ROCHESTER HILLS TRIO MIXED-USE DEVELOPMENT TRAFFIC IMPACT STUDY

ROCHESTER HILLS, MICHIGAN

AUGUST 29, 2018

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Agency Review	Date	Comments

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1 INTRODUCTION

This report presents the results of the Traffic Impact Study (TIS) for the proposed mixed-use development in Rochester Hills, Michigan. The proposed site is located in the northeast quadrant of the Auburn Road & Livernois Road intersection, the site location is shown on **Figure 1**. The development is proposed to include 124 apartments and 21,000 SF of retail and office with site access provided via both Livernois Road and Auburn Road. The Road Commission for Oakland County (RCOC) has jurisdiction over Livernois Road and the Michigan Department of Transportation (MDOT) has jurisdiction over Auburn Road.

The purpose of this study is to evaluate the impact of the proposed development on the adjacent roadway network and provide recommendations for roadway and intersection geometry. Specific tasks undertaken for this study include the following:

1. Obtain and review the proposed site plan which includes the proposed land uses, densities, and desired site access locations.
2. Collect Weekday AM (7:00 AM to 9:00 AM) and PM (4:00 PM to 6:00 PM) and Friday PM (5:00 PM to 7:00 PM) peak period turning movement counts at the study intersections.
3. Provide an analysis of the traffic related impacts of the proposed development at the following study intersections:
    - Livernois Road & Auburn Road,
    - Lower Ridge Drive & Auburn Road, and
    - The proposed site access locations
4. Identify the Existing Weekday AM and PM and Friday PM peak hour traffic volumes at the study intersections based on turning movement count data collected.
5. Calculate the ***Existing*** vehicle delays, Levels of Service (LOS), and vehicle queues at the study intersections based on the methodologies of the *Highway Capacity Manual, 6th Edition (HCM)* using Synchro, Version 10 traffic analysis software.
6. Calculate the future background traffic volumes based on an appropriate traffic growth rate to the project build-out year and/or any applicable background developments in the vicinity of this project.
7. Calculate the ***Background (without the proposed development)*** vehicle delays, LOS, and vehicle queues at the study intersections and identify improvements (if any) that would be required to mitigate any unacceptable background traffic conditions.
8. Forecast the number of Weekday AM and PM and Friday PM peak hour trips that would be generated by the proposed development based on data published by the Institute of Transportation Engineers (ITE) in *Trip Generation, 10th Edition.*
9. Assign the trips that would be generated by the proposed development to the adjacent road network based on the existing traffic patterns.
10. Combine the site-generated traffic assignments with the background traffic forecasts to establish the Future Weekday AM and PM and Friday PM peak hour traffic volumes.
11. Calculate the ***Future (with the proposed development)*** vehicle delays, LOS, and vehicle queues at the study intersections.
12. Identify improvements (if any) for the study road network that would be required to accommodate the site-generated traffic volumes.
13. Evaluate the RCOC and MDOT standards for right and left turn lanes at the proposed site driveways.

The scope of the study was developed based on Fleis & VandenBrink's (F&V) knowledge of the study area, understanding of the development program, accepted traffic engineering practice and methodologies published by the Institute of Transportation Engineers (ITE). Additionally, F&V solicited input regarding the scope of work from RCOC and MDOT.

Sources of data for this study include traffic counts conducted by F&V subconsultant Traffic Data Collection, Inc. (TDC), information provided by RCOC, MDOT and ITE. All background information is provided in **Appendix A**.

2 BACKGROUND DATA

2.1 EXISTING ROAD NETWORK

Vehicle transportation for the study area is provided by Livernois Road and Auburn Road. Regional transportation is provided by I-75 and M-59. The study intersection of Livernois Road & Auburn Road is signalized and Auburn Road & Lower Ridge Drive is a stop-controlled intersection on the minor approach. The lane use and traffic control at the study intersections are shown on **Figure 2** and the study roadways are further described below. For the purposes of this study, all minor streets and driveways are assumed to have an operating speed of 25 miles per hour (mph).

Livernois Road runs generally in the north and south directions with a posted speed limit of 50 mph. Livernois Road is under the jurisdiction of RCOC and is classified as an Urban Minor Arterial with an average daily traffic (ADT) volume of approximately 15,200 vehicles per day (SEMCOG 2016). The study section of Livernois Road has a typical 2-lane cross section.

Auburn Road runs in the east and west directions with a posted speed limit of 45 mph. Auburn Road is under the jurisdiction of MDOT and is classified as an Urban Minor Arterial with an ADT volume of approximately 14,000 vehicles per day (SEMCOG 2014). The study section of Auburn Road has a typical 2-lane cross section.

2.2 EXISTING TRAFFIC VOLUMES

The existing weekday turning movement traffic volume data were collected by F&V subconsultant Traffic Data Collection, Inc. (TDC) on Thursday, June 21, 2018 and Friday, June 22, 2018. Intersection turning movement counts were collected during the weekday AM (7:00 AM to 9:00 AM), PM (4:00 PM to 6:00 PM) and Friday PM (5:00 PM to 7:00 PM) peak periods at the study intersections. F&V also collected an inventory of existing lane use and traffic controls at the study intersections and obtained existing traffic signal timing information from RCOC. The Auburn Road and Livernois signalized intersection runs on RCOC SCATS, therefore the signal timings were optimized for each scenario studied. The existing AM, PM, Friday PM peak hour traffic volumes were identified based on the data collected.

These data were used as a baseline to establish the current peak hour traffic volumes for the analysis of existing traffic conditions. During collection of the turning movement counts, pedestrian data and commercial truck percentages were recorded and used in the traffic analysis. Peak Hour Factors (PHFs) were also calculated for each study intersection approach.

The peak hour volumes for each intersection were utilized for this study and the volumes were balanced upward through the study network. In general, the peak hours of existing network traffic were identified to occur between 7:45 AM to 8:45 AM and 5:00 PM to 6:00 PM for weekday PM and 5:00 PM to 6:00 PM for Friday.

The traffic volume data are included in **Appendix A** and the existing peak hour traffic volumes are summarized in **Figure 3**.

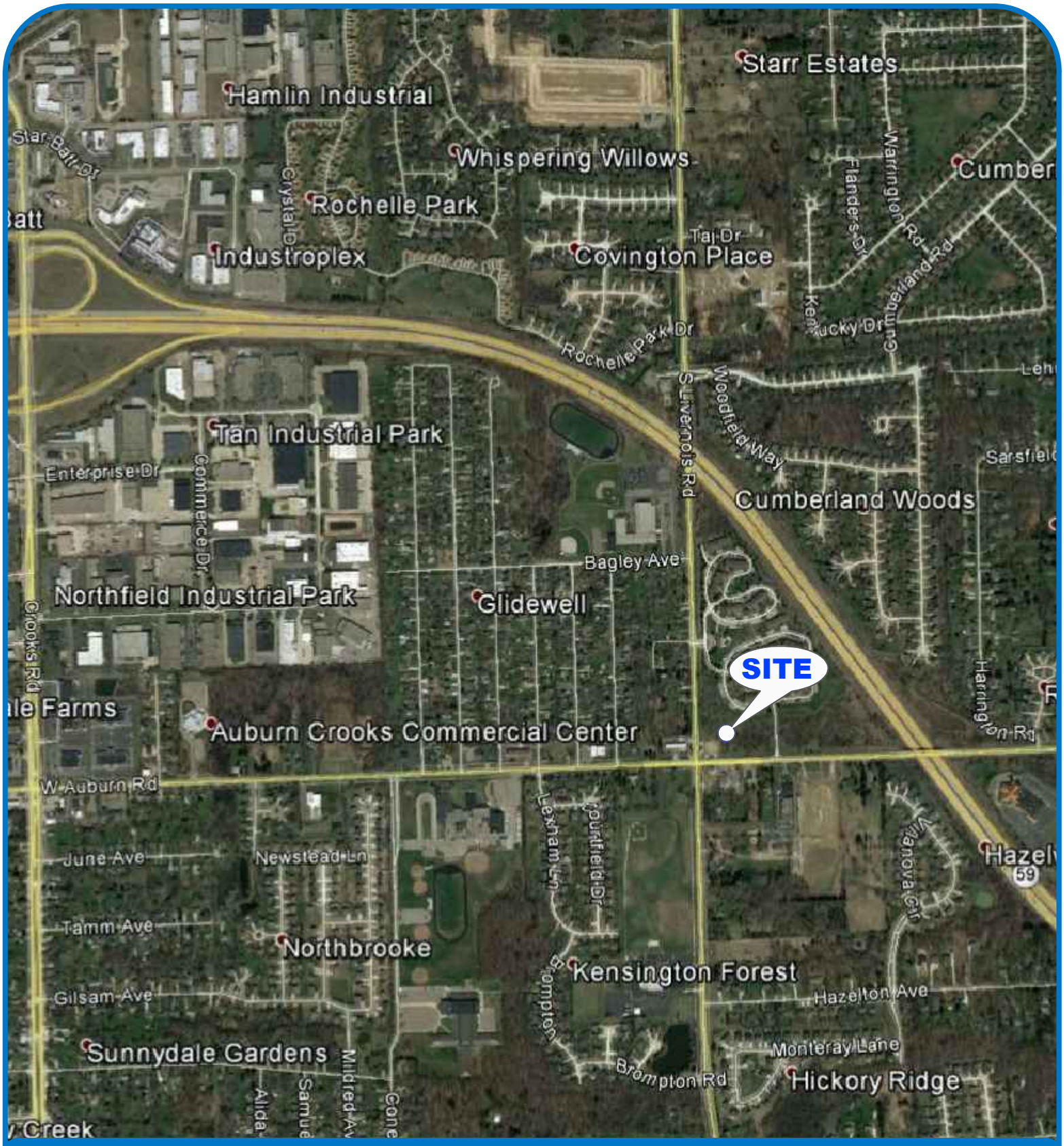


FIGURE 1
SITE LOCATION MAP

ROCHESTER HILLS TRIO DEVELOPMENT - ROCHESTER HILLS, , MI

LEGEND

SITE — SITE LOCATION

NORTH

SCALE: NOT TO SCALE

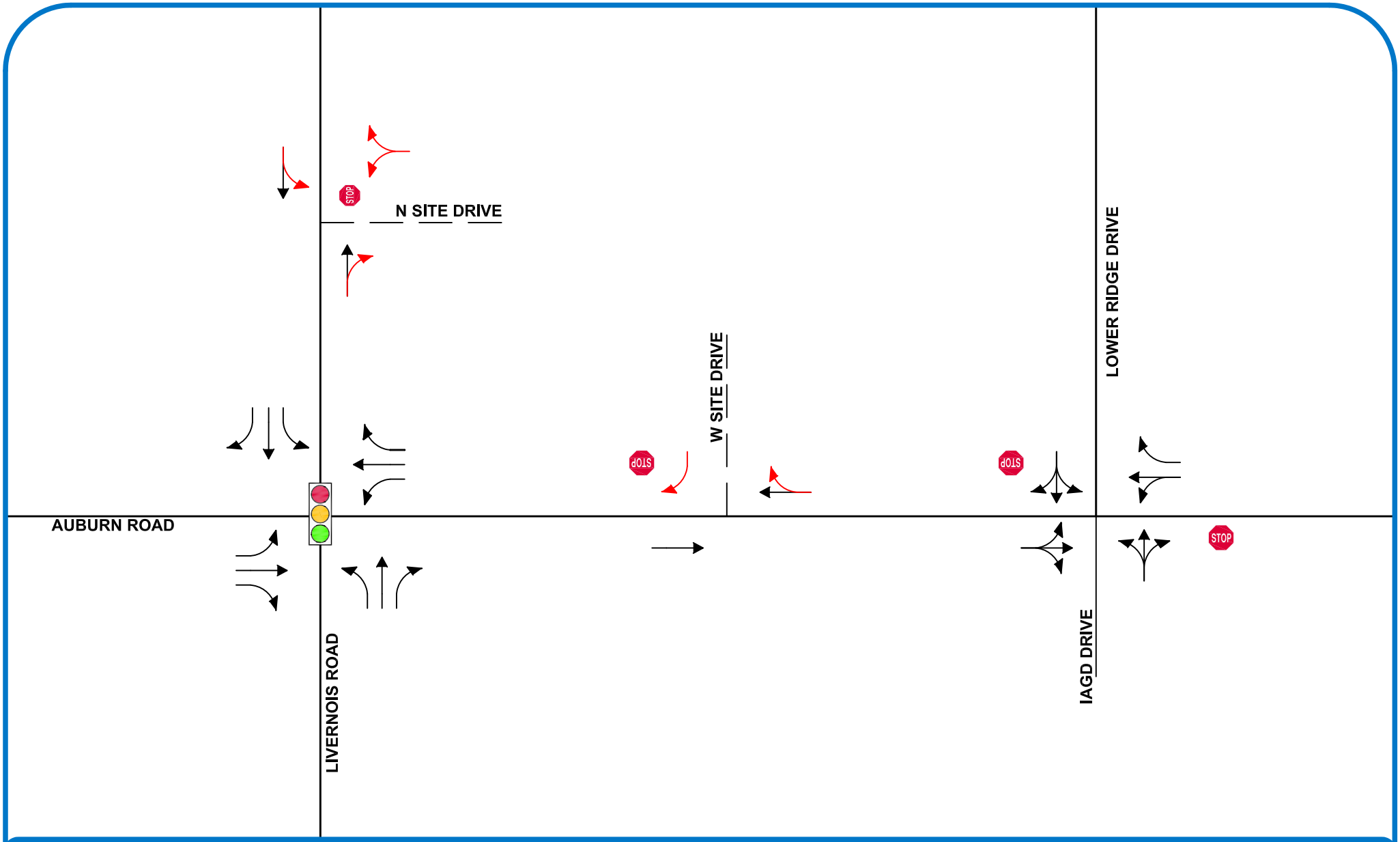


FIGURE 2
LANE USE AND TRAFFIC CONTROL

ROCHESTER HILLS TRIO DEVELOPMENT - ROCHESTER HILLS, , MI

LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- ROADS
- LANE USE

NORTH

SCALE: NOT TO SCALE

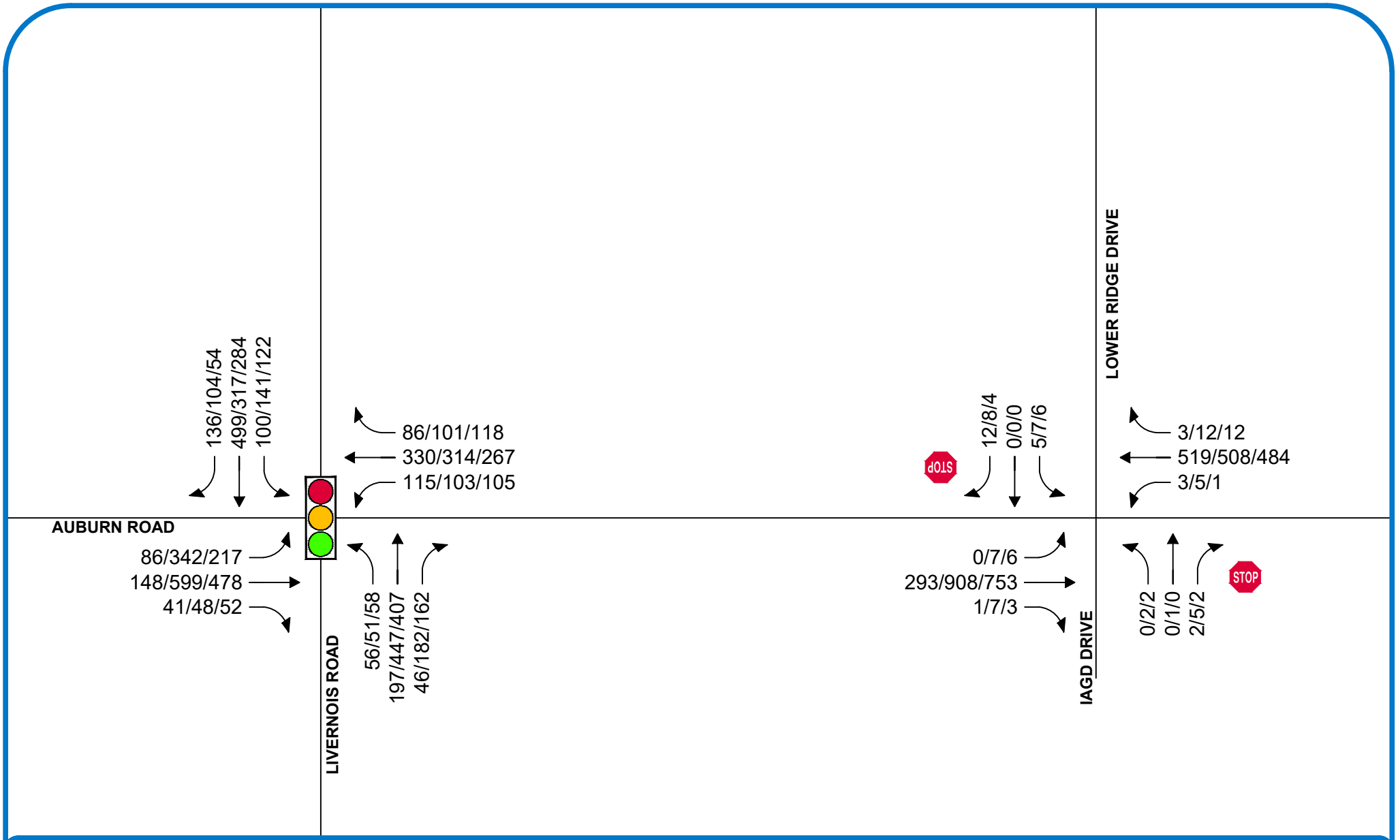


FIGURE 3
EXISTING TRAFFIC VOLUMES

ROCHESTER HILLS TRIO DEVELOPMENT - ROCHESTER HILLS, , MI

LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- TRAFFIC VOLUMES (AM/PM/FRI PM)
- ROADS

NORTH

SCALE: NOT TO SCALE

3 ANALYSIS

3.1 EXISTING CONDITIONS

The existing AM, PM and Friday PM peak hour vehicle delays and Levels of Service (LOS) were calculated at the study intersections using Synchro (Version 10) traffic analysis software. The results of the analysis of existing conditions were based on the existing lane use and traffic control shown on **Figure 2**, the existing traffic volumes provided in **Figure 3**, and the methodologies presented in the HCM.

Descriptions of LOS "A" through "F" as defined in the HCM are provided in **Appendix C** for signalized and unsignalized intersections. Typically, LOS D is considered acceptable, with LOS A representing minimal delay, and LOS F indicating failing conditions. The results of the analysis of existing conditions are presented in **Appendix B** and are summarized in **Table 1**. Microsimulation was also conducted at the study intersections using SimTraffic to further evaluate the network performance.

The results of the existing conditions analysis indicate that all approaches and movements at the intersection of Livernois Road & Auburn Road currently operate at LOS D or better during the all peak periods. The review of SimTraffic network simulations during the PM and Friday PM peak hours indicates periods of long vehicle queues for the eastbound and northbound approaches at Livernois Road & Auburn Road. However, these queues are typically serviced during the green time and are not present throughout the peak hour.

Table 1: Existing Intersection Operations

Intersection		Control	Approach	AM Peak		PM Peak		PM Friday Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
1	Livernois Road And Auburn Road	Signalized	EBL	35.1	D	39.3	D	31.2	C
			EBT	32.3	C	53.3	D	52.4	D
			EBR	25.2	C	22.8	C	26.4	C
			WBL	28.1	C	36.2	D	41.2	D
			WBT	43.0	D	43.9	D	42.3	D
			WBR	23.3	C	30.5	C	33.3	C
			NBL	21.2	C	27.5	C	21.9	C
			NBT	22.2	C	49.7	D	33.9	C
			NBR	15.1	B	27.7	C	22.5	C
			SBL	17.2	B	49.3	D	27.5	C
			SBT	33.4	C	35.8	D	28.2	C
			SBR	17.4	B	16.8	B	15.0	B
			Overall	30.1	C	42.0	D	35.9	D
2	Auburn Road and Lower Ridge Drive	STOP (minor)	EBL	0.0*	A	8.6	A	8.5	A
			EBT	Free		Free		Free	
			WBL	8.2	A	10.1	B	9.4	A
			WBT	Free		Free		Free	
			NB	10.6	B	28.5	D	25.0	D
			SB	14.7	B	31.8	D	26.7	D

3.2 TURN LANE WARRANT – EXISTING CONDITIONS

The MDOT requirements for a left-turn lane at the existing Auburn Road and Lower Ridge Drive intersection was evaluated. The analysis indicates that a left-turn lane treatment is **currently recommended** for existing conditions. The results of the analysis are summarized in **Table 2** and the warrant is provided in **Appendix E**.

