.26(X) + 23.12		
		Gross Trips	28	81	109	81	49	130
		Net Auto Trips	**28**	**81**	**109**	**81**	**49**	**130**

As detailed in **Table 7**, the proposed development is expected to generate 109 new auto trips during the weekday AM peak hour (28 trips in / 81 trips out) and 130 new auto trips during the weekday PM peak hour (81 trips in / 49 trips out).

4.2 Trip Distribution

The trip distribution for the proposed development is based on a combination of access to major transportation infrastructure and 2016 TTS study area origin-destination (O-D) patterns. The resulting trip distribution is summarized in **Table 8** and site generated trips are illustrated in **Figure 10**.

Table 8: Trip Distribution Summary

From / To	Via	Inbound	Outbound
North	Kalar Road	20%	20%
South	Kalar Road	10%	10%
East	McLeod Road	45%	45%
West	McLeod Road	25%	25%
Total		**100%**	**100%**

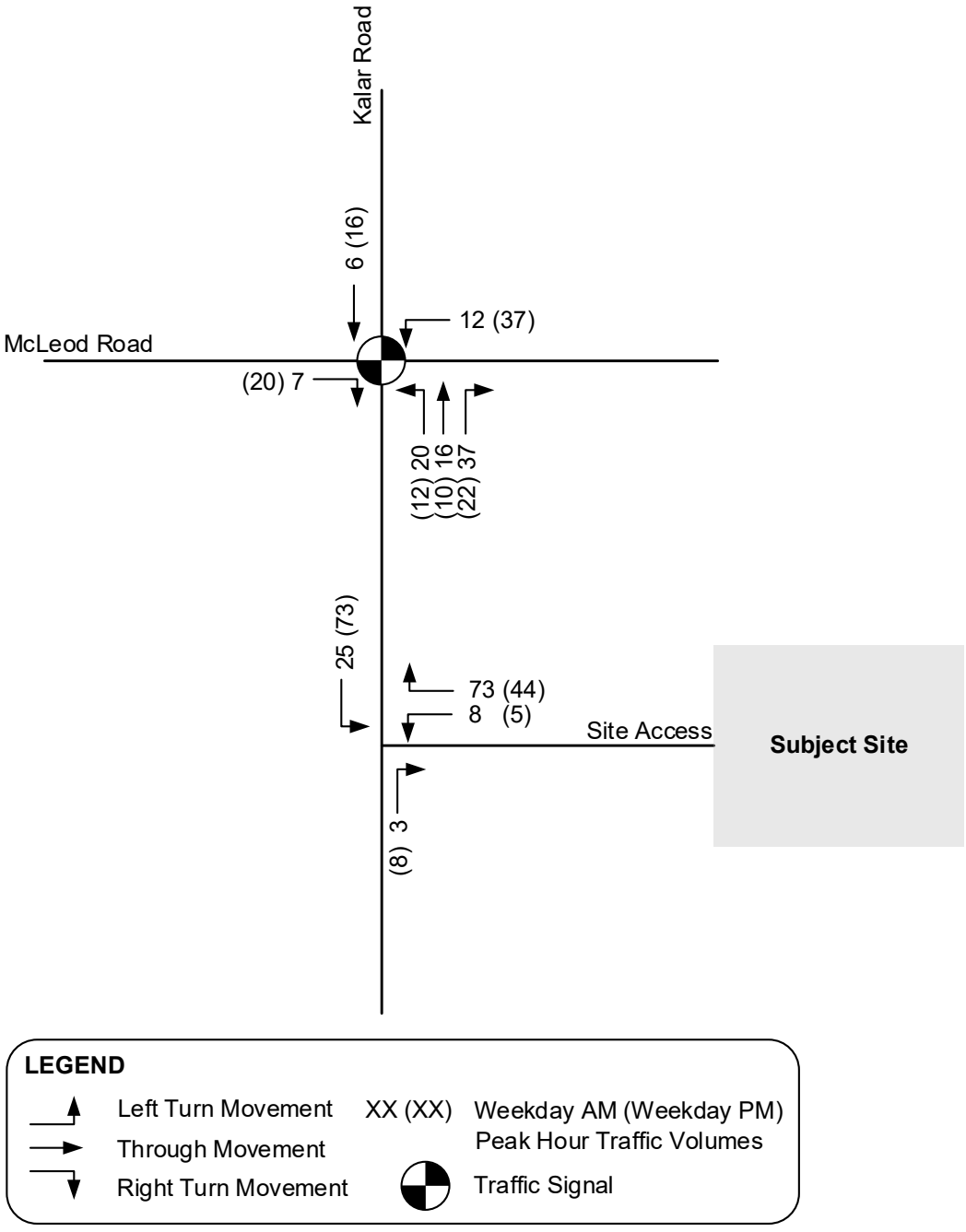


Figure 10: Site Traffic

5.0 Future Total Conditions

Traffic operations under future 2025 and 2030 total conditions were analyzed for the weekday AM and weekday PM peak hours using the Synchro 11 software. The traffic analysis and results for the future total conditions are discussed in this section.

5.1 Future (2025) Total Intersection Operations

Future (2025) total intersection operations were assessed using the future lane configurations illustrated in **Figure 11**. The future (2025) total traffic volumes were estimated by adding the site traffic (**Figure 10**) to the future (2025) background volumes (**Figure 7**) and the resulting future (2025) total traffic volumes are illustrated in **Figure 12**. The analysis results are provided in **Table 9** and detailed calculations are provided in **Appendix E**.

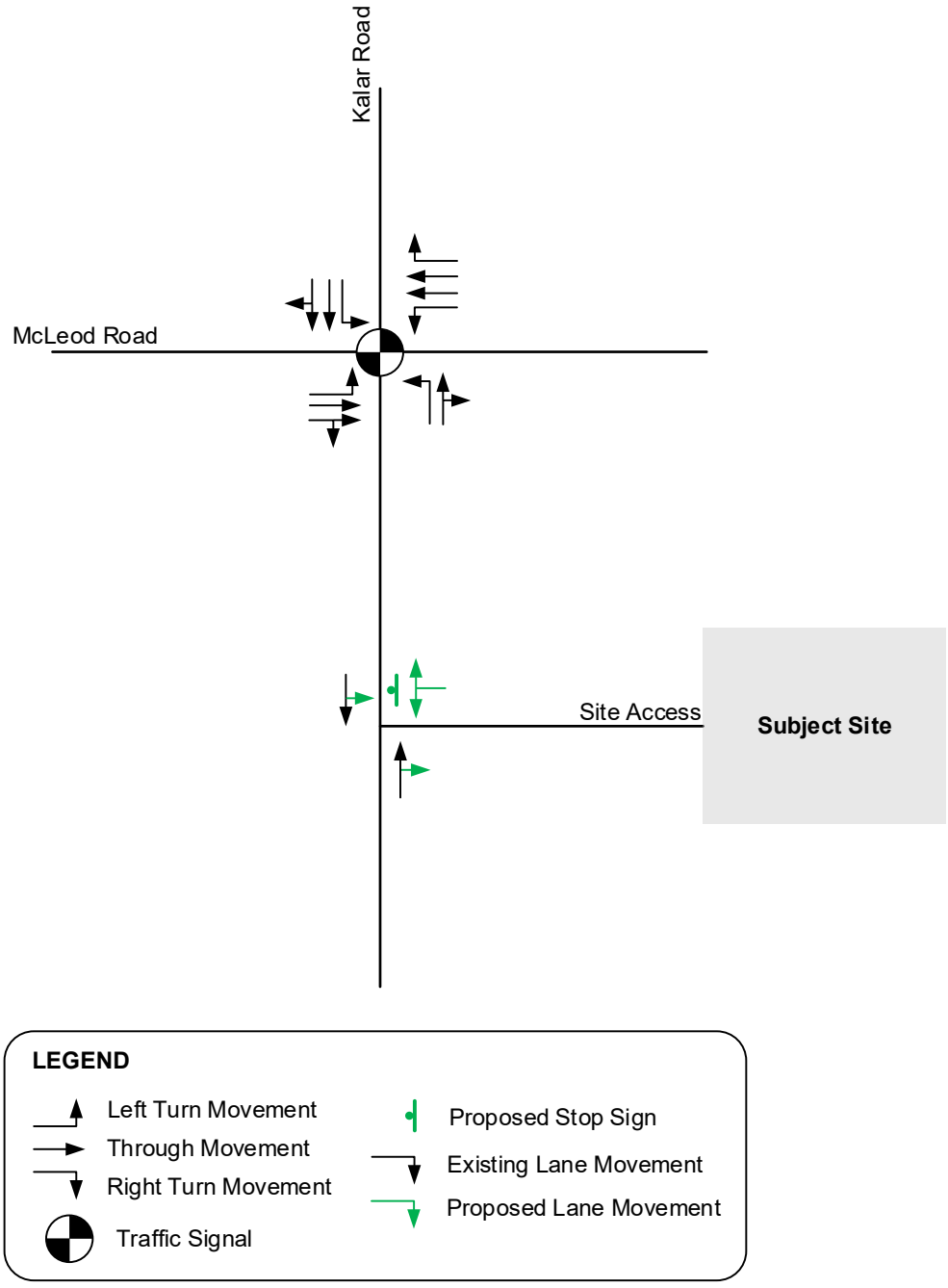


Figure 11: Future Intersection Lane Configuration

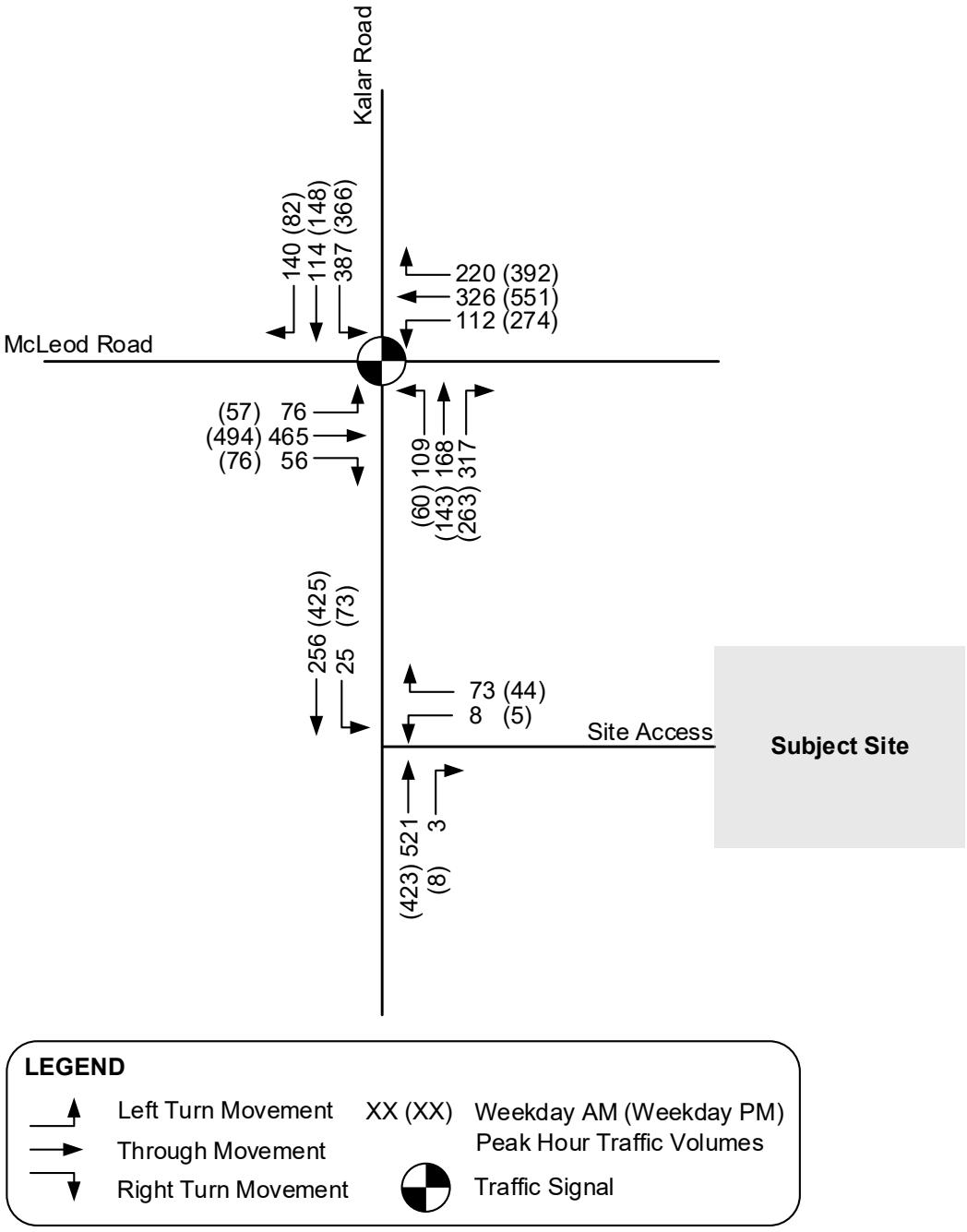


Figure 12: Future (2025) Total Traffic Volumes

Table 9: Future (2025) Total Conditions Intersection Operations

Intersection / Movement	AM Peak Hour				PM Peak Hour				Available Storage (m)
	LOS	Delay (s)	v/c ratio	95th Percentile Queue (m)	LOS	Delay (s)	v/c ratio	95th Percentile Queue (m)	
Kalar Road at McLeod Road (Signalized)									
Overall	D	48	**1.07**	-	E	60	**1.24**	-	-
EBL	C	22	0.27	20	B	17	0.21	16	70
EBTR	C	26	0.53	60	B	20	0.45	66	>300
WBL	D	53	0.77	49	**F**	180	**1.26**	**144**	90
WBT	C	32	0.49	47	C	27	0.56	80	>300
WBR	C	29	0.17	19	C	24	0.29	26	50
NBL	C	22	0.33	37	C	27	0.24	22	60
NBTR	D	45	**0.89**	173	D	50	**0.87**	122	>200
SBL	**F**	142	**1.22**	155	**F**	168	**1.28**	145	190
SBTR	B	12	0.13	16	B	16	0.15	18	>300
Kalar Road at Site Access (Unsignalized)									
WBLR	B	14	0.18	<7	B	13	0.10	<7	>200
SBTL	A	1	0.03	<7	A	2	0.07	<7	>200

Note: LOS – level of service, v/c ratio – volume to capacity ratio

The analysis results in **Table 9** indicate that all movements at the study intersections are expected to operate with acceptable level of service and residual capacity during the weekday AM and weekday PM peak hours under future (2025) total conditions except for the following movements similar to future (2025) background conditions at the Kalar Road at McLeod Road intersection:

- Westbound left movement during the weekday PM peak hour.
- Northbound through-right and southbound left movements during the weekday AM and weekday PM peak hours.

5.1.1 Proposed Mitigation Measures

Based on the analysis results provided in **Table 9**, in addition to the mitigation measures proposed under future (2025) background conditions, the following additional mitigation measures are proposed under future (2025) total conditions at the Kalar Road at McLeod Road intersection:

- Modify the westbound left turn phase from permissive to protected/permissive during the weekday PM peak hour.
- Increase the storage length for the dedicated northbound right turn lane from 60 metres to 75 metres, i.e., the site trips from the subject development require an additional 15 metres of storage in the northbound right turn lane needed for future (2025) background conditions.

The analysis results with mitigation are provided in **Table 10** and detailed calculations are provided in **Appendix E**.

Table 10: Future (2025) Total Conditions Intersection Operations with Mitigation

Intersection / Movement	AM Peak Hour				PM Peak Hour				Available Storage (m)
	LOS	Delay (s)	v/c ratio	95th Percentile Queue (m)	LOS	Delay (s)	v/c ratio	95th Percentile Queue (m)	
Kalar Road at McLeod Road (Signalized)									
Overall	C	26	0.68	-	C	27	0.81	-	-
EBL	C	22	0.29	26	C	23	0.23	14	70
EBTR	C	25	0.54	77	C	34	0.74	88	>300
WBL	D	42	0.71	51	C	24	0.74	57	90
WBT	C	29	0.45	54	C	22	0.47	66	>300
WBR	C	27	0.17	20	B	20	0.30	19	50
NBL	D	37	0.60	48	D	37	0.45	28	60
NBT	C	35	0.58	67	D	39	0.59	56	>200
NBR	D	39	0.68	75	C	34	0.20	25	75
SBL	B	16	0.63	100	C	29	0.78	120	190
SBTR	B	11	0.13	17	B	18	0.16	23	>300

Note: LOS – level of service, v/c ratio – volume to capacity ratio

5.2 Future (2030) Total Intersection Operations

Future (2030) total intersection operations were assessed using the future lane configurations illustrated in **Figure 11**. The future (2030) total traffic volumes were estimated by adding the site traffic (**Figure 10**) to future (2030) background volumes (**Figure 8**) and the resulting future (2030) total traffic volumes are illustrated in **Figure 13**. The analysis results are provided in **Table 11** and detailed calculations are provided in **Appendix F**.

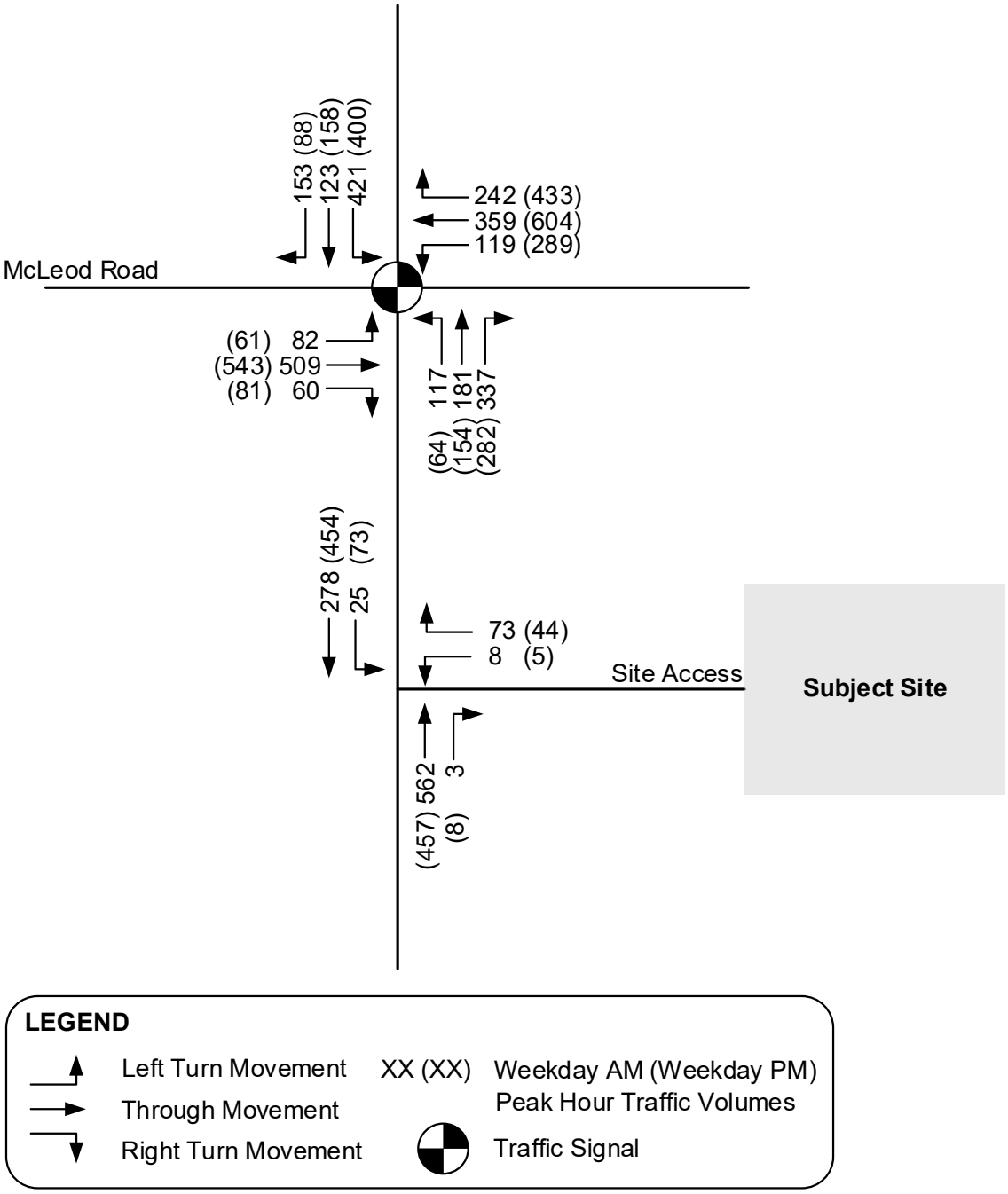


Figure 13: Future (2030) Total Traffic Volumes

Table 11: Future (2030) Total Conditions Intersection Operations

Intersection / Movement	AM Peak Hour				PM Peak Hour				Available Storage (m)
	LOS	Delay (s)	v/c ratio	95th Percentile Queue (m)	LOS	Delay (s)	v/c ratio	95th Percentile Queue (m)	
Kalar Road at McLeod Road (Signalized)									
Overall	E	70	**1.24**	-	E	77	**1.41**	-	-
EBL	C	22	0.29	22	B	19	0.25	17	70
EBTR	C	26	0.56	67	C	21	0.50	73	>300
WBL	E	60	0.81	55	**F**	258	**1.45**	**155**	90
WBT	C	32	0.51	52	C	29	0.63	89	>300
WBR	C	29	0.19	20	C	26	0.33	29	50
NBL	C	23	0.36	40	C	27	0.25	24	60
NBTR	E	61	**0.97**	191	D	54	**0.90**	140	>200
SBL	**F**	256	**1.48**	187	**F**	241	**1.45**	170	190
SBTR	B	12	0.15	17	B	16	0.16	19	>300
Kalar Road at Site Access (Unsignalized)									
WBLR	B	15	0.19	<7	B	14	0.11	<7	>200
SBTL	A	1	0.03	<7	A	2	0.07	<7	>200

Note: LOS – level of service, v/c ratio – volume to capacity ratio

The analysis results in **Table 11** indicate that all movements at the study intersections are expected to operate with acceptable level of service and residual capacity during the weekday AM and weekday PM peak hours under future (2030) total conditions except for the following movements similar to future (2030) background conditions at the Kalar Road at McLeod Road intersection:

- Westbound left movement during the weekday PM peak hour.
- Northbound through-right and southbound left movements during the weekday AM and weekday PM peak hours.

5.2.1 Proposed Mitigation Measures

Based on the analysis results provided in **Table 11**, in addition to the mitigation measures proposed under future (2030) background conditions, the following additional mitigation measure is proposed under future (2030) total conditions at the Kalar Road at McLeod Road intersection:

- Increase the storage length for the dedicated northbound right turn lane from 70 metres to 90 metres, i.e., the site trips from the subject development require an additional 20 metres of storage in the northbound right turn lane needed for future (2030) background conditions.

The analysis results with mitigation are provided in **Table 12** and detailed calculations are provided in **Appendix F**.

Table 12: Future (2030) Total Conditions Intersection Operations with Mitigation

Intersection / Movement	AM Peak Hour				PM Peak Hour				Available Storage (m)
	LOS	Delay (s)	v/c	95th Percentile Queue (m)	LOS	Delay (s)	v/c	95th Percentile Queue (m)	
Kalar Road at McLeod Road (Signalized)									
Overall	C	28	0.74	-	C	32	0.88	-	-
EBL	C	22	0.31	27	C	25	0.26	17	70
EBTR	C	25	0.56	84	D	39	0.78	108	>300
WBL	D	44	0.72	55	C	30	0.79	86	90
WBT	C	29	0.46	59	C	23	0.50	84	>300
WBR	C	27	0.19	20	C	22	0.37	35	50
NBL	D	38	0.60	51	D	40	0.45	32	60
NBT	D	35	0.58	70	D	42	0.59	62	>200
NBR	D	43	0.74	86	D	44	0.63	63	90
SBL	B	20	0.72	117	D	41	0.87	156	190
SBTR	B	12	0.15	19	B	20	0.17	26	>300

Note: LOS – level of service, v/c ratio – volume to capacity ratio

A comparison of the intersection operations without mitigation measures was conducted to compare the impacts from the site generated traffic on the study area road network during the weekday AM and weekday PM peak hours as summarized in **Table 13** and **Table 14**, respectively. It is noted that the critical movements at the Kalar Road at McLeod intersection are generally triggered under future background conditions due to the background growth in traffic plus site generated traffic from the other background developments within the study area. The impacts on the study road network from the additional site traffic generated by the proposed development are relatively low compared to the future background conditions.