Table 2: Turn Lane Warrant – Existing Conditions

Intersection	Control	Movement	AM Peak	PM Peak	PM Friday Peak	Recommended
Auburn Road and Lower Ridge Drive	STOP (minor)	EB LT	None	LT Lane	LT Lane	LT Lane

3.3 BACKGROUND CONDITIONS

In order to determine the applicable traffic growth rate for the existing traffic volumes to the project buildout year of 2020, historical traffic data in the vicinity of the project was referenced. Historical traffic volume data along Livernois Road indicates that traffic volumes between 2012 and 2016 increased an average of 3.3% per year. Additionally, population and employment projections from the Southeast Michigan Council of Governments (SEMCOG) shows a growth of 0.2% from 2010 to 2030. Therefore, a conservative background growth rate of 3.3% per year was assumed for this study for the analysis of background conditions ***without the proposed development.***

In addition to background growth, it is important to account for traffic that will be generated by approved developments within the vicinity of the study area that have yet to be constructed or are currently under construction. The background growth from the proposed Islamic Association of Greater Detroit (IAGD) Mosque expansion located in the southeast quadrant of the intersection of Livernois Road & Auburn Road was included as background traffic as it would contribute additional traffic to the roadway network. The trip generation and trip distribution were taken from a traffic impact study completed in 2013 by Traffic Engineering Associates, Inc. Background peak hour traffic volumes are shown in **Figure 4.**

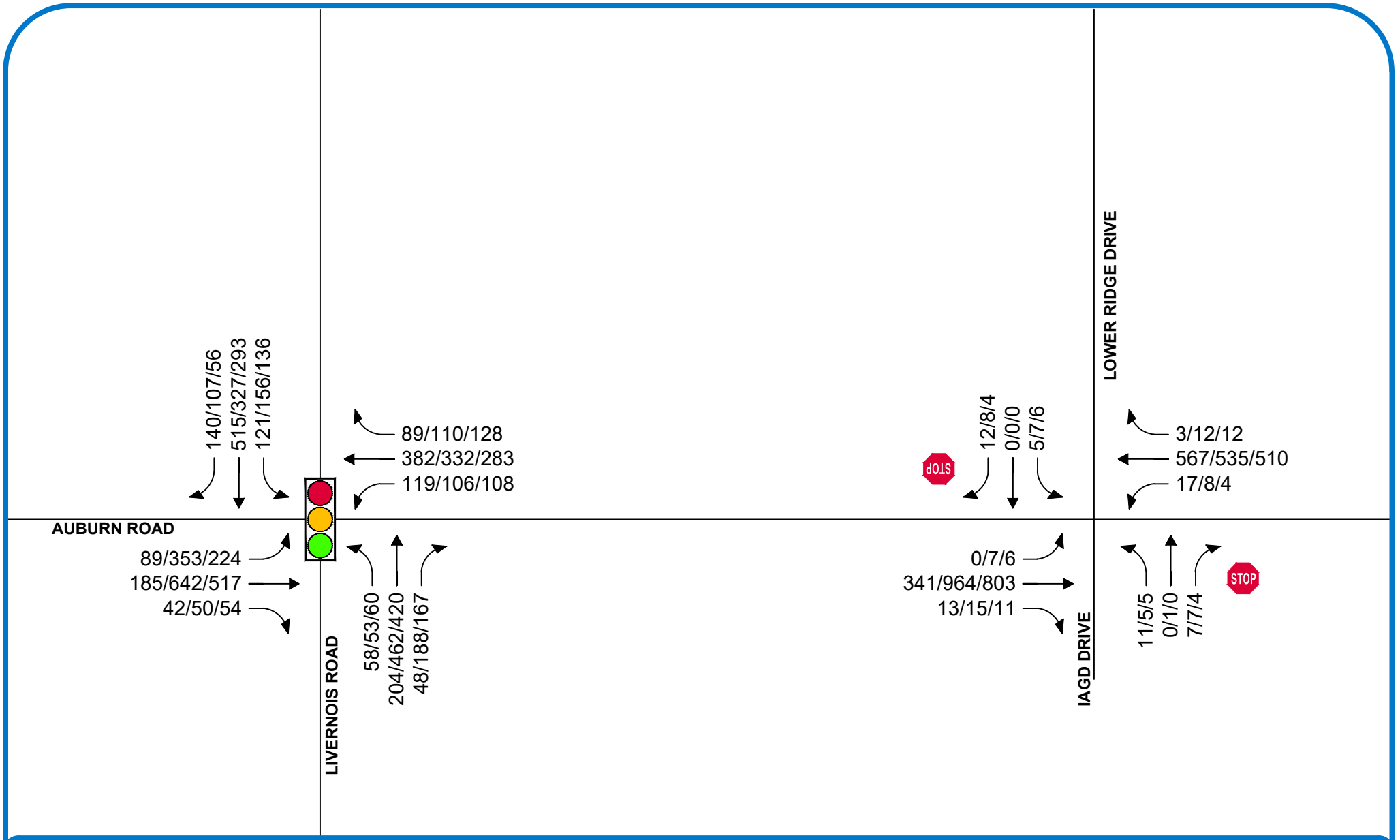


FIGURE 4
BACKGROUND TRAFFIC VOLUMES

ROCHESTER HILLS TRIO DEVELOPMENT - ROCHESTER HILLS, , MI

LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- TRAFFIC VOLUMES (AM/PM/FRI PM)
- ROADS

NORTH

SCALE: NOT TO SCALE

3.4 BACKGROUND OPERATIONS

Background peak hour vehicle delays and LOS were calculated based on the existing lane use and traffic control shown on **Figure 2**, the background traffic volumes shown on **Figure 4**, and the methodologies presented in the HCM. The results of the analysis of background conditions are presented in **Appendix C** and are summarized in **Table 3**.

The results of the background conditions analysis indicate that the intersection of Livernois Road & Auburn Road will continue to operate at LOS D or better; with the exception of the eastbound and northbound through movements at the intersection of Livernois Road & Auburn Road, which are expected to operate at LOS E. In addition, the northbound and southbound approaches at the minor street stop-controlled intersection of Auburn Road & Lower Ridge Road will operate at a LOS E during the PM peak period.

A review of the network simulations indicates background traffic operations will be similar to existing conditions. Periods of long vehicle queues are continued to be observed for the eastbound and northbound approaches at the intersection of Livernois Road and Auburn Road; however, these vehicle queues were generally observed to dissipate throughout the peak hour. Additionally, microsimulations indicate that vehicles on the minor, stop-controlled, approach at Auburn Road and Lower Ridge Drive are able to find gaps within the through traffic along Auburn Road.

Table 3: Background Intersection Operations

Intersection		Control	Approach	Existing Conditions						Background Conditions					
				AM Peak		PM Peak		PM Friday Peak		AM Peak		PM Peak		PM Friday Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
1	Livernois Road and Auburn Road	Signalized	EBL	35.1	D	39.3	D	31.2	C	28.3	C	47.8	D	29.8	C
			EBT	32.3	C	53.3	D	52.4	D	31.5	C	58.0	E	52.5	D
			EBR	25.2	C	22.8	C	26.4	C	25.0	C	21.6	C	24.4	C
			WBL	28.1	C	36.2	D	41.2	D	24.5	C	48.6	D	41.8	D
			WBT	43.0	D	43.9	D	42.3	D	41.7	D	45.9	D	40.1	D
			WBR	23.3	C	30.5	C	33.3	C	22.3	C	29.0	C	30.0	C
			NBL	21.2	C	27.5	C	21.9	C	21.3	C	28.6	C	24.5	C
			NBT	22.2	C	49.7	D	33.9	C	22.6	C	59.4	E	40.8	D
			NBR	15.1	B	27.7	C	22.5	C	15.6	B	31.0	C	25.9	C
			SBL	17.2	B	49.3	D	27.5	C	17.1	B	53.4	D	30.1	C
			SBT	33.4	C	35.8	D	28.2	C	34.7	C	36.5	D	31.1	C
			SBR	17.4	B	16.8	B	15.0	B	16.7	B	17.1	B	16.6	B
			Overall	30.1	C	42.0	D	35.9	D	29.7	C	46.9	D	37.5	D
2	Auburn Road and Lower Ridge Drive	STOP (minor)	EBL	0.0*	A	8.6	A	8.5	A	0.0*	A	8.7	A	8.6	A
			EBT	Free		Free		Free		Free		Free		Free	
			WBL	8.2	A	10.1	B	9.4	A	8.4	A	10.5	B	9.7	A
			WBT	Free		Free		Free		Free		Free		Free	
			NB	10.6	B	28.5	D	25.0	D	22.0	C	39.0	E	31.0	D
			SB	14.7	B	31.8	D	26.7	D	16.8	C	37.7	E	30.6	D

3.5 SITE TRIP GENERATION ANALYSIS

The number of AM, PM and PM Friday peak hour vehicle trips that would be generated by the proposed development was forecast based on data published by ITE in the *Trip Generation Manual, 10th Edition*. The site trip generation forecast is summarized in **Table 4**. As is typical of shopping centers, a portion of the site-generated trips are already present on the adjacent road network and are interrupted to visit the site. These trips are known as "pass-by" trips and result in turning movements at the site driveways, but do not increase traffic volumes on the adjacent road network. The percentage of pass-by trips was determined based on the rates published by ITE in the *Trip Generation Handbook, 3rd Edition*.

Table 4: Site Trip Generation Summary

Land Use	ITE Code	Amount	Units	Average Daily Traffic (vpd)	AM Peak Hour (vph)			PM Peak Hour (vph)		
					In	Out	Total	In	Out	Total
Multi-Family Home (Mid-Rise)	221	124	D.U.	674	11	31	42	33	21	54
General Office Building	710	10,500	SF	119	31	5	36	2	11	13
Shopping Center	820	10,500	SF	1,298	97	60	157	49	54	103
Pass-By	*34%*			*441*	*33*	*20*	*53*	*17*	*18*	*35*
New Trips				857	64	40	104	32	36	68
Total Trips				2,091	139	96	235	84	86	170
Total Pass-By				*441*	*33*	*20*	*53*	*17*	*18*	*35*
Total New Trips				1,650	106	76	182	67	68	135

3.6 SITE TRIP DISTRIBUTION

The vehicle trips that would be generated by the proposed development were assigned to the study road network based on existing peak hour traffic patterns and the methodologies published by ITE. This methodology indicates that new trips will return to their direction of origin, while pass-by trips enter and exit the development in their original direction of travel. The site trip distributions used in the analysis are summarized in **Table 5**.

Table 5: Site Trip Distribution Summary

New Trips					
Commercial				Residential	
AM	PM	To/From	Via	AM	PM
40%	32%	North	Livernois Road	20%	20%
16%	17%	South	Livernois Road	36%	25%
29%	34%	East	Auburn Road	16%	19%
15%	17%	West	Auburn Road	28%	36%
100%	100%	Total		100%	100%

Commercial Pass-by/Diverted Link Trips			
From / To	Via	AM	PM
North to South	Livernois Road	38%	19%
South to North	Livernois Road	19%	31%
East to West	Auburn Road	27%	18%
West to East	Auburn Road	16%	32%
Total		100%	100%

The site-generated traffic volumes in **Table 4** were distribution to the adjacent roadway network based on the distribution shown in **Table 5.** The site generated traffic volumes are shown in **Figure 5** and were added to the background traffic volumes to calculate the future traffic volumes with the proposed development. Future traffic volumes are provided in **Figure 6.**

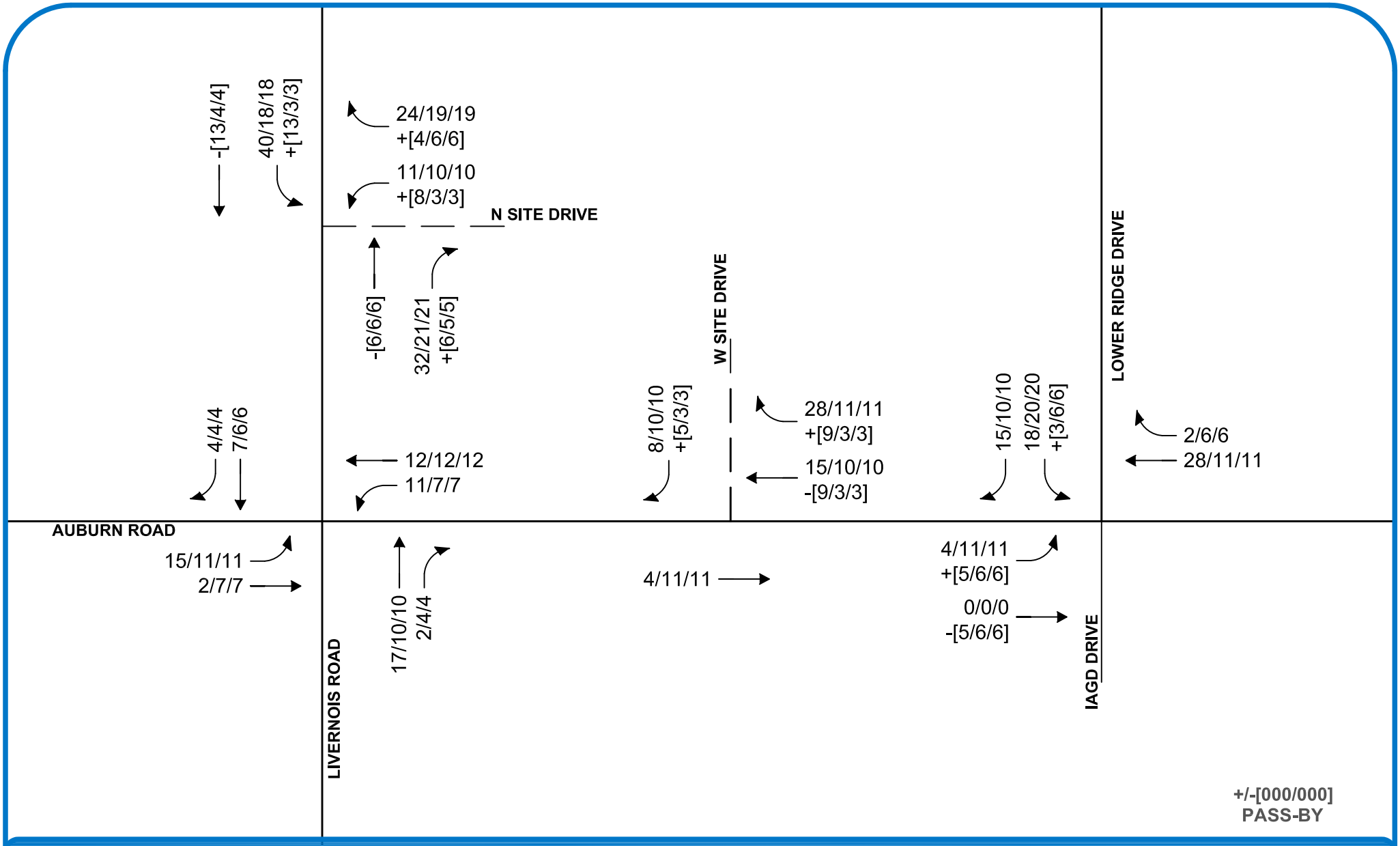


FIGURE 5
SITE-GENERATED TRAFFIC VOLUMES

ROCHESTER HILLS TRIO DEVELOPMENT - ROCHESTER HILLS, , MI

LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- TRAFFIC VOLUMES (AM/PM/FRI PM)
- ROADS

NORTH

SCALE: NOT TO SCALE

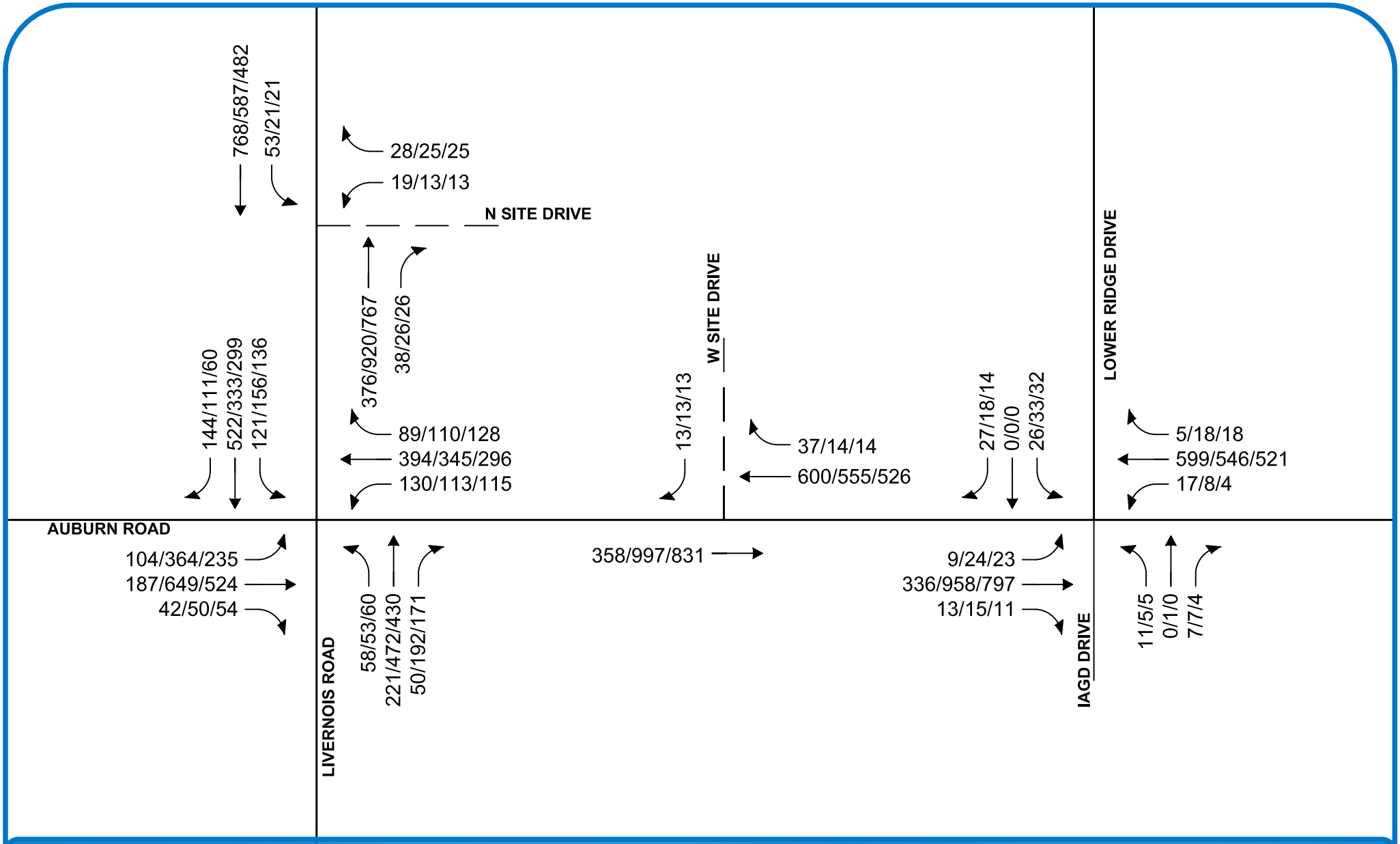


FIGURE 6
FUTURE TRAFFIC VOLUMES

ROCHESTER HILLS TRIO DEVELOPMENT - ROCHESTER HILLS, , MI

LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- TRAFFIC VOLUMES (AM/PM/FRI PM)
- ROADS

NORTH

SCALE: NOT TO SCALE

3.7 FUTURE CONDITIONS

Future peak hour vehicle delays and LOS ***with the proposed development*** were calculated based on the existing lane use and traffic control shown on **Figure 2**, the proposed site access plan, the future traffic volumes shown on **Figure 6**, and the methodologies presented in the HCM. The results of the future conditions analysis are presented in **Appendix D** and are summarized in **Table 6.**

The results of the future conditions analysis indicate operations similar to existing and background conditions. The eastbound and northbound through movements at the intersection of Livernois Road & Auburn Road and the northbound approach at the intersection of Auburn Road & Lower Ridge Drive will continue to operate at LOS E during the PM peak period. In addition, the southbound approach at the minor street stop-controlled intersection of Auburn Road & Lower Ridge Road will operate at a LOS F during the PM peak period.

Review of the network simulations indicates occasional periods of vehicle queues for the northbound and southbound approaches at the minor street stop-controlled intersection of Auburn Road & Lower Ridge Road; however, these vehicle queues were observed to dissipate within the peak hour. The observed queues at the minor stop-controlled approach are the result of vehicles waiting for gaps within the through traffic. The Auburn Road corridor is operating on the SCATS system and would therefore platoon vehicles traveling along Auburn Road, allowing for additional gaps for vehicles wishing to turn onto Auburn Road than what was observed in the SimTraffic simulation.