Table 13: Intersection Operations Comparison Table (AM Peak Hour)

Intersection / Critical Movement	LOS					v/c ratio							95th Percentile Queue (m)						
	Ex	2025 FB	2025 FT	2030 FB	2030 FT	Ex	2025 FB	2025 FT	2025 FT-FB	2030 FB	2030 FT	2030 FT-FB	Ex	2025 FB	2025 FT	2025 FT-FB	2030 FB	2030 FT	2030 FT-FB
Kalar Road at McLeod Road (Signalized)																			
WBL	C	D	D	D	E	0.46	0.69	0.77	+0.08	0.74	0.81	+0.07	26	41	49	+8	48	55	+7
NBTR	C	D	D	D	E	0.71	**0.86**	**0.89**	+0.03	**0.88**	**0.97**	+0.09	71	143	173	+30	162	191	+29
SBL	B	**F**	**F**	**F**	**F**	0.71	**1.11**	**1.22**	+0.11	**1.30**	**1.48**	+0.18	71	163	155	-8	172	187	+15

Note: Ex – existing, FB – future background, FT – future total, LOS – level of service, v/c ratio – volume to capacity ratio

Table 14: Intersection Operations Comparison Table (PM Peak Hour)

Intersection / Critical Movement	LOS					v/c ratio							95th Percentile Queue (m)						
	Ex	2025 FB	2025 FT	2030 FB	2030 FT	Ex	2025 FB	2025 FT	2025 FT-FB	2030 FB	2030 FT	2030 FT-FB	Ex	2025 FB	2025 FT	2025 FT-FB	2030 FB	2030 FT	2030 FT-FB
Kalar Road at McLeod Road (Signalized)																			
WBL	C	**F**	**F**	**F**	**F**	0.69	**1.04**	**1.26**	+0.22	**1.21**	**1.45**	+0.24	50	**122**	**144**	+22	**133**	**155**	+22
NBTR	C	D	D	D	D	0.67	**0.86**	**0.87**	+0.01	**0.87**	**0.90**	+0.03	68	101	122	+21	122	140	+18
SBL	B	**F**	**F**	**F**	**F**	0.73	**1.24**	**1.28**	+0.04	**1.39**	**1.45**	+0.06	82	140	145	+5	164	170	+6

Note: Ex – existing, FB – future background, FT – future total, LOS – level of service, v/c ratio – volume to capacity ratio

6.0 Site Plan and Circulation Review

6.1 Site Plan Review

The subject site is located on the east side of Kalar Road approximately 65 metres south of McLeod Road. The proposed development will consist of two residential condominiums with a total of 412 units. A total of 518 parking spaces will be provided. The regular parking spaces including the new parking spaces provided in the site concept plan have a width of 2.75 metres and a length of 6.00 metres which meet the by-law requirements outlined in the City's Zoning By-law. A full-moves access is proposed for the subject site fronting on Kalar Road.

6.1.1 Left Turn Warrant Analysis

A left turn warrant analysis was conducted based on the criteria outlined in the *"Geometric Design Standards for Ontario Highways"* guidelines to determine if a left turn lane is warranted on Kalar Road at the proposed site access under future total conditions. A design speed of 60 km/h (for a posted speed of 50 km/h) was considered for the analysis. Detailed left turn warrant calculations are provided in **Appendix G**. The analysis results indicate that a left turn lane is warranted on Kalar Road at the proposed site access under future (2025) total conditions with a storage length of 25 metres.

6.2 Site Circulation

A swept path analysis was undertaken for the site plan to assess the site circulation using the following design vehicles and the results are provided in **Appendix H**:

1. Garbage Truck Front-end Loader (NCHRP 659, 2010);
2. Aerial Fire Truck Tractor (NCHRP 659, 2010); and
3. Passenger Car (TAC Geometric Design Guide for Canadian Roads, 1999).

The swept path analysis results in **Appendix H** indicate that both the garbage truck and the aerial fire truck can be accommodated at the site access and internally through the site. Moreover, the site circulation was assessed using a passenger car and the swept path analysis results in **Appendix H** indicate that the passenger car can be accommodated at the designated parking spaces.

7.0 Parking Review

The proposed development will consist of two residential condominiums with a total of 412 units. A total of 518 parking spaces will be provided.

7.1 Zoning By-law Requirement

The by-law requirement for the proposed land use categories outlined in the City's Zoning By-law 79-200 is:

- Dwelling containing 3 or more dwelling units save and except an on-street townhouse dwelling: 1.4 parking space for each dwelling unit.

Based on the preceding by-law requirement, the parking supply for the proposed development is summarized in **Table 15**.

Table 15: Zoning By-law Parking Requirement

Land Use	Units	By-law Requirement	Calculated Parking Supply per By-law	Proposed Parking Supply	Surplus (Deficiency)
Residential Apartments	412	1.4 space per dwelling unit	577	518	(59)

The results in **Table 15** indicate that the proposed parking supply is deficient by 59 spaces which represents a parking ratio of 1.257 space per unit compared to a parking ratio of 1.4 space per unit outlined in the City's Zoning By-law. However, based on consultations with City staff, it is noted that the proposed rate of 1.257 is acceptable given that the site abuts a transit route. The subject site will be provided with bike parking spaces to encourage non-auto mode of travel and it is noted that the subject site is within proximity of various amenities that is accessible via active transportation modes. Therefore, it is concluded that the proposed parking supply will meet the expected parking demand for the proposed development.

8.0 Conclusions

Based on the analysis results, the following conclusions can be made:

Existing Conditions

- The analysis results indicate that all movements at the study intersection are operating with acceptable level of service and residual capacity during the weekday AM and weekday PM peak hours.

Future Background Conditions

- The analysis results indicate that all movements at the Kalar Road and McLeod Road intersection are expected to operate with acceptable level of service and residual capacity during the weekday AM and weekday PM peak hours under both future (2025) background and future (2030) background conditions except for the following movements:
    - Westbound left movement during the weekday PM peak hour.
    - Northbound through-right and southbound left movements during the weekday AM and weekday PM peak hours.
- The following mitigation measures are proposed at the intersection of Kalar Road and McLeod Road under future (2025) background conditions:
    - Increase the cycle length from 107.1 seconds to 140 seconds during the weekday AM and weekday PM peak hours.
    - Add a dedicated northbound right turn lane with a storage length of 60 metres.
- In addition to the mitigation measures proposed under future (2025) background conditions, the following additional mitigation measures are proposed under future (2030) background conditions at the Kalar Road and McLeod Road intersections:
    - Modify the westbound left turn phase from permissive to protected/permissive during the PM peak hour.
    - Increase the storage length for the dedicated northbound right turn lane from 60 metres to 70 metres.

Site Trip Generation

- The proposed expansion is expected to generate 109 bi-directional new auto trips during the weekday AM peak hour and 130 bi-directional new auto trips during the weekday PM peak hour.

Future Total Conditions (with proposed development)

- The analysis results indicate that all movements at the study intersections are expected to operate with acceptable level of service and residual capacity during the weekday AM and weekday PM peak hours under future (2025) and future (2030) total conditions except for the same critical movements identified at the Kalar Road and McLeod Road intersections under future background conditions.
- In addition to the mitigation measures proposed under future (2025) background conditions, the following additional mitigation measures are proposed under future (2025) total conditions at the Kalar Road and McLeod Road intersection:
    - Modify the westbound left turn phase from permissive to protected/permissive during the PM peak hour.
    - Increase the storage length for the dedicated northbound right turn lane from 60 metres to 75 metres, i.e., the site trips from the subject development require an additional 15 metres of storage in the northbound right turn lane needed for future (2025) background conditions.
- In addition to the mitigation measures proposed under future (2030) background conditions, the following additional mitigation measure is proposed under future (2030) total conditions at the Kalar Road and McLeod Road intersection:
    - Increase the storage length for the dedicated northbound right turn lane from 70 metres to 90 metres, i.e., the site trips from the subject development require an additional 20 metres of storage in the northbound right turn lane needed for future (2030) background conditions.
- A comparison of the intersection operations during the weekday AM and weekday PM peak hour summarized in **Table 13** and **Table 14**, respectively, indicate the critical movements at the Kalar Road and McLeod Road intersection are generally triggered under future background conditions due to the background growth in traffic plus site generated traffic from the other background developments within the study area. The impacts on the study road network from the additional site traffic generated by the proposed development are relatively low compared to the future background conditions.

Site Plan and Circulation Review

- Based on the swept path analysis, it is observed that both the garbage truck and the aerial fire truck can be accommodated at the site access and internally through the site.
- The swept path analysis also shows that a passenger car can be accommodated at dedicated parking spaces.
- The left turn warrant analysis results indicate that a left turn lane is warranted on Kalar Road at the proposed site access under future (2025) total conditions with a storage length of 25 metres.

Parking Review

- The proposed parking supply for the subject site is deficient by 59 spaces which represents a parking ratio of 1.257 space per unit compared to a parking ratio of 1.4 space per unit outlined in the City's Zoning By-law.
- However, based on consultations with City staff, it is noted that the proposed rate of 1.257 is acceptable given that the site abuts a transit route. The subject site will be provided with bike parking spaces to encourage non-auto mode of travel and it is noted that the subject site is within proximity of various amenities that is accessible via active transportation modes. Therefore, it is concluded that the proposed parking supply will meet the expected parking demand for the proposed development.

Appendix A

Existing Turning Movement Count Data and Signal Timing Plan

Accu-Traffic Inc.
Traffic Monitoring & Data Analysis

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 10:00:00

One Hour Peak
From: 7:45:00
To: 8:45:00

Municipality: Niagara Falls
Site #: 2312400001
Intersection: McLeod Rd & Kalar Rd
TFR File #: 1
Count date: 17-May-23

Weather conditions:

Person counted:
Person prepared:
Person checked:

**** Signalized Intersection ****

Major Road: McLeod Rd runs W/E

North Leg Total: 910
North Entering: 526
North Peds: 59
Peds Cross: ⋈

Heavys	4	3	7	14
Trucks	2	0	0	2
Cars	114	86	310	510
Totals	120	89	317	

Heavys	16
Trucks	4
Cars	364
Totals	384

East Leg Total: 1478
East Entering: 578
East Peds: 3
Peds Cross: ⧖

Kalar Rd

Heavys	Trucks	Cars	Totals
17	12	469	498

Cars	Trucks	Heavys	Totals
207	2	2	211
280	9	12	301
58	2	6	66
545	13	20	

McLeod Rd

N
W E
S

Heavys	Trucks	Cars	Totals
2	0	53	55
17	6	380	403
2	0	39	41
21	6	472	

McLeod Rd

Cars	Trucks	Heavys	Totals
860	8	32	900

Kalar Rd

Peds Cross: ⧖
West Peds: 3
West Entering: 499
West Leg Total: 997

Cars	183
Trucks	2
Heavys	11
Totals	196

Cars	75	104	170	349
Trucks	1	2	2	5
Heavys	1	12	8	21
Totals	77	118	180	

Peds Cross: ⋈
South Peds: 2
South Entering: 375
South Leg Total: 571

Comments

Accu-Traffic Inc.
Traffic Monitoring & Data Analysis

Afternoon Peak Diagram

Specified Period
From: 14:00:00
To: 18:00:00

One Hour Peak
From: 16:30:00
To: 17:30:00

Municipality: Niagara Falls
Site #: 2312400001
Intersection: McLeod Rd & Kalar Rd
TFR File #: 1
Count date: 17-May-23

Weather conditions:

Person counted:
Person prepared:
Person checked:

**** Signalized Intersection ****

Major Road: McLeod Rd runs W/E

North Leg Total: 967
North Entering: 451
North Peds: 6
Peds Cross: ⋈

Heavys	3	0	0	3
Trucks	0	1	1	2
Cars	48	90	308	446
Totals	51	91	309	

Heavys	4
Trucks	3
Cars	509
Totals	516

East Leg Total: 1939
East Entering: 1004
East Peds: 7
Peds Cross: ⧖

Kalar Rd

Heavys	Trucks	Cars	Totals
6	4	564	574

Cars	Trucks	Heavys	Totals
373	2	2	377
484	3	1	488
138	0	1	139
995	5	4	

N
W E
S

McLeod Rd

Heavys	Trucks	Cars	Totals
0	1	34	35
6	1	443	450
0	0	44	44
6	2	521	

McLeod Rd

Cars	Trucks	Heavys	Totals
923	2	10	935

Kalar Rd

Peds Cross: ⧖
West Peds: 5
West Entering: 529
West Leg Total: 1103

Cars	272
Trucks	1
Heavys	1
Totals	274

Cars	32	102	172	306
Trucks	1	0	0	1
Heavys	2	2	4	8
Totals	35	104	176	

Peds Cross: ⋈
South Peds: 2
South Entering: 315
South Leg Total: 589

Comments

Accu-Traffic Inc.
Traffic Monitoring & Data Analysis

Total Count Diagram

Municipality: Niagara Falls
Site #: 2312400001
Intersection: McLeod Rd & Kalar Rd
TFR File #: 1
Count date: 17-May-23

Weather conditions:

Person counted:
Person prepared:
Person checked:

**** Signalized Intersection ****

Major Road: McLeod Rd runs W/E

North Leg Total:	5794			
North Entering:	2958			
North Peds:	138			
Peds Cross:	⋈			
Heavys	25	15	19	59
Trucks	3	11	12	26
Cars	445	530	1898	2873
Totals	473	556	1929	
Heavys	74			
Trucks	25			
Cars	2737			
Totals	2836			
East Leg Total:	11209			
East Entering:	5372			
East Peds:	33			
Peds Cross:	⧖			

Kalar Rd

Heavys	Trucks	Cars	Totals
90	44	3277	3411

McLeod Rd

Heavys	Trucks	Cars	Totals
7	2	279	288
79	33	2741	2853
9	2	232	243
95	37	3252	

Cars	Trucks	Heavys	Totals
1921	14	31	1966
2568	35	59	2662
704	9	31	744
5193	58	121	

N
W E
S

McLeod Rd

Cars	Trucks	Heavys	Totals
5640	57	140	5837

Kalar Rd

Peds Cross:	⧖			
West Peds:	34			
West Entering:	3384			
West Leg Total:	6795			
Cars	1466			
Trucks	22			
Heavys	55			
Totals	1543			
Cars	264	537	1001	1802
Trucks	6	9	12	27
Heavys	6	36	42	84
Totals	276	582	1055	
Peds Cross:	⋈			
South Peds:	9			
South Entering:	1913			
South Leg Total:	3456			

Comments

Accu-Traffic Inc.
Traffic Monitoring & Data Analysis

Traffic Count Summary

Intersection: McLeod Rd & Kalar Rd | **Count Date:** 17-May-23 | **Municipality:** Niagara Falls

North Approach Totals

Hour Ending	Includes Cars, Trucks, & Heavys				Total Peds
	Left	Thru	Right	Grand Total	
7:00:00	0	0	0	0	0
8:00:00	199	46	97	342	10
9:00:00	333	95	89	517	56
10:00:00	240	47	58	345	5
14:00:00	0	0	0	0	0
15:00:00	279	81	57	417	27
16:00:00	312	114	75	501	14
17:00:00	279	84	48	411	21
18:00:00	287	89	49	425	5
Totals:	1929	556	473	2958	138

North/South Total Approaches: 4871

South Approach Totals

Hour Ending	Includes Cars, Trucks, & Heavys				Total Peds
	Left	Thru	Right	Grand Total	
7:00:00	0	0	0	0	0
8:00:00	61	50	124	235	0
9:00:00	54	125	190	369	2
10:00:00	28	40	139	207	0
14:00:00	0	0	0	0	0
15:00:00	34	95	128	257	2
16:00:00	31	91	147	269	0
17:00:00	40	79	168	287	2
18:00:00	28	102	159	289	3
S Totals:	276	582	1055	1913	9

East Approach Totals

Hour Ending	Includes Cars, Trucks, & Heavys				Total Peds
	Left	Thru	Right	Grand Total	
7:00:00	0	0	0	0	0
8:00:00	58	297	120	475	2
9:00:00	67	271	220	558	2
10:00:00	81	283	186	550	2
14:00:00	0	0	0	0	0
15:00:00	93	399	335	827	6
16:00:00	160	468	362	990	4
17:00:00	145	504	371	1020	5
18:00:00	140	440	372	952	12
Totals:	744	2662	1966	5372	33

East/West Total Approaches: 8756

West Approach Totals

Hour Ending	Includes Cars, Trucks, & Heavys				Total Peds
	Left	Thru	Right	Grand Total	
7:00:00	0	0	0	0	0
8:00:00	19	307	25	351	2
9:00:00	54	396	43	493	4
10:00:00	38	375	30	443	2
14:00:00	0	0	0	0	0
15:00:00	72	458	30	560	11
16:00:00	42	407	40	489	5
17:00:00	33	446	34	513	7
18:00:00	30	464	41	535	3
W Totals:	288	2853	243	3384	34

Calculated Values for Traffic Crossing Major Street

Hours Ending:	7:00	8:00	9:00	10:00	15:00	16:00	17:00	18:00
Crossing Values:	0	314	518	319	425	466	415	432

Accu-Traffic Inc.
Traffic Monitoring & Data Analysis

Count Date: 17-May-23 Site #: 2312400001

Interval Time	Passenger Cars - North Approach						Trucks - North Approach						Heavys - North Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		North Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	34	34	8	8	15	15	1	1	1	1	0	0	2	2	0	0	0	0	0	0
7:30:00	78	44	16	8	26	11	1	0	1	0	0	0	2	0	0	0	0	0	0	0
7:45:00	120	42	28	12	44	18	2	1	2	1	0	0	2	0	0	0	1	1	5	5
8:00:00	192	72	43	15	94	50	2	0	2	0	1	1	5	3	1	1	2	1	10	5
8:15:00	267	75	68	25	115	21	2	0	2	0	1	0	5	0	1	0	3	1	11	1
8:30:00	342	75	86	18	136	21	2	0	2	0	2	1	9	4	2	1	4	1	15	4
8:45:00	430	88	114	28	158	22	2	0	2	0	2	0	9	0	3	1	5	1	64	49
9:00:00	514	84	135	21	178	20	5	3	2	0	2	0	13	4	4	1	6	1	66	2
9:15:00	595	81	149	14	204	26	6	1	2	0	2	0	15	2	6	2	8	2	66	0
9:30:00	658	63	161	12	217	13	7	1	3	1	2	0	15	0	6	0	9	1	67	1
9:45:00	698	40	170	9	224	7	7	0	3	0	2	0	15	0	7	1	10	1	67	0
10:00:00	750	52	176	6	232	8	7	0	5	2	2	0	15	0	7	0	10	0	71	4
10:15:00	750	0	176	0	232	0	7	0	5	0	2	0	15	0	7	0	10	0	71	0
14:00:00	750	0	176	0	232	0	7	0	5	0	2	0	15	0	7	0	10	0	71	0
14:15:00	807	57	186	10	245	13	8	1	6	1	2	0	15	0	8	1	11	1	71	0
14:30:00	883	76	205	19	262	17	8	0	7	1	2	0	15	0	9	1	11	0	86	15
14:45:00	949	66	223	18	272	10	8	0	7	0	2	0	16	1	9	0	12	1	97	11
15:00:00	1027	78	251	28	285	13	8	0	7	0	3	1	16	0	11	2	13	1	98	1
15:15:00	1124	97	293	42	309	24	8	0	7	0	3	0	17	1	14	3	16	3	104	6
15:30:00	1186	62	318	25	324	15	8	0	7	0	3	0	18	1	14	0	17	1	107	3
15:45:00	1253	67	341	23	341	17	10	2	9	2	3	0	18	0	14	0	20	3	111	4
16:00:00	1334	81	359	18	353	12	10	0	9	0	3	0	19	1	15	1	20	0	112	1
16:15:00	1393	59	376	17	361	8	10	0	10	1	3	0	19	0	15	0	21	1	122	10
16:30:00	1453	60	394	18	375	14	11	1	10	0	3	0	19	0	15	0	21	0	129	7
16:45:00	1540	87	423	29	390	15	12	1	10	0	3	0	19	0	15	0	23	2	131	2
17:00:00	1611	71	442	19	398	8	12	0	10	0	3	0	19	0	15	0	23	0	133	2
17:15:00	1684	73	461	19	410	12	12	0	11	1	3	0	19	0	15	0	24	1	133	0
17:30:00	1761	77	484	23	423	13	12	0	11	0	3	0	19	0	15	0	24	0	135	2
17:45:00	1841	80	500	16	434	11	12	0	11	0	3	0	19	0	15	0	25	1	135	0
18:00:00	1898	57	530	30	445	11	12	0	11	0	3	0	19	0	15	0	25	0	138	3
18:15:00	1898	0	530	0	445	0	12	0	11	0	3	0	19	0	15	0	25	0	138	0
18:15:15	1898	0	530	0	445	0	12	0	11	0	3	0	19	0	15	0	25	0	138	0

Accu-Traffic Inc.
Traffic Monitoring & Data Analysis

Count Date: 17-May-23 Site #: 2312400001

Interval Time	Passenger Cars - East Approach						Trucks - East Approach						Heavys - East Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		East Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	9	9	42	42	12	12	1	1	0	0	0	0	0	0	1	1	0	0	0	0
7:30:00	22	13	109	67	35	23	1	0	2	2	0	0	0	0	3	2	2	2	0	0
7:45:00	36	14	184	75	63	28	3	2	5	3	0	0	1	1	10	7	4	2	1	1
8:00:00	51	15	270	86	114	51	3	0	9	4	2	2	4	3	18	8	4	0	2	1
8:15:00	64	13	341	71	166	52	3	0	11	2	2	0	5	1	20	2	4	0	3	1
8:30:00	83	19	402	61	224	58	4	1	13	2	2	0	6	1	20	0	6	2	4	1
8:45:00	94	11	464	62	270	46	5	1	14	1	2	0	7	1	22	2	6	0	4	0
9:00:00	111	17	531	67	328	58	6	1	14	0	2	0	8	1	23	1	10	4	4	0
9:15:00	138	27	585	54	378	50	6	0	15	1	3	1	9	1	26	3	11	1	6	2
9:30:00	154	16	652	67	423	45	6	0	16	1	4	1	9	0	30	4	11	0	6	0
9:45:00	172	18	725	73	461	38	6	0	17	1	6	2	10	1	32	2	12	1	6	0
10:00:00	190	18	799	74	505	44	6	0	18	1	9	3	10	0	34	2	12	0	6	0
10:15:00	190	0	799	0	505	0	6	0	18	0	9	0	10	0	34	0	12	0	6	0
14:00:00	190	0	799	0	505	0	6	0	18	0	9	0	10	0	34	0	12	0	6	0
14:15:00	209	19	913	114	576	71	6	0	19	1	9	0	10	0	39	5	13	1	6	0
14:30:00	228	19	994	81	651	75	6	0	20	1	10	1	11	1	40	1	14	1	11	5
14:45:00	257	29	1082	88	750	99	6	0	21	1	10	0	14	3	45	5	17	3	12	1
15:00:00	277	20	1182	100	830	80	6	0	22	1	11	1	16	2	46	1	20	3	12	0
15:15:00	312	35	1289	107	906	76	7	1	23	1	11	0	19	3	48	2	21	1	14	2
15:30:00	344	32	1408	119	994	88	7	0	24	1	11	0	21	2	50	2	24	3	14	0
15:45:00	388	44	1520	112	1085	91	8	1	24	0	11	0	22	1	53	3	25	1	15	1
16:00:00	425	37	1636	116	1187	102	8	0	26	2	11	0	26	4	56	3	25	0	16	1
16:15:00	469	44	1746	110	1270	83	8	0	31	5	12	1	26	0	56	0	27	2	17	1
16:30:00	501	32	1874	128	1359	89	9	1	31	0	12	0	28	2	57	1	28	1	20	3
16:45:00	538	37	1998	124	1455	96	9	0	32	1	13	1	28	0	58	1	30	2	21	1
17:00:00	567	29	2132	134	1551	96	9	0	32	0	13	0	28	0	58	0	30	0	21	0
17:15:00	607	40	2234	102	1648	97	9	0	34	2	13	0	29	1	58	0	30	0	21	0
17:30:00	639	32	2358	124	1732	84	9	0	34	0	14	1	29	0	58	0	30	0	27	6
17:45:00	672	33	2464	106	1819	87	9	0	35	1	14	0	30	1	59	1	31	1	29	2
18:00:00	704	32	2568	104	1921	102	9	0	35	0	14	0	31	1	59	0	31	0	33	4
18:15:00	704	0	2568	0	1921	0	9	0	35	0	14	0	31	0	59	0	31	0	33	0
18:15:15	704	0	2568	0	1921	0	9	0	35	0	14	0	31	0	59	0	31	0	33	0