Table 6: Future Intersection Operations

Intersection		Control	Approach	2020 Background						2020 Build-out					
				AM Peak		PM Peak		PM Friday Peak		AM Peak		PM Peak		PM Friday Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
1	Livernois Road and Auburn Road	Signalized	EBL	28.3	C	47.8	D	29.8	C	33.0	C	52.2	D	30.6	C
			EBT	31.5	C	58.0	E	52.5	D	31.5	C	64.3	E	52.8	D
			EBR	25.0	C	21.6	C	24.4	C	25.0	C	22.0	C	24.1	C
			WBL	24.5	C	48.6	D	41.8	D	24.6	C	50.0	D	46.3	D
			WBT	41.7	D	45.9	D	40.1	D	44.6	D	49.7	D	41.3	D
			WBR	22.3	C	29.0	C	30.0	C	22.1	C	28.7	C	30.9	C
			NBL	21.3	C	28.6	C	24.5	C	21.7	C	29.6	C	24.4	C
			NBT	22.6	C	59.4	E	40.8	D	23.2	C	70.1	E	40.7	D
			NBR	15.6	B	31.0	C	25.9	C	15.6	B	31.5	C	25.6	C
			SBL	17.1	B	53.4	D	30.1	C	17.4	C	54.9	D	34.4	C
			SBT	34.7	C	36.5	D	31.1	C	36.2	D	37.2	D	31.7	C
			SBR	16.7	B	17.1	B	16.6	B	16.9	B	16.8	B	16.6	B
			Overall	29.7	C	46.9	D	37.5	D	30.9	C	51.2	D	38.3	D
2	Auburn Road and Lower Ridge Drive	STOP (minor)	EBL	0.0*	A	8.7	A	8.6	A	8.9	A	8.8	A	8.7	A
			EBT	Free		Free		Free		Free		Free		Free	
			WBL	8.4	A	10.5	B	9.7	A	8.4	A	10.5	A	9.7	A
			WBT	Free		Free		Free		Free		Free		Free	
			NB	22.0	C	39.0	E	31.0	D	24.7	C	43.8	E	34.2	D
			SB	16.8	C	37.7	E	30.6	D	25.0	C	131.7	F	62.5	F
3	Livernois Road and Site Access	STOP (minor)	WB							21.7	C	32.2	D	23.2	C
			NB							Free		Free		Free	
			SB							8.4	A	10.5	B	9.8	A
4	Auburn Road and Site Access	STOP (minor)	EB							Free		Free		Free	
			WB							Free		Free		Free	
			SB							10.7	B	10.3	B	10.2	B

3.8 TURN LANE WARRANTS

The RCOC and MDOT requirements for auxiliary turn lanes at proposed site driveway intersections were evaluated. The existing Lower Ridge Drive already has a right-turn deceleration lane; therefore, only the left-turn lane warrant was evaluated. The analysis indicates that a left-turn lane treatment is recommended. The results of the analysis for the site access point along Livernois Road indicated that a left turn lane and a right turn taper are required. Because left-turns will be prohibited at the west site access point along Auburn Road, only the right-turn lane warrant was evaluated; the results indicate that a right-taper is recommended. The results of the analysis are summarized in **Table 7** and the turn lane warrants are provided in **Appendix E**.

Table 7: Turn Lane Warrants Summary

Intersection		Control	Movement	2020 Build-out			Recommended
				AM Peak	PM Peak	PM Friday Peak	
2	Auburn Road and Lower Ridge Drive	STOP (minor)	EB LT	None	LT Lane	LT Lane	LT Lane
3	Livernois Road and Site Access	STOP (minor)	NB RT	RT Taper	RT Taper	RT Taper	RT Taper
			SB LT	LT Lane	LT Lane	LT Lane	LT Lane
4	Auburn Road and Site Access	STOP (minor)	WB RT	RT Taper	RT Radius	RT Radius	RT Taper

4 CONCLUSIONS

The conclusions of this TIS are as follows:

1. The Existing condition analysis showed that all study intersection approaches and movements currently operate acceptably at a LOS D or better.
2. The Background condition analysis indicates similar operations to existing conditions with the exception of the intersection of Livernois Road & Auburn Road which will operate at LOS E during the PM peak hour for the eastbound and northbound through movements. Additionally, the minor stop-controlled approaches at Auburn Road & Lower Ridge Drive will operate at a LOS E.
    - Review of network simulations indicates periods of long vehicle queues at the northbound and eastbound approaches of Livernois Road & Auburn Road; however, these queues generally dissipate throughout the peak hour.
3. The Future condition analysis indicates that the southbound, minor stop-controlled, approach at the intersection of Auburn Road & Lower Ridge Drive will operate at a LOS F during the PM and Friday PM peak periods.
    - Review of network simulations indicates periods of vehicle queues; however, these queues are not present throughout the peak periods. Additionally, the Auburn Road corridor is operating on the SCATS system and would therefore facilitate vehicle platoons along Auburn Road, creating more opportunities, then what is observed in microsimulations, for gaps within the through traffic.

5 RECOMMENDATIONS

The recommendations of this TIS are as follows:

1. In accordance with RCOC and MDOT standards, auxiliary turn lane treatments were evaluated at the site driveways. At the intersection of Auburn Road and Lower Ridge Drive, the left-turn lane warrant is **currently met** for existing conditions. The following auxiliary turn lane treatments are recommended at the proposed driveways:

Intersection		Control	Movement	Existing Conditions Recommendation	Future Conditions Recommendation
2	Auburn Road and Lower Ridge Drive	STOP (minor)	EB LT	LT Lane	LT Lane
3	Livernois Road and Site Access	EB LT NB RT	NB RT	N/A	RT Taper
			SB LT	N/A	LT Lane
4	Auburn Road and Site Access	SB LT	WB RT	N/A	RT Taper

    - MDOT should consider installing an eastbound left-turn lane at the intersection of Auburn Road and Lower Ridge Drive, as the warrant **is met** for existing condition.

Appendix A

BACKGROUND INFORMATION

Traffic Data Collection, LLC

www:tdccounts.com

Phone: 586.786-5407

Traffic Study Performed For:

Fleis & VandenBrink

Project: Rochester Hills TIS
Study:2 Hr. Video Turning Movement Count
Weather: Cldy. Dry Deg's 70's
Count By Miovision Video VCU 4SY SE

File Name : TMC_1 Auburn & Livernois_Fri_6-22-18
Site Code : TMC_1
Start Date : 6/22/2018
Page No : 1

2 Hour traffic study was conducted during weekday (Friday) from 5:00 PM - 7:00 PM afternoon peak hours.

Groups Printed- Pass Cars - Single Units - Heavy Trucks - Peds

	Livernois Road Southbound					Auburn Road Westbound					Livernois Road Northbound					Auburn Road Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
05:00 PM	13	88	31	0	132	35	61	30	0	126	43	105	16	0	164	17	121	73	0	211	633
05:15 PM	9	68	31	0	108	22	55	24	0	101	35	112	11	0	158	12	137	52	0	201	568
05:30 PM	12	55	26	0	93	32	65	32	0	129	50	112	18	0	180	17	124	48	0	189	591
05:45 PM	20	73	34	1	128	29	86	19	0	134	34	78	13	0	125	6	96	44	0	146	533
Total	54	284	122	1	461	118	267	105	0	490	162	407	58	0	627	52	478	217	0	747	2325
06:00 PM	13	72	31	0	116	35	69	22	0	126	34	77	14	0	125	10	98	46	0	154	521
06:15 PM	10	80	24	0	114	19	56	29	0	104	31	75	10	0	116	8	85	43	0	136	470
06:30 PM	12	64	25	0	101	28	64	21	0	113	38	51	14	0	103	15	80	40	0	135	452
06:45 PM	12	72	29	1	114	21	51	21	0	93	26	69	16	0	111	17	83	39	0	139	457
Total	47	288	109	1	445	103	240	93	0	436	129	272	54	0	455	50	346	168	0	564	1900
Grand Total	101	572	231	2	906	221	507	198	0	926	291	679	112	0	1082	102	824	385	0	1311	4225
Apprch %	11.1	63.1	25.5	0.2		23.9	54.8	21.4	0		26.9	62.8	10.4	0		7.8	62.9	29.4	0		
Total %	2.4	13.5	5.5	0	21.4	5.2	12	4.7	0	21.9	6.9	16.1	2.7	0	25.6	2.4	19.5	9.1	0	31	
Pass Cars	101	570	230	0	901	221	504	198	0	923	291	678	110	0	1079	101	819	382	0	1302	4205
% Pass Cars	100	99.7	99.6	0	99.4	100	99.4	100	0	99.7	100	99.9	98.2	0	99.7	99	99.4	99.2	0	99.3	99.5
Single Units	0	2	0	0	2	0	2	0	0	2	0	1	2	0	3	1	1	2	0	4	11
% Single Units	0	0.3	0	0	0.2	0	0.4	0	0	0.2	0	0.1	1.8	0	0.3	1	0.1	0.5	0	0.3	0.3
Heavy Trucks	0	0	1	0	1	0	1	0	0	1	0	0	0	0	0	0	4	1	0	5	7
% Heavy Trucks	0	0	0.4	0	0.1	0	0.2	0	0	0.1	0	0	0	0	0	0	0.5	0.3	0	0.4	0.2
Peds	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
% Peds	0	0	0	100	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TDC Traffic Comments: SCATS signalized intersection with push button ped. signals for all quadrants. NTOR signed for NB approach leg. Video VCU camera was located within SE intersection quadrant. Note: Peds. are excluded from peak hour reports.

Traffic Data Collection, LLC

www:tdccounts.com

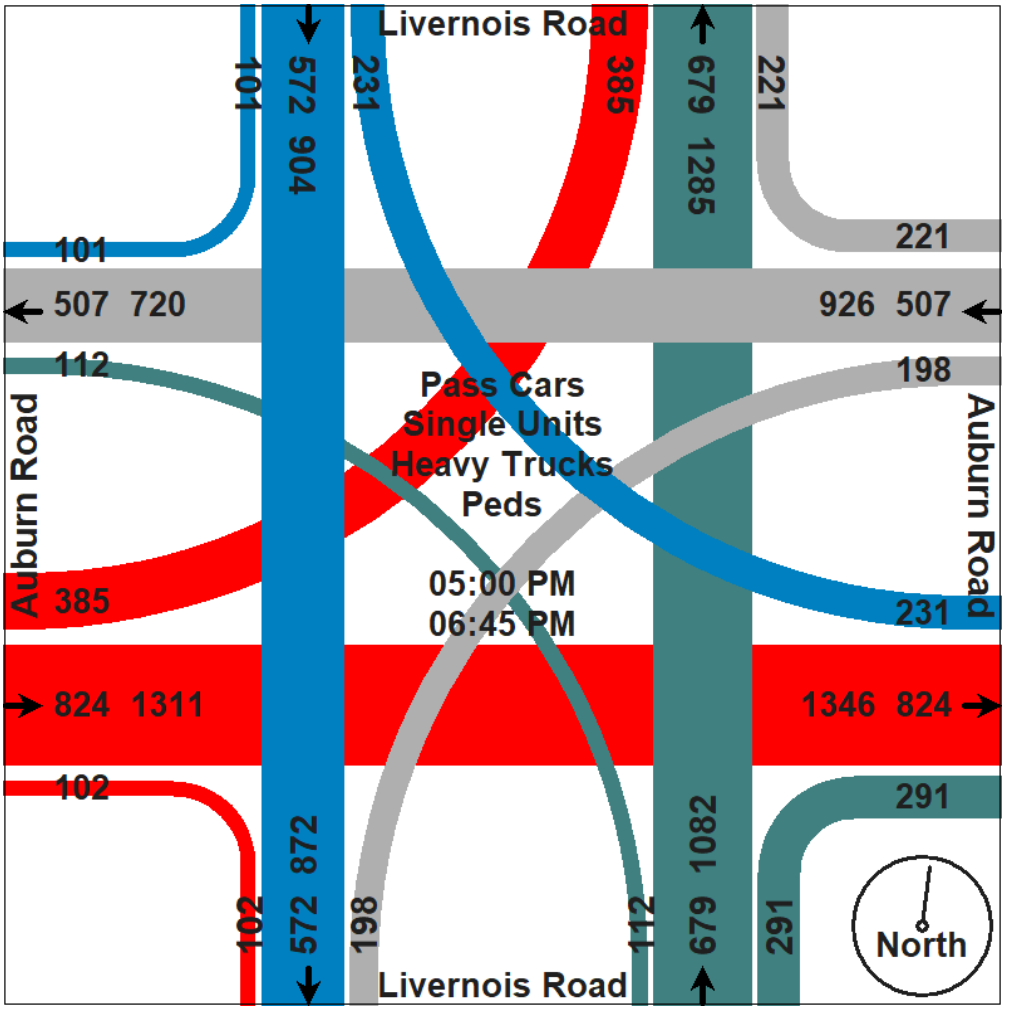
Phone: 586.786-5407

Traffic Study Performed For:

Fleis & VandenBrink

Project: Rochester Hills TIS
Study:2 Hr. Video Turning Movement Count
Weather: Cldy. Dry Deg's 70's
Count By Miovision Video VCU 4SY SE

File Name : TMC_1 Auburn & Livernois_Fri_6-22-18
Site Code : TMC_1
Start Date : 6/22/2018
Page No : 2



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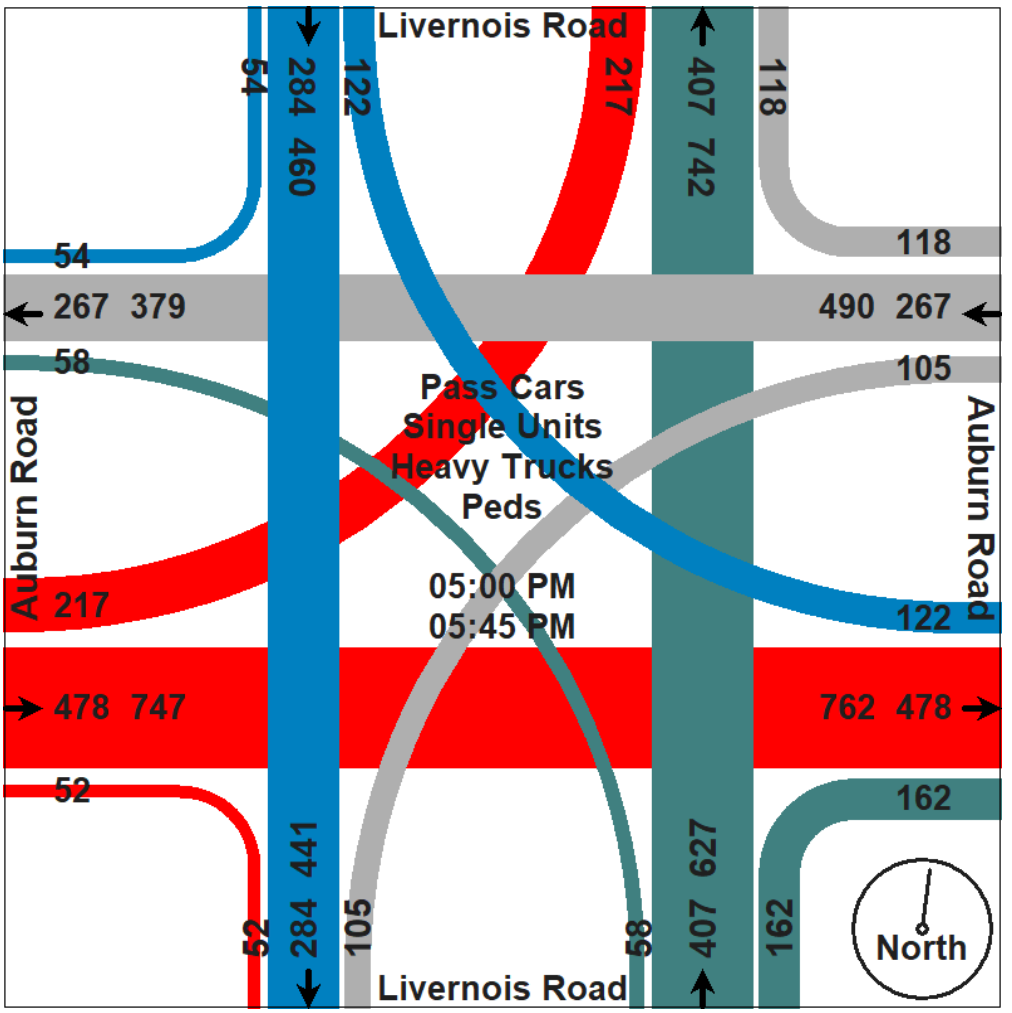
File Name : TMC_1 Auburn & Livernois_Fri_6-22-18
Site Code : TMC_1
Start Date : 6/22/2018
Page No : 3

	Livernois Road Southbound				Auburn Road Westbound				Livernois Road Northbound				Auburn Road Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 05:00 PM to 06:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	13	**88**	31	**132**	**35**	61	30	126	43	105	16	164	**17**	121	**73**	**211**	**633**
05:15 PM	9	68	31	108	22	55	24	101	35	**112**	11	158	12	**137**	52	201	568
05:30 PM	12	55	26	93	32	65	**32**	129	**50**	112	**18**	**180**	17	124	48	189	591
05:45 PM	**20**	73	**34**	127	29	**86**	19	**134**	34	78	13	125	6	96	44	146	532
Total Volume	54	284	122	460	118	267	105	490	162	407	58	627	52	478	217	747	2324
% App. Total	11.7	61.7	26.5		24.1	54.5	21.4		25.8	64.9	9.3		7	64	29		
PHF	.675	.807	.897	.871	.843	.776	.820	.914	.810	.908	.806	.871	.765	.872	.743	.885	.918
Pass Cars	54	283	122	459	118	266	105	489	162	407	56	625	51	474	214	739	2312
% Pass Cars	100	99.6	100	99.8	100	99.6	100	99.8	100	100	96.6	99.7	98.1	99.2	98.6	98.9	99.5
Single Units	0	1	0	1	0	0	0	0	0	0	2	2	1	1	2	4	7
% Single Units	0	0.4	0	0.2	0	0	0	0	0	0	3.4	0.3	1.9	0.2	0.9	0.5	0.3
Heavy Trucks	0	0	0	0	0	1	0	1	0	0	0	0	0	3	1	4	5
% Heavy Trucks	0	0	0	0	0	0.4	0	0.2	0	0	0	0	0	0.6	0.5	0.5	0.2
Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



Traffic Data Collection, LLC

www:tdccounts.com

Phone: 586.786-5407

Traffic Study Performed For:

Fleis & VandenBrink

Project: Rochester Hills TIS
Study:4 Hr. Video Turning Movement Count
Weather: Sunny/Cldy. Dry Deg's 80's
Count By Miovision Video VCU 4YS SE

File Name : TMC_1 Auburn & Livernois_Thu_6-21-18
Site Code : TMC_1
Start Date : 6/21/2018
Page No : 1

4 Hour traffic study was conducted during typical weekday (Tuesday-Thursday) from 7:00 AM - 9:00 AM morning & 4:00 PM - 6:00 PM afternoon peak hours.

Groups Printed- Pass Cars - Single Units - Heavy Trucks - Peds

	Livernois Road Southbound					Auburn Road Westbound					Northbound					Auburn Road Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	20	91	21	0	132	11	60	16	0	87	5	29	7	0	41	9	27	10	0	46	306
07:15 AM	32	110	15	0	157	10	55	26	0	91	4	29	13	0	46	11	32	11	0	54	348
07:30 AM	34	139	24	0	197	19	64	33	0	116	12	47	15	0	74	7	27	9	0	43	430
07:45 AM	45	142	24	0	211	19	87	30	0	136	17	43	16	0	76	11	29	16	0	56	479
Total	131	482	84	0	697	59	266	105	0	430	38	148	51	0	237	38	115	46	0	199	1563
08:00 AM	27	122	24	0	173	23	87	29	0	139	5	52	15	0	72	15	26	19	0	60	444
08:15 AM	35	120	28	0	183	23	74	24	0	121	14	53	9	0	76	9	50	27	0	86	466
08:30 AM	29	115	24	0	168	21	71	32	0	124	10	49	16	0	75	6	43	24	0	73	440
08:45 AM	26	113	29	0	168	16	68	23	0	107	11	59	13	0	83	17	49	18	0	84	442
Total	117	470	105	0	692	83	300	108	0	491	40	213	53	0	306	47	168	88	0	303	1792
*** BREAK ***																					
04:00 PM	17	64	24	0	105	32	68	19	0	119	32	102	12	0	146	18	123	52	0	193	563
04:15 PM	27	77	23	0	127	20	68	24	0	112	49	121	18	0	188	9	97	75	0	181	608
04:30 PM	23	87	31	0	141	38	63	23	0	124	40	99	10	0	149	20	130	80	0	230	644
04:45 PM	15	84	36	0	135	26	71	19	0	116	44	118	18	0	180	16	147	66	0	229	660
Total	82	312	114	0	508	116	270	85	0	471	165	440	58	0	663	63	497	273	0	833	2475
05:00 PM	22	80	34	0	136	27	71	25	0	123	43	114	13	0	170	14	152	83	0	249	678
05:15 PM	25	76	36	0	137	28	75	30	0	133	31	117	12	0	160	11	138	102	0	251	681
05:30 PM	29	88	39	1	157	26	88	29	0	143	46	103	11	0	160	18	151	78	0	247	707
05:45 PM	28	73	32	0	133	20	67	19	0	106	62	113	15	0	190	5	158	79	0	242	671
Total	104	317	141	1	563	101	301	103	0	505	182	447	51	0	680	48	599	342	0	989	2737
Grand Total	434	1581	444	1	2460	359	1137	401	0	1897	425	1248	213	0	1886	196	1379	749	0	2324	8567
Apprch %	17.6	64.3	18	0		18.9	59.9	21.1	0		22.5	66.2	11.3	0		8.4	59.3	32.2	0		
Total %	5.1	18.5	5.2	0	28.7	4.2	13.3	4.7	0	22.1	5	14.6	2.5	0	22	2.3	16.1	8.7	0	27.1	
Pass Cars	431	1568	443	0	2442	355	1117	398	0	1870	421	1235	211	0	1867	190	1359	740	0	2289	8468
% Pass Cars	99.3	99.2	99.8	0	99.3	98.9	98.2	99.3	0	98.6	99.1	99	99.1	0	99	96.9	98.5	98.8	0	98.5	98.8
Single Units	3	9	1	0	13	4	14	3	0	21	4	9	2	0	15	4	15	7	0	26	75
% Single Units	0.7	0.6	0.2	0	0.5	1.1	1.2	0.7	0	1.1	0.9	0.7	0.9	0	0.8	2	1.1	0.9	0	1.1	0.9
Heavy Trucks	0	4	0	0	4	0	6	0	0	6	0	4	0	0	4	2	5	2	0	9	23
% Heavy Trucks	0	0.3	0	0	0.2	0	0.5	0	0	0.3	0	0.3	0	0	0.2	1	0.4	0.3	0	0.4	0.3
Peds	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
% Peds	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TDC Traffic Comments: SCATS signalized intersection with push button ped. signals for all quadrants. NTOR signed for NB approach leg. Video VCU camera was located within SE intersection quadrant. Note: Peds. are excluded from peak hour reports.

Traffic Data Collection, LLC

www:tdccounts.com

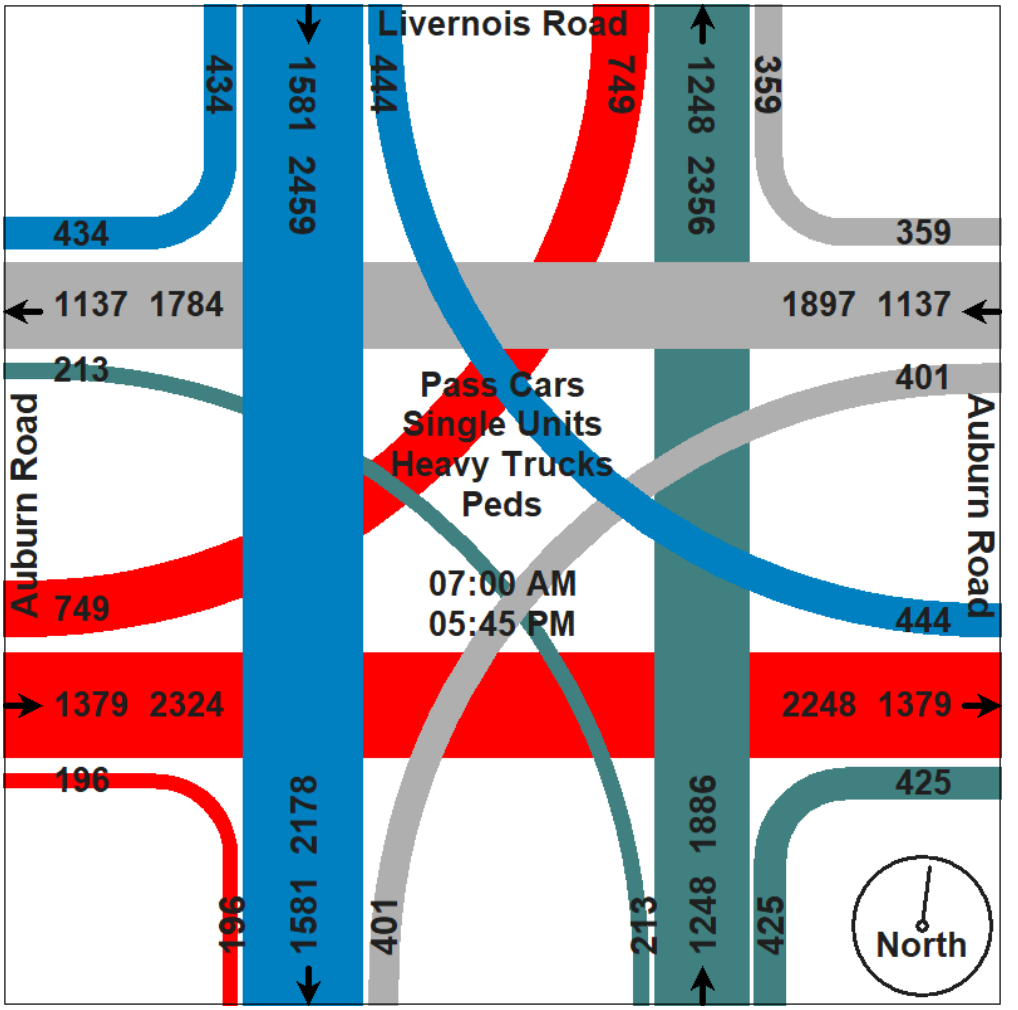
Phone: 586.786-5407

Traffic Study Performed For:

Fleis & VandenBrink

Project: Rochester Hills TIS
Study:4 Hr. Video Turning Movement Count
Weather: Sunny/Cldy. Dry Deg's 80's
Count By Miovision Video VCU 4YS SE

File Name : TMC_1 Auburn & Livernois_Thu_6-21-18
Site Code : TMC_1
Start Date : 6/21/2018
Page No : 2



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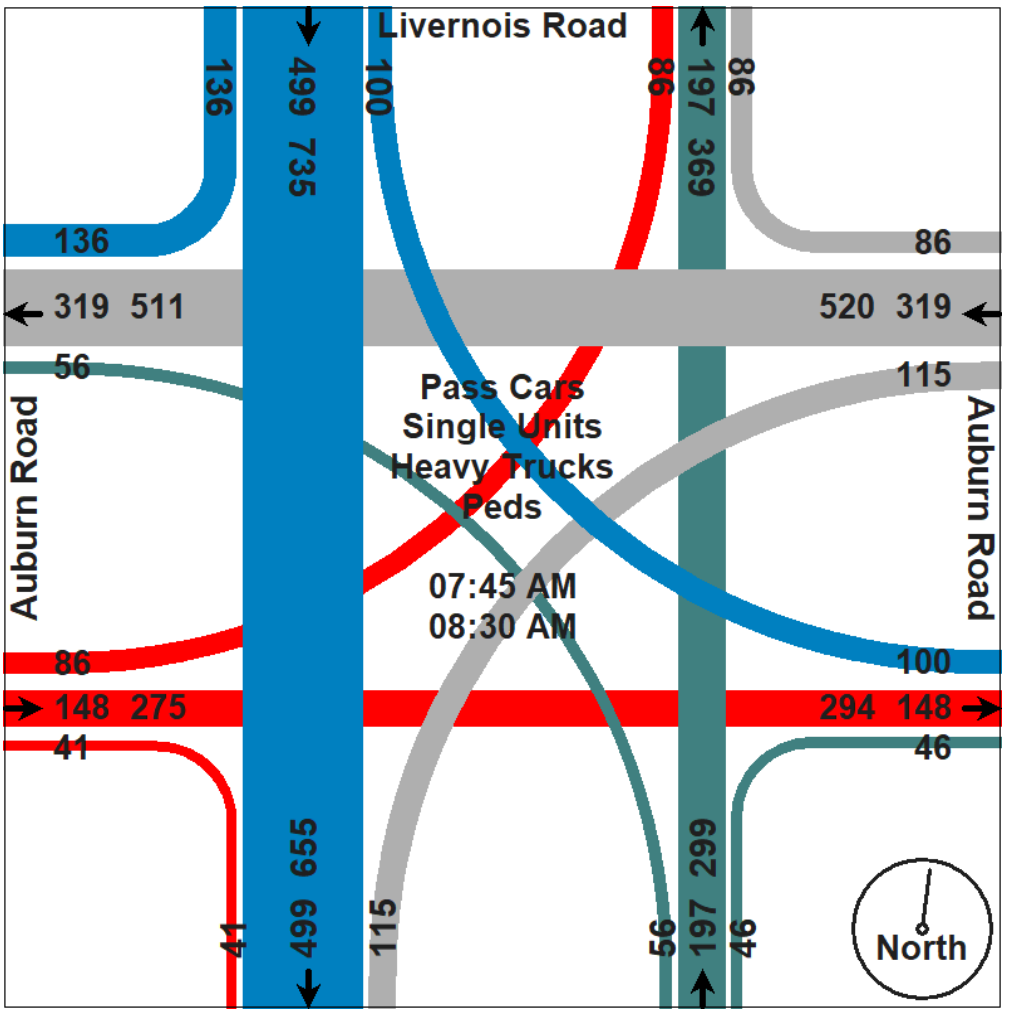
Site Code : TMC_1
Start Date : 6/21/2018
Page No : 3

	Livernois Road Southbound				Auburn Road Westbound				Northbound				Auburn Road Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45 AM																	
07:45 AM	**45**	**142**	24	**211**	19	**87**	30	136	**17**	43	**16**	**76**	11	29	16	56	**479**
08:00 AM	27	122	24	173	**23**	87	29	**139**	5	52	15	72	**15**	26	19	60	444
08:15 AM	35	120	**28**	183	23	74	24	121	14	**53**	9	76	9	**50**	**27**	**86**	466
08:30 AM	29	115	24	168	21	71	**32**	124	10	49	16	75	6	43	24	73	440
Total Volume	136	499	100	735	86	319	115	520	46	197	56	299	41	148	86	275	1829
% App. Total	18.5	67.9	13.6		16.5	61.3	22.1		15.4	65.9	18.7		14.9	53.8	31.3		
PHF	.756	.879	.893	.871	.935	.917	.898	.935	.676	.929	.875	.984	.683	.740	.796	.799	.955
Pass Cars	135	495	100	730	83	313	113	509	45	195	56	296	40	142	84	266	1801
% Pass Cars	99.3	99.2	100	99.3	96.5	98.1	98.3	97.9	97.8	99.0	100	99.0	97.6	95.9	97.7	96.7	98.5
Single Units	1	3	0	4	3	4	2	9	1	2	0	3	1	4	1	6	22
% Single Units	0.7	0.6	0	0.5	3.5	1.3	1.7	1.7	2.2	1.0	0	1.0	2.4	2.7	1.2	2.2	1.2
Heavy Trucks	0	1	0	1	0	2	0	2	0	0	0	0	0	2	1	3	6
% Heavy Trucks	0	0.2	0	0.1	0	0.6	0	0.4	0	0	0	0	0	1.4	1.2	1.1	0.3
Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



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Study:4 Hr. Video Turning Movement Count
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File Name : TMC_1 Auburn & Livernois_Thu_6-21-18
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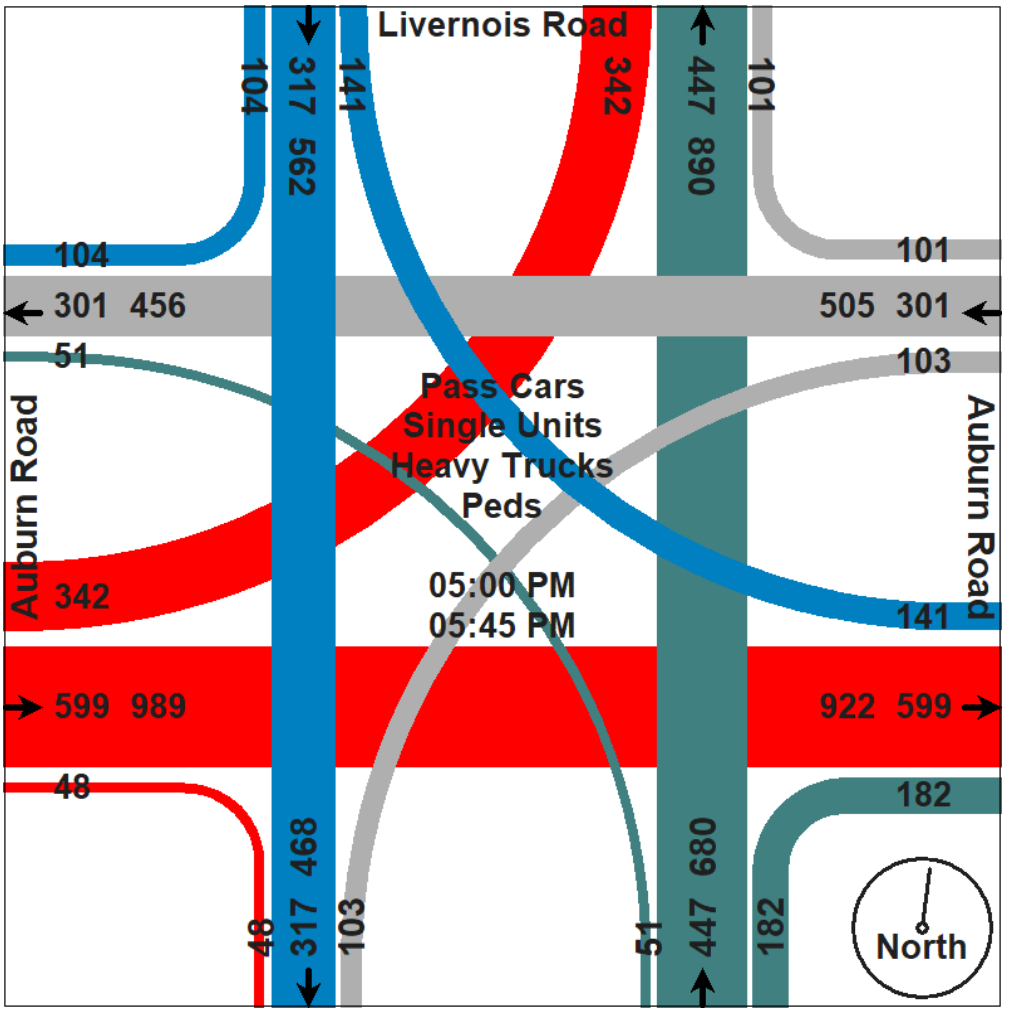
	Livernois Road Southbound				Auburn Road Westbound				Northbound				Auburn Road Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	22	80	34	136	27	71	25	123	43	114	13	170	14	152	83	249	678
05:15 PM	25	76	36	137	**28**	75	**30**	133	31	**117**	12	160	11	138	**102**	**251**	681
05:30 PM	**29**	**88**	**39**	**156**	26	**88**	29	**143**	46	103	11	160	**18**	151	78	247	**706**
05:45 PM	28	73	32	133	20	67	19	106	**62**	113	**15**	**190**	5	**158**	79	242	671
Total Volume	104	317	141	562	101	301	103	505	182	447	51	680	48	599	342	989	2736
% App. Total	18.5	56.4	25.1		20	59.6	20.4		26.8	65.7	7.5		4.9	60.6	34.6		
PHF	.897	.901	.904	.901	.902	.855	.858	.883	.734	.955	.850	.895	.667	.948	.838	.985	.969
Pass Cars	103	315	141	559	100	299	103	502	181	443	51	675	47	594	340	981	2717
% Pass Cars	99.0	99.4	100	99.5	99.0	99.3	100	99.4	99.5	99.1	100	99.3	97.9	99.2	99.4	99.2	99.3
Single Units	1	1	0	2	1	0	0	1	1	2	0	3	0	4	1	5	11
% Single Units	1.0	0.3	0	0.4	1.0	0	0	0.2	0.5	0.4	0	0.4	0	0.7	0.3	0.5	0.4
Heavy Trucks	0	1	0	1	0	2	0	2	0	2	0	2	1	1	1	3	8
% Heavy Trucks	0	0.3	0	0.2	0	0.7	0	0.4	0	0.4	0	0.3	2.1	0.2	0.3	0.3	0.3
Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



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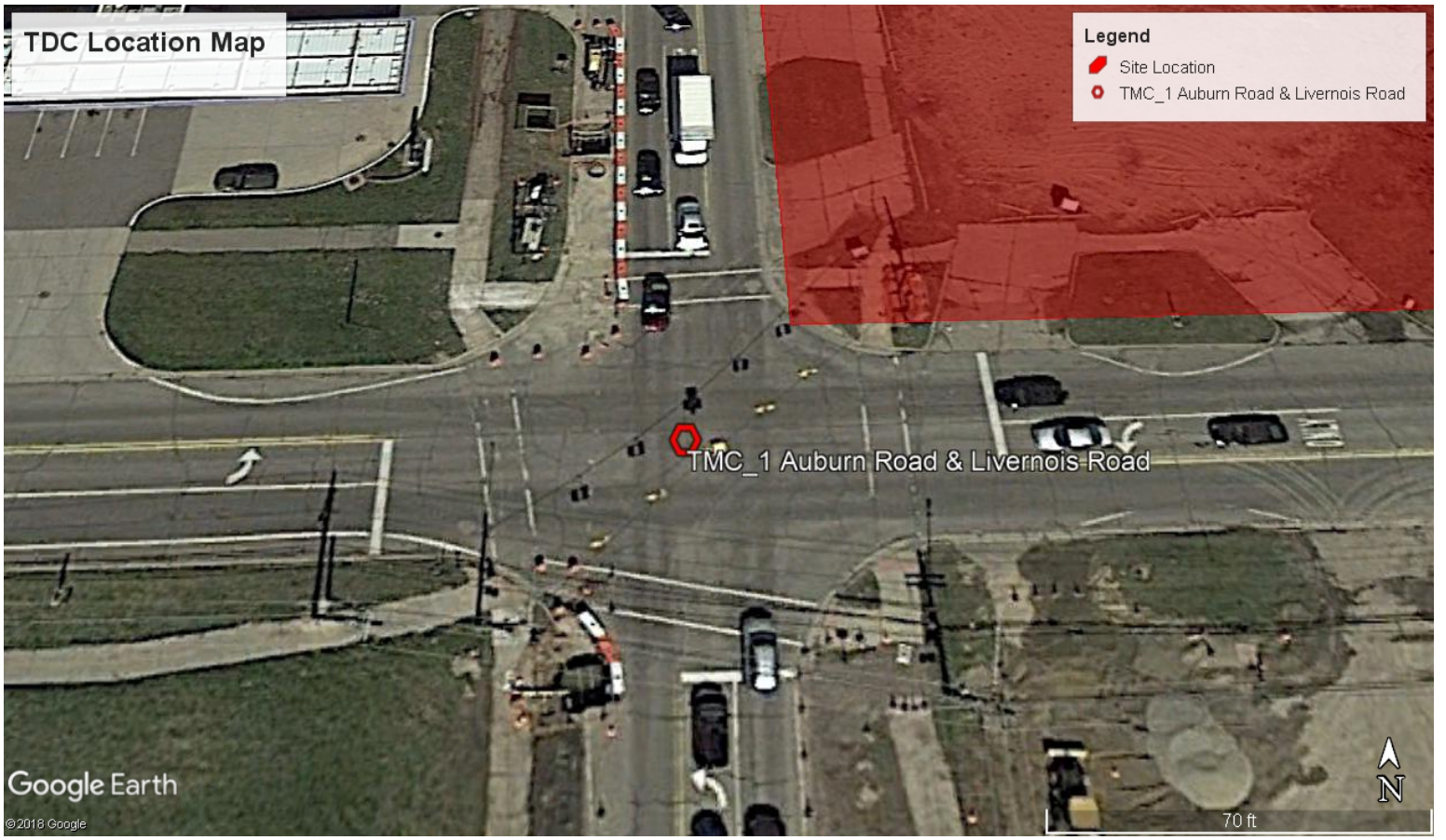
Traffic Study Performed For:

Fleis & VandenBrink

Project: Rochester Hills TIS
Study:4 Hr. Video Turning Movement Count
Weather: Sunny/Cldy. Dry Deg's 80's
Count By Miovision Video VCU 4YS SE

File Name : TMC_1 Auburn & Livernois_Thu_6-21-18
Site Code : TMC_1
Start Date : 6/21/2018
Page No : 5

Aerial Photo



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Traffic Study Performed For:

Fleis & VandenBrink

Project: Rochester Hills TIS
Study:2 Hr. Video Turning Movement Count
Weather: Cldy. Dry Deg's 70's
Count By Miovision Video VCU 34ZN NE

File Name : TMC_2 Auburn & LowerRidge_Fri_6-22-18
Site Code : TMC_2
Start Date : 6/22/2018
Page No : 1

2 Hour traffic study was conducted during weekday (Friday) from 5:00 PM - 7:00 PM afternoon peak hours.

Groups Printed- Pass Cars - Single Units - Heavy Trucks - Peds

	Lower Ridge Drive Southbound					Auburn Road Westbound					Islamis Assoc. of Greater Detroit Northbound					Auburn Road Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
05:00 PM	1	0	3	0	4	5	115	0	0	120	1	0	0	0	1	0	192	1	0	193	318
05:15 PM	1	0	1	0	2	1	110	1	0	112	1	0	1	0	2	0	203	2	0	205	321
05:30 PM	0	0	1	0	1	2	130	0	0	132	0	0	1	0	1	3	203	1	0	207	341
05:45 PM	2	0	1	0	3	4	123	0	0	127	0	0	0	0	0	0	158	2	0	160	290
Total	4	0	6	0	10	12	478	1	0	491	2	0	2	0	4	3	756	6	0	765	1270
06:00 PM	1	0	2	0	3	1	124	1	0	126	1	0	0	1	2	1	165	1	0	167	298
06:15 PM	0	0	2	0	2	4	105	11	0	120	0	0	0	0	0	1	143	2	0	146	268
06:30 PM	2	0	1	0	3	4	107	6	0	117	0	0	0	0	0	3	143	0	0	146	266
06:45 PM	1	0	2	1	4	0	92	8	0	100	0	0	0	0	0	8	131	3	0	142	246
Total	4	0	7	1	12	9	428	26	0	463	1	0	0	1	2	13	582	6	0	601	1078
Grand Total	8	0	13	1	22	21	906	27	0	954	3	0	2	1	6	16	1338	12	0	1366	2348
Apprch %	36.4	0	59.1	4.5		2.2	95	2.8	0		50	0	33.3	16.7		1.2	98	0.9	0		
Total %	0.3	0	0.6	0	0.9	0.9	38.6	1.1	0	40.6	0.1	0	0.1	0	0.3	0.7	57	0.5	0	58.2	
Pass Cars	8	0	13	0	21	21	903	27	0	951	3	0	2	0	5	16	1332	12	0	1360	2337
% Pass Cars	100	0	100	0	95.5	100	99.7	100	0	99.7	100	0	100	0	83.3	100	99.6	100	0	99.6	99.5
Single Units	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	2	0	0	2	4
% Single Units	0	0	0	0	0	0	0.2	0	0	0.2	0	0	0	0	0	0	0.1	0	0	0.1	0.2
Heavy Trucks	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	4	0	0	4	5
% Heavy Trucks	0	0	0	0	0	0	0.1	0	0	0.1	0	0	0	0	0	0	0.3	0	0	0.3	0.2
Peds	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2
% Peds	0	0	0	100	4.5	0	0	0	0	0	0	0	0	100	16.7	0	0	0	0	0	0.1

TDC Traffic Comments: Non-signalized intersection. Video VCU camera was located within NE intersection quadrant. Note: Peds. are excluded from peak hour reports.