Accu-Traffic Inc.
Traffic Monitoring & Data Analysis

Count Date: 17-May-23 Site #: 2312400001

Interval Time	Passenger Cars - South Approach						Trucks - South Approach						Heavys - South Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		South Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	6	6	9	9	20	20	0	0	0	0	2	2	1	1	1	1	2	2	0	0
7:30:00	13	7	17	8	39	19	0	0	0	0	4	2	1	0	2	1	2	0	0	0
7:45:00	25	12	28	11	79	40	0	0	1	1	4	0	1	0	5	3	4	2	0	0
8:00:00	59	34	43	15	115	36	0	0	1	0	4	0	2	1	6	1	5	1	0	0
8:15:00	80	21	58	15	167	52	0	0	2	1	4	0	2	0	10	4	7	2	1	1
8:30:00	93	13	93	35	207	40	0	0	3	1	5	1	2	0	15	5	10	3	2	1
8:45:00	100	7	132	39	249	42	1	1	3	0	6	1	2	0	17	2	12	2	2	0
9:00:00	110	10	150	18	294	45	2	1	6	3	7	1	3	1	19	2	13	1	2	0
9:15:00	116	6	163	13	331	37	2	0	6	0	8	1	3	0	19	0	19	6	2	0
9:30:00	126	10	171	8	363	32	2	0	6	0	9	1	3	0	20	1	20	1	2	0
9:45:00	133	7	176	5	387	24	2	0	6	0	10	1	3	0	20	0	22	2	2	0
10:00:00	137	4	188	12	419	32	2	0	6	0	10	0	4	1	21	1	24	2	2	0
10:15:00	137	0	188	0	419	0	2	0	6	0	10	0	4	0	21	0	24	0	2	0
14:00:00	137	0	188	0	419	0	2	0	6	0	10	0	4	0	21	0	24	0	2	0
14:15:00	147	10	204	16	451	32	3	1	6	0	11	1	4	0	21	0	27	3	2	0
14:30:00	156	9	220	16	481	30	3	0	7	1	11	0	4	0	22	1	27	0	2	0
14:45:00	163	7	246	26	511	30	3	0	9	2	11	0	4	0	23	1	28	1	4	2
15:00:00	170	7	275	29	541	30	3	0	9	0	12	1	4	0	26	3	28	0	4	0
15:15:00	178	8	301	26	578	37	4	1	9	0	12	0	4	0	28	2	32	4	4	0
15:30:00	183	5	319	18	607	29	4	0	9	0	12	0	4	0	29	1	33	1	4	0
15:45:00	192	9	340	21	640	33	5	1	9	0	12	0	4	0	30	1	35	2	4	0
16:00:00	199	7	361	21	679	39	5	0	9	0	12	0	4	0	31	1	37	2	4	0
16:15:00	208	9	378	17	721	42	5	0	9	0	12	0	4	0	31	0	38	1	4	0
16:30:00	218	10	391	13	753	32	5	0	9	0	12	0	4	0	32	1	38	0	5	1
16:45:00	232	14	407	16	797	44	5	0	9	0	12	0	5	1	32	0	38	0	5	0
17:00:00	237	5	438	31	844	47	5	0	9	0	12	0	6	1	33	1	40	2	6	1
17:15:00	246	9	464	26	886	42	5	0	9	0	12	0	6	0	33	0	41	1	6	0
17:30:00	250	4	493	29	925	39	6	1	9	0	12	0	6	0	34	1	42	1	7	1
17:45:00	257	7	507	14	969	44	6	0	9	0	12	0	6	0	35	1	42	0	9	2
18:00:00	264	7	537	30	1001	32	6	0	9	0	12	0	6	0	36	1	42	0	9	0
18:15:00	264	0	537	0	1001	0	6	0	9	0	12	0	6	0	36	0	42	0	9	0
18:15:15	264	0	537	0	1001	0	6	0	9	0	12	0	6	0	36	0	42	0	9	0

Accu-Traffic Inc.
Traffic Monitoring & Data Analysis

Count Date: 17-May-23 Site #: 2312400001

Interval Time	Passenger Cars - West Approach						Trucks - West Approach						Heavys - West Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		West Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	2	2	53	53	7	7	0	0	2	2	0	0	0	0	0	0	0	0	0	0
7:30:00	2	0	128	75	11	4	0	0	4	2	0	0	0	0	3	3	0	0	0	0
7:45:00	9	7	199	71	17	6	0	0	5	1	0	0	0	0	8	5	1	1	1	1
8:00:00	19	10	287	88	24	7	0	0	7	2	0	0	0	0	13	5	1	0	2	1
8:15:00	33	14	396	109	40	16	0	0	8	1	0	0	0	0	19	6	2	1	3	1
8:30:00	46	13	486	90	49	9	0	0	9	1	0	0	1	1	21	2	2	0	4	1
8:45:00	62	16	579	93	56	7	0	0	11	2	0	0	2	1	25	4	3	1	4	0
9:00:00	71	9	664	85	65	9	0	0	14	3	0	0	2	0	25	0	3	0	6	2
9:15:00	78	7	766	102	73	8	0	0	18	4	0	0	2	0	29	4	3	0	7	1
9:30:00	93	15	852	86	79	6	0	0	18	0	0	0	3	1	33	4	4	1	7	0
9:45:00	103	10	939	87	81	2	0	0	21	3	0	0	3	0	34	1	4	0	7	0
10:00:00	108	5	1020	81	92	11	0	0	22	1	0	0	3	0	36	2	6	2	8	1
10:15:00	108	0	1020	0	92	0	0	0	22	0	0	0	3	0	36	0	6	0	8	0
14:00:00	108	0	1020	0	92	0	0	0	22	0	0	0	3	0	36	0	6	0	8	0
14:15:00	125	17	1115	95	93	1	0	0	23	1	0	0	3	0	41	5	6	0	8	0
14:30:00	144	19	1249	134	108	15	0	0	23	0	0	0	5	2	54	13	7	1	13	5
14:45:00	159	15	1355	106	117	9	0	0	23	0	0	0	5	0	57	3	7	0	18	5
15:00:00	176	17	1454	99	121	4	1	1	23	0	0	0	6	1	59	2	7	0	19	1
15:15:00	181	5	1547	93	128	7	1	0	24	1	1	1	7	1	62	3	8	1	21	2
15:30:00	195	14	1641	94	139	11	1	0	27	3	1	0	7	0	62	0	8	0	23	2
15:45:00	203	8	1741	100	147	8	1	0	28	1	2	1	7	0	65	3	8	0	23	0
16:00:00	217	14	1847	106	158	11	1	0	28	0	2	0	7	0	68	3	8	0	24	1
16:15:00	223	6	1959	112	162	4	1	0	32	4	2	0	7	0	71	3	8	0	26	2
16:30:00	233	10	2075	116	168	6	1	0	32	0	2	0	7	0	72	1	9	1	26	0
16:45:00	244	11	2160	85	177	9	1	0	32	0	2	0	7	0	75	3	9	0	30	4
17:00:00	250	6	2280	120	191	14	1	0	32	0	2	0	7	0	77	2	9	0	31	1
17:15:00	257	7	2418	138	202	11	1	0	33	1	2	0	7	0	77	0	9	0	31	0
17:30:00	267	10	2518	100	212	10	2	1	33	0	2	0	7	0	78	1	9	0	31	0
17:45:00	274	7	2611	93	222	10	2	0	33	0	2	0	7	0	79	1	9	0	33	2
18:00:00	279	5	2741	130	232	10	2	0	33	0	2	0	7	0	79	0	9	0	34	1
18:15:00	279	0	2741	0	232	0	2	0	33	0	2	0	7	0	79	0	9	0	34	0
18:15:15	279	0	2741	0	232	0	2	0	33	0	2	0	7	0	79	0	9	0	34	0

Signal Code: KLRMCL

Intersection: MCLEOD RD. & KALAR RD.

Municipality: niagarafalls

Owner: city

Last Modified: 2011-10-19 11:42:12 AM

Timing Parameters	EBD ADV. MCLEOD RD.	EBD/WBD THRU MCLEOD RD.	SBD ADV. KALAR RD.	NBD/SBD THRU KALAR RD.	n/a	n/a
Min Green	6	10	6	8	0	0
Walk	0	14	0	14	0	0
Ped Clearance	0	25	0	24	0	0
Vehicle Ext.	2.5	2.5	2.5	2.5	0	0
Max Green	11	30.7	12	34.7	0	0
Yellow	3	3.3	3	3.3	0	0
All Red	0	3.1	0	3	0	0

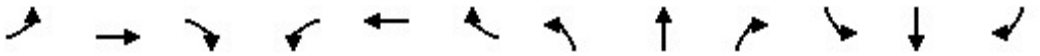
		Offset
Minimum Cycle	30.7	0
Pedestrian Cycle	89.7	
Maximum Cycle	107.1	0
Operation	FA	

Installed On:	2008-11-18
Count Date:	--/--/----

FA = Fully Actuated SA = Semi Actuated FT = Fixed Time

Appendix B

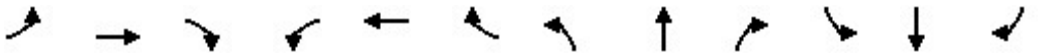
Existing Intersection Operation Calculations (Synchro)



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	55	403	41	66	301	211	77	118	180	317	89	120
Future Volume (vph)	55	403	41	66	301	211	77	118	180	317	89	120
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3		3.0	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.96	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	0.99	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.91		1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1586	3092		1484	3107	1397	1612	1456		1629	2896	
Flt Permitted	0.46	1.00		0.48	1.00	1.00	0.61	1.00		0.35	1.00	
Satd. Flow (perm)	765	3092		744	3107	1397	1035	1456		606	2896	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	438	45	72	327	229	84	128	196	345	97	130
RTOR Reduction (vph)	0	8	0	0	0	180	0	56	0	0	66	0
Lane Group Flow (vph)	60	475	0	72	327	49	84	268	0	345	161	0
Confl. Peds. (#/hr)	59		2	2		59	3		3	3		3
Heavy Vehicles (%)	4%	6%	5%	12%	7%	2%	3%	12%	6%	2%	3%	5%
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	21.8	21.8		14.4	14.4	14.4	17.6	17.6		33.2	33.2	
Effective Green, g (s)	21.8	21.8		14.4	14.4	14.4	17.6	17.6		33.2	33.2	
Actuated g/C Ratio	0.32	0.32		0.21	0.21	0.21	0.26	0.26		0.49	0.49	
Clearance Time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3		3.0	6.3	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	299	995		158	660	297	269	378		487	1420	
v/s Ratio Prot	0.01	c0.15			0.11			0.18		c0.13	0.06	
v/s Ratio Perm	0.05			0.10		0.03	0.08			c0.22		
v/c Ratio	0.20	0.48		0.46	0.50	0.16	0.31	0.71		0.71	0.11	
Uniform Delay, d1	16.2	18.4		23.2	23.5	21.7	20.2	22.7		11.8	9.3	
Progression Factor	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		1.5	0.4	0.2	0.5	5.5		4.3	0.0	
Delay (s)	16.5	18.6		24.8	23.9	21.9	20.7	28.3		16.2	9.3	
Level of Service	B	B		C	C	C	C	C		B	A	
Approach Delay (s)		18.4			23.3			26.7			13.5	
Approach LOS		B			C			C			B	

Intersection Summary			
HCM 2000 Control Delay	20.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	67.7	Sum of lost time (s)	18.7
Intersection Capacity Utilization	90.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	450	44	139	488	377	35	104	176	309	91	51
Future Volume (vph)	35	450	44	139	488	377	35	104	176	309	91	51
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3		3.0	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.91		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1613	3218		1645	3292	1450	1522	1538		1661	3045	
Flt Permitted	0.33	1.00		0.45	1.00	1.00	0.65	1.00		0.34	1.00	
Satd. Flow (perm)	568	3218		783	3292	1450	1048	1538		599	3045	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	489	48	151	530	410	38	113	191	336	99	55
RTOR Reduction (vph)	0	8	0	0	0	296	0	65	0	0	30	0
Lane Group Flow (vph)	38	529	0	151	530	114	38	239	0	336	124	0
Confl. Peds. (#/hr)	6		2	2		6	5		7	7		5
Heavy Vehicles (%)	3%	2%	0%	1%	1%	1%	9%	2%	2%	0%	1%	6%
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	26.9	26.9		20.1	20.1	20.1	16.7	16.7		32.5	32.5	
Effective Green, g (s)	26.9	26.9		20.1	20.1	20.1	16.7	16.7		32.5	32.5	
Actuated g/C Ratio	0.37	0.37		0.28	0.28	0.28	0.23	0.23		0.45	0.45	
Clearance Time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3		3.0	6.3	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	266	1200		218	917	404	242	356		458	1372	
v/s Ratio Prot	0.01	c0.16			0.16			0.16		c0.13	0.04	
v/s Ratio Perm	0.05			c0.19		0.08	0.04			c0.20		
v/c Ratio	0.14	0.44		0.69	0.58	0.28	0.16	0.67		0.73	0.09	
Uniform Delay, d1	14.8	17.0		23.2	22.4	20.4	22.1	25.2		14.3	11.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	0.2		8.5	0.7	0.3	0.2	4.5		5.7	0.0	
Delay (s)	15.0	17.1		31.7	23.1	20.6	22.3	29.7		20.0	11.4	
Level of Service	B	B		C	C	C	C	C		B	B	
Approach Delay (s)		17.0			23.4			28.9			17.3	
Approach LOS		B			C			C			B	

Intersection Summary			
HCM 2000 Control Delay	21.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	72.1	Sum of lost time (s)	18.7
Intersection Capacity Utilization	83.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	60	483	72	327	229	84	324	345	227
v/c Ratio	0.16	0.51	0.45	0.49	0.48	0.31	0.75	0.66	0.15
Control Delay	16.2	20.7	37.5	28.3	8.2	25.4	30.0	19.0	5.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.2	20.7	37.5	28.3	8.2	25.4	30.0	19.0	5.6
Queue Length 50th (m)	4.9	25.1	8.6	20.8	0.0	9.0	29.9	25.0	3.4
Queue Length 95th (m)	14.7	47.7	25.7	41.4	18.4	24.3	70.3	#70.4	11.5
Internal Link Dist (m)		395.7		445.1			96.3		353.2
Turn Bay Length (m)	70.0		90.0		50.0	60.0		190.0	
Base Capacity (vph)	416	2199	362	1515	786	569	836	526	2263
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.22	0.20	0.22	0.29	0.15	0.39	0.66	0.10

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

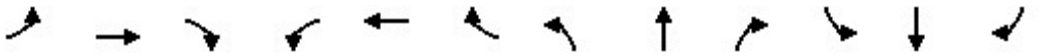
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	38	537	151	530	410	38	304	336	154
v/c Ratio	0.11	0.47	0.69	0.57	0.58	0.16	0.73	0.69	0.11
Control Delay	13.9	18.2	43.4	25.9	6.5	27.2	31.1	24.1	10.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.9	18.2	43.4	25.9	6.5	27.2	31.1	24.1	10.1
Queue Length 50th (m)	3.1	28.3	20.0	35.4	0.0	4.6	30.7	32.2	4.5
Queue Length 95th (m)	9.7	50.0	#49.4	62.0	22.3	13.9	67.3	#81.7	12.0
Internal Link Dist (m)		395.7		445.1			96.3		353.2
Turn Bay Length (m)	70.0		90.0		50.0	60.0		190.0	
Base Capacity (vph)	405	2190	365	1536	894	551	850	494	2246
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.25	0.41	0.35	0.46	0.07	0.36	0.68	0.07

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Appendix C

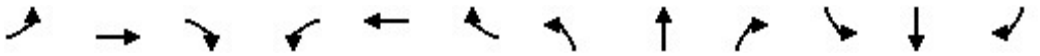
Future (2025) Background Intersection Operation Calculations (Synchro)



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	76	465	49	100	326	220	89	152	280	387	108	140
Future Volume (vph)	76	465	49	100	326	220	89	152	280	387	108	140
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3		3.0	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.95	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	0.99	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.90		1.00	0.92	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1584	3091		1483	3107	1385	1612	1448		1630	2899	
Flt Permitted	0.44	1.00		0.44	1.00	1.00	0.59	1.00		0.22	1.00	
Satd. Flow (perm)	730	3091		692	3107	1385	994	1448		386	2899	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	83	505	53	109	354	239	97	165	304	421	117	152
RTOR Reduction (vph)	0	9	0	0	0	184	0	62	0	0	74	0
Lane Group Flow (vph)	83	549	0	109	354	55	97	407	0	421	195	0
Confl. Peds. (#/hr)	59		2	2		59	3		3	3		3
Heavy Vehicles (%)	4%	6%	5%	12%	7%	2%	3%	12%	6%	2%	3%	5%
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	29.7	29.7		19.8	19.8	19.8	28.5	28.5		44.2	44.2	
Effective Green, g (s)	29.7	29.7		19.8	19.8	19.8	28.5	28.5		44.2	44.2	
Actuated g/C Ratio	0.34	0.34		0.23	0.23	0.23	0.33	0.33		0.51	0.51	
Clearance Time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3		3.0	6.3	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	318	1060		158	710	316	327	476		379	1479	
v/s Ratio Prot	0.02	c0.18			0.11			0.28		c0.16	0.07	
v/s Ratio Perm	0.07			c0.16		0.04	0.10			c0.40		
v/c Ratio	0.26	0.52		0.69	0.50	0.17	0.30	0.86		1.11	0.13	
Uniform Delay, d1	19.8	22.7		30.6	29.1	26.8	21.6	27.1		16.8	11.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.3		10.9	0.4	0.2	0.4	13.9		79.7	0.0	
Delay (s)	20.2	23.1		41.5	29.5	27.0	22.0	41.0		96.4	11.2	
Level of Service	C	C		D	C	C	C	D		F	B	
Approach Delay (s)		22.7			30.5			37.7			63.2	
Approach LOS		C			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	38.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	86.6	Sum of lost time (s)	18.7
Intersection Capacity Utilization	102.8%	ICU Level of Service	G
Analysis Period (min)	15		

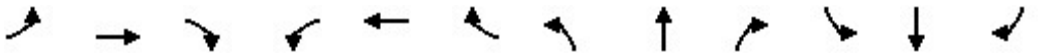
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	76	465	49	100	326	220	89	152	280	387	108	140
Future Volume (vph)	76	465	49	100	326	220	89	152	280	387	108	140
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3	6.3	3.0	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.95	1.00	1.00	0.99	1.00	0.99	
Flpb, ped/bikes	0.99	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.92	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1584	3091		1483	3107	1386	1612	1562	1384	1629	2899	
Flt Permitted	0.44	1.00		0.44	1.00	1.00	0.59	1.00	1.00	0.52	1.00	
Satd. Flow (perm)	739	3091		692	3107	1386	994	1562	1384	896	2899	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	83	505	53	109	354	239	97	165	304	421	117	152
RTOR Reduction (vph)	0	6	0	0	0	183	0	0	155	0	72	0
Lane Group Flow (vph)	83	552	0	109	354	56	97	165	149	421	197	0
Confl. Peds. (#/hr)	59		2	2		59	3		3	3		3
Heavy Vehicles (%)	4%	6%	5%	12%	7%	2%	3%	12%	6%	2%	3%	5%
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6		6	8		8	4		
Actuated Green, G (s)	27.3	27.3		19.8	19.8	19.8	15.4	15.4	15.4	44.5	44.5	
Effective Green, g (s)	27.3	27.3		19.8	19.8	19.8	15.4	15.4	15.4	44.5	44.5	
Actuated g/C Ratio	0.32	0.32		0.23	0.23	0.23	0.18	0.18	0.18	0.53	0.53	
Clearance Time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3	6.3	3.0	6.3	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	283	998		162	728	324	181	284	252	698	1526	
v/s Ratio Prot	0.02	c0.18			0.11			0.11		c0.19	0.07	
v/s Ratio Perm	0.08			c0.16		0.04	0.10		0.11	c0.13		
v/c Ratio	0.29	0.55		0.67	0.49	0.17	0.54	0.58	0.59	0.60	0.13	
Uniform Delay, d1	20.5	23.6		29.4	28.0	25.8	31.3	31.6	31.7	12.9	10.2	
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	0.4	0.5		9.6	0.4	0.2	2.4	2.5	2.9	1.2	0.0	
Delay (s)	21.0	24.1		39.0	28.3	26.0	33.7	34.1	34.6	14.1	10.2	
Level of Service	C	C		D	C	C	C	C	C	B	B	
Approach Delay (s)		23.7			29.2			34.3			12.6	
Approach LOS		C			C			C			B	

Intersection Summary			
HCM 2000 Control Delay	24.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	84.5	Sum of lost time (s)	18.7
Intersection Capacity Utilization	85.7%	ICU Level of Service	E
Analysis Period (min)	15		

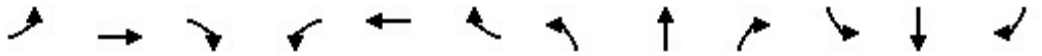
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	57	494	56	237	551	392	48	133	241	366	132	82
Future Volume (vph)	57	494	56	237	551	392	48	133	241	366	132	82
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3		3.0	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85	1.00	0.90		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1613	3212		1645	3292	1449	1521	1533		1662	3027	
Flt Permitted	0.31	1.00		0.43	1.00	1.00	0.61	1.00		0.20	1.00	
Satd. Flow (perm)	519	3212		738	3292	1449	972	1533		349	3027	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	62	537	61	258	599	426	52	145	262	398	143	89
RTOR Reduction (vph)	0	8	0	0	0	282	0	67	0	0	51	0
Lane Group Flow (vph)	62	590	0	258	599	144	52	340	0	398	181	0
Confl. Peds. (#/hr)	6		2	2		6	5		7	7		5
Heavy Vehicles (%)	3%	2%	0%	1%	1%	1%	9%	2%	2%	0%	1%	6%
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	40.8	40.8		31.3	31.3	31.3	24.1	24.1		39.3	39.3	
Effective Green, g (s)	40.8	40.8		31.3	31.3	31.3	24.1	24.1		39.3	39.3	
Actuated g/C Ratio	0.44	0.44		0.34	0.34	0.34	0.26	0.26		0.42	0.42	
Clearance Time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3		3.0	6.3	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	304	1412		248	1110	488	252	398		320	1281	
v/s Ratio Prot	0.01	c0.18			0.18			0.22		c0.16	0.06	
v/s Ratio Perm	0.08			c0.35		0.10	0.05			c0.36		
v/c Ratio	0.20	0.42		1.04	0.54	0.29	0.21	0.86		1.24	0.14	
Uniform Delay, d1	15.7	17.8		30.8	24.9	22.6	26.9	32.7		22.1	16.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	0.1		68.1	0.4	0.2	0.3	16.1		133.3	0.0	
Delay (s)	15.9	18.0		98.8	25.3	22.9	27.2	48.8		155.4	16.4	
Level of Service	B	B		F	C	C	C	D		F	B	
Approach Delay (s)		17.8			39.3			46.3			104.2	
Approach LOS		B			D			D			F	