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Traffic Study Performed For:

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Project: Rochester Hills TIS
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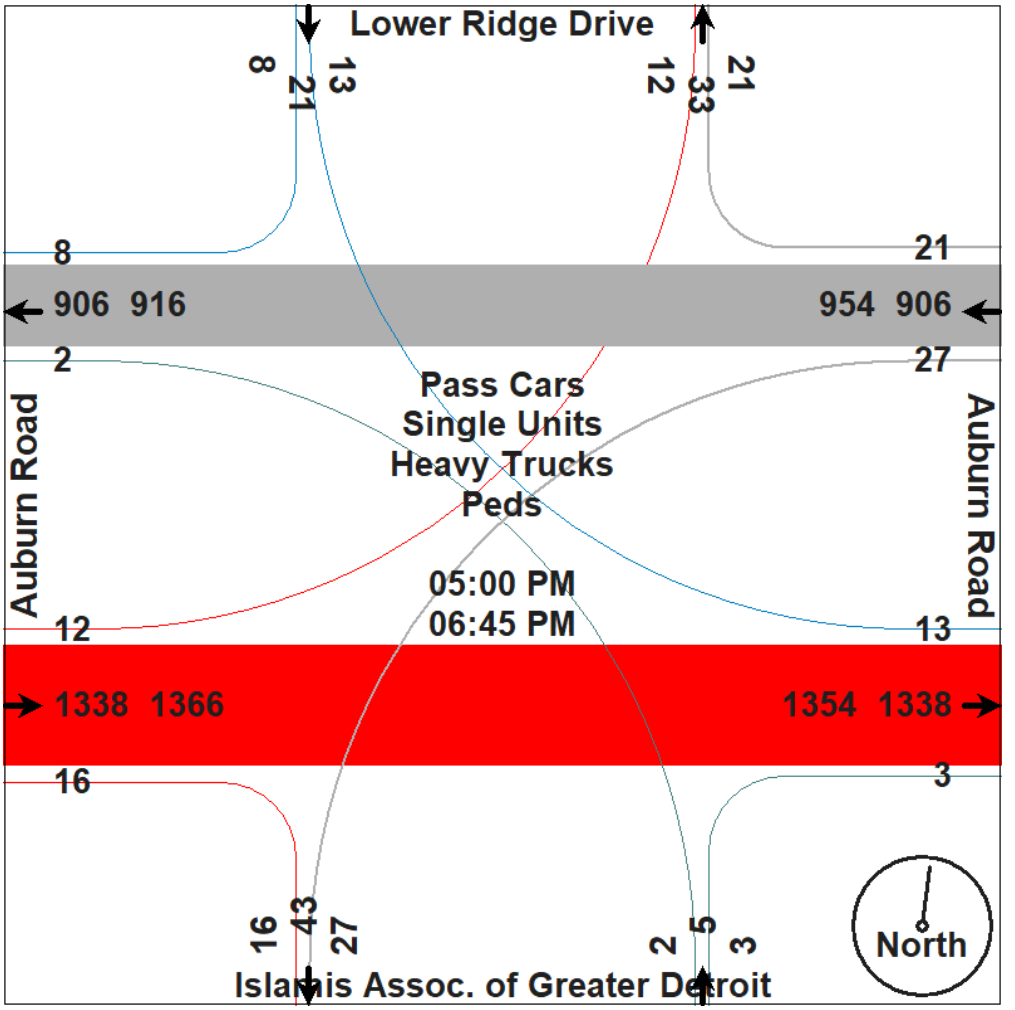
Weather: Cldy. Dry Deg's 70's
Count By Miovision Video VCU 34ZN NE

File Name : TMC_2 Auburn & LowerRidge_Fri_6-22-18
Site Code : TMC_2
Start Date : 6/22/2018
Page No : 2



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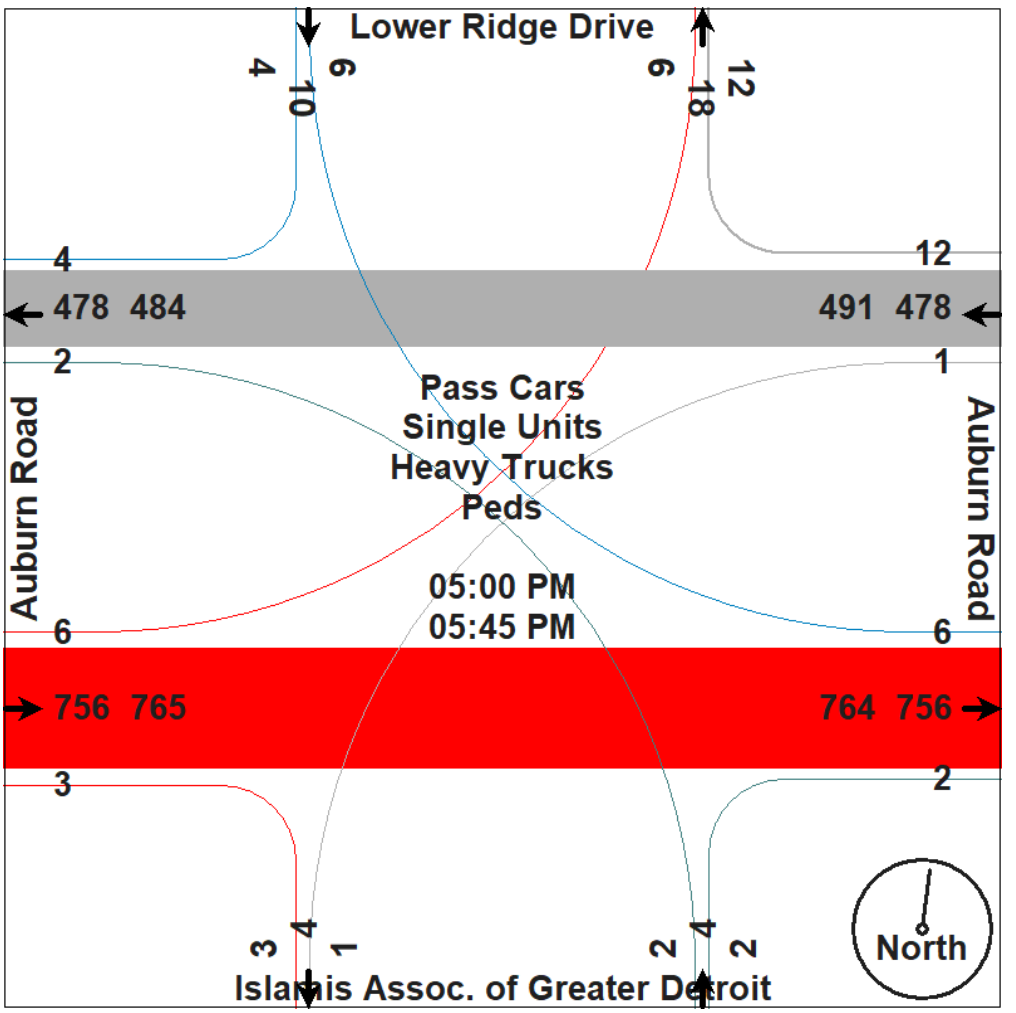
File Name : TMC_2 Auburn & LowerRidge_Fri_6-22-18
Site Code : TMC_2
Start Date : 6/22/2018
Page No : 3

	Lower Ridge Drive Southbound				Auburn Road Westbound				Islamis Assoc. of Greater Detroit Northbound				Auburn Road Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 05:00 PM to 06:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	1	0	**3**	**4**	**5**	115	0	120	**1**	0	0	1	0	192	1	193	318
05:15 PM	1	0	1	2	1	110	**1**	112	1	0	**1**	**2**	0	**203**	**2**	205	321
05:30 PM	0	0	1	1	2	**130**	0	**132**	0	0	1	1	**3**	203	1	**207**	**341**
05:45 PM	**2**	0	1	3	4	123	0	127	0	0	0	0	0	158	2	160	290
Total Volume	4	0	6	10	12	478	1	491	2	0	2	4	3	756	6	765	1270
% App. Total	40	0	60		2.4	97.4	0.2		50	0	50		0.4	98.8	0.8		
PHF	.500	.000	.500	.625	.600	.919	.250	.930	.500	.000	.500	.500	.250	.931	.750	.924	.931
Pass Cars	4	0	6	10	12	477	1	490	2	0	2	4	3	752	6	761	1265
% Pass Cars	100	0	100	100	100	99.8	100	99.8	100	0	100	100	100	99.5	100	99.5	99.6
Single Units	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2
% Single Units	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0	0.3	0.2
Heavy Trucks	0	0	0	0	0	1	0	1	0	0	0	0	0	2	0	2	3
% Heavy Trucks	0	0	0	0	0	0.2	0	0.2	0	0	0	0	0	0.3	0	0.3	0.2
Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



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Phone: 586.786-5407

Traffic Study Performed For:

Fleis & VandenBrink

Project: Rochester Hills TIS
Study:4 Hr. Video Turning Movement Count
Weather: Sunny/Cldy. Dry Deg's 80's
Count By Miovision Video VCU 34N NE

File Name : TMC_2 Auburn & LowerRidge_Thu_6-21-18
Site Code : TMC_2
Start Date : 6/21/2018
Page No : 1

4 Hour traffic study was conducted during typical weekday (Tuesday-Thursday) from 7:00 AM - 9:00 AM morning & 4:00 PM - 6:00 PM afternoon peak hours.

Groups Printed- Pass Cars - Single Units - Heavy Trucks - Peds

	Lower Ridge Drive Southbound					Auburn Road Westbound					Islamic Assoc. of Greater Detroit Northbound					Auburn Road Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	3	0	4	0	7	0	92	1	0	93	0	0	0	0	0	0	50	0	0	50	150
07:15 AM	4	0	3	0	7	0	85	1	0	86	1	0	0	0	1	0	57	0	0	57	151
07:30 AM	3	0	1	0	4	0	128	0	0	128	0	0	0	0	0	0	67	0	0	67	199
07:45 AM	3	0	1	0	4	1	134	0	0	135	0	0	0	0	0	0	61	0	0	61	200
Total	13	0	9	0	22	1	439	2	0	442	1	0	0	0	1	0	235	0	0	235	700
08:00 AM	4	0	1	0	5	0	135	2	0	137	2	0	0	0	2	1	56	0	0	57	201
08:15 AM	2	0	2	0	4	2	122	1	0	125	0	0	0	0	0	0	101	0	0	101	230
08:30 AM	4	0	4	0	8	0	112	0	0	112	0	0	0	0	0	0	77	0	0	77	197
08:45 AM	6	0	2	0	8	2	102	0	0	104	0	0	0	0	0	1	88	0	0	89	201
Total	16	0	9	0	25	4	471	3	0	478	2	0	0	0	2	2	322	0	0	324	829
*** BREAK ***																					
04:00 PM	0	0	3	0	3	3	120	0	0	123	0	0	0	0	0	0	181	1	0	182	308
04:15 PM	2	0	0	0	2	4	108	0	0	112	1	0	0	0	1	1	172	1	0	174	289
04:30 PM	1	0	1	0	2	8	121	3	0	132	1	0	0	0	1	3	200	0	0	203	338
04:45 PM	0	0	0	0	0	3	110	3	0	116	2	0	1	0	3	0	232	0	0	232	351
Total	3	0	4	0	7	18	459	6	0	483	4	0	1	0	5	4	785	2	0	791	1286
05:00 PM	3	0	2	0	5	4	128	2	0	134	1	1	1	0	3	1	236	0	0	237	379
05:15 PM	4	0	2	0	6	4	138	0	0	142	0	0	0	0	0	3	199	2	0	204	352
05:30 PM	0	0	1	0	1	2	135	1	0	138	2	0	0	0	2	1	241	1	0	243	384
05:45 PM	1	0	2	0	3	2	107	2	0	111	2	0	1	0	3	2	245	4	0	251	368
Total	8	0	7	0	15	12	508	5	0	525	5	1	2	0	8	7	921	7	0	935	1483
Grand Total	40	0	29	0	69	35	1877	16	0	1928	12	1	3	0	16	13	2263	9	0	2285	4298
Apprch %	58	0	42	0		1.8	97.4	0.8	0		75	6.2	18.8	0		0.6	99	0.4	0		
Total %	0.9	0	0.7	0	1.6	0.8	43.7	0.4	0	44.9	0.3	0	0.1	0	0.4	0.3	52.7	0.2	0	53.2	
Pass Cars	40	0	29	0	69	35	1847	15	0	1897	11	1	3	0	15	12	2237	9	0	2258	4239
% Pass Cars	100	0	100	0	100	100	98.4	93.8	0	98.4	91.7	100	100	0	93.8	92.3	98.9	100	0	98.8	98.6
Single Units	0	0	0	0	0	0	24	1	0	25	1	0	0	0	1	1	22	0	0	23	49
% Single Units	0	0	0	0	0	0	1.3	6.2	0	1.3	8.3	0	0	0	6.2	7.7	1	0	0	1	1.1
Heavy Trucks	0	0	0	0	0	0	6	0	0	6	0	0	0	0	0	0	4	0	0	4	10
% Heavy Trucks	0	0	0	0	0	0	0.3	0	0	0.3	0	0	0	0	0	0	0.2	0	0	0.2	0.2
Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TDC Traffic Comments: Non-signalized intersection. Video VCU camera was located within NE intersection quadrant. Note: Peds. are excluded from peak hour reports.

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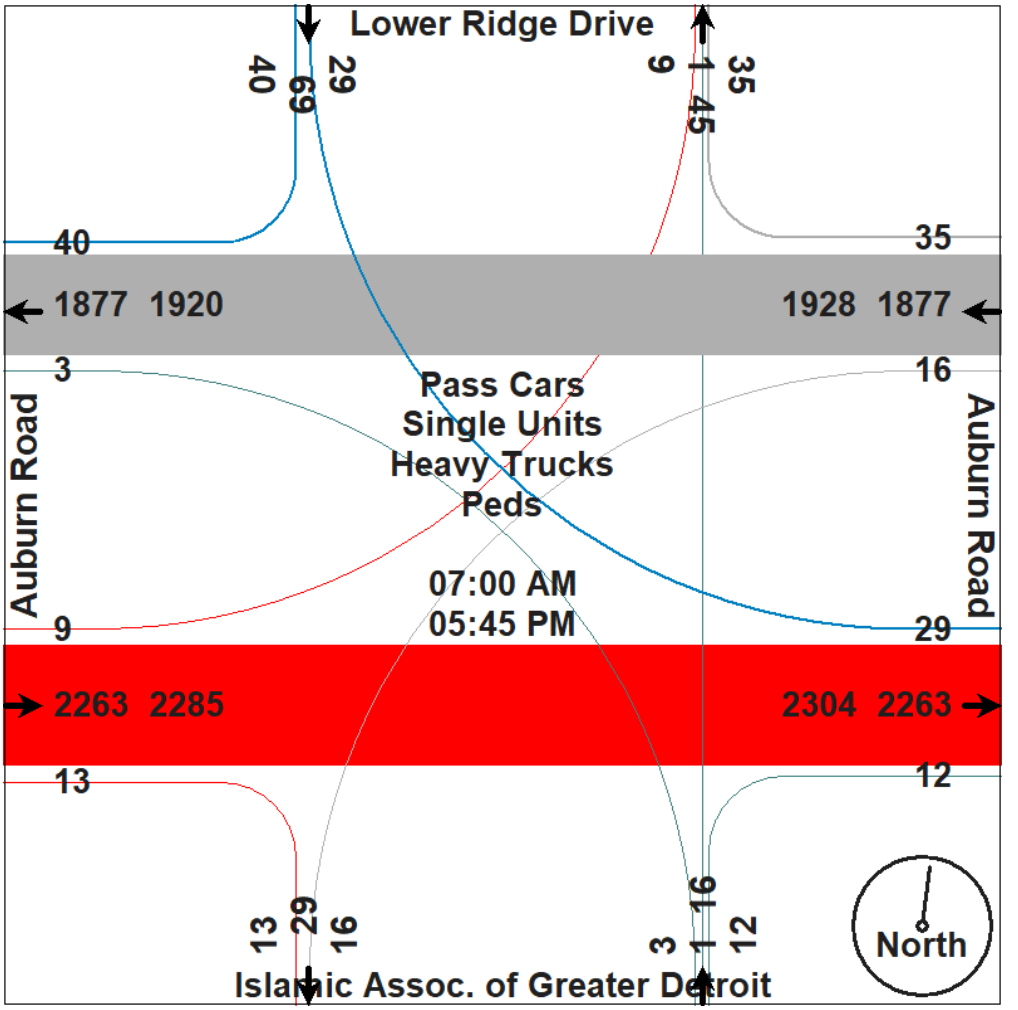
Phone: 586.786-5407

Traffic Study Performed For:

Fleis & VandenBrink

Project: Rochester Hills TIS
Study:4 Hr. Video Turning Movement Count
Weather: Sunny/Cldy. Dry Deg's 80's
Count By Miovision Video VCU 34N NE

File Name : TMC_2 Auburn & LowerRidge_Thu_6-21-18
Site Code : TMC_2
Start Date : 6/21/2018
Page No : 2



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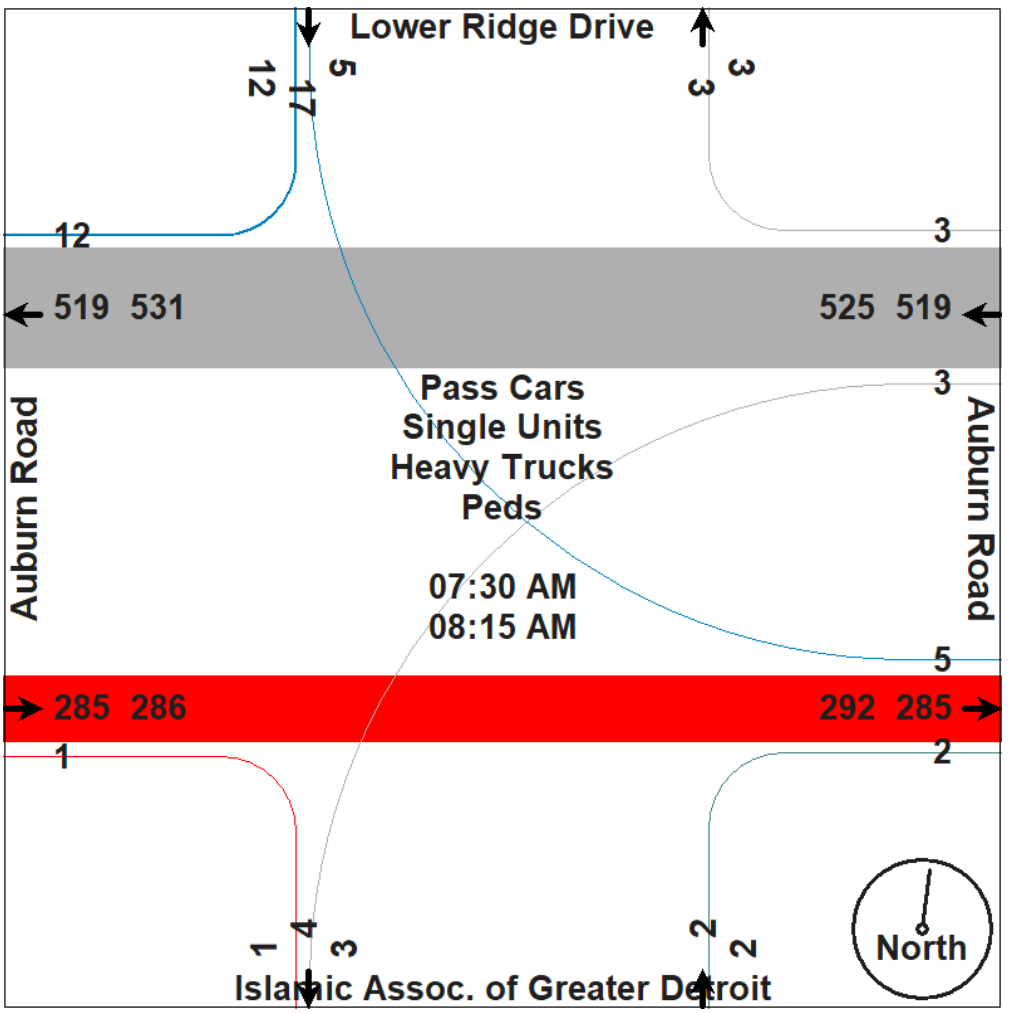
Count By Miovision Video VCU 34N NE

File Name : TMC_2 Auburn & LowerRidge_Thu_6-21-18
Site Code : TMC_2
Start Date : 6/21/2018
Page No : 3

	Lower Ridge Drive Southbound				Auburn Road Westbound				Islamic Assoc. of Greater Detroit Northbound				Auburn Road Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30 AM																	
07:30 AM	3	0	1	4	0	128	0	128	0	0	0	0	0	67	0	67	199
07:45 AM	3	0	1	4	1	134	0	135	0	0	0	0	0	61	0	61	200
08:00 AM	**4**	0	1	**5**	0	**135**	**2**	**137**	**2**	0	0	**2**	**1**	56	0	57	201
08:15 AM	2	0	**2**	4	**2**	122	1	125	0	0	0	0	0	**101**	0	**101**	**230**
Total Volume	12	0	5	17	3	519	3	525	2	0	0	2	1	285	0	286	830
% App. Total	70.6	0	29.4		0.6	98.9	0.6		100	0	0		0.3	99.7	0		
PHF	.750	.000	.625	.850	.375	.961	.375	.958	.250	.000	.000	.250	.250	.705	.000	.708	.902
Pass Cars	12	0	5	17	3	507	3	513	1	0	0	1	0	280	0	280	811
% Pass Cars	100	0	100	100	100	97.7	100	97.7	50.0	0	0	50.0	0	98.2	0	97.9	97.7
Single Units	0	0	0	0	0	11	0	11	1	0	0	1	1	4	0	5	17
% Single Units	0	0	0	0	0	2.1	0	2.1	50.0	0	0	50.0	100	1.4	0	1.7	2.0
Heavy Trucks	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1	2
% Heavy Trucks	0	0	0	0	0	0.2	0	0.2	0	0	0	0	0	0.4	0	0.3	0.2
Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



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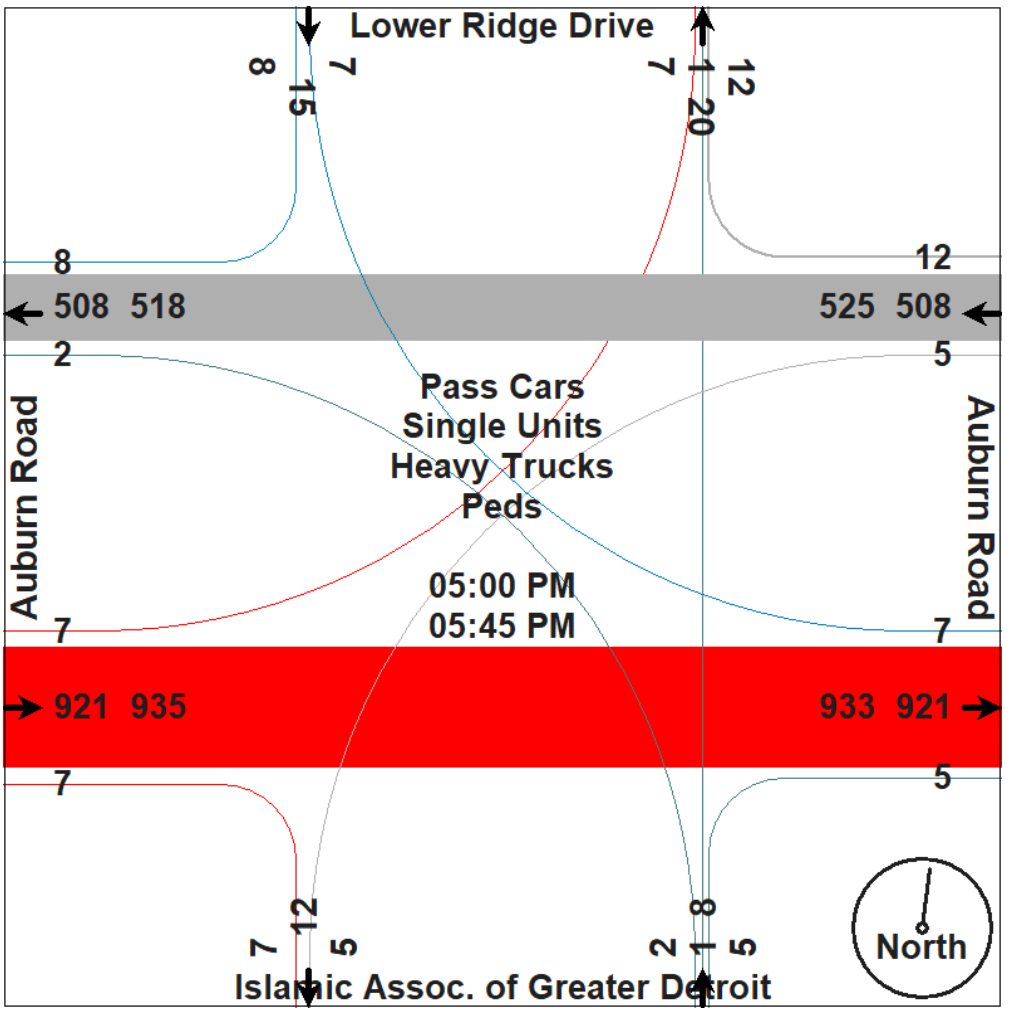
Traffic Study Performed For:

Fleis & VandenBrink

Project: Rochester Hills TIS
Study:4 Hr. Video Turning Movement Count
Weather: Sunny/Cldy. Dry Deg's 80's
Count By Miovision Video VCU 34N NE

File Name : TMC_2 Auburn & LowerRidge_Thu_6-21-18
Site Code : TMC_2
Start Date : 6/21/2018
Page No : 4

	Lower Ridge Drive Southbound				Auburn Road Westbound				Islamic Assoc. of Greater Detroit Northbound				Auburn Road Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	3	0	**2**	5	**4**	128	**2**	134	1	**1**	**1**	**3**	1	236	0	237	379
05:15 PM	**4**	0	2	**6**	4	**138**	0	**142**	0	0	0	0	**3**	199	2	204	352
05:30 PM	0	0	1	1	2	135	1	138	**2**	0	0	2	1	241	1	243	**384**
05:45 PM	1	0	2	3	2	107	2	111	2	0	1	3	2	**245**	**4**	**251**	368
Total Volume	8	0	7	15	12	508	5	525	5	1	2	8	7	921	7	935	1483
% App. Total	53.3	0	46.7		2.3	96.8	1		62.5	12.5	25		0.7	98.5	0.7		
PHF	.500	.000	.875	.625	.750	.920	.625	.924	.625	.250	.500	.667	.583	.940	.438	.931	.965
Pass Cars	8	0	7	15	12	503	5	520	5	1	2	8	7	916	7	930	1473
% Pass Cars	100	0	100	100	100	99.0	100	99.0	100	100	100	100	100	99.5	100	99.5	99.3
Single Units	0	0	0	0	0	3	0	3	0	0	0	0	0	5	0	5	8
% Single Units	0	0	0	0	0	0.6	0	0.6	0	0	0	0	0	0.5	0	0.5	0.5
Heavy Trucks	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	2
% Heavy Trucks	0	0	0	0	0	0.4	0	0.4	0	0	0	0	0	0	0	0	0.1
Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



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Phone: 586.786-5407

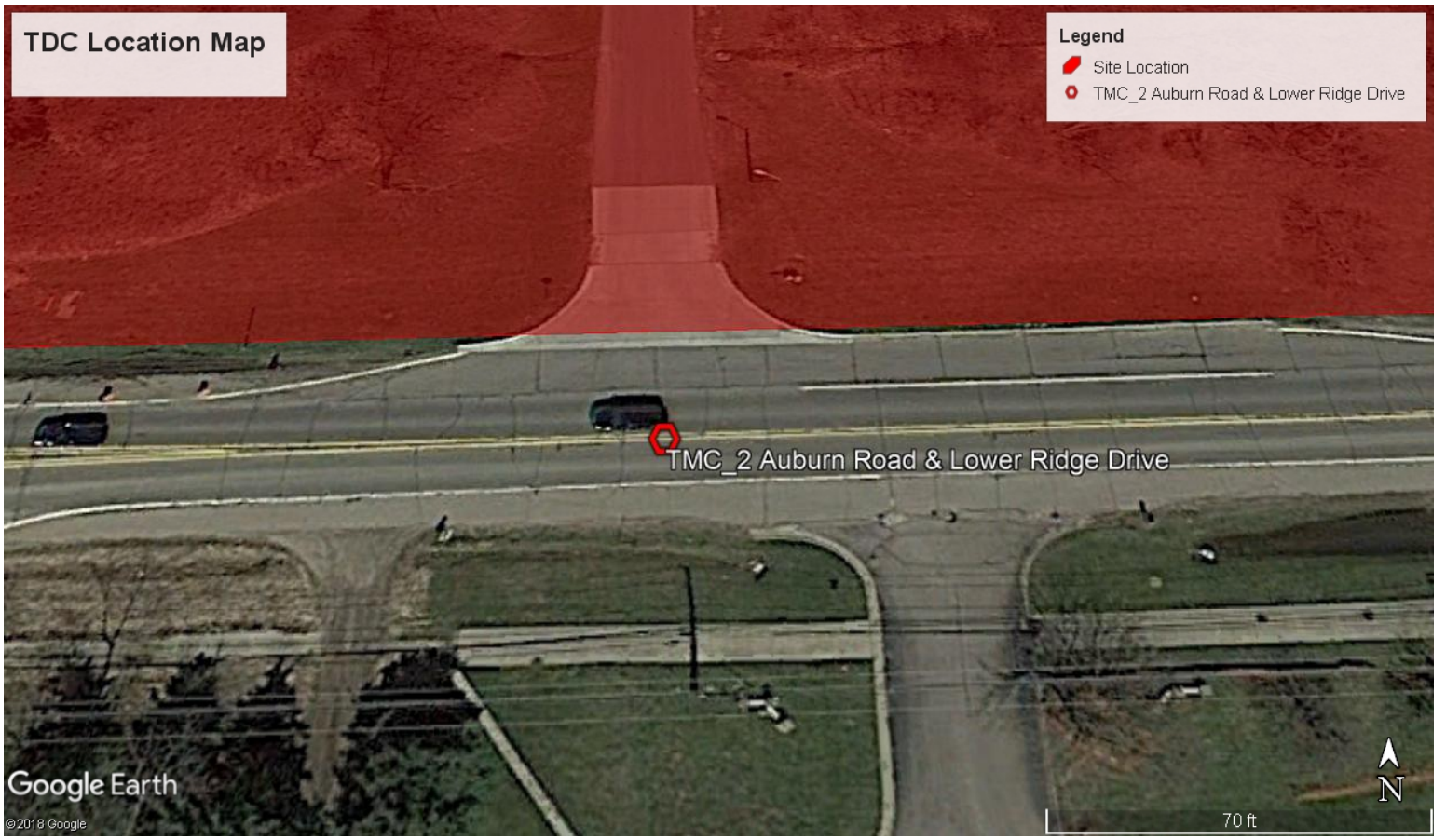
Traffic Study Performed For:

Fleis & VandenBrink

Project: Rochester Hills TIS
Study:4 Hr. Video Turning Movement Count
Weather: Sunny/Cldy. Dry Deg's 80's
Count By Miovision Video VCU 34N NE

File Name : TMC_2 Auburn & LowerRidge_Thu_6-21-18
Site Code : TMC_2
Start Date : 6/21/2018
Page No : 5

Aerial Photo



Appendix B

EXISTING TRAFFIC CONDITIONS

Level of Service Criteria for Stop Sign Controlled Intersections

The level of service criteria are given in Table 17-2. As used here, control delay is defined as the total elapsed time from the time a vehicle stops at the end of the queue until the vehicle departs from the stop line; this time includes the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position, including deceleration of vehicles from free-flow speed to the speed of vehicles in queue.

The average total delay for any particular minor movement is a function of the service rate or capacity of the approach and the degree of saturation. . . .

Exhibit 17-2. Level of Service Criteria for TWSC Intersections

LEVEL OF SERVICE	AVERAGE CONTROL DELAY (sec/veh)
A	≤ 10
B	> 10 and ≤ 15
C	> 15 and ≤ 25
D	> 25 and ≤ 35
E	> 35 and ≤ 50
F	> 50

Average total delay less than 10 sec/veh is defined as Level of Service (LOS) A. Follow-up times of less than 5 sec have been measured when there is no conflicting traffic for a minor street movement, so control delays of less than 10 sec/veh are appropriate for low flow conditions. To remain consistent with the AWSC intersection analysis procedure described later in this chapter, a total delay of 50 sec/veh is assumed as the break point between LOS E and F.

The proposed level of service criteria for TWSC intersections are somewhat different from the criteria used in Chapter 16 for signalized intersections. The primary reason for this difference is that drivers expect different levels of performance from different kinds of transportation facilities. The expectation is that a signalized intersection is designed to carry higher traffic volumes than an unsignalized intersection. Additionally, several driver behavior considerations combine to make delays at signalized intersections less onerous than at unsignalized intersections. For example, drivers at signalized intersections are able to relax during the red interval, where drivers on the minor approaches to unsignalized intersections must remain attentive to the task of identifying acceptable gaps and vehicle conflicts. Also, there is often much more variability in the amount of delay experienced by individual drivers at unsignalized than signalized intersections. For these reasons, it is considered that the total delay threshold for any given level of service is less for an unsignalized intersection than for a signalized intersection. . . .

LOS F exists when there are insufficient gaps of suitable size to allow a side street demand to cross safely through a major street traffic stream. This level of service is generally evident from extremely long total delays experienced by side street traffic and by queueing on the minor approaches. The method, however, is based on a constant critical gap size - that is, the critical gap remains constant, no matter how long the side street motorist waits. LOS F may also appear in the form of side street vehicles' selecting smaller-than-usual gaps. In such cases, safety may be a problem and some disruption to the major traffic stream may result. It is important to note that LOS F may not always result in long queues but may result in adjustments to normal gap acceptance behavior. The latter is more difficult to observe on the field than queueing, which is more obvious.

Source: Highway Capacity Manual, 2010. Transportation Research Board, National Research Council

Level of Service for Signalized Intersections

Level of service for signalized intersections is defined in terms of delay, which is a measure of driver discomfort and frustration, fuel consumption, and lost travel time. Specifically, level-of-service (LOS) criteria are stated in terms of the average stopped delay per vehicle for a 15-min analysis period. The criteria are given in Exhibit 16-2. Delay may be measured in the field or estimated using procedures presented later in this chapter. Delay is a complex measure and is dependent on a number of variables, including the quality of progression, the cycle length, the green ratio, and the *v/c* ratio for the lane group in question.

LOS A describes operations with very low delay, up to 10 sec per vehicle. This level of service occurs when progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.

LOS B describes operations with delay greater than 10 and up to 20 sec per vehicle. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of average delay.

Exhibit 16-2. Level-of-Service Criteria for Signalized Intersections

LEVEL OF SERVICE	STOPPED DELAY PER VEHICLE (SEC)
A	≤10.0
B	> 10.0 and ≤20.0
C	> 20.0 and ≤ 35.0
D	> 35.0 and ≤ 55.0
E	> 55.0 and ≤ 80.0
F	>80.0

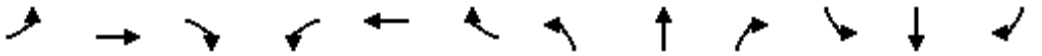
LOS C describes operations with delay greater than 20 and up to 35 sec per vehicle. These higher delays may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.

LOS D describes operations with delay greater than 35 and up to 55 sec per vehicle. At level D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high *v/c* ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

LOS E describes operations with delay greater than 55 and up to 80 sec per vehicle. This level is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high *v/c* ratios. Individual cycle failures are frequent occurrences.

LOS F describes operations with delay in excess of 80 sec per vehicle. This level, considered to be unacceptable to most drivers, often occurs with oversaturation, that is, when arrival flow rates exceed the capacity of the intersection. It may also occur at high *v/c* ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

Source: Highway Capacity Manual, 2010. Transportation Research Board, National Research Council



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	86	148	41	115	330	86	56	197	46	100	499	136
Future Volume (veh/h)	86	148	41	115	330	86	56	197	46	100	499	136
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1870	1870	1870	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	108	185	51	122	351	91	59	207	48	115	574	156
Peak Hour Factor	0.80	0.80	0.80	0.94	0.94	0.94	0.95	0.95	0.95	0.87	0.87	0.87
Percent Heavy Veh, %	3	3	3	2	2	2	1	1	1	1	1	1
Cap, veh/h	189	392	419	311	416	484	214	671	691	494	723	675
Arrive On Green	0.04	0.21	0.22	0.05	0.22	0.24	0.03	0.36	0.37	0.06	0.38	0.38
Sat Flow, veh/h	1767	1856	1572	1781	1870	1585	1795	1885	1598	1795	1885	1598
Grp Volume(v), veh/h	108	185	51	122	351	91	59	207	48	115	574	156
Grp Sat Flow(s),veh/h/ln	1767	1856	1572	1781	1870	1585	1795	1885	1598	1795	1885	1598
Q Serve(g_s), s	3.5	7.9	2.2	4.5	16.2	3.8	1.9	7.2	1.6	3.6	24.3	5.6
Cycle Q Clear(g_c), s	3.5	7.9	2.2	4.5	16.2	3.8	1.9	7.2	1.6	3.6	24.3	5.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	189	392	419	311	416	484	214	671	691	494	723	675
V/C Ratio(X)	0.57	0.47	0.12	0.39	0.84	0.19	0.28	0.31	0.07	0.23	0.79	0.23
Avail Cap(c_a), veh/h	189	546	550	311	571	616	219	671	691	509	723	675
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	31.1	31.1	25.0	27.3	33.5	23.0	20.5	21.0	14.9	16.9	24.6	16.6
Incr Delay (d2), s/veh	4.1	1.3	0.2	0.8	9.6	0.3	0.7	1.2	0.2	0.2	8.8	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	3.4	0.8	2.0	7.9	1.3	0.8	3.1	0.6	1.4	11.5	2.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	35.1	32.3	25.2	28.1	43.0	23.3	21.2	22.2	15.1	17.2	33.4	17.4
LnGrp LOS	D	C	C	C	D	C	C	C	B	B	C	B
Approach Vol, veh/h		344			564			314			845	
Approach Delay, s/veh		32.2			36.6			20.9			28.2	
Approach LOS		C			D			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.3	39.2	11.0	27.5	9.8	41.7	12.0	26.5
Change Period (Y+Rc), s	* 6	* 6	* 6.3	* 6.3	* 6	* 6	* 6.3	* 6.3
Max Green Setting (Gmax), s	* 7	* 25	* 4.7	* 29	* 4	* 28	* 5.7	* 28
Max Q Clear Time (g_c+I1), s	6.6	10.2	6.5	19.2	4.9	27.3	7.5	10.9
Green Ext Time (p_c), s	0.0	1.0	0.0	2.1	0.0	0.3	0.0	1.3

Intersection Summary	
HCM 6th Ctrl Delay	30.1
HCM 6th LOS	C

Notes

User approved pedestrian interval to be less than phase max green.
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.
User approved changes to right turn type.