Intersection Summary			
HCM 2000 Control Delay	49.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	92.8	Sum of lost time (s)	18.7
Intersection Capacity Utilization	99.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	57	494	56	237	551	392	48	133	241	366	132	82
Future Volume (vph)	57	494	56	237	551	392	48	133	241	366	132	82
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3	6.3	3.0	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	0.99	
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	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1613	3212		1645	3292	1449	1521	1716	1433	1659	3027	
Flt Permitted	0.34	1.00		0.43	1.00	1.00	0.61	1.00	1.00	0.52	1.00	
Satd. Flow (perm)	585	3212		738	3292	1449	972	1716	1433	912	3027	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	62	537	61	258	599	426	52	145	262	398	143	89
RTOR Reduction (vph)	0	6	0	0	0	246	0	0	157	0	57	0
Lane Group Flow (vph)	62	592	0	258	599	180	52	145	105	398	175	0
Confl. Peds. (#/hr)	6		2	2		6	5		7	7		5
Heavy Vehicles (%)	3%	2%	0%	1%	1%	1%	9%	2%	2%	0%	1%	6%
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6		6	8		8	4		
Actuated Green, G (s)	47.5	47.5		40.0	40.0	40.0	14.4	14.4	14.4	34.5	34.5	
Effective Green, g (s)	47.5	47.5		40.0	40.0	40.0	14.4	14.4	14.4	34.5	34.5	
Actuated g/C Ratio	0.50	0.50		0.42	0.42	0.42	0.15	0.15	0.15	0.36	0.36	
Clearance Time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3	6.3	3.0	6.3	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	342	1611		311	1390	612	147	260	217	467	1102	
v/s Ratio Prot	0.01	c0.18			0.18			0.08		c0.15	0.06	
v/s Ratio Perm	0.08			c0.35		0.12	0.05		0.07	c0.16		
v/c Ratio	0.18	0.37		0.83	0.43	0.29	0.35	0.56	0.48	0.85	0.16	
Uniform Delay, d1	12.6	14.4		24.3	19.3	18.0	36.0	37.2	36.8	25.7	20.3	
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	0.1		16.2	0.2	0.2	1.1	2.1	1.2	13.8	0.0	
Delay (s)	12.8	14.5		40.5	19.5	18.2	37.0	39.3	38.0	39.5	20.4	
Level of Service	B	B		D	B	B	D	D	D	D	C	
Approach Delay (s)		14.4			23.3			38.3			32.4	
Approach LOS		B			C			D			C	

Intersection Summary				
HCM 2000 Control Delay	25.5	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.84			
Actuated Cycle Length (s)	94.7	Sum of lost time (s)	18.7	
Intersection Capacity Utilization	85.9%	ICU Level of Service	E	
Analysis Period (min)	15			

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	83	558	109	354	239	97	469	421	269
v/c Ratio	0.23	0.53	0.69	0.50	0.48	0.30	0.88	1.07	0.17
Control Delay	19.5	24.3	56.6	32.8	7.6	27.4	42.3	85.7	6.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.5	24.3	56.6	32.8	7.6	27.4	42.3	85.7	6.6
Queue Length 50th (m)	9.8	41.7	18.9	30.6	0.0	12.6	63.5	~56.9	5.4
Queue Length 95th (m)	19.9	59.0	40.4	46.7	18.4	30.7	#142.8	#162.2	15.1
Internal Link Dist (m)		395.7		445.1			96.3		353.2
Turn Bay Length (m)	70.0		90.0		50.0	60.0		190.0	
Base Capacity (vph)	388	1691	258	1163	662	420	665	394	1816
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.33	0.42	0.30	0.36	0.23	0.71	1.07	0.15

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	83	558	109	354	239	97	165	304	421	269
v/c Ratio	0.26	0.57	0.68	0.49	0.48	0.55	0.60	0.76	0.58	0.17
Control Delay	22.5	26.9	55.2	32.2	7.6	48.9	45.2	27.8	16.1	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.5	26.9	55.2	32.2	7.6	48.9	45.2	27.8	16.1	5.9
Queue Length 50th (m)	9.4	40.4	17.5	28.3	0.0	15.5	26.6	17.9	37.7	4.7
Queue Length 95th (m)	24.2	71.8	43.4	51.1	19.2	39.0	58.1	58.2	91.0	15.0
Internal Link Dist (m)		395.7		445.1			96.3			353.2
Turn Bay Length (m)	70.0		90.0		50.0	60.0		15.0	190.0	
Base Capacity (vph)	325	2093	397	1785	877	507	798	799	804	2472
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	0.26	0.27	0.27	0.20	0.27	0.19	0.21	0.38	0.52	0.11

Intersection Summary

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	62	598	258	599	426	52	407	398	232
v/c Ratio	0.18	0.43	1.04	0.54	0.55	0.21	0.88	1.19	0.17
Control Delay	16.6	19.7	101.9	29.3	6.0	28.9	45.9	134.3	10.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.6	19.7	101.9	29.3	6.0	28.9	45.9	134.3	10.3
Queue Length 50th (m)	6.2	39.1	~55.4	49.3	0.0	7.7	59.1	~70.7	8.4
Queue Length 95th (m)	15.7	63.0	#121.1	79.8	25.2	18.1	100.4	#139.6	16.3
Internal Link Dist (m)		395.7		445.1			96.3		353.2
Turn Bay Length (m)	70.0		90.0		50.0	60.0		190.0	
Base Capacity (vph)	377	1592	249	1115	772	372	642	334	1698
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.38	1.04	0.54	0.55	0.14	0.63	1.19	0.14

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

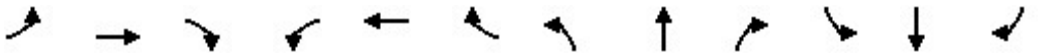
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	62	598	258	599	426	52	145	262	398	232
v/c Ratio	0.16	0.38	0.83	0.43	0.50	0.36	0.57	0.71	0.80	0.20
Control Delay	11.2	14.4	47.9	20.0	3.9	48.8	50.5	25.4	41.3	16.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.2	14.4	47.9	20.0	3.9	48.8	50.5	25.4	41.3	16.0
Queue Length 50th (m)	5.2	33.2	42.9	41.6	0.0	9.3	26.7	13.7	62.4	10.0
Queue Length 95th (m)	12.9	52.8	89.9	63.4	17.0	24.7	55.4	47.9	#156.2	23.4
Internal Link Dist (m)		395.7		445.1			96.3			353.2
Turn Bay Length (m)	70.0		90.0		50.0	60.0		15.0	190.0	
Base Capacity (vph)	379	2407	499	2229	1117	423	748	728	500	1997
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	0.16	0.25	0.52	0.27	0.38	0.12	0.19	0.36	0.80	0.12

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Appendix D

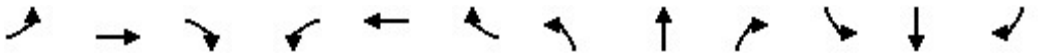
Future (2030) Background Intersection Operation Calculations (Synchro)



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	82	509	53	107	359	242	97	165	300	421	117	153
Future Volume (vph)	82	509	53	107	359	242	97	165	300	421	117	153
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3		3.0	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.95	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	0.99	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.90		1.00	0.92	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1585	3091		1483	3107	1381	1612	1448		1630	2898	
Flt Permitted	0.40	1.00		0.42	1.00	1.00	0.57	1.00		0.20	1.00	
Satd. Flow (perm)	673	3091		657	3107	1381	971	1448		349	2898	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	89	553	58	116	390	263	105	179	326	458	127	166
RTOR Reduction (vph)	0	8	0	0	0	200	0	59	0	0	81	0
Lane Group Flow (vph)	89	603	0	116	390	63	105	446	0	458	212	0
Confl. Peds. (#/hr)	59		2	2		59	3		3	3		3
Heavy Vehicles (%)	4%	6%	5%	12%	7%	2%	3%	12%	6%	2%	3%	5%
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	32.2	32.2		22.0	22.0	22.0	32.2	32.2		47.6	47.6	
Effective Green, g (s)	32.2	32.2		22.0	22.0	22.0	32.2	32.2		47.6	47.6	
Actuated g/C Ratio	0.35	0.35		0.24	0.24	0.24	0.35	0.35		0.51	0.51	
Clearance Time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3		3.0	6.3	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	305	1076		156	738	328	338	504		351	1491	
v/s Ratio Prot	0.02	c0.19			0.13			0.31		c0.17	0.07	
v/s Ratio Perm	0.08			c0.18		0.05	0.11			c0.50		
v/c Ratio	0.29	0.56		0.74	0.53	0.19	0.31	0.88		1.30	0.14	
Uniform Delay, d1	21.0	24.4		32.6	30.7	28.1	22.0	28.4		17.9	11.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	0.5		16.5	0.5	0.2	0.4	16.6		156.4	0.0	
Delay (s)	21.4	24.9		49.1	31.3	28.3	22.4	45.0		174.3	11.8	
Level of Service	C	C		D	C	C	C	D		F	B	
Approach Delay (s)		24.5			33.0			41.1			110.9	
Approach LOS		C			C			D			F	

Intersection Summary			
HCM 2000 Control Delay	53.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	92.5	Sum of lost time (s)	18.7
Intersection Capacity Utilization	106.9%	ICU Level of Service	G
Analysis Period (min)	15		

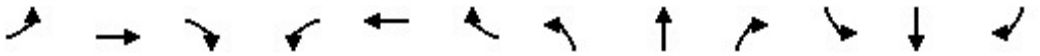
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	82	509	53	107	359	242	97	165	300	421	117	153
Future Volume (vph)	82	509	53	107	359	242	97	165	300	421	117	153
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3	6.3	3.0	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.95	1.00	1.00	0.99	1.00	0.99	
Flpb, ped/bikes	0.99	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.92	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1585	3091		1484	3107	1384	1612	1562	1384	1629	2898	
Flt Permitted	0.42	1.00		0.42	1.00	1.00	0.57	1.00	1.00	0.50	1.00	
Satd. Flow (perm)	703	3091		657	3107	1384	972	1562	1384	856	2898	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	89	553	58	116	390	263	105	179	326	458	127	166
RTOR Reduction (vph)	0	6	0	0	0	195	0	0	149	0	81	0
Lane Group Flow (vph)	89	605	0	116	390	68	105	179	177	458	212	0
Confl. Peds. (#/hr)	59		2	2		59	3		3	3		3
Heavy Vehicles (%)	4%	6%	5%	12%	7%	2%	3%	12%	6%	2%	3%	5%
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6		6	8		8	4		
Actuated Green, G (s)	30.3	30.3		22.8	22.8	22.8	17.0	17.0	17.0	44.6	44.6	
Effective Green, g (s)	30.3	30.3		22.8	22.8	22.8	17.0	17.0	17.0	44.6	44.6	
Actuated g/C Ratio	0.35	0.35		0.26	0.26	0.26	0.19	0.19	0.19	0.51	0.51	
Clearance Time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3	6.3	3.0	6.3	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	288	1069		171	808	360	188	303	268	652	1475	
v/s Ratio Prot	0.02	c0.20			0.13			0.11		c0.20	0.07	
v/s Ratio Perm	0.09			c0.18		0.05	0.11		0.13	c0.16		
v/c Ratio	0.31	0.57		0.68	0.48	0.19	0.56	0.59	0.66	0.70	0.14	
Uniform Delay, d1	20.0	23.3		29.1	27.4	25.2	31.9	32.1	32.6	14.9	11.4	
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	0.4	0.6		9.3	0.3	0.2	2.9	2.6	5.4	3.2	0.0	
Delay (s)	20.5	23.9		38.4	27.7	25.4	34.8	34.7	38.0	18.1	11.4	
Level of Service	C	C		D	C	C	C	C	D	B	B	
Approach Delay (s)		23.4			28.6			36.5			15.5	
Approach LOS		C			C			D			B	

Intersection Summary			
HCM 2000 Control Delay	25.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	87.6	Sum of lost time (s)	18.7
Intersection Capacity Utilization	88.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	61	543	61	252	604	433	52	144	260	400	142	88
Future Volume (vph)	61	543	61	252	604	433	52	144	260	400	142	88
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3		3.0	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85	1.00	0.90		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1614	3213		1645	3292	1449	1521	1533		1662	3026	
Flt Permitted	0.26	1.00		0.40	1.00	1.00	0.60	1.00		0.19	1.00	
Satd. Flow (perm)	445	3213		697	3292	1449	956	1533		324	3026	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	66	590	66	274	657	471	57	157	283	435	154	96
RTOR Reduction (vph)	0	8	0	0	0	313	0	65	0	0	54	0
Lane Group Flow (vph)	66	648	0	274	657	158	57	375	0	435	196	0
Confl. Peds. (#/hr)	6		2	2		6	5		7	7		5
Heavy Vehicles (%)	3%	2%	0%	1%	1%	1%	9%	2%	2%	0%	1%	6%
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	41.0	41.0		31.3	31.3	31.3	26.9	26.9		42.1	42.1	
Effective Green, g (s)	41.0	41.0		31.3	31.3	31.3	26.9	26.9		42.1	42.1	
Actuated g/C Ratio	0.43	0.43		0.33	0.33	0.33	0.28	0.28		0.44	0.44	
Clearance Time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3		3.0	6.3	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	272	1375		227	1075	473	268	430		312	1329	
v/s Ratio Prot	0.02	c0.20			0.20			0.24		c0.18	0.06	
v/s Ratio Perm	0.09			c0.39		0.11	0.06			c0.43		
v/c Ratio	0.24	0.47		1.21	0.61	0.33	0.21	0.87		1.39	0.15	
Uniform Delay, d1	17.2	19.6		32.2	27.1	24.4	26.4	32.8		21.7	16.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.2		127.1	0.9	0.3	0.3	17.3		195.9	0.0	
Delay (s)	17.5	19.8		159.3	28.0	24.7	26.6	50.1		217.6	16.1	
Level of Service	B	B		F	C	C	C	D		F	B	
Approach Delay (s)		19.6			52.6			47.4			144.1	
Approach LOS		B			D			D			F	

Intersection Summary			
HCM 2000 Control Delay	63.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.28		
Actuated Cycle Length (s)	95.8	Sum of lost time (s)	18.7
Intersection Capacity Utilization	105.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	61	543	61	252	604	433	52	144	260	400	142	88
Future Volume (vph)	61	543	61	252	604	433	52	144	260	400	142	88
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.4		3.0	6.4	6.4	6.3	6.3	6.3	3.0	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	0.99	
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	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1613	3213		1646	3292	1449	1521	1716	1433	1659	3026	
Flt Permitted	0.40	1.00		0.21	1.00	1.00	0.60	1.00	1.00	0.49	1.00	
Satd. Flow (perm)	683	3213		367	3292	1449	956	1716	1433	859	3026	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	66	590	66	274	657	471	57	157	283	435	154	96
RTOR Reduction (vph)	0	6	0	0	0	256	0	0	157	0	56	0
Lane Group Flow (vph)	66	650	0	274	657	215	57	157	126	435	194	0
Confl. Peds. (#/hr)	6		2	2		6	5		7	7		5
Heavy Vehicles (%)	3%	2%	0%	1%	1%	1%	9%	2%	2%	0%	1%	6%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	pm+pt	NA	
Protected Phases	5	2		1	6			8		7	4	
Permitted Phases	2			6		6	8		8	4		
Actuated Green, G (s)	30.3	25.7		44.4	36.8	36.8	15.1	15.1	15.1	40.2	40.2	
Effective Green, g (s)	30.3	25.7		44.4	36.8	36.8	15.1	15.1	15.1	40.2	40.2	
Actuated g/C Ratio	0.31	0.26		0.46	0.38	0.38	0.16	0.16	0.16	0.41	0.41	
Clearance Time (s)	3.0	6.4		3.0	6.4	6.4	6.3	6.3	6.3	3.0	6.3	
Vehicle Extension (s)	2.5	2.5		3.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	256	848		373	1245	548	148	266	222	536	1250	
v/s Ratio Prot	0.01	0.20		c0.12	0.20			0.09		c0.18	0.06	
v/s Ratio Perm	0.07			c0.22		0.15	0.06		0.09	c0.15		
v/c Ratio	0.26	0.77		0.73	0.53	0.39	0.39	0.59	0.57	0.81	0.15	
Uniform Delay, d1	24.1	33.0		18.8	23.5	22.1	36.9	38.2	38.1	22.9	17.9	
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	0.4	4.0		7.3	0.3	0.3	1.2	2.9	2.7	8.9	0.0	
Delay (s)	24.4	37.0		26.1	23.8	22.4	38.1	41.1	40.8	31.8	17.9	
Level of Service	C	D		C	C	C	D	D	D	C	B	
Approach Delay (s)		35.9			23.8			40.6			26.7	
Approach LOS		D			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	29.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	97.3	Sum of lost time (s)	18.7
Intersection Capacity Utilization	88.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	89	611	116	390	263	105	505	458	293
v/c Ratio	0.26	0.58	0.74	0.53	0.50	0.31	0.90	1.25	0.19
Control Delay	20.3	26.0	62.9	34.1	7.4	28.2	45.9	156.4	6.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.3	26.0	62.9	34.1	7.4	28.2	45.9	156.4	6.8
Queue Length 50th (m)	11.1	49.0	21.5	35.7	0.0	14.6	76.7	~85.1	6.3
Queue Length 95th (m)	21.1	65.4	#47.1	51.4	19.6	33.3	#161.4	#171.6	16.0
Internal Link Dist (m)		395.7		445.1			96.3		353.2
Turn Bay Length (m)	70.0		90.0		50.0	60.0		190.0	
Base Capacity (vph)	366	1557	226	1070	644	378	619	365	1689
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.39	0.51	0.36	0.41	0.28	0.82	1.25	0.17

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	89	611	116	390	263	105	179	326	458	293
v/c Ratio	0.27	0.58	0.68	0.48	0.48	0.57	0.60	0.79	0.67	0.19
Control Delay	21.0	25.9	53.2	30.5	6.8	48.6	44.2	30.9	21.1	6.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.0	25.9	53.2	30.5	6.8	48.6	44.2	30.9	21.1	6.7
Queue Length 50th (m)	9.7	43.4	18.3	30.5	0.0	16.9	29.0	23.2	46.9	5.6
Queue Length 95th (m)	24.3	76.2	45.3	54.1	18.9	41.3	61.9	67.3	110.9	17.4
Internal Link Dist (m)		395.7		445.1			96.3			353.2
Turn Bay Length (m)	70.0		90.0		50.0	60.0		15.0	190.0	
Base Capacity (vph)	327	2096	377	1784	887	522	841	829	707	2391
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	0.27	0.29	0.31	0.22	0.30	0.20	0.21	0.39	0.65	0.12

Intersection Summary

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	66	656	274	657	471	57	440	435	250
v/c Ratio	0.22	0.48	1.20	0.61	0.60	0.21	0.89	1.34	0.18
Control Delay	18.0	21.6	157.8	32.0	6.7	28.6	47.1	193.0	10.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.0	21.6	157.8	32.0	6.7	28.6	47.1	193.0	10.2
Queue Length 50th (m)	7.2	47.5	~69.5	59.2	0.8	8.6	67.7	~91.7	9.2
Queue Length 95th (m)	16.5	70.1	#132.6	88.6	28.6	19.5	#122.0	#163.6	17.4
Internal Link Dist (m)		395.7		445.1			96.3		353.2
Turn Bay Length (m)	70.0		90.0		50.0	60.0		190.0	
Base Capacity (vph)	341	1543	228	1081	787	354	625	325	1652
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.43	1.20	0.61	0.60	0.16	0.70	1.34	0.15

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	66	656	274	657	471	57	157	283	435	250
v/c Ratio	0.22	0.79	0.71	0.53	0.59	0.39	0.59	0.75	0.76	0.19
Control Delay	17.0	41.6	27.2	25.9	7.3	47.4	49.5	28.1	32.5	12.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.0	41.6	27.2	25.9	7.3	47.4	49.5	28.1	32.5	12.4
Queue Length 50th (m)	6.5	62.0	31.2	52.8	7.7	10.2	29.1	17.5	61.9	9.6
Queue Length 95th (m)	16.2	98.2	60.6	81.3	37.9	25.6	56.9	53.3	#131.4	21.5
Internal Link Dist (m)		395.7		445.1			96.3			353.2
Turn Bay Length (m)	70.0		90.0		50.0	60.0		15.0	190.0	
Base Capacity (vph)	302	1356	450	1874	999	402	723	710	573	2107
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	0.22	0.48	0.61	0.35	0.47	0.14	0.22	0.40	0.76	0.12

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

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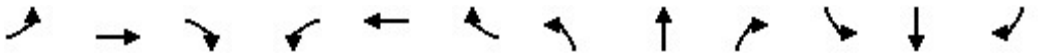
Appendix E

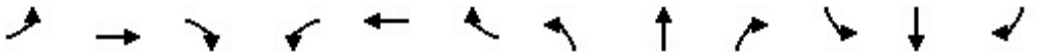
Future (2025) Total Intersection Operation Calculations (Synchro)



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	76	465	56	112	326	220	109	168	317	387	114	140
Future Volume (vph)	76	465	56	112	326	220	109	168	317	387	114	140
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3		3.0	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.95	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	0.99	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85	1.00	0.90		1.00	0.92	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1583	3085		1483	3107	1379	1612	1447		1630	2907	
Flt Permitted	0.43	1.00		0.44	1.00	1.00	0.58	1.00		0.20	1.00	
Satd. Flow (perm)	720	3085		686	3107	1379	987	1447		339	2907	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	83	505	61	122	354	239	118	183	345	421	124	152
RTOR Reduction (vph)	0	10	0	0	0	183	0	60	0	0	72	0
Lane Group Flow (vph)	83	556	0	122	354	56	118	468	0	421	204	0
Confl. Peds. (#/hr)	59		2	2		59	3		3	3		3
Heavy Vehicles (%)	4%	6%	5%	12%	7%	2%	3%	12%	6%	2%	3%	5%
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	32.2	32.2		22.0	22.0	22.0	34.5	34.5		49.7	49.7	
Effective Green, g (s)	32.2	32.2		22.0	22.0	22.0	34.5	34.5		49.7	49.7	
Actuated g/C Ratio	0.34	0.34		0.23	0.23	0.23	0.36	0.36		0.53	0.53	
Clearance Time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3		3.0	6.3	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	310	1050		159	722	320	359	527		344	1527	
v/s Ratio Prot	0.02	c0.18			0.11			0.32		c0.16	0.07	
v/s Ratio Perm	0.07			c0.18		0.04	0.12			c0.48		
v/c Ratio	0.27	0.53		0.77	0.49	0.17	0.33	0.89		1.22	0.13	
Uniform Delay, d1	21.9	25.1		33.9	31.4	29.0	21.7	28.2		18.1	11.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.4		18.9	0.4	0.2	0.4	16.5		124.0	0.0	
Delay (s)	22.2	25.5		52.8	31.8	29.2	22.1	44.7		142.1	11.5	
Level of Service	C	C		D	C	C	C	D		F	B	
Approach Delay (s)		25.1			34.5			40.6			90.4	
Approach LOS		C			C			D			F	

Intersection Summary			
HCM 2000 Control Delay	48.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	94.6	Sum of lost time (s)	18.7
Intersection Capacity Utilization	105.9%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	76	465	56	112	326	220	109	168	317	387	114	140
Future Volume (vph)	76	465	56	112	326	220	109	168	317	387	114	140
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3	6.3	3.0	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.95	1.00	1.00	0.99	1.00	0.99	
Flpb, ped/bikes	0.99	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.92	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1583	3085		1483	3107	1382	1612	1562	1384	1629	2907	
Flt Permitted	0.45	1.00		0.44	1.00	1.00	0.58	1.00	1.00	0.49	1.00	
Satd. Flow (perm)	746	3085		686	3107	1382	987	1562	1384	848	2907	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	83	505	61	122	354	239	118	183	345	421	124	152
RTOR Reduction (vph)	0	7	0	0	0	179	0	0	156	0	72	0
Lane Group Flow (vph)	83	559	0	122	354	60	118	183	189	421	204	0
Confl. Peds. (#/hr)	59		2	2		59	3		3	3		3
Heavy Vehicles (%)	4%	6%	5%	12%	7%	2%	3%	12%	6%	2%	3%	5%
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6		6	8		8	4		
Actuated Green, G (s)	30.1	30.1		22.6	22.6	22.6	18.1	18.1	18.1	47.2	47.2	
Effective Green, g (s)	30.1	30.1		22.6	22.6	22.6	18.1	18.1	18.1	47.2	47.2	
Actuated g/C Ratio	0.33	0.33		0.25	0.25	0.25	0.20	0.20	0.20	0.52	0.52	
Clearance Time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3	6.3	3.0	6.3	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	291	1031		172	780	347	198	314	278	671	1524	
v/s Ratio Prot	0.01	c0.18			0.11			0.12		c0.18	0.07	
v/s Ratio Perm	0.08			c0.18		0.04	0.12		0.14	c0.15		
v/c Ratio	0.29	0.54		0.71	0.45	0.17	0.60	0.58	0.68	0.63	0.13	
Uniform Delay, d1	21.2	24.3		30.7	28.5	26.4	32.6	32.5	33.3	13.9	10.9	
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	0.4	0.5		11.7	0.3	0.2	4.0	2.3	6.1	1.6	0.0	
Delay (s)	21.5	24.8		42.4	28.8	26.6	36.6	34.8	39.4	15.5	11.0	
Level of Service	C	C		D	C	C	D	C	D	B	B	
Approach Delay (s)		24.4			30.4			37.6			13.7	
Approach LOS		C			C			D			B	