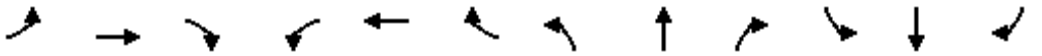
Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↰	↗		↕			↕	
Traffic Vol, veh/h	0	293	1	3	519	3	0	0	2	5	0	12
Future Vol, veh/h	0	293	1	3	519	3	0	0	2	5	0	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	100	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	71	71	71	95	95	95	65	65	65	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2	0	0	0	0	0	0
Mvmt Flow	0	413	1	3	546	3	0	0	3	6	0	14

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	549	0	0	414	0	0	975	969	414	967	966	546
Stage 1	-	-	-	-	-	-	414	414	-	552	552	-
Stage 2	-	-	-	-	-	-	561	555	-	415	414	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1021	-	-	1145	-	-	233	256	643	236	257	541
Stage 1	-	-	-	-	-	-	620	597	-	522	518	-
Stage 2	-	-	-	-	-	-	516	516	-	619	597	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1021	-	-	1145	-	-	226	255	643	234	256	541
Mov Cap-2 Maneuver	-	-	-	-	-	-	226	255	-	234	256	-
Stage 1	-	-	-	-	-	-	620	597	-	522	516	-
Stage 2	-	-	-	-	-	-	501	514	-	616	597	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	10.6	14.7
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	643	1021	-	-	1145	-	-	390
HCM Lane V/C Ratio	0.005	-	-	-	0.003	-	-	0.051
HCM Control Delay (s)	10.6	0	-	-	8.2	0	-	14.7
HCM Lane LOS	B	A	-	-	A	A	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.2



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	342	599	48	103	314	101	51	447	182	141	317	104
Future Volume (veh/h)	342	599	48	103	314	101	51	447	182	141	317	104
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	360	631	51	117	357	115	57	497	202	157	352	116
Peak Hour Factor	0.95	0.95	0.95	0.88	0.88	0.88	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	432	684	631	204	504	507	291	604	611	208	637	792
Arrive On Green	0.16	0.36	0.36	0.06	0.27	0.27	0.03	0.32	0.32	0.05	0.34	0.34
Sat Flow, veh/h	1795	1885	1598	1795	1885	1598	1795	1885	1598	1795	1885	1598
Grp Volume(v), veh/h	360	631	51	117	357	115	57	497	202	157	352	116
Grp Sat Flow(s),veh/h/ln	1795	1885	1598	1795	1885	1598	1795	1885	1598	1795	1885	1598
Q Serve(g_s), s	16.8	38.5	2.4	5.6	20.5	6.4	2.5	29.2	10.7	6.0	18.2	4.7
Cycle Q Clear(g_c), s	16.8	38.5	2.4	5.6	20.5	6.4	2.5	29.2	10.7	6.0	18.2	4.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	432	684	631	204	504	507	291	604	611	208	637	792
V/C Ratio(X)	0.83	0.92	0.08	0.57	0.71	0.23	0.20	0.82	0.33	0.76	0.55	0.15
Avail Cap(c_a), veh/h	444	749	687	207	561	555	293	604	611	208	637	792
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	26.8	36.6	22.7	32.5	39.8	30.1	27.1	37.7	26.2	34.6	32.3	16.5
Incr Delay (d2), s/veh	12.5	16.6	0.1	3.7	4.2	0.3	0.3	12.1	1.4	14.7	3.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.3	19.9	0.9	2.6	9.8	2.4	1.1	14.8	4.2	3.8	8.5	1.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.3	53.3	22.8	36.2	43.9	30.5	27.5	49.7	27.7	49.3	35.8	16.8
LnGrp LOS	D	D	C	D	D	C	C	D	C	D	D	B
Approach Vol, veh/h		1042			589			756			625	
Approach Delay, s/veh		47.0			39.8			42.2			35.7	
Approach LOS		D			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.0	44.4	25.2	38.4	9.9	46.6	13.8	49.8
Change Period (Y+Rc), s	* 6	* 6	* 6.3	* 6.3	* 6	* 6	* 6.3	* 6.3
Max Green Setting (Gmax), s	* 6	* 34	* 20	* 36	* 4	* 36	* 7.7	* 48
Max Q Clear Time (g_c+I1), s	8.0	31.2	18.8	22.5	4.5	20.2	7.6	40.5
Green Ext Time (p_c), s	0.0	1.0	0.1	2.7	0.0	1.9	0.0	3.0

Intersection Summary	
HCM 6th Ctrl Delay	42.0
HCM 6th LOS	D

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

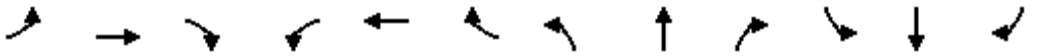
Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	7	908	7	5	508	12	2	1	5	7	0	8
Future Vol, veh/h	7	908	7	5	508	12	2	1	5	7	0	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	100	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	92	92	92	67	67	67	65	65	65
Heavy Vehicles, %	1	1	1	1	1	1	0	0	0	0	0	0
Mvmt Flow	8	976	8	5	552	13	3	1	7	11	0	12

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	565	0	0	984	0	0	1571	1571	980	1562	1562	552
Stage 1	-	-	-	-	-	-	996	996	-	562	562	-
Stage 2	-	-	-	-	-	-	575	575	-	1000	1000	-
Critical Hdwy	4.11	-	-	4.11	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.209	-	-	2.209	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1012	-	-	706	-	-	91	112	306	92	113	537
Stage 1	-	-	-	-	-	-	297	325	-	515	513	-
Stage 2	-	-	-	-	-	-	507	506	-	295	324	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1012	-	-	706	-	-	87	109	306	87	110	537
Mov Cap-2 Maneuver	-	-	-	-	-	-	87	109	-	87	110	-
Stage 1	-	-	-	-	-	-	292	319	-	506	508	-
Stage 2	-	-	-	-	-	-	490	501	-	282	318	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.1	28.5	31.8
HCM LOS			D	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	165	1012	-	-	706	-	-	157
HCM Lane V/C Ratio	0.072	0.007	-	-	0.008	-	-	0.147
HCM Control Delay (s)	28.5	8.6	0	-	10.1	0	-	31.8
HCM Lane LOS	D	A	A	-	B	A	-	D
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.5



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	217	478	52	105	267	118	58	407	162	122	284	54
Future Volume (veh/h)	217	478	52	105	267	118	58	407	162	122	284	54
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1900	1900	1900	1900	1900	1900	1900	1900	1900
Adj Flow Rate, veh/h	244	537	58	115	293	130	67	468	186	140	326	62
Peak Hour Factor	0.89	0.89	0.89	0.91	0.91	0.91	0.87	0.87	0.87	0.87	0.87	0.87
Percent Heavy Veh, %	1	1	1	0	0	0	0	0	0	0	0	0
Cap, veh/h	377	598	560	184	473	468	395	738	702	285	754	826
Arrive On Green	0.12	0.32	0.32	0.05	0.25	0.25	0.03	0.39	0.39	0.04	0.40	0.40
Sat Flow, veh/h	1795	1885	1598	1810	1900	1610	1810	1900	1610	1810	1900	1610
Grp Volume(v), veh/h	244	537	58	115	293	130	67	468	186	140	326	62
Grp Sat Flow(s),veh/h/ln	1795	1885	1598	1810	1900	1610	1810	1900	1610	1810	1900	1610
Q Serve(g_s), s	11.7	32.6	2.9	5.7	16.4	7.5	2.7	24.0	8.8	5.0	15.0	2.3
Cycle Q Clear(g_c), s	11.7	32.6	2.9	5.7	16.4	7.5	2.7	24.0	8.8	5.0	15.0	2.3
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	377	598	560	184	473	468	395	738	702	285	754	826
V/C Ratio(X)	0.65	0.90	0.10	0.63	0.62	0.28	0.17	0.63	0.26	0.49	0.43	0.08
Avail Cap(c_a), veh/h	434	718	662	184	534	519	395	738	702	285	754	826
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	28.5	39.1	26.3	34.7	40.0	32.9	21.7	29.8	21.6	26.2	26.3	14.8
Incr Delay (d2), s/veh	2.7	13.3	0.1	6.5	2.3	0.5	0.2	4.1	0.9	1.3	1.8	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.1	16.6	1.1	2.8	7.7	2.9	1.1	11.1	3.4	2.4	6.8	0.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	31.2	52.4	26.4	41.2	42.3	33.3	21.9	33.9	22.5	27.5	28.2	15.0
LnGrp LOS	C	D	C	D	D	C	C	C	C	C	C	B
Approach Vol, veh/h		839			538			721			528	
Approach Delay, s/veh		44.4			39.9			29.8			26.4	
Approach LOS		D			D			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.0	52.6	20.2	36.2	10.0	53.6	12.0	44.4
Change Period (Y+Rc), s	* 6	* 6	* 6.3	* 6.3	* 6	* 6	* 6.3	* 6.3
Max Green Setting (Gmax), s	* 5	* 39	* 18	* 34	* 4	* 40	* 5.7	* 46
Max Q Clear Time (g_c+I1), s	7.0	26.0	13.7	18.4	4.7	17.0	7.7	34.6
Green Ext Time (p_c), s	0.0	2.6	0.3	2.5	0.0	1.8	0.0	3.4

Intersection Summary	
HCM 6th Ctrl Delay	35.9
HCM 6th LOS	D

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.
User approved changes to right turn type.

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	753	3	1	484	12	2	0	2	6	0	4
Future Vol, veh/h	6	753	3	1	484	12	2	0	2	6	0	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	100	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	93	93	93	65	65	65	65	65	65
Heavy Vehicles, %	1	1	1	0	0	0	0	0	0	0	0	0
Mvmt Flow	7	818	3	1	520	13	3	0	3	9	0	6

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	533	0	0	821	0	0	1366	1369	820	1357	1357	520
Stage 1	-	-	-	-	-	-	834	834	-	522	522	-
Stage 2	-	-	-	-	-	-	532	535	-	835	835	-
Critical Hdwy	4.11	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.209	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1040	-	-	817	-	-	126	148	378	127	150	560
Stage 1	-	-	-	-	-	-	365	386	-	542	534	-
Stage 2	-	-	-	-	-	-	535	527	-	365	386	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1040	-	-	817	-	-	123	146	378	125	148	560
Mov Cap-2 Maneuver	-	-	-	-	-	-	123	146	-	125	148	-
Stage 1	-	-	-	-	-	-	361	381	-	535	533	-
Stage 2	-	-	-	-	-	-	528	526	-	358	381	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0	25	26.7
HCM LOS			D	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	186	1040	-	-	817	-	-	181
HCM Lane V/C Ratio	0.033	0.006	-	-	0.001	-	-	0.085
HCM Control Delay (s)	25	8.5	0	-	9.4	0	-	26.7
HCM Lane LOS	D	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.3

Intersection: 1: Livernois Rd. & Auburn Rd. (Push Buttons)/Auburn Rd.

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	R	L	T	R
Maximum Queue (ft)	114	175	48	126	272	48	114	193	59	210	495	210
Average Queue (ft)	45	68	13	52	151	16	32	79	15	71	240	72
95th Queue (ft)	92	137	36	101	240	35	75	152	44	183	439	205
Link Distance (ft)		920	920		530	530		426	426		510	
Upstream Blk Time (%)											2	
Queuing Penalty (veh)											0	
Storage Bay Dist (ft)	180			200			65			130		130
Storage Blk Time (%)		0			3		1	13		0	24	0
Queuing Penalty (veh)		0			3		2	7		1	57	0

Intersection: 2: IAGD 1/Lower Ridge Dr & Auburn Rd.

Movement	WB	NB	SB
Directions Served	LT	LTR	LTR
Maximum Queue (ft)	18	31	35
Average Queue (ft)	1	2	12
95th Queue (ft)	13	15	36
Link Distance (ft)	666	442	512
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)	0		
Queuing Penalty (veh)	0		

Zone Summary

Zone wide Queuing Penalty: 71

Intersection: 1: Livernois Rd. & Auburn Rd. (Push Buttons)/Auburn Rd.

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	R	L	T	R
Maximum Queue (ft)	360	555	52	113	343	78	144	434	194	209	434	181
Average Queue (ft)	215	306	11	56	178	30	51	294	79	97	163	48
95th Queue (ft)	359	474	33	103	302	69	144	444	155	193	308	159
Link Distance (ft)		920	920		530	530		426	426		510	
Upstream Blk Time (%)								3			0	
Queuing Penalty (veh)								10			0	
Storage Bay Dist (ft)	180			200			65			130		130
Storage Blk Time (%)	14	28			8		3	58		9	15	0
Queuing Penalty (veh)	84	95			9		12	30		39	38	0

Intersection: 2: IAGD 1/Lower Ridge Dr. & Auburn Rd.

Movement	EB	WB	NB	SB
Directions Served	LTR	LT	LTR	LTR
Maximum Queue (ft)	47	81	31	44
Average Queue (ft)	4	3	8	15
95th Queue (ft)	28	33	29	42
Link Distance (ft)	530	666	442	512
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)		0		
Queuing Penalty (veh)		0		

Zone Summary

Zone wide Queuing Penalty: 316

Intersection: 1: Livernois Rd. & Auburn Rd. (Push Buttons)/Auburn Rd.

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	R	L	T	R
Maximum Queue (ft)	360	493	42	126	265	89	144	422	145	209	270	108
Average Queue (ft)	129	248	12	59	139	29	52	235	61	71	126	15
95th Queue (ft)	264	411	32	104	225	65	142	389	120	146	224	57
Link Distance (ft)		920	920		530	530		426	426		510	
Upstream Blk Time (%)								0				
Queuing Penalty (veh)								1				
Storage Bay Dist (ft)	180			200			65			130		130
Storage Blk Time (%)	1	20			3		2	49		2	10	
Queuing Penalty (veh)	5	44			3		8	29		7	19	

Intersection: 2: IAGD 1/Lower Ridge Dr. & Auburn Rd.

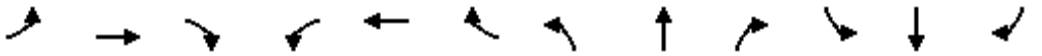
Movement	EB	NB	SB
Directions Served	LTR	LTR	LTR
Maximum Queue (ft)	39	31	52
Average Queue (ft)	2	4	10
95th Queue (ft)	18	21	37
Link Distance (ft)	530	442	512
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Zone Summary

Zone wide Queuing Penalty: 115

Appendix C

BACKGROUND TRAFFIC CONDITIONS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	89	185	42	119	382	89	58	204	48	121	515	140
Future Volume (veh/h)	89	185	42	119	382	89	58	204	48	121	515	140
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1870	1870	1870	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	111	231	52	127	406	95	61	215	51	139	592	161
Peak Hour Factor	0.80	0.80	0.80	0.94	0.94	0.94	0.95	0.95	0.95	0.87	0.87	0.87
Percent Heavy Veh, %	3	3	3	2	2	2	1	1	1	1	1	1
Cap, veh/h	216	436	425	347	477	510	216	665	679	502	725	698
Arrive On Green	0.05	0.24	0.24	0.07	0.26	0.26	0.03	0.35	0.35	0.07	0.38	0.38
Sat Flow, veh/h	1767	1856	1572	1781	1870	1585	1795	1885	1598	1795	1885	1598
Grp Volume(v), veh/h	111	231	52	127	406	95	61	215	51	139	592	161
Grp Sat Flow(s),veh/h/ln	1767	1856	1572	1781	1870	1585	1795	1885	1598	1795	1885	1598
Q Serve(g_s), s	4.3	9.8	2.2	4.8	18.6	3.9	1.9	7.5	1.7	4.4	25.4	5.7
Cycle Q Clear(g_c), s	4.3	9.8	2.2	4.8	18.6	3.9	1.9	7.5	1.7	4.4	25.4	5.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	216	436	425	347	477	510	216	665	679	502	725	698
V/C Ratio(X)	0.51	0.53	0.12	0.37	0.85	0.19	0.28	0.32	0.08	0.28	0.82	0.23
Avail Cap(c_a), veh/h	216	571	539	351	617	629	233	665	679	502	725	698
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	26.2	30.1	24.8	23.8	31.9	22.0	20.6	21.3	15.4	16.8	24.9	15.9
Incr Delay (d2), s/veh	2.1	1.4	0.2	0.6	9.8	0.2	0.7	1.3	0.2	0.3	9.9	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	4.3	0.8	1.9	9.1	1.4	0.8	3.2	0.6	1.7	12.0	2.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	28.3	31.5	25.0	24.5	41.7	22.3	21.3	22.6	15.6	17.1	34.7	16.7
LnGrp LOS	C	C	C	C	D	C	C	C	B	B	C	B
Approach Vol, veh/h		394			628			327			892	
Approach Delay, s/veh		29.7			35.3			21.2			28.7	
Approach LOS		C			D			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.0	37.7	11.0	29.3	9.1	40.6	12.8	27.5
Change Period (Y+Rc), s	* 6	* 6	* 6.3	* 6.3	* 6	* 6	* 6.3	* 6.3
Max Green Setting (Gmax), s	* 6	* 25	* 4.7	* 30	* 4	* 27	* 6.7	* 28
Max Q Clear Time (g_c+I1), s	6.4	9.5	6.3	20.6	3.9	27.4	6.8	11.8
Green Ext Time (p_c), s	0.0	1.0	0.0	2.4	0.0	0.0	0.0	1.7

Intersection Summary	
HCM 6th Ctrl Delay	29.7
HCM 6th LOS	C

Notes

User approved pedestrian interval to be less than phase max green.
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.
User approved changes to right turn type.

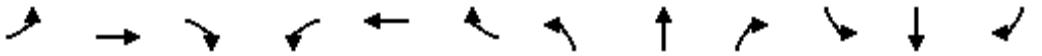
Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕	↱		↕			↕	
Traffic Vol, veh/h	0	341	13	17	567	3	11	0	7	5	0	12
Future Vol, veh/h	0	341	13	17	567	3	11	0	7	5	0	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	100	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	71	71	71	95	95	95	65	65	65	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2	0	0	0	0	0	0
Mvmt Flow	0	480	18	18	597	3	17	0	11	6	0	14

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	600	0	0	498	0	0	1131	1125	489	1128	1131	597
Stage 1	-	-	-	-	-	-	489	489	-	633	633	-
Stage 2	-	-	-	-	-	-	642	636	-	495	498	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	977	-	-	1066	-	-	182	207	583	183	205	507
Stage 1	-	-	-	-	-	-	564	553	-	471	476	-
Stage 2	-	-	-	-	-	-	466	475	-	560	548	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	977	-	-	1066	-	-	174	202	583	176	200	507
Mov Cap-2 Maneuver	-	-	-	-	-	-	174	202	-	176	200	-
Stage 1	-	-	-	-	-	-	564	553	-	471	464	-
Stage 2	-	-	-	-	-	-	442	463	-	550	548	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.2	22	16.8
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	239	977	-	-	1066	-	-	326
HCM Lane V/C Ratio	0.116	-	-	-	0.017	-	-	0.061
HCM Control Delay (s)	22	0	-	-	8.4	0	-	16.8
HCM Lane LOS	C	A	-	-	A	A	-	C
HCM 95th %tile Q(veh)	0.4	0	-	-	0.1	-	-	0.2



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	353	642	50	106	332	110	53	462	188	156	327	107
Future Volume (veh/h)	353	642	50	106	332	110	53	462	188	156	327	107
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	372	676	53	120	377	125	59	513	209	173	363	119
Peak Hour Factor	0.95	0.95	0.95	0.88	0.88	0.88	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	418	712	657	167	507	537	284	572	560	211	634	786
Arrive On Green	0.16	0.38	0.38	0.05	0.27	0.27	0.03	0.30	0.30	0.07	0.34	0.34
Sat Flow, veh/h	1795	1885	1598	1795	1885	1598	1795	1885	1598	1795	1885	1598
Grp Volume(v), veh/h	372	676	53	120	377	125	59	513	209	173	363	119
Grp Sat Flow(s),veh/h/ln	1795	1885	1598	1795	1885	1598	1795	1885	1598	1795	1885	1598
Q Serve(g_s), s	17.5	41.8	2.4	5.7	21.9	6.8	2.7	31.3	11.7	8.0	19.0	4.9
Cycle Q Clear(g_c), s	17.5	41.8	2.4	5.7	21.9	6.8	2.7	31.3	11.7	8.0	19.0	4.9
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	418	712	657	167	507	537	284	572	560	211	634	786
V/C Ratio(X)	0.89	0.95	0.08	0.72	0.74	0.23	0.21	0.90	0.37	0.82	0.57	0.15
Avail Cap(c_a), veh/h	418	734	676	167	529	555	299	572	560	211	634	786
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	27.4	36.2	21.5	34.7	40.1	28.7	28.3	40.0	29.1	31.6	32.7	16.7
Incr Delay (d2), s/veh	20.4	21.7	0.1	13.9	5.9	0.3	0.4	19.4	1.9	21.8	3.7	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.4	22.4	0.9	3.1	10.6	2.6	1.1	16.8	4.6	4.6	8.9	1.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	47.8	58.0	21.6	48.6	45.9	29.0	28.6	59.4	31.0	53.4	36.5	17.1
LnGrp LOS	D	E	C	D	D	C	C	E	C	D	D	B
Approach Vol, veh/h		1101			622			781			655	
Approach Delay, s/veh		52.8			43.0			49.5			37.4	
Approach LOS		D			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.0	42.4	25.0	38.6	10.0	46.3	12.0	51.6
Change Period (Y+Rc), s	* 6	* 6	* 6.3	* 6.3	* 6	* 6	* 6.3	* 6.3
Max Green Setting (Gmax), s	* 8	* 35	* 19	* 34	* 5	* 38	* 5.7	* 47
Max Q Clear Time (g_c+I1), s	10.0	33.3	19.5	23.9	4.7	21.0	7.7	43.8
Green Ext Time (p_c), s	0.0	0.7	0.0	2.4	0.0	2.1	0.0	1.5

Intersection Summary	
HCM 6th Ctrl Delay	46.9
HCM 6th LOS	D

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

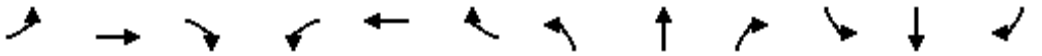
Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↰	↗		↕			↕	
Traffic Vol, veh/h	7	964	15	8	535	12	5	1	7	7	0	8
Future Vol, veh/h	7	964	15	8	535	12	5	1	7	7	0	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	100	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	92	92	92	67	67	67	65	65	65
Heavy Vehicles, %	1	1	1	1	1	1	0	0	0	0	0	0
Mvmt Flow	8	1037	16	9	582	13	7	1	10	11	0	12