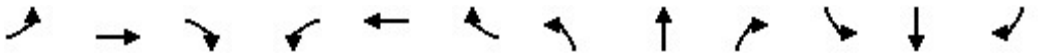
Intersection Summary			
HCM 2000 Control Delay	26.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.7
Intersection Capacity Utilization	86.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	8	73	521	3	25	256
Future Volume (Veh/h)	8	73	521	3	25	256
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	79	566	3	27	278
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						155
pX, platoon unblocked	0.97					
vC, conflicting volume	900	568			569	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	879	568			569	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	97	85			97	
cM capacity (veh/h)	302	527			1013	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	88	569	305
Volume Left	9	0	27
Volume Right	79	3	0
cSH	489	1700	1013
Volume to Capacity	0.18	0.33	0.03
Queue Length 95th (m)	5.2	0.0	0.7
Control Delay (s)	14.0	0.0	1.0
Lane LOS	B		A
Approach Delay (s)	14.0	0.0	1.0
Approach LOS	B		

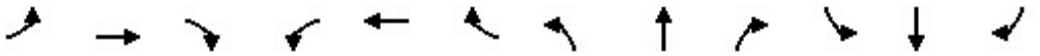
Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	45.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	57	494	76	274	551	392	60	143	263	366	148	82
Future Volume (vph)	57	494	76	274	551	392	60	143	263	366	148	82
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3		3.0	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85	1.00	0.90		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1613	3197		1645	3292	1449	1521	1532		1662	3045	
Flt Permitted	0.30	1.00		0.42	1.00	1.00	0.60	1.00		0.18	1.00	
Satd. Flow (perm)	507	3197		722	3292	1449	956	1532		321	3045	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	62	537	83	298	599	426	65	155	286	398	161	89
RTOR Reduction (vph)	0	11	0	0	0	287	0	66	0	0	50	0
Lane Group Flow (vph)	62	609	0	298	599	139	65	375	0	398	200	0
Confl. Peds. (#/hr)	6		2	2		6	5		7	7		5
Heavy Vehicles (%)	3%	2%	0%	1%	1%	1%	9%	2%	2%	0%	1%	6%
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	40.9	40.9		31.3	31.3	31.3	26.8	26.8		42.0	42.0	
Effective Green, g (s)	40.9	40.9		31.3	31.3	31.3	26.8	26.8		42.0	42.0	
Actuated g/C Ratio	0.43	0.43		0.33	0.33	0.33	0.28	0.28		0.44	0.44	
Clearance Time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3		3.0	6.3	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	293	1367		236	1077	474	268	429		312	1337	
v/s Ratio Prot	0.01	c0.19			0.18			0.24		c0.16	0.07	
v/s Ratio Perm	0.08			c0.41		0.10	0.07			c0.40		
v/c Ratio	0.21	0.45		1.26	0.56	0.29	0.24	0.87		1.28	0.15	
Uniform Delay, d1	16.9	19.3		32.1	26.4	23.9	26.6	32.8		21.7	16.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.2		147.6	0.5	0.3	0.3	17.4		146.6	0.0	
Delay (s)	17.1	19.5		179.7	26.9	24.2	26.9	50.2		168.3	16.1	
Level of Service	B	B		F	C	C	C	D		F	B	
Approach Delay (s)		19.3			60.5			47.2			109.6	
Approach LOS		B			E			D			F	

Intersection Summary			
HCM 2000 Control Delay	59.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.24		
Actuated Cycle Length (s)	95.6	Sum of lost time (s)	18.7
Intersection Capacity Utilization	103.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	57	494	76	274	551	392	60	143	263	366	148	82
Future Volume (vph)	57	494	76	274	551	392	60	143	263	366	148	82
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.4		3.0	6.4	6.4	6.3	6.3	6.3	3.0	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	0.99	
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	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1613	3197		1646	3292	1449	1521	1716	1434	1659	3045	
Flt Permitted	0.43	1.00		0.24	1.00	1.00	0.60	1.00	1.00	0.50	1.00	
Satd. Flow (perm)	722	3197		408	3292	1449	956	1716	1434	878	3045	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	62	537	83	298	599	426	65	155	286	398	161	89
RTOR Reduction (vph)	0	9	0	0	0	261	0	0	242	0	54	0
Lane Group Flow (vph)	62	611	0	298	599	165	65	155	44	398	196	0
Confl. Peds. (#/hr)	6		2	2		6	5		7	7		5
Heavy Vehicles (%)	3%	2%	0%	1%	1%	1%	9%	2%	2%	0%	1%	6%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	pm+pt	NA	
Protected Phases	5	2		1	6			8		7	4	
Permitted Phases	2			6		6	8		8	4		
Actuated Green, G (s)	28.4	23.8		42.8	35.2	35.2	14.0	14.0	14.0	36.3	36.3	
Effective Green, g (s)	28.4	23.8		42.8	35.2	35.2	14.0	14.0	14.0	36.3	36.3	
Actuated g/C Ratio	0.31	0.26		0.47	0.38	0.38	0.15	0.15	0.15	0.40	0.40	
Clearance Time (s)	3.0	6.4		3.0	6.4	6.4	6.3	6.3	6.3	3.0	6.3	
Vehicle Extension (s)	2.5	2.5		3.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	268	828		405	1262	555	145	261	218	511	1204	
v/s Ratio Prot	0.01	0.19		c0.13	0.18			0.09		c0.16	0.06	
v/s Ratio Perm	0.06			c0.21		0.11	0.07		0.03	c0.14		
v/c Ratio	0.23	0.74		0.74	0.47	0.30	0.45	0.59	0.20	0.78	0.16	
Uniform Delay, d1	22.8	31.1		17.2	21.3	19.7	35.4	36.3	34.0	22.2	17.9	
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	0.3	3.3		6.8	0.2	0.2	1.6	3.0	0.3	7.1	0.0	
Delay (s)	23.1	34.4		24.0	21.5	19.9	37.0	39.3	34.3	29.3	18.0	
Level of Service	C	C		C	C	B	D	D	C	C	B	
Approach Delay (s)		33.4			21.6			36.2			24.9	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	27.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	91.8	Sum of lost time (s)	18.7
Intersection Capacity Utilization	87.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	5	44	423	8	73	425
Future Volume (Veh/h)	5	44	423	8	73	425
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	48	460	9	79	462
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						155
pX, platoon unblocked	0.82					
vC, conflicting volume	1084	464			469	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	996	464			469	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	92			93	
cM capacity (veh/h)	209	602			1103	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	53	469	541
Volume Left	5	0	79
Volume Right	48	9	0
cSH	511	1700	1103
Volume to Capacity	0.10	0.28	0.07
Queue Length 95th (m)	2.8	0.0	1.8
Control Delay (s)	12.9	0.0	2.0
Lane LOS	B		A
Approach Delay (s)	12.9	0.0	2.0
Approach LOS	B		

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	62.5%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	83	566	122	354	239	118	528	421	276
v/c Ratio	0.24	0.54	0.77	0.49	0.48	0.33	0.90	1.17	0.17
Control Delay	20.1	25.9	64.9	33.9	7.4	28.2	45.6	124.3	6.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.1	25.9	64.9	33.9	7.4	28.2	45.6	124.3	6.9
Queue Length 50th (m)	10.3	44.4	22.6	31.9	0.0	16.5	82.4	~71.1	6.1
Queue Length 95th (m)	19.9	59.8	#48.5	46.7	18.4	37.0	#172.2	#154.1	15.6
Internal Link Dist (m)		395.7		445.1			96.3		353.2
Turn Bay Length (m)	70.0		90.0		50.0	60.0		190.0	
Base Capacity (vph)	368	1502	228	1034	615	371	603	359	1636
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.38	0.54	0.34	0.39	0.32	0.88	1.17	0.17

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	83	566	122	354	239	118	183	345	421	276
v/c Ratio	0.25	0.56	0.72	0.46	0.46	0.61	0.60	0.81	0.60	0.17
Control Delay	23.0	27.3	58.7	32.2	7.2	51.8	45.0	32.4	18.1	6.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.0	27.3	58.7	32.2	7.2	51.8	45.0	32.4	18.1	6.6
Queue Length 50th (m)	10.0	43.2	20.9	29.6	0.0	20.2	31.2	26.6	41.0	5.4
Queue Length 95th (m)	25.3	76.6	50.4	53.4	19.3	47.9	66.2	74.7	100.0	16.9
Internal Link Dist (m)		395.7		445.1			96.3			353.2
Turn Bay Length (m)	70.0		90.0		50.0	60.0		15.0	190.0	
Base Capacity (vph)	329	2049	391	1777	874	481	761	773	753	2345
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	0.25	0.28	0.31	0.20	0.27	0.25	0.24	0.45	0.56	0.12

Intersection Summary

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	62	620	298	599	426	65	441	398	250
v/c Ratio	0.19	0.46	1.26	0.55	0.56	0.24	0.89	1.22	0.18
Control Delay	17.7	21.0	177.8	30.8	6.2	29.1	47.0	147.9	10.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.7	21.0	177.8	30.8	6.2	29.1	47.0	147.9	10.6
Queue Length 50th (m)	6.7	43.7	~77.4	52.5	0.0	9.8	67.4	~76.1	9.6
Queue Length 95th (m)	15.7	65.1	#143.7	79.8	25.2	21.8	#121.9	#144.7	17.9
Internal Link Dist (m)		395.7		445.1			96.3		353.2
Turn Bay Length (m)	70.0		90.0		50.0	60.0		190.0	
Base Capacity (vph)	362	1540	237	1082	761	355	626	325	1663
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.40	1.26	0.55	0.56	0.18	0.70	1.22	0.15

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

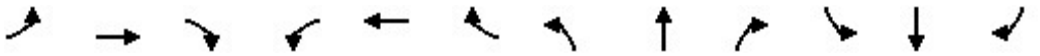
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	62	620	298	599	426	65	155	286	398	250
v/c Ratio	0.20	0.76	0.71	0.47	0.52	0.45	0.59	0.62	0.73	0.20
Control Delay	15.2	38.6	24.4	23.1	4.6	48.5	48.1	11.3	31.1	13.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.2	38.6	24.4	23.1	4.6	48.5	48.1	11.3	31.1	13.2
Queue Length 50th (m)	5.6	54.2	31.8	44.3	0.4	11.0	26.8	0.0	52.8	9.6
Queue Length 95th (m)	13.6	87.6	56.9	66.0	18.9	28.0	55.1	24.9	#119.5	22.5
Internal Link Dist (m)		395.7		445.1			96.3			353.2
Turn Bay Length (m)	70.0		90.0		50.0	60.0			190.0	
Base Capacity (vph)	317	1430	523	2096	1074	426	766	796	547	2140
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	0.20	0.43	0.57	0.29	0.40	0.15	0.20	0.36	0.73	0.12

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Appendix F

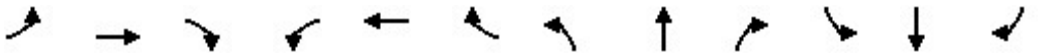
Future (2030) Total Intersection Operation Calculations (Synchro)



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	82	509	60	119	359	242	117	181	337	421	123	153
Future Volume (vph)	82	509	60	119	359	242	117	181	337	421	123	153
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3		3.0	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.94	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	0.99	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85	1.00	0.90		1.00	0.92	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1584	3086		1483	3107	1378	1612	1447		1630	2906	
Flt Permitted	0.40	1.00		0.42	1.00	1.00	0.57	1.00		0.16	1.00	
Satd. Flow (perm)	674	3086		652	3107	1378	965	1447		268	2906	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	89	553	65	129	390	263	127	197	366	458	134	166
RTOR Reduction (vph)	0	9	0	0	0	198	0	59	0	0	80	0
Lane Group Flow (vph)	89	609	0	129	390	65	127	504	0	458	220	0
Confl. Peds. (#/hr)	59		2	2		59	3		3	3		3
Heavy Vehicles (%)	4%	6%	5%	12%	7%	2%	3%	12%	6%	2%	3%	5%
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	34.3	34.3		23.9	23.9	23.9	35.2	35.2		50.4	50.4	
Effective Green, g (s)	34.3	34.3		23.9	23.9	23.9	35.2	35.2		50.4	50.4	
Actuated g/C Ratio	0.35	0.35		0.25	0.25	0.25	0.36	0.36		0.52	0.52	
Clearance Time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3		3.0	6.3	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	306	1086		159	762	338	348	522		309	1503	
v/s Ratio Prot	0.02	c0.20			0.13			0.35		c0.19	0.08	
v/s Ratio Perm	0.08			c0.20		0.05	0.13			c0.58		
v/c Ratio	0.29	0.56		0.81	0.51	0.19	0.36	0.97		1.48	0.15	
Uniform Delay, d1	21.9	25.5		34.6	31.7	29.1	22.9	30.5		22.3	12.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	0.5		25.4	0.4	0.2	0.5	30.6		233.6	0.0	
Delay (s)	22.3	26.0		60.0	32.2	29.3	23.4	61.1		255.9	12.3	
Level of Service	C	C		E	C	C	C	E		F	B	
Approach Delay (s)		25.5			35.8			54.1			159.5	
Approach LOS		C			D			D			F	

Intersection Summary			
HCM 2000 Control Delay	69.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.24		
Actuated Cycle Length (s)	97.4	Sum of lost time (s)	18.7
Intersection Capacity Utilization	110.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	82	509	60	119	359	242	117	181	337	421	123	153
Future Volume (vph)	82	509	60	119	359	242	117	181	337	421	123	153
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3	6.3	3.0	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.95	1.00	1.00	0.99	1.00	0.99	
Flpb, ped/bikes	0.99	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.92	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1584	3086		1483	3107	1379	1612	1562	1383	1629	2906	
Flt Permitted	0.42	1.00		0.42	1.00	1.00	0.57	1.00	1.00	0.48	1.00	
Satd. Flow (perm)	706	3086		652	3107	1379	965	1562	1383	821	2906	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	89	553	65	129	390	263	127	197	366	458	134	166
RTOR Reduction (vph)	0	7	0	0	0	191	0	0	143	0	81	0
Lane Group Flow (vph)	89	611	0	129	390	72	127	197	223	458	219	0
Confl. Peds. (#/hr)	59		2	2		59	3		3	3		3
Heavy Vehicles (%)	4%	6%	5%	12%	7%	2%	3%	12%	6%	2%	3%	5%
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6		6	8		8	4		
Actuated Green, G (s)	33.6	33.6		26.1	26.1	26.1	20.8	20.8	20.8	48.8	48.8	
Effective Green, g (s)	33.6	33.6		26.1	26.1	26.1	20.8	20.8	20.8	48.8	48.8	
Actuated g/C Ratio	0.35	0.35		0.27	0.27	0.27	0.22	0.22	0.22	0.51	0.51	
Clearance Time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3	6.3	3.0	6.3	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	290	1090		178	852	378	211	341	302	633	1491	
v/s Ratio Prot	0.01	c0.20			0.13			0.13		c0.19	0.08	
v/s Ratio Perm	0.09			c0.20		0.05	0.13		0.16	c0.18		
v/c Ratio	0.31	0.56		0.72	0.46	0.19	0.60	0.58	0.74	0.72	0.15	
Uniform Delay, d1	21.2	24.8		31.2	28.6	26.4	33.4	33.2	34.6	16.0	12.2	
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	0.4	0.5		12.8	0.3	0.2	4.0	1.9	8.6	3.8	0.0	
Delay (s)	21.7	25.3		44.1	28.9	26.6	37.5	35.2	43.2	19.8	12.2	
Level of Service	C	C		D	C	C	D	D	D	B	B	
Approach Delay (s)		24.9			30.6			39.9			16.8	
Approach LOS		C			C			D			B	

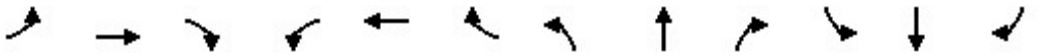
Intersection Summary			
HCM 2000 Control Delay	27.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	95.1	Sum of lost time (s)	18.7
Intersection Capacity Utilization	89.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	8	73	562	3	25	278
Future Volume (Veh/h)	8	73	562	3	25	278
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	79	611	3	27	302
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						155
pX, platoon unblocked	0.96					
vC, conflicting volume	968	612			614	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	947	612			614	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	97	84			97	
cM capacity (veh/h)	273	496			975	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	88	614	329
Volume Left	9	0	27
Volume Right	79	3	0
cSH	458	1700	975
Volume to Capacity	0.19	0.36	0.03
Queue Length 95th (m)	5.6	0.0	0.7
Control Delay (s)	14.7	0.0	1.0
Lane LOS	B		A
Approach Delay (s)	14.7	0.0	1.0
Approach LOS	B		

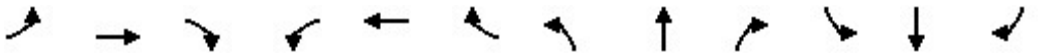
Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	47.0%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	61	543	81	289	604	433	64	154	282	400	158	88
Future Volume (vph)	61	543	81	289	604	433	64	154	282	400	158	88
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3		3.0	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85	1.00	0.90		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1614	3199		1645	3292	1449	1521	1532		1662	3044	
Flt Permitted	0.26	1.00		0.39	1.00	1.00	0.59	1.00		0.16	1.00	
Satd. Flow (perm)	435	3199		682	3292	1449	939	1532		288	3044	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	66	590	88	314	657	471	70	167	307	435	172	96
RTOR Reduction (vph)	0	11	0	0	0	317	0	64	0	0	53	0
Lane Group Flow (vph)	66	667	0	314	657	154	70	410	0	435	215	0
Confl. Peds. (#/hr)	6		2	2		6	5		7	7		5
Heavy Vehicles (%)	3%	2%	0%	1%	1%	1%	9%	2%	2%	0%	1%	6%
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases	5	2			6			8		7	4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)	40.9	40.9		31.2	31.2	31.2	29.0	29.0		44.2	44.2	
Effective Green, g (s)	40.9	40.9		31.2	31.2	31.2	29.0	29.0		44.2	44.2	
Actuated g/C Ratio	0.42	0.42		0.32	0.32	0.32	0.30	0.30		0.45	0.45	
Clearance Time (s)	3.0	6.4		6.4	6.4	6.4	6.3	6.3		3.0	6.3	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	262	1337		217	1050	462	278	454		301	1375	
v/s Ratio Prot	0.02	c0.21			0.20			0.27		c0.18	0.07	
v/s Ratio Perm	0.09			c0.46		0.11	0.07			c0.47		
v/c Ratio	0.25	0.50		1.45	0.63	0.33	0.25	0.90		1.45	0.16	
Uniform Delay, d1	18.1	20.9		33.3	28.3	25.4	26.2	33.0		22.4	15.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	0.2		225.1	1.0	0.3	0.3	21.0		218.2	0.0	
Delay (s)	18.5	21.1		258.4	29.3	25.7	26.5	54.0		240.6	15.8	
Level of Service	B	C		F	C	C	C	D		F	B	
Approach Delay (s)		20.9			78.0			50.5			154.9	
Approach LOS		C			E			D			F	

Intersection Summary			
HCM 2000 Control Delay	77.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.41		
Actuated Cycle Length (s)	97.8	Sum of lost time (s)	18.7
Intersection Capacity Utilization	109.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	61	543	81	289	604	433	64	154	282	400	158	88
Future Volume (vph)	61	543	81	289	604	433	64	154	282	400	158	88
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	6.4		3.0	6.4	6.4	6.3	6.3	6.3	3.0	6.3	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	0.99	
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	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1613	3199		1646	3292	1448	1521	1716	1433	1659	3043	
Flt Permitted	0.40	1.00		0.20	1.00	1.00	0.59	1.00	1.00	0.47	1.00	
Satd. Flow (perm)	683	3199		345	3292	1448	939	1716	1433	829	3043	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	66	590	88	314	657	471	70	167	307	435	172	96
RTOR Reduction (vph)	0	9	0	0	0	253	0	0	158	0	58	0
Lane Group Flow (vph)	66	669	0	314	657	218	70	167	149	435	210	0
Confl. Peds. (#/hr)	6		2	2		6	5		7	7		5
Heavy Vehicles (%)	3%	2%	0%	1%	1%	1%	9%	2%	2%	0%	1%	6%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	pm+pt	NA	
Protected Phases	5	2		1	6			8		7	4	
Permitted Phases	2			6		6	8		8	4		
Actuated Green, G (s)	31.9	27.3		48.5	40.9	40.9	16.8	16.8	16.8	40.5	40.5	
Effective Green, g (s)	31.9	27.3		48.5	40.9	40.9	16.8	16.8	16.8	40.5	40.5	
Actuated g/C Ratio	0.31	0.27		0.48	0.40	0.40	0.17	0.17	0.17	0.40	0.40	
Clearance Time (s)	3.0	6.4		3.0	6.4	6.4	6.3	6.3	6.3	3.0	6.3	
Vehicle Extension (s)	2.5	2.5		3.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	256	858		397	1323	582	155	283	236	499	1211	
v/s Ratio Prot	0.01	0.21		c0.14	0.20			0.10		c0.18	0.07	
v/s Ratio Perm	0.07			c0.24		0.15	0.07		0.10	c0.17		
v/c Ratio	0.26	0.78		0.79	0.50	0.37	0.45	0.59	0.63	0.87	0.17	
Uniform Delay, d1	25.0	34.4		19.2	22.7	21.4	38.3	39.3	39.6	25.4	19.8	
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	0.4	4.4		10.3	0.2	0.3	1.5	2.7	4.8	15.2	0.0	
Delay (s)	25.4	38.8		29.5	22.9	21.7	39.8	42.0	44.3	40.7	19.8	
Level of Service	C	D		C	C	C	D	D	D	D	B	
Approach Delay (s)		37.6			24.0			43.0			32.7	
Approach LOS		D			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	31.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	101.7	Sum of lost time (s)	18.7
Intersection Capacity Utilization	92.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	5	44	457	8	73	454
Future Volume (Veh/h)	5	44	457	8	73	454
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	48	497	9	79	493
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						155
pX, platoon unblocked	0.81					
vC, conflicting volume	1152	502			506	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1070	502			506	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	97	92			93	
cM capacity (veh/h)	185	574			1069	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	53	506	572
Volume Left	5	0	79
Volume Right	48	9	0
cSH	479	1700	1069
Volume to Capacity	0.11	0.30	0.07
Queue Length 95th (m)	3.0	0.0	1.9
Control Delay (s)	13.5	0.0	2.0
Lane LOS	B		A
Approach Delay (s)	13.5	0.0	2.0
Approach LOS	B		

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	65.8%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	89	618	129	390	263	127	563	458	300
v/c Ratio	0.26	0.57	0.81	0.51	0.49	0.36	0.97	1.44	0.19
Control Delay	20.1	26.5	70.1	34.1	7.1	29.8	58.4	235.1	7.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.1	26.5	70.1	34.1	7.1	29.8	58.4	235.1	7.1
Queue Length 50th (m)	11.1	49.6	24.6	35.8	0.0	19.6	~103.2	~109.3	7.4
Queue Length 95th (m)	21.1	66.3	#54.7	51.4	19.6	39.8	#190.6	#186.4	16.6
Internal Link Dist (m)		395.7		445.1			96.3		353.2
Turn Bay Length (m)	70.0		90.0		50.0	60.0		190.0	
Base Capacity (vph)	361	1451	210	998	619	350	583	319	1591
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.43	0.61	0.39	0.42	0.36	0.97	1.44	0.19

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	89	618	129	390	263	127	197	366	458	300
v/c Ratio	0.27	0.58	0.72	0.46	0.47	0.62	0.59	0.83	0.69	0.19
Control Delay	22.8	27.4	58.2	31.6	6.7	50.6	43.7	36.1	23.2	7.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.8	27.4	58.2	31.6	6.7	50.6	43.7	36.1	23.2	7.2
Queue Length 50th (m)	10.7	48.1	22.6	33.0	0.0	22.7	35.0	35.3	54.4	6.8
Queue Length 95th (m)	26.4	83.8	54.4	58.1	19.7	50.6	69.7	85.7	116.6	18.7
Internal Link Dist (m)		395.7		445.1			96.3			353.2
Turn Bay Length (m)	70.0		90.0		50.0	60.0		15.0	190.0	
Base Capacity (vph)	326	1966	349	1664	845	484	784	785	682	2253
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	0.27	0.31	0.37	0.23	0.31	0.26	0.25	0.47	0.67	0.13

Intersection Summary

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	66	678	314	657	471	70	474	435	268
v/c Ratio	0.22	0.51	1.44	0.62	0.60	0.25	0.91	1.39	0.19
Control Delay	18.7	22.7	251.4	33.2	6.8	29.1	50.4	217.4	10.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.7	22.7	251.4	33.2	6.8	29.1	50.4	217.4	10.5
Queue Length 50th (m)	7.8	53.2	~92.9	63.2	0.9	10.7	76.9	~100.1	10.3
Queue Length 95th (m)	16.5	72.4	#154.6	88.6	28.6	23.3	#139.5	#170.0	19.0
Internal Link Dist (m)		395.7		445.1			96.3		353.2
Turn Bay Length (m)	70.0		90.0		50.0	60.0		190.0	
Base Capacity (vph)	330	1503	218	1055	780	340	612	312	1624
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.45	1.44	0.62	0.60	0.21	0.77	1.39	0.17

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	66	678	314	657	471	70	167	307	435	268
v/c Ratio	0.22	0.80	0.77	0.50	0.56	0.45	0.59	0.78	0.83	0.21
Control Delay	17.1	43.2	31.6	24.7	6.4	50.6	49.7	31.3	39.7	14.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.1	43.2	31.6	24.7	6.4	50.6	49.7	31.3	39.7	14.2
Queue Length 50th (m)	6.4	65.4	36.0	51.8	6.0	13.0	31.7	22.6	66.6	11.5
Queue Length 95th (m)	16.4	107.3	#85.8	83.1	34.4	31.3	61.9	62.4	#155.2	25.2
Internal Link Dist (m)		395.7		445.1			96.3			353.2
Turn Bay Length (m)	70.0		90.0		50.0	60.0		15.0	190.0	
Base Capacity (vph)	300	1279	481	1882	1007	375	685	684	527	1963
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	0.22	0.53	0.65	0.35	0.47	0.19	0.24	0.45	0.83	0.14

Intersection Summary

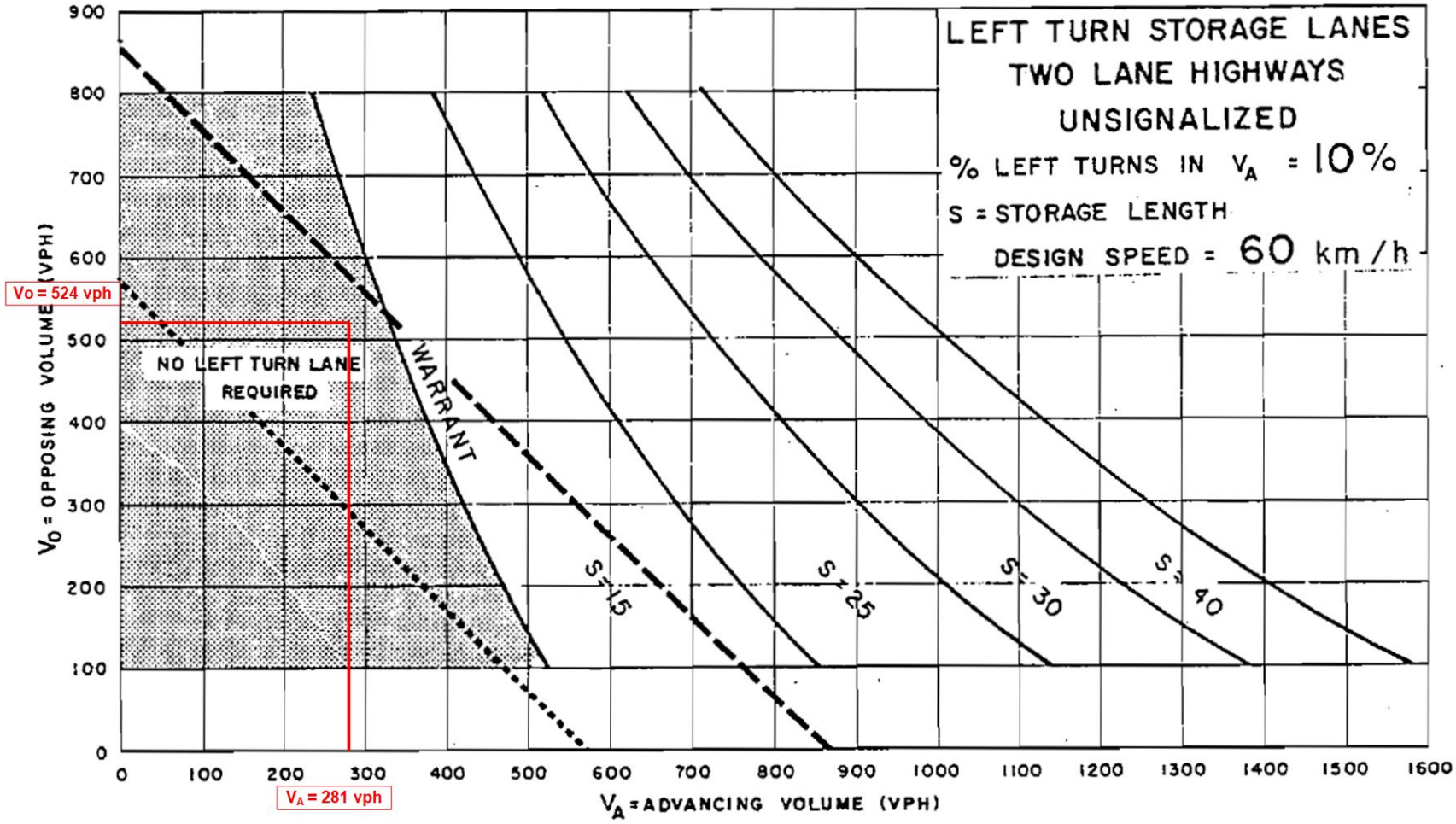
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

TRAFFMOBILITY

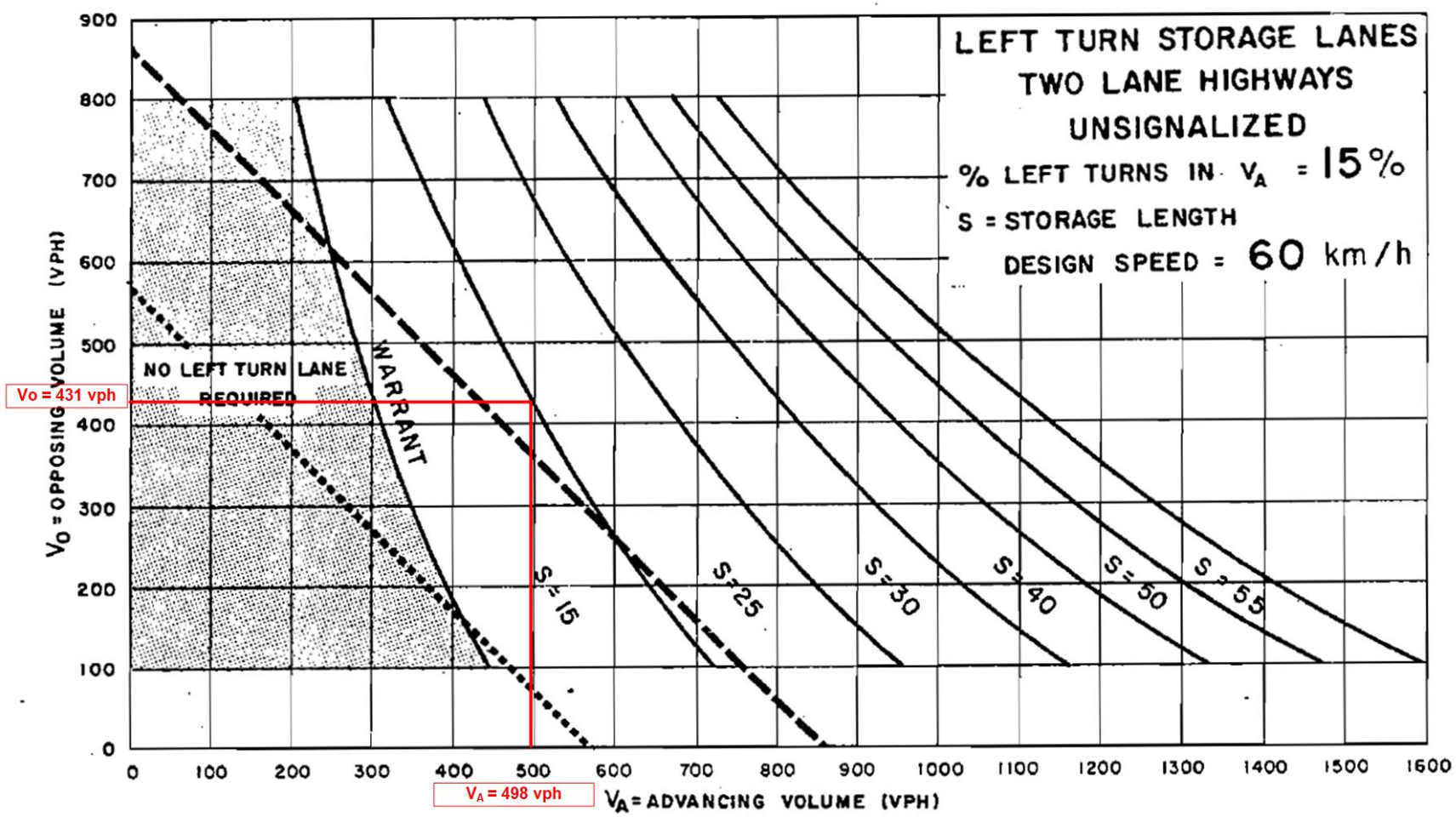
Appendix G

Left Turn Warrant Analysis

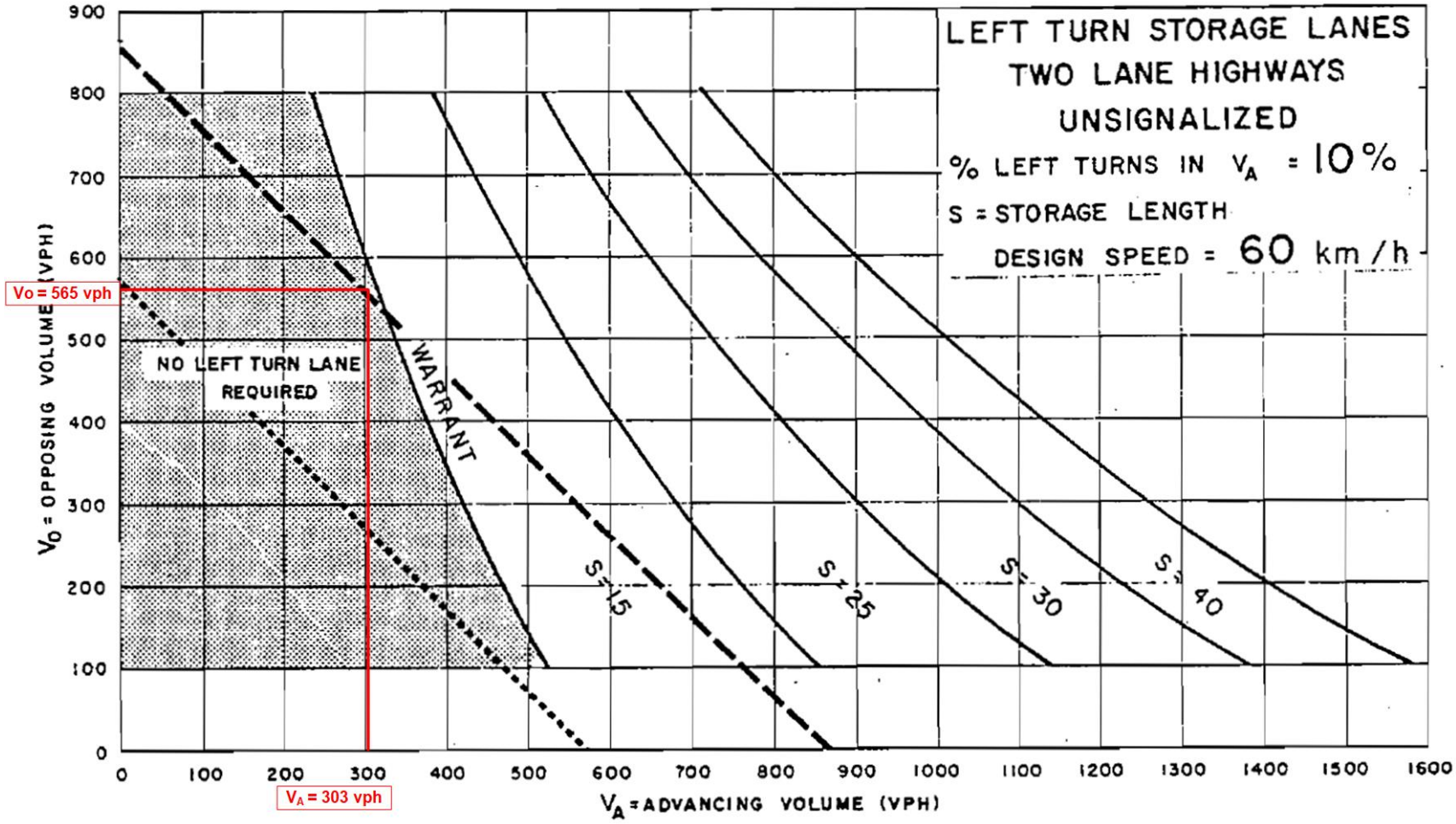
Future (2025) Total Conditions (AM Peak Hour)



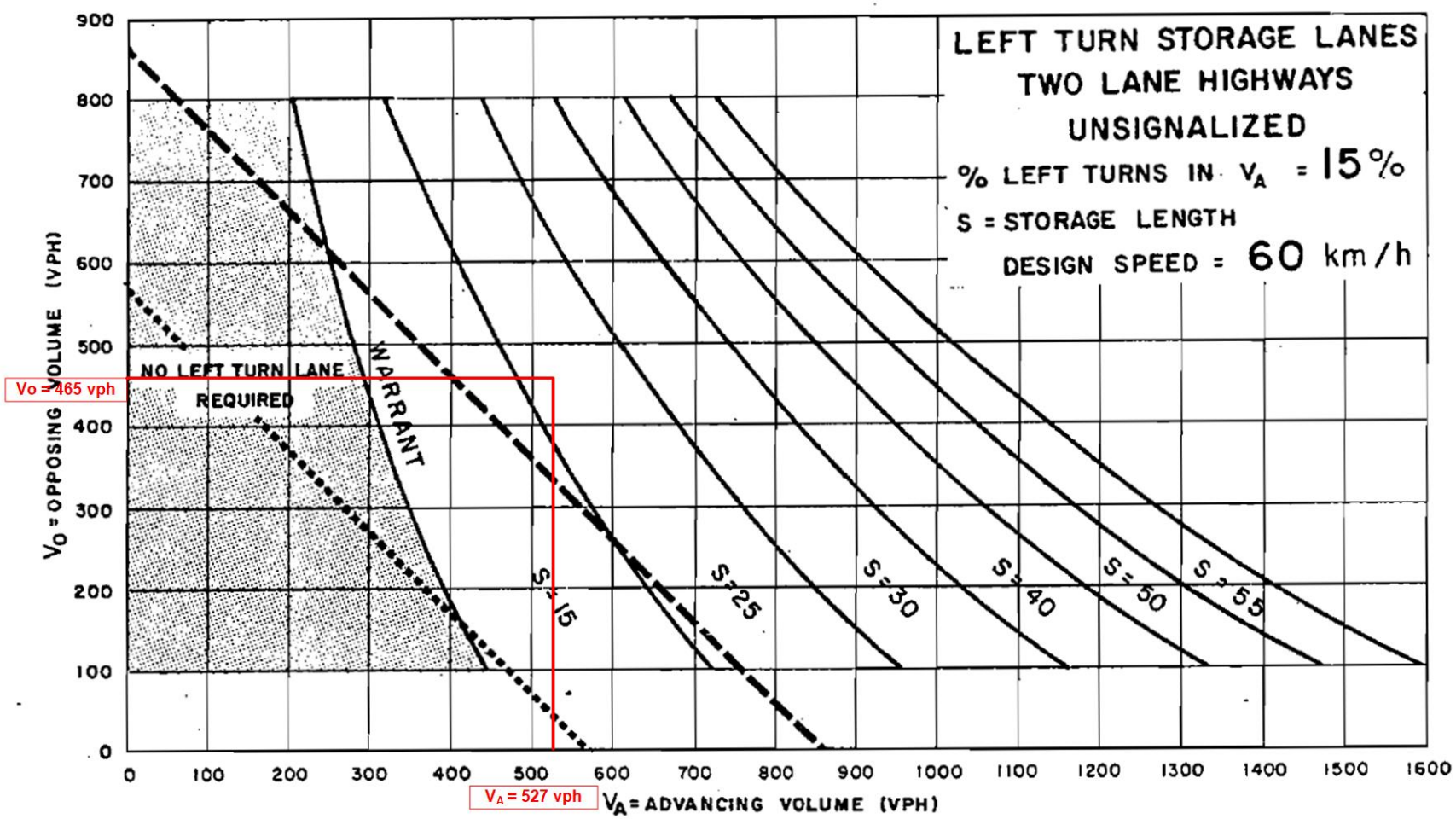
Future (2025) Total Conditions (PM Peak Hour)



Future (2030) Total Conditions (AM Peak Hour)



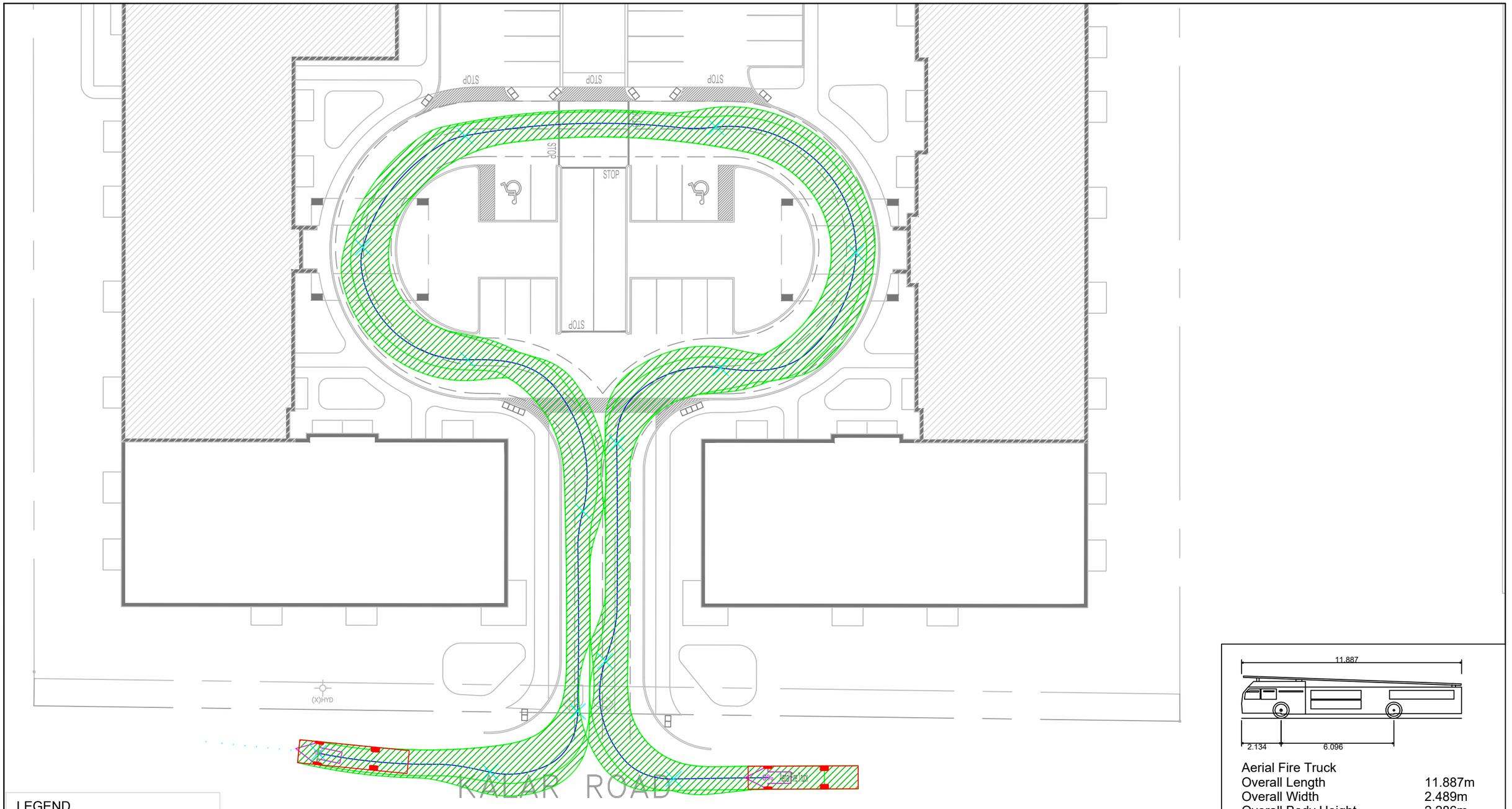
Future (2030) Total Conditions (PM Peak Hour)



TRAFFMOBILITY

Appendix H

Swept Path Analysis



LEGEND

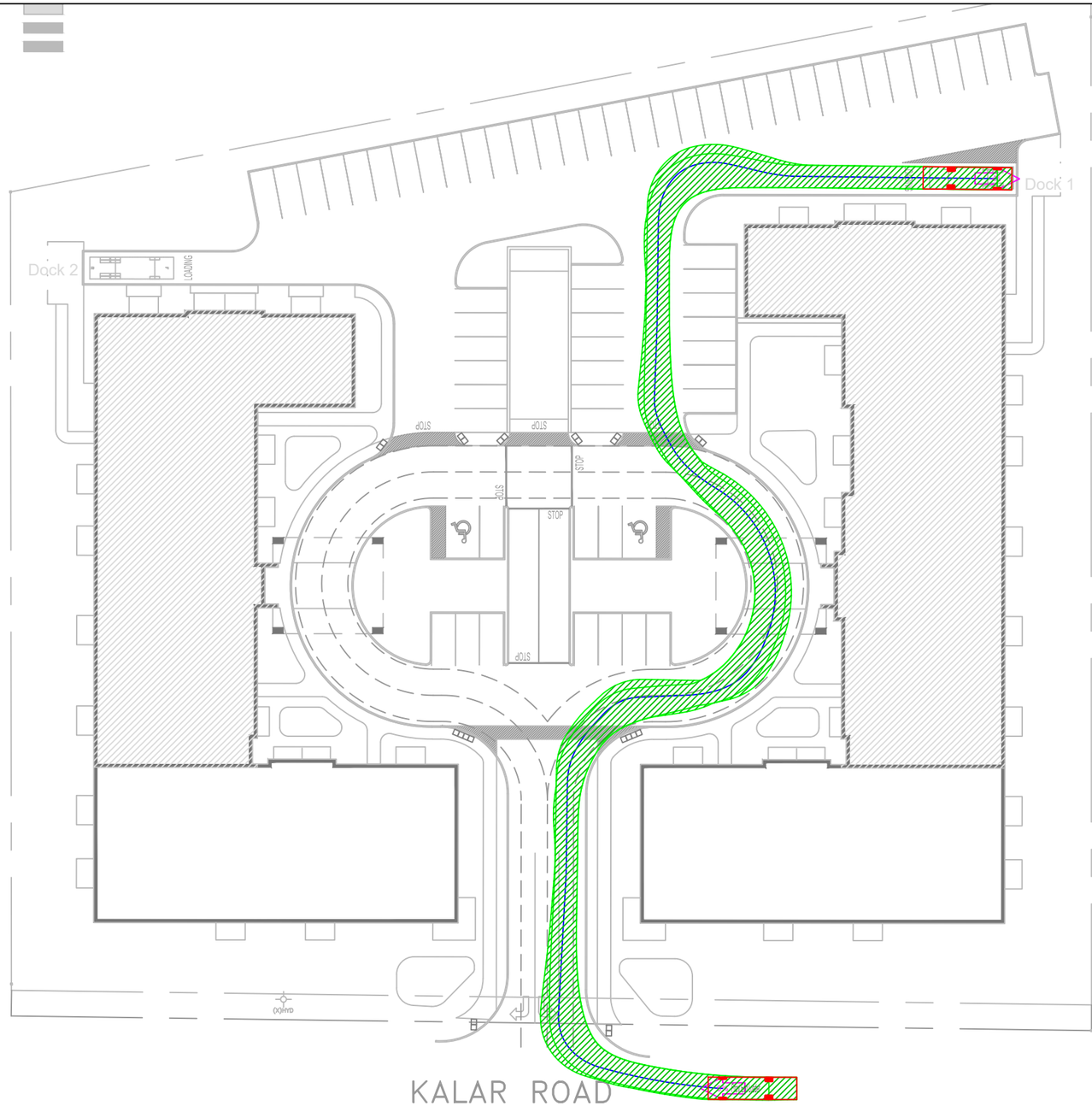
- Forward Path
- Reverse Path

Aerial Fire Truck

Overall Length	11.887m
Overall Width	2.489m
Overall Body Height	2.286m
Min Body Ground Clearance	0.229m
Track Width	2.489m
Lock-to-lock time	5.00s
Max Wheel Angle	45.00°

TRAFFMOBILITY

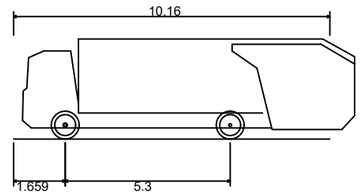
DESIGN		DRAWN		CHECKED		CONTRACT No.
SCALE:		DRAWING NUMBER		Fire Truck Ingress/Egress		
DATE:						



LEGEND

Forward Path

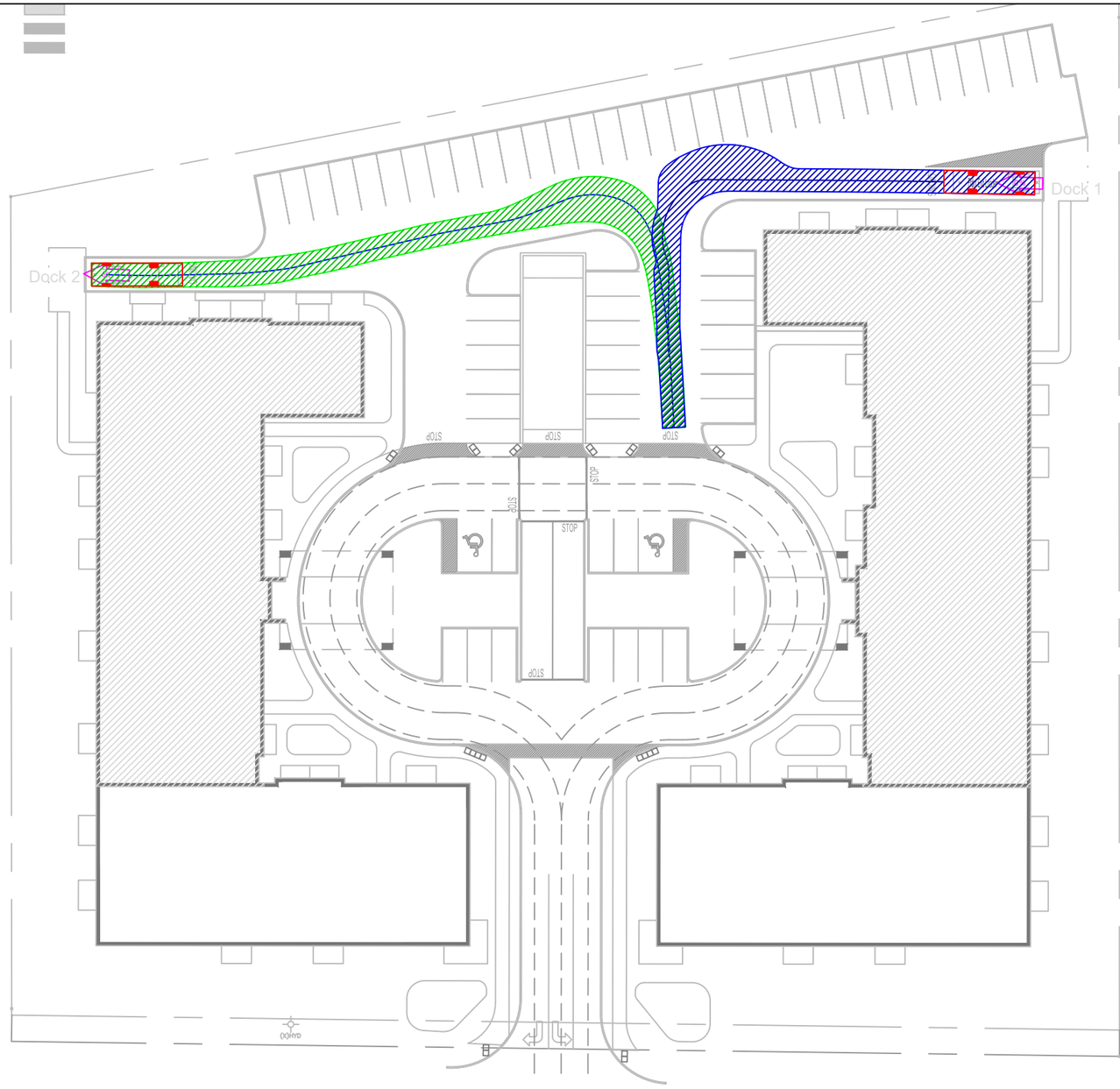
Reverse Path



Front- Loader Garbage Truck	
Overall Length	10.160m
Overall Width	2.553m
Overall Body Height	3.215m
Min Body Ground Clearance	0.305m
Track Width	2.553m
Lock-to-lock time	6.00s
Curb to Curb Turning Radius	8.931m

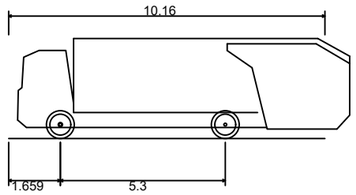
TRAFFMOBILITY

DESIGN		DRAWN		CHECKED		CONTRACT No.
SCALE:			DRAWING NUMBER			Front-Load Garbage Truck Ingress to Loading Dock 1
DATE:						



LEGEND

- Forward Path
- Reverse Path



Front- Loader Garbage Truck

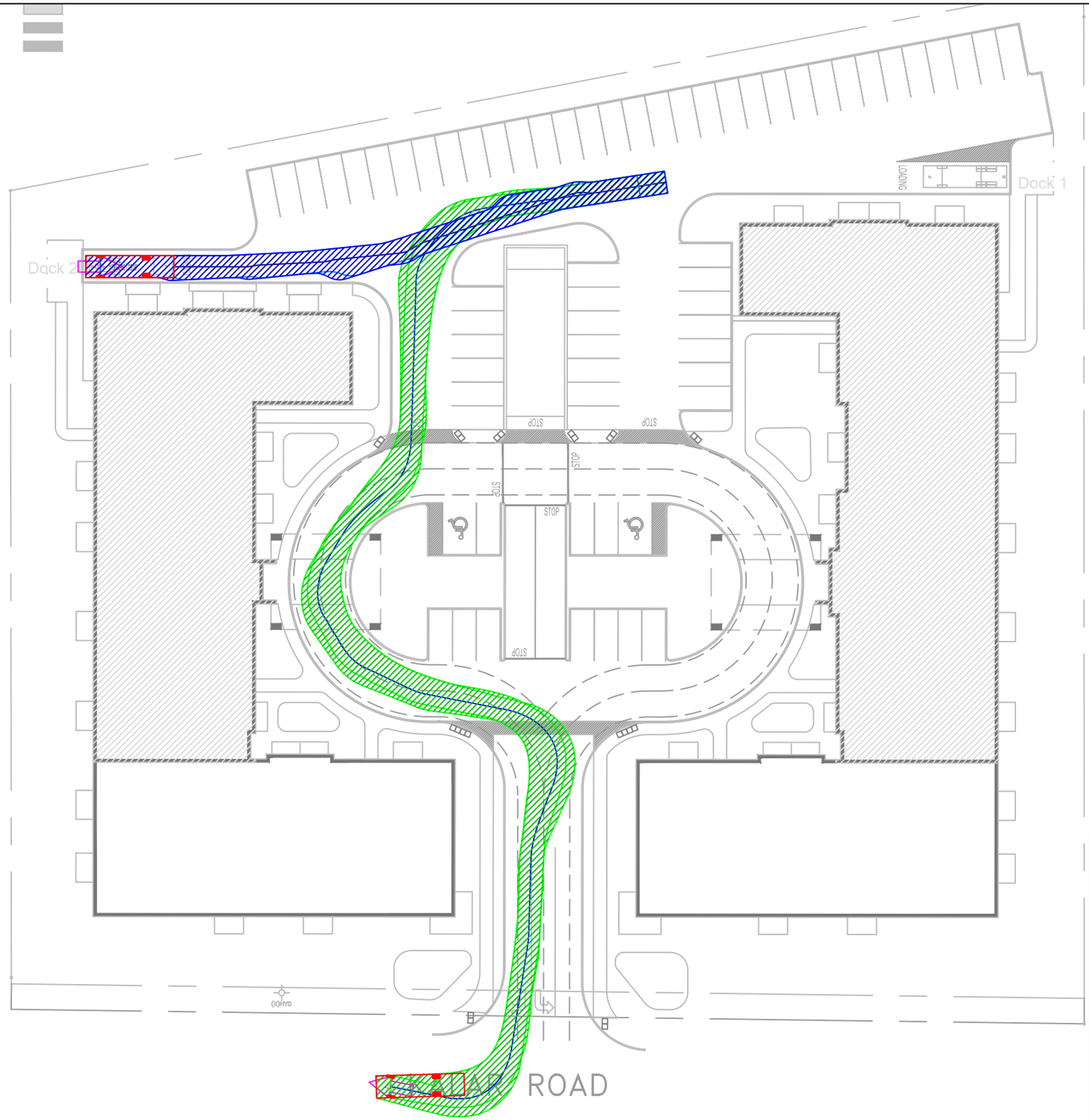
Overall Length	10.160m
Overall Width	2.553m
Overall Body Height	3.215m
Min Body Ground Clearance	0.305m
Track Width	2.553m
Lock-to-lock time	6.00s
Curb to Curb Turning Radius	8.931m

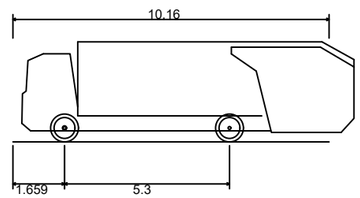
TRAFFMOBILITY

DESIGN		DRAWN		CHECKED		CONTRACT No.
SCALE:						
DATE:						

DRAWING NUMBER

Front-Load Garbage Truck
Ingress from Loading Dock 1 to 2





Front- Loader Garbage Truck

Overall Length	10.160m
Overall Width	2.553m
Overall Body Height	3.215m
Min Body Ground Clearance	0.305m
Track Width	2.553m
Lock-to-lock time	6.00s
Curb to Curb Turning Radius	8.931m

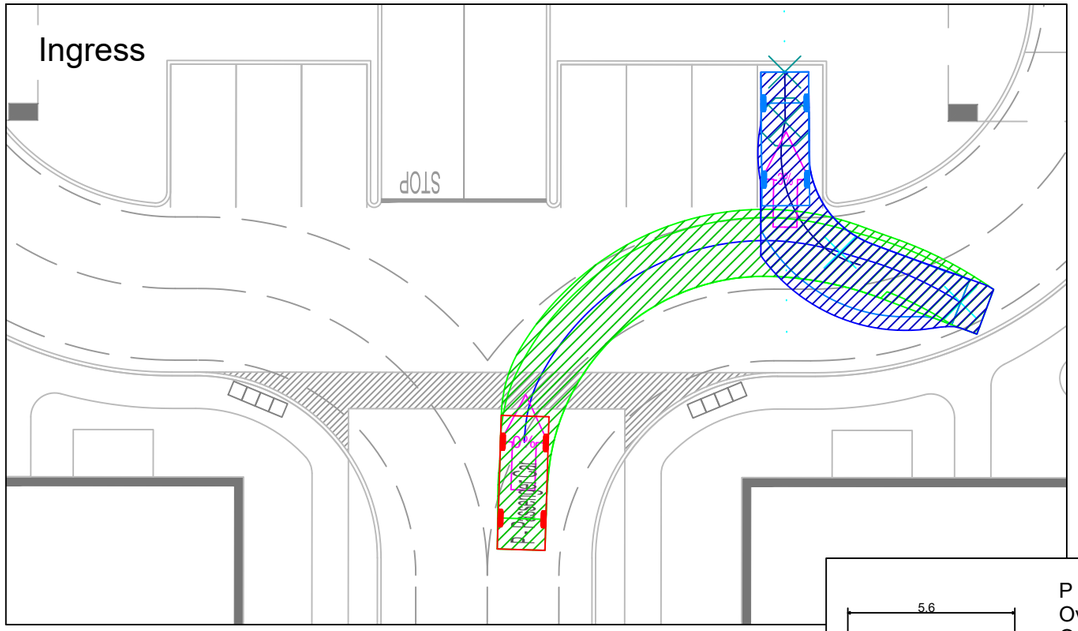
LEGEND

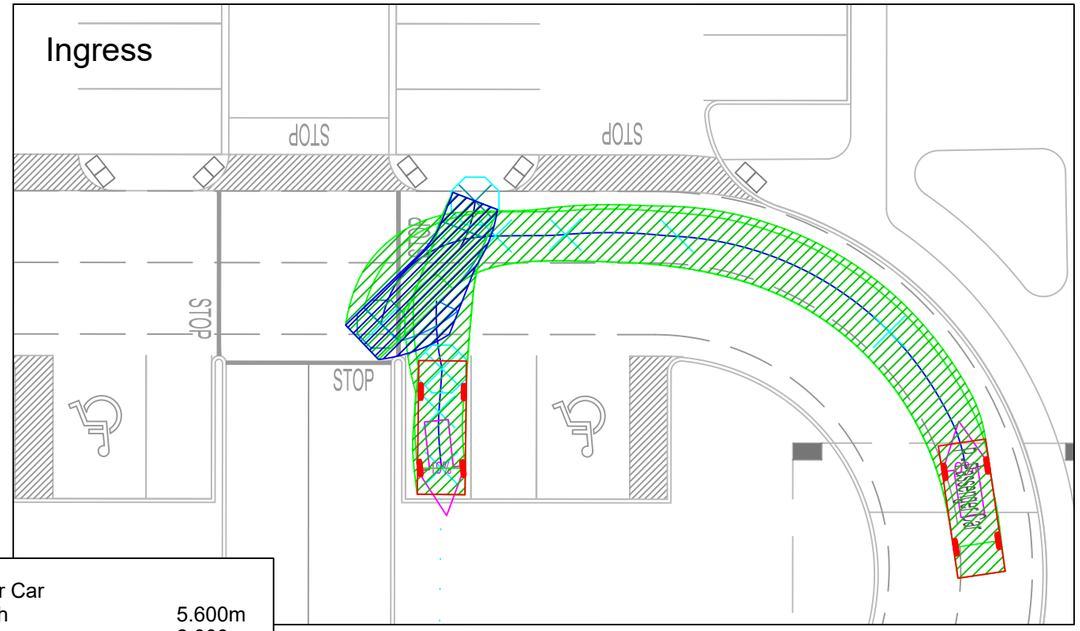
Forward Path

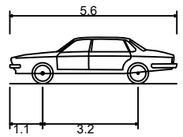
Reverse Path

TRAFFMOBILITY

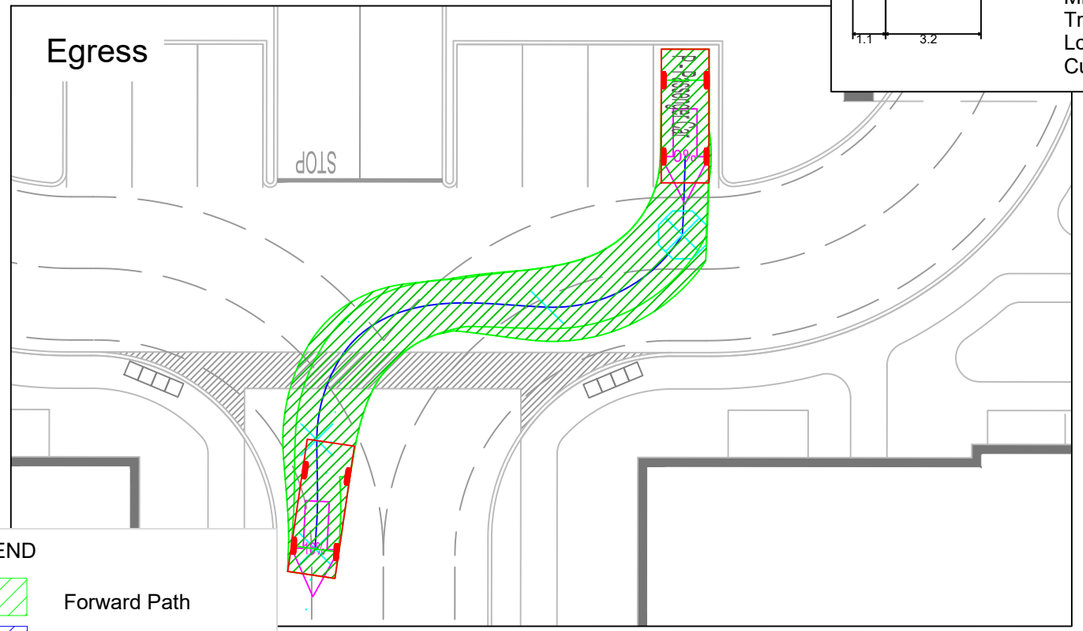
DESIGN		DRAWN		CHECKED		CONTRACT No.
SCALE:						
DATE:		DRAWING NUMBER		Front-Load Garbage Truck Egress from Loading Dock 2		

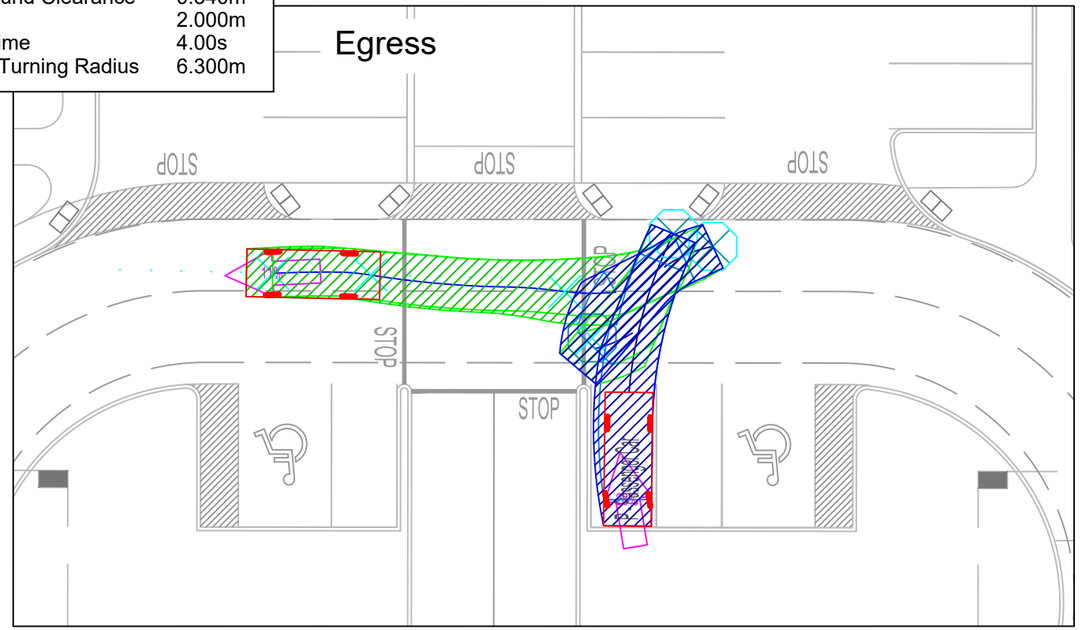






P - Passenger Car	
Overall Length	5.600m
Overall Width	2.000m
Overall Body Height	1.555m
Min Body Ground Clearance	0.340m
Track Width	2.000m
Lock-to-lock time	4.00s
Curb to Curb Turning Radius	6.300m





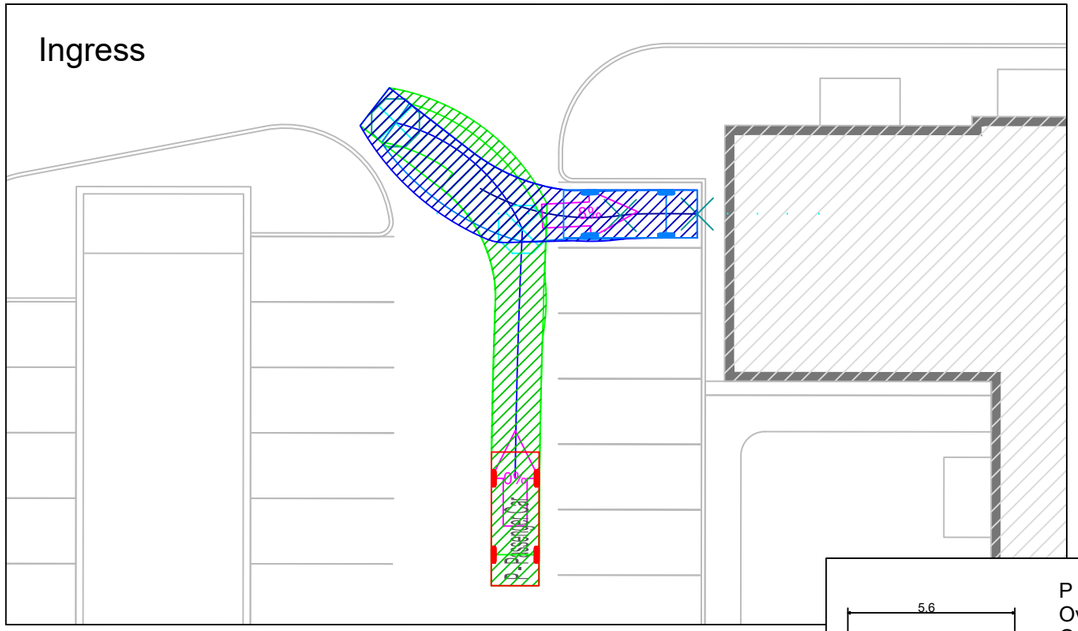
LEGEND

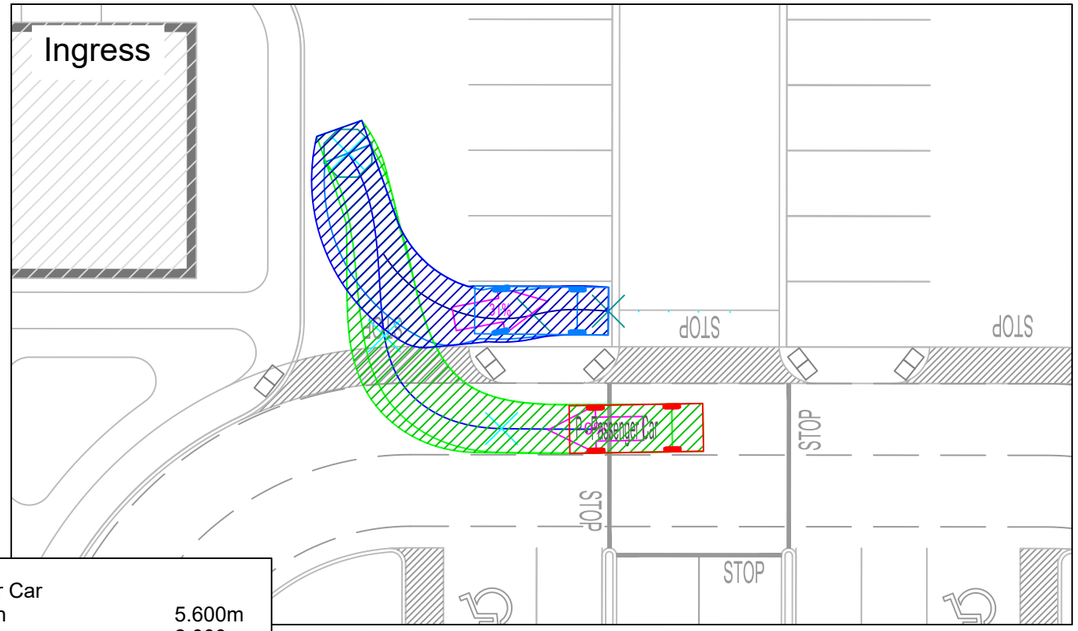
Forward Path

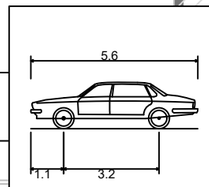
Reverse Path

TRAFFMOBILITY

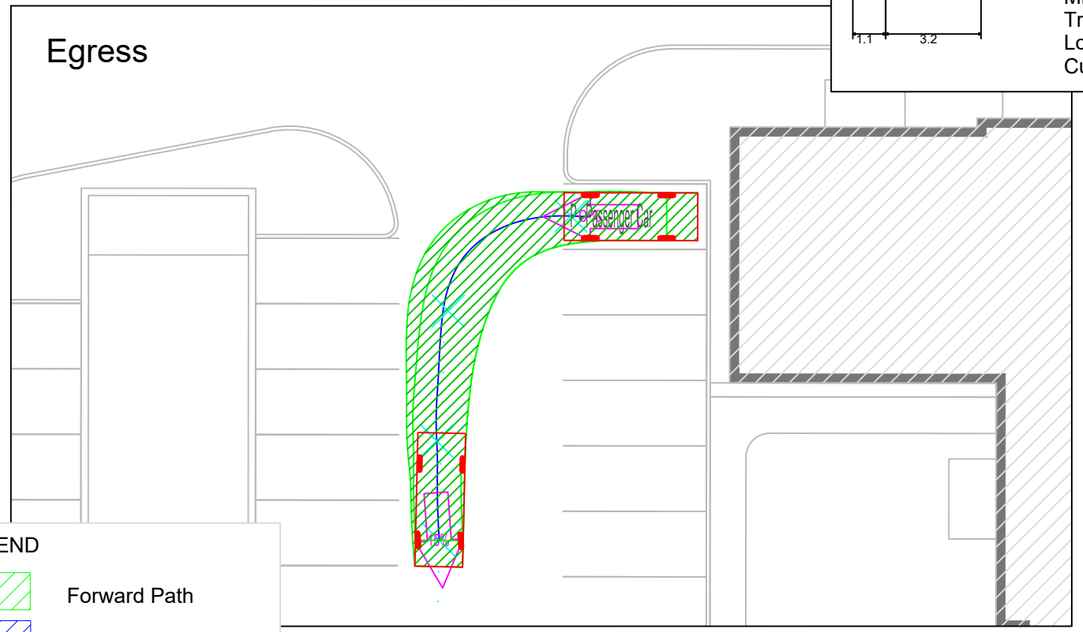
DESIGN		DRAWN		CHECKED		CONTRACT No.
SCALE:						
DATE:				DRAWING NUMBER		Passenger Car Ingress 1

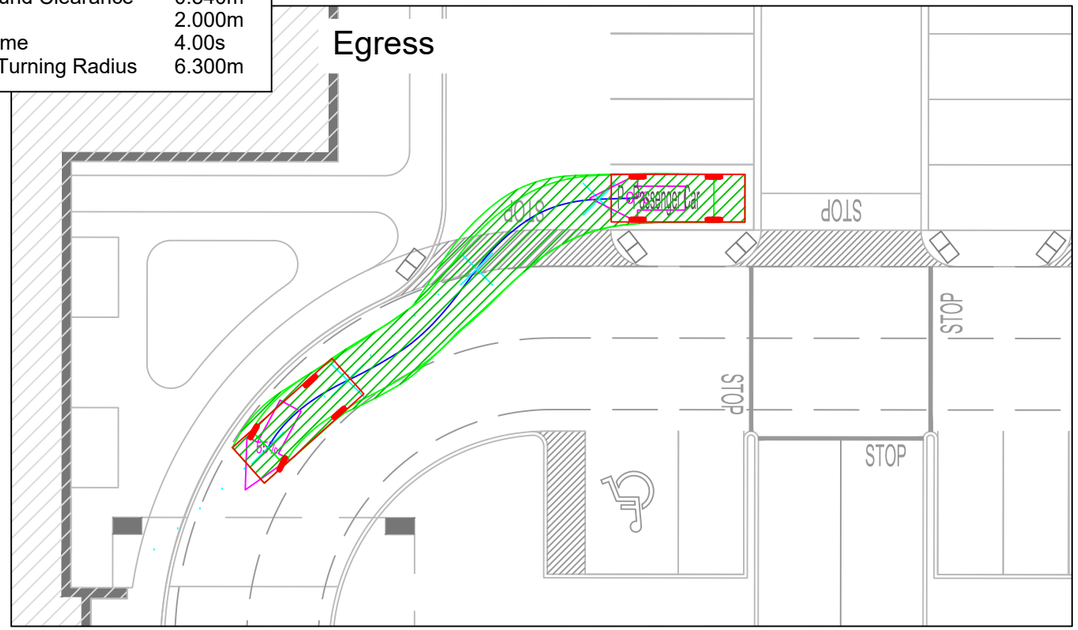






P - Passenger Car	
Overall Length	5.600m
Overall Width	2.000m
Overall Body Height	1.555m
Min Body Ground Clearance	0.340m
Track Width	2.000m
Lock-to-lock time	4.00s
Curb to Curb Turning Radius	6.300m





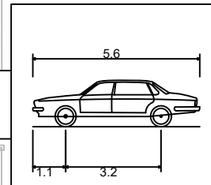
LEGEND

Forward Path

Reverse Path

TRAFFMOBILITY

DESIGN		DRAWN		CHECKED		CONTRACT No.
SCALE:						
DATE:				DRAWING NUMBER		Passenger Car Ingress 2



P - Passenger Car	
Overall Length	5.600m
Overall Width	2.000m
Overall Body Height	1.555m
Min Body Ground Clearance	0.340m
Track Width	2.000m
Lock-to-lock time	4.00s
Curb to Curb Turning Radius	6.300m

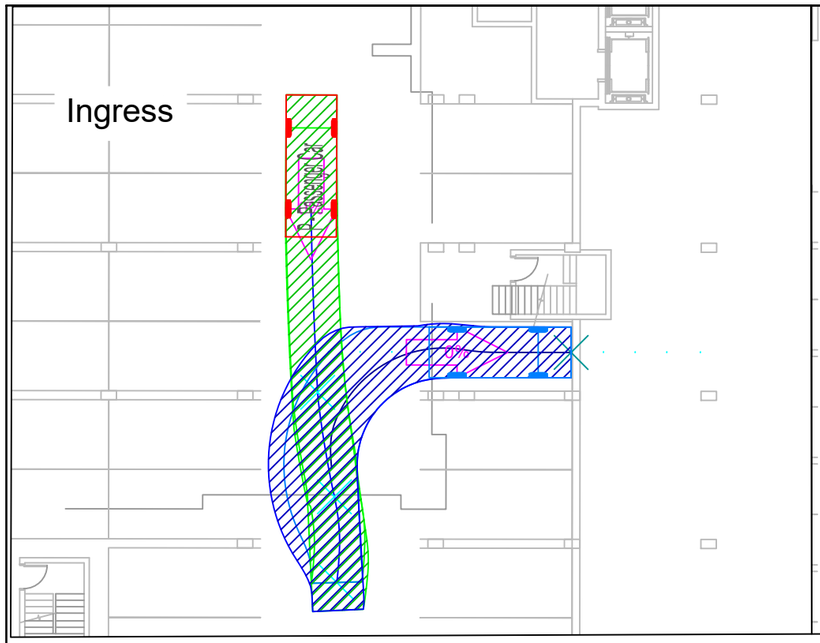
LEGEND

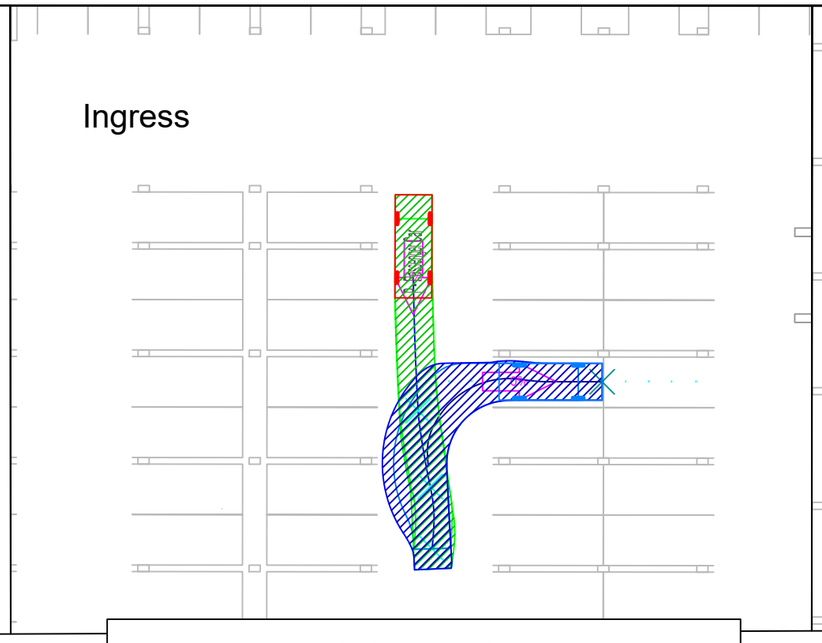
Forward Path

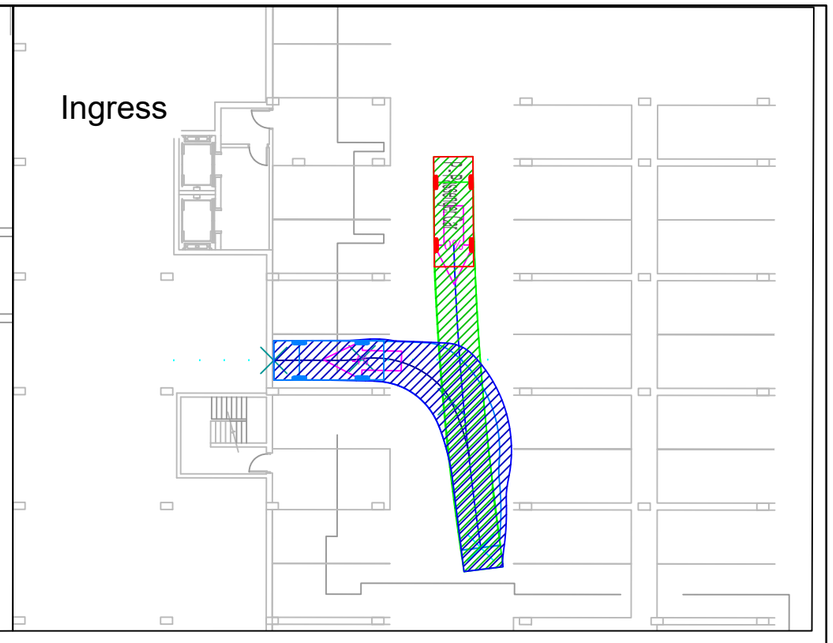
Reverse Path

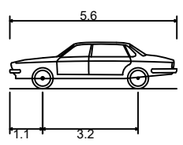
TRAFFMOBILITY

DESIGN		DRAWN		CHECKED		CONTRACT No.
SCALE:						
DATE:				DRAWING NUMBER		Passenger Car Ingress 3

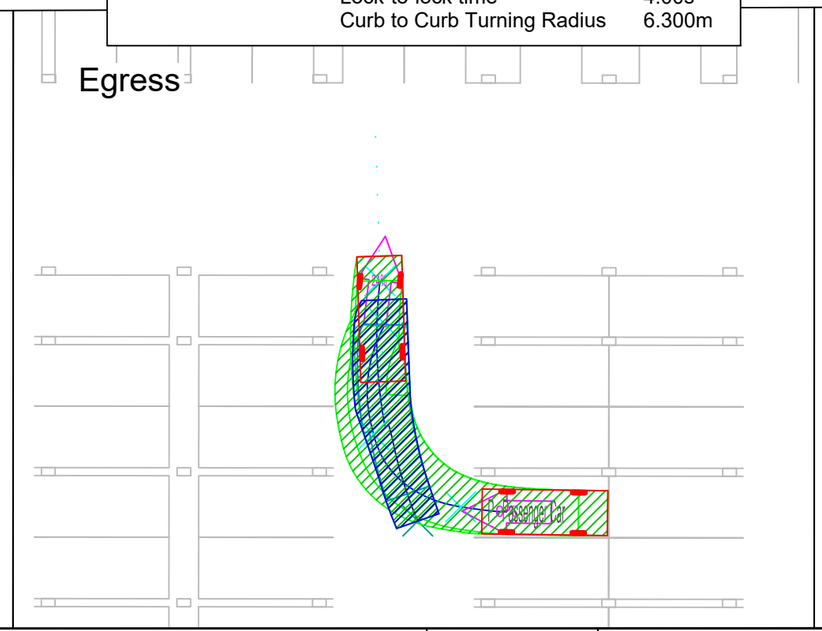


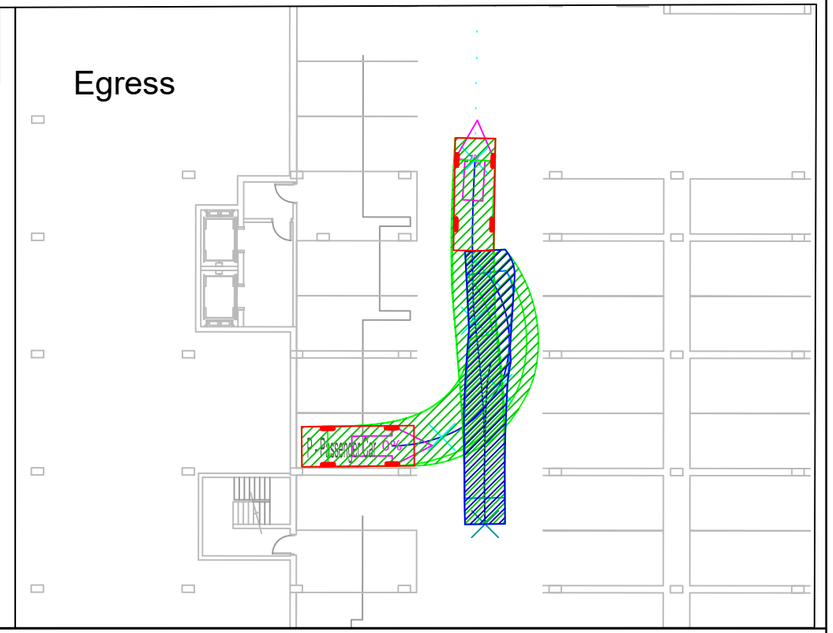






P - Passenger Car	
Overall Length	5.600m
Overall Width	2.000m
Overall Body Height	1.555m
Min Body Ground Clearance	0.340m
Track Width	2.000m
Lock-to-lock time	4.00s
Curb to Curb Turning Radius	6.300m





LEGEND

Forward Path

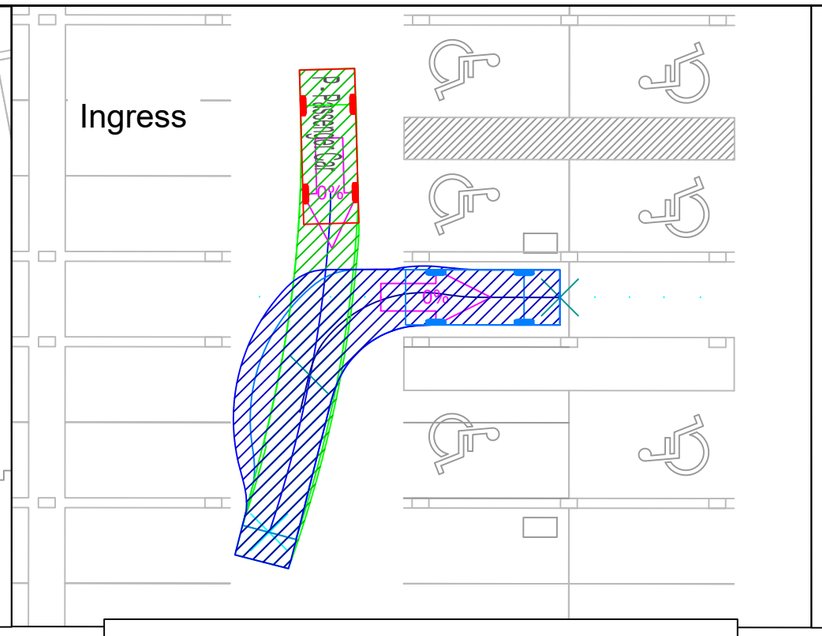
Reverse Path

TRAFFMOBILITY

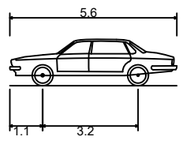
DESIGN		DRAWN		CHECKED		CONTRACT No.
SCALE:				DRAWING NUMBER		Passenger Car Ingress 4
DATE:						

Ingress

Ingress

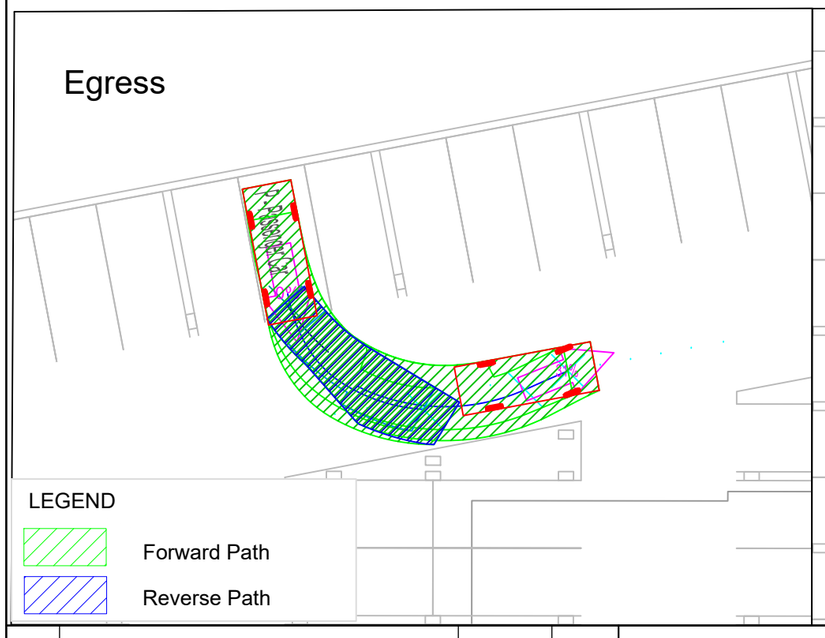


Ingress

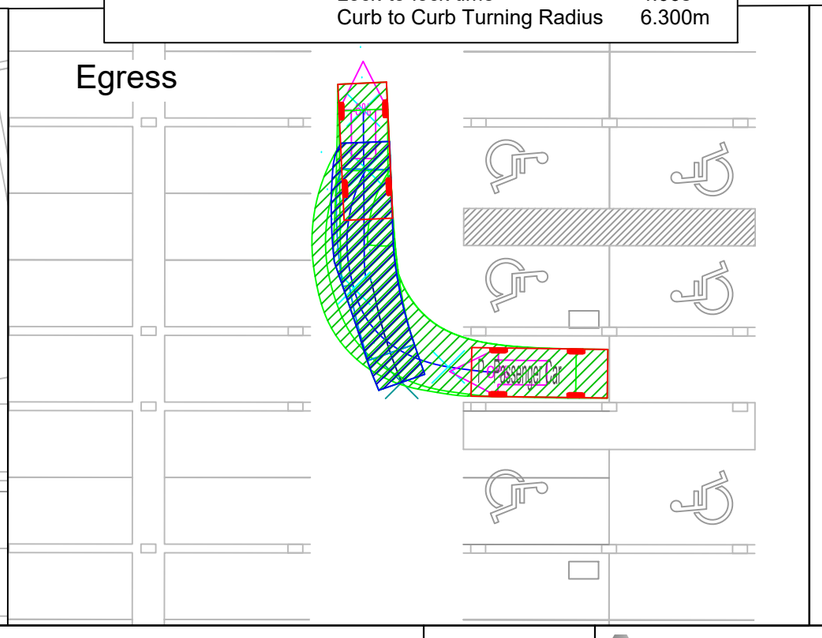


P - Passenger Car	
Overall Length	5.600m
Overall Width	2.000m
Overall Body Height	1.555m
Min Body Ground Clearance	0.340m
Track Width	2.000m
Lock-to-lock time	4.00s
Curb to Curb Turning Radius	6.300m

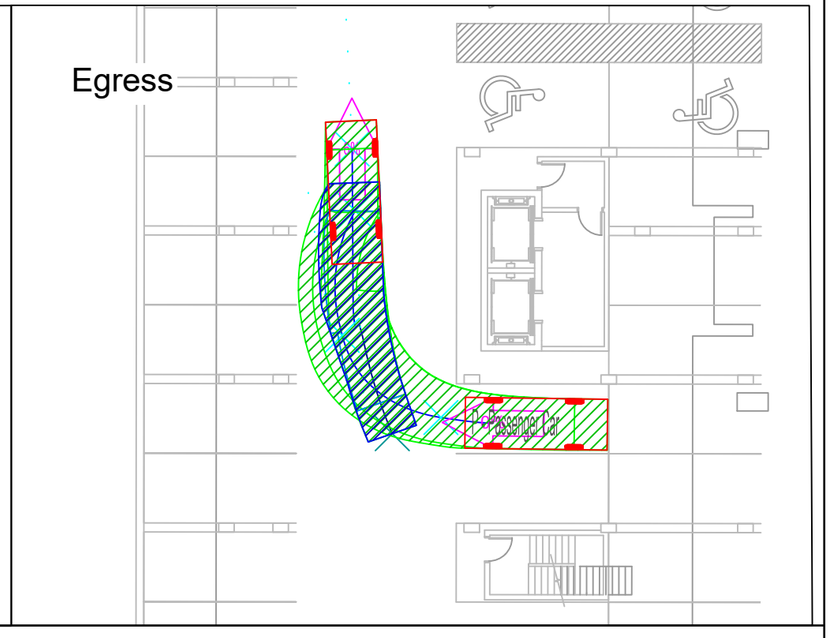
Egress



Egress



Egress



LEGEND

Forward Path

Reverse Path

TRAFFMOBILITY

DESIGN		DRAWN		CHECKED		CONTRACT No.
SCALE:				DRAWING NUMBER		Passenger Car Ingress 5
DATE:						