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	595	0	0	1053	0	0	1674	1674	1045	1667	1669	582
Stage 1	-	-	-	-	-	-	1061	1061	-	600	600	-
Stage 2	-	-	-	-	-	-	613	613	-	1067	1069	-
Critical Hdwy	4.11	-	-	4.11	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.209	-	-	2.209	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	986	-	-	665	-	-	77	97	280	78	97	517
Stage 1	-	-	-	-	-	-	273	303	-	491	493	-
Stage 2	-	-	-	-	-	-	483	486	-	271	300	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	986	-	-	665	-	-	73	93	280	72	93	517
Mov Cap-2 Maneuver	-	-	-	-	-	-	73	93	-	72	93	-
Stage 1	-	-	-	-	-	-	268	297	-	481	483	-
Stage 2	-	-	-	-	-	-	462	476	-	254	294	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.2	39	37.7
HCM LOS			E	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	125	986	-	-	665	-	-	133
HCM Lane V/C Ratio	0.155	0.008	-	-	0.013	-	-	0.174
HCM Control Delay (s)	39	8.7	0	-	10.5	0	-	37.7
HCM Lane LOS	E	A	A	-	B	A	-	E
HCM 95th %tile Q(veh)	0.5	0	-	-	0	-	-	0.6



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	224	517	54	108	283	128	60	420	167	136	293	56
Future Volume (veh/h)	224	517	54	108	283	128	60	420	167	136	293	56
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1900	1900	1900	1900	1900	1900	1900	1900	1900
Adj Flow Rate, veh/h	252	581	61	119	311	141	69	483	192	156	337	64
Peak Hour Factor	0.89	0.89	0.89	0.91	0.91	0.91	0.87	0.87	0.87	0.87	0.87	0.87
Percent Heavy Veh, %	1	1	1	0	0	0	0	0	0	0	0	0
Cap, veh/h	389	640	601	182	515	530	362	665	640	265	706	784
Arrive On Green	0.12	0.34	0.34	0.05	0.27	0.27	0.04	0.35	0.35	0.06	0.37	0.37
Sat Flow, veh/h	1795	1885	1598	1810	1900	1610	1810	1900	1610	1810	1900	1610
Grp Volume(v), veh/h	252	581	61	119	311	141	69	483	192	156	337	64
Grp Sat Flow(s),veh/h/ln	1795	1885	1598	1810	1900	1610	1810	1900	1610	1810	1900	1610
Q Serve(g_s), s	11.7	35.3	3.0	5.7	17.1	7.7	2.9	26.6	9.8	6.7	16.3	2.5
Cycle Q Clear(g_c), s	11.7	35.3	3.0	5.7	17.1	7.7	2.9	26.6	9.8	6.7	16.3	2.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	389	640	601	182	515	530	362	665	640	265	706	784
V/C Ratio(X)	0.65	0.91	0.10	0.65	0.60	0.27	0.19	0.73	0.30	0.59	0.48	0.08
Avail Cap(c_a), veh/h	431	734	681	182	565	573	371	665	640	265	706	784
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	26.9	37.9	24.3	33.6	38.1	29.6	24.3	34.0	24.7	26.7	28.8	16.4
Incr Delay (d2), s/veh	2.9	14.7	0.1	8.2	2.0	0.4	0.3	6.8	1.2	3.4	2.3	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.1	18.1	1.1	2.8	8.0	0.1	1.2	12.8	3.8	3.0	7.5	0.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	29.8	52.5	24.4	41.8	40.1	30.0	24.5	40.8	25.9	30.1	31.1	16.6
LnGrp LOS	C	D	C	D	D	C	C	D	C	C	C	B
Approach Vol, veh/h		894			571			744			557	
Approach Delay, s/veh		44.2			38.0			35.5			29.2	
Approach LOS		D			D			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.0	48.0	20.2	38.8	10.4	50.6	12.0	47.0
Change Period (Y+Rc), s	* 6	* 6	* 6.3	* 6.3	* 6	* 6	* 6.3	* 6.3
Max Green Setting (Gmax), s	* 7	* 36	* 17	* 36	* 5	* 38	* 5.7	* 47
Max Q Clear Time (g_c+I1), s	8.7	28.6	13.7	19.1	4.9	18.3	7.7	37.3
Green Ext Time (p_c), s	0.0	2.0	0.2	2.8	0.0	1.8	0.0	3.4

Intersection Summary	
HCM 6th Ctrl Delay	37.5
HCM 6th LOS	D

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	803	11	4	510	12	5	0	4	6	0	4
Future Vol, veh/h	6	803	11	4	510	12	5	0	4	6	0	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	100	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	93	93	93	65	65	65	65	65	65
Heavy Vehicles, %	1	1	1	0	0	0	0	0	0	0	0	0
Mvmt Flow	7	873	12	4	548	13	8	0	6	9	0	6

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	561	0	0	885	0	0	1459	1462	879	1452	1455	548
Stage 1	-	-	-	-	-	-	893	893	-	556	556	-
Stage 2	-	-	-	-	-	-	566	569	-	896	899	-
Critical Hdwy	4.11	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.209	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1015	-	-	773	-	-	108	130	350	110	131	540
Stage 1	-	-	-	-	-	-	339	363	-	519	516	-
Stage 2	-	-	-	-	-	-	513	509	-	338	360	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1015	-	-	773	-	-	105	127	350	106	128	540
Mov Cap-2 Maneuver	-	-	-	-	-	-	105	127	-	106	128	-
Stage 1	-	-	-	-	-	-	334	358	-	512	512	-
Stage 2	-	-	-	-	-	-	503	505	-	327	355	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.1	31	30.6
HCM LOS			D	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	152	1015	-	-	773	-	-	156
HCM Lane V/C Ratio	0.091	0.006	-	-	0.006	-	-	0.099
HCM Control Delay (s)	31	8.6	0	-	9.7	0	-	30.6
HCM Lane LOS	D	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	0.3	0	-	-	0	-	-	0.3

Intersection: 1: Livernois Rd. & Auburn Rd. (Push Buttons)/Auburn Rd.

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	R	L	T	R
Maximum Queue (ft)	106	181	55	123	292	49	74	159	48	209	512	210
Average Queue (ft)	45	73	13	50	170	19	33	81	13	82	255	80
95th Queue (ft)	89	141	36	100	261	39	59	143	37	188	472	218
Link Distance (ft)		920	920		530	530		426	426		510	
Upstream Blk Time (%)											3	
Queuing Penalty (veh)											0	
Storage Bay Dist (ft)	180			200			65			130		130
Storage Blk Time (%)		0			4		1	16		1	28	
Queuing Penalty (veh)		0			4		2	9		5	75	

Intersection: 2: IAGD 1/Lower Ridge Dr. & Auburn Rd.

Movement	WB	NB	SB
Directions Served	LT	LTR	LTR
Maximum Queue (ft)	42	44	47
Average Queue (ft)	2	16	15
95th Queue (ft)	19	43	41
Link Distance (ft)	666	442	512
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)	0		
Queuing Penalty (veh)	0		

Zone Summary

Zone wide Queuing Penalty: 95

Intersection: 1: Livernois Rd. & Auburn Rd. (Push Buttons)/Auburn Rd.

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	R	L	T	R
Maximum Queue (ft)	360	952	909	190	355	112	144	440	222	209	384	210
Average Queue (ft)	308	563	233	69	198	38	58	362	88	101	160	36
95th Queue (ft)	439	1021	868	141	315	85	146	512	176	182	302	120
Link Distance (ft)		920	920		530	530		426	426		510	
Upstream Blk Time (%)		15	5					14			0	
Queuing Penalty (veh)		0	0					49			0	
Storage Bay Dist (ft)	180			200			65			130		130
Storage Blk Time (%)	35	39		0	11		5	63		6	16	
Queuing Penalty (veh)	224	137		0	12		23	34		25	42	

Intersection: 2: IAGD 1/Lower Ridge Dr. & Auburn Rd.

Movement	EB	WB	NB	SB
Directions Served	LTR	LT	LTR	LTR
Maximum Queue (ft)	82	166	45	47
Average Queue (ft)	4	13	12	14
95th Queue (ft)	36	83	38	39
Link Distance (ft)	530	666	442	512
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)		1		
Queuing Penalty (veh)		0		

Zone Summary

Zone wide Queuing Penalty: 546

Intersection: 1: Livernois Rd. & Auburn Rd. (Push Buttons)/Auburn Rd.

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	R	L	T	R
Maximum Queue (ft)	321	481	59	134	301	101	144	392	173	209	323	133
Average Queue (ft)	120	261	14	63	148	34	63	250	67	83	135	18
95th Queue (ft)	245	405	37	113	243	74	153	396	138	166	249	74
Link Distance (ft)		920	920		530	530		426	426		510	
Upstream Blk Time (%)								2				
Queuing Penalty (veh)								9				
Storage Bay Dist (ft)	180			200			65			130		130
Storage Blk Time (%)	1	23			4		2	52		2	11	
Queuing Penalty (veh)	4	51			4		7	31		8	22	

Intersection: 2: IAGD 1/Lower Ridge Dr. & Auburn Rd.

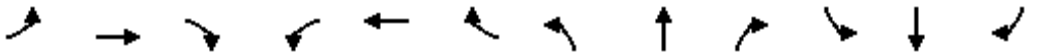
Movement	EB	WB	NB	SB
Directions Served	LTR	LT	LTR	LTR
Maximum Queue (ft)	104	111	47	40
Average Queue (ft)	5	5	10	9
95th Queue (ft)	42	48	35	32
Link Distance (ft)	530	666	442	512
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)		0		
Queuing Penalty (veh)		0		

Zone Summary

Zone wide Queuing Penalty: 136

Appendix D

FUTURE TRAFFIC CONDITIONS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	104	187	42	130	394	89	58	221	50	121	522	144
Future Volume (veh/h)	104	187	42	130	394	89	58	221	50	121	522	144
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1870	1870	1870	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	130	234	52	138	419	95	61	233	53	139	600	166
Peak Hour Factor	0.80	0.80	0.80	0.94	0.94	0.94	0.95	0.95	0.95	0.87	0.87	0.87
Percent Heavy Veh, %	3	3	3	2	2	2	1	1	1	1	1	1
Cap, veh/h	211	437	425	350	482	514	208	660	678	484	720	693
Arrive On Green	0.05	0.24	0.24	0.07	0.26	0.26	0.03	0.35	0.35	0.07	0.38	0.38
Sat Flow, veh/h	1767	1856	1572	1781	1870	1585	1795	1885	1598	1795	1885	1598
Grp Volume(v), veh/h	130	234	52	138	419	95	61	233	53	139	600	166
Grp Sat Flow(s),veh/h/ln	1767	1856	1572	1781	1870	1585	1795	1885	1598	1795	1885	1598
Q Serve(g_s), s	4.7	9.9	2.2	5.2	19.3	3.9	1.9	8.3	1.8	4.4	26.0	5.9
Cycle Q Clear(g_c), s	4.7	9.9	2.2	5.2	19.3	3.9	1.9	8.3	1.8	4.4	26.0	5.9
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	211	437	425	350	482	514	208	660	678	484	720	693
V/C Ratio(X)	0.62	0.54	0.12	0.39	0.87	0.18	0.29	0.35	0.08	0.29	0.83	0.24
Avail Cap(c_a), veh/h	211	530	504	350	576	594	226	660	678	484	720	693
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	27.7	30.1	24.8	23.8	31.9	21.8	20.9	21.7	15.4	17.0	25.2	16.1
Incr Delay (d2), s/veh	5.3	1.4	0.2	0.7	12.7	0.2	0.8	1.5	0.2	0.3	10.9	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.3	4.3	0.8	2.1	9.8	1.4	0.8	3.6	0.6	1.7	12.5	2.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	33.0	31.5	25.0	24.6	44.6	22.1	21.7	23.2	15.6	17.4	36.2	16.9
LnGrp LOS	C	C	C	C	D	C	C	C	B	B	D	B
Approach Vol, veh/h		416			652			347			905	
Approach Delay, s/veh		31.2			37.1			21.8			29.7	
Approach LOS		C			D			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.0	37.5	11.0	29.5	9.1	40.4	13.0	27.5
Change Period (Y+Rc), s	* 6	* 6	* 6.3	* 6.3	* 6	* 6	* 6.3	* 6.3
Max Green Setting (Gmax), s	* 6	* 27	* 4.7	* 28	* 4	* 29	* 6.7	* 26
Max Q Clear Time (g_c+I1), s	6.4	10.3	6.7	21.3	3.9	28.0	7.2	11.9
Green Ext Time (p_c), s	0.0	1.1	0.0	1.9	0.0	0.5	0.0	1.6

Intersection Summary	
HCM 6th Ctrl Delay	30.9
HCM 6th LOS	C

Notes

User approved pedestrian interval to be less than phase max green.
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.
User approved changes to right turn type.

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕	↱		↕			↕	
Traffic Vol, veh/h	9	336	13	17	599	5	11	0	7	26	0	27
Future Vol, veh/h	9	336	13	17	599	5	11	0	7	26	0	27
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	100	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	71	71	71	95	95	95	65	65	65	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2	0	0	0	0	0	0
Mvmt Flow	13	473	18	18	631	5	17	0	11	31	0	32

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	636	0	0	491	0	0	1194	1180	482	1181	1184	631
Stage 1	-	-	-	-	-	-	508	508	-	667	667	-
Stage 2	-	-	-	-	-	-	686	672	-	514	517	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	947	-	-	1072	-	-	165	192	588	168	191	485
Stage 1	-	-	-	-	-	-	551	542	-	451	460	-
Stage 2	-	-	-	-	-	-	441	458	-	547	537	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	947	-	-	1072	-	-	149	183	588	159	182	485
Mov Cap-2 Maneuver	-	-	-	-	-	-	149	183	-	159	182	-
Stage 1	-	-	-	-	-	-	541	532	-	442	448	-
Stage 2	-	-	-	-	-	-	401	446	-	527	527	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.2	24.7	25
HCM LOS			C	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	210	947	-	-	1072	-	-	242
HCM Lane V/C Ratio	0.132	0.013	-	-	0.017	-	-	0.258
HCM Control Delay (s)	24.7	8.9	0	-	8.4	0	-	25
HCM Lane LOS	C	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	0.4	0	-	-	0.1	-	-	1

Intersection	
Int Delay, s/veh	1.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	19	28	376	38	53	768
Future Vol, veh/h	19	28	376	38	53	768
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	21	30	409	41	58	835

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1381	430	0	0	450	0
Stage 1	430	-	-	-	-	-
Stage 2	951	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	159	625	-	-	1110	-
Stage 1	656	-	-	-	-	-
Stage 2	375	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	144	625	-	-	1110	-
Mov Cap-2 Maneuver	144	-	-	-	-	-
Stage 1	592	-	-	-	-	-
Stage 2	375	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	21.7	0	0.5
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	266	1110	-
HCM Lane V/C Ratio	-	-	0.192	0.052	-
HCM Control Delay (s)	-	-	21.7	8.4	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.7	0.2	-

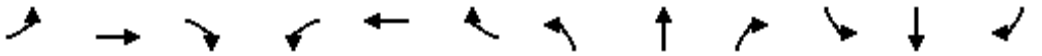
Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑↑↱			↱
Traffic Vol, veh/h	0	358	600	37	0	13
Future Vol, veh/h	0	358	600	37	0	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	389	652	40	0	14

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	-	346
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.93
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.319
Pot Cap-1 Maneuver	0	-	-	-	0	651
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	-	-	-	-	-	651
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	10.7
HCM LOS			B

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	651
HCM Lane V/C Ratio	-	-	-	0.022
HCM Control Delay (s)	-	-	-	10.7
HCM Lane LOS	-	-	-	B
HCM 95th %tile Q(veh)	-	-	-	0.1



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	364	649	50	113	345	110	53	472	192	156	333	111
Future Volume (veh/h)	364	649	50	113	345	110	53	472	192	156	333	111
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	383	683	53	128	392	125	59	524	213	173	370	123
Peak Hour Factor	0.95	0.95	0.95	0.88	0.88	0.88	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	418	702	648	172	498	542	275	550	555	208	628	795
Arrive On Green	0.16	0.37	0.37	0.06	0.26	0.26	0.03	0.29	0.29	0.08	0.33	0.33
Sat Flow, veh/h	1795	1885	1598	1795	1885	1598	1795	1885	1598	1795	1885	1598
Grp Volume(v), veh/h	383	683	53	128	392	125	59	524	213	173	370	123
Grp Sat Flow(s),veh/h/ln	1795	1885	1598	1795	1885	1598	1795	1885	1598	1795	1885	1598
Q Serve(g_s), s	18.1	42.8	2.4	6.3	23.2	6.7	2.8	32.7	12.0	8.0	19.5	5.0
Cycle Q Clear(g_c), s	18.1	42.8	2.4	6.3	23.2	6.7	2.8	32.7	12.0	8.0	19.5	5.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	418	702	648	172	498	542	275	550	555	208	628	795
V/C Ratio(X)	0.92	0.97	0.08	0.74	0.79	0.23	0.21	0.95	0.38	0.83	0.59	0.15
Avail Cap(c_a), veh/h	418	702	648	172	498	542	275	550	555	208	628	795
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	27.5	37.0	21.9	34.0	41.0	28.4	29.2	41.7	29.5	31.2	33.2	16.4
Incr Delay (d2), s/veh	24.7	27.3	0.1	16.1	8.6	0.3	0.4	28.4	2.0	23.6	4.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.1	23.9	0.9	3.4	11.6	2.5	1.2	18.7	4.8	4.6	9.2	1.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	52.2	64.3	22.0	50.0	49.7	28.7	29.6	70.1	31.5	54.9	37.2	16.8
LnGrp LOS	D	E	C	D	D	C	C	E	C	D	D	B
Approach Vol, veh/h		1119			645			796			666	
Approach Delay, s/veh		58.2			45.7			56.7			38.0	
Approach LOS		E			D			E			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.0	41.0	26.0	38.0	10.0	46.0	13.0	51.0
Change Period (Y+Rc), s	* 6	* 6	* 6.3	* 6.3	* 6	* 6	* 6.3	* 6.3
Max Green Setting (Gmax), s	* 9	* 35	* 20	* 32	* 4	* 40	* 6.7	* 45
Max Q Clear Time (g_c+I1), s	10.0	34.7	20.1	25.2	4.8	21.5	8.3	44.8
Green Ext Time (p_c), s	0.0	0.1	0.0	1.9	0.0	2.2	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	51.2
HCM 6th LOS	D

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection	
Int Delay, s/veh	6.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	24	958	15	8	546	18	5	1	7	33	0	18
Future Vol, veh/h	24	958	15	8	546	18	5	1	7	33	0	18
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	100	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	92	92	92	67	67	67	65	65	65
Heavy Vehicles, %	1	1	1	1	1	1	0	0	0	0	0	0
Mvmt Flow	26	1030	16	9	593	20	7	1	10	51	0	28

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	613	0	0	1046	0	0	1725	1721	1038	1707	1709	593
Stage 1	-	-	-	-	-	-	1090	1090	-	611	611	-
Stage 2	-	-	-	-	-	-	635	631	-	1096	1098	-
Critical Hdwy	4.11	-	-	4.11	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.209	-	-	2.209	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	971	-	-	669	-	-	71	90	283	73	92	509
Stage 1	-	-	-	-	-	-	263	294	-	484	487	-
Stage 2	-	-	-	-	-	-	470	477	-	261	291	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	971	-	-	669	-	-	63	83	283	65	84	509
Mov Cap-2 Maneuver	-	-	-	-	-	-	63	83	-	65	84	-
Stage 1	-	-	-	-	-	-	246	275	-	453	477	-
Stage 2	-	-	-	-	-	-	436	467	-	234	272	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.1	43.8	131.7
HCM LOS			E	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	112	971	-	-	669	-	-	94
HCM Lane V/C Ratio	0.173	0.027	-	-	0.013	-	-	0.835
HCM Control Delay (s)	43.8	8.8	0	-	10.5	0	-	131.7
HCM Lane LOS	E	A	A	-	B	A	-	F
HCM 95th %tile Q(veh)	0.6	0.1	-	-	0	-	-	4.5

Intersection	
Int Delay, s/veh	0.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	13	25	920	26	21	587
Future Vol, veh/h	13	25	920	26	21	587
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	14	27	1000	28	23	638

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1698	1014	0	0	1028	0
Stage 1	1014	-	-	-	-	-
Stage 2	684	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	102	290	-	-	676	-
Stage 1	350	-	-	-	-	-
Stage 2	501	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	97	290	-	-	676	-
Mov Cap-2 Maneuver	97	-	-	-	-	-
Stage 1	331	-	-	-	-	-
Stage 2	501	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	32.2	0	0.4
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	173	676	-
HCM Lane V/C Ratio	-	-	0.239	0.034	-
HCM Control Delay (s)	-	-	32.2	10.5	0
HCM Lane LOS	-	-	D	B	A
HCM 95th %tile Q(veh)	-	-	0.9	0.1	-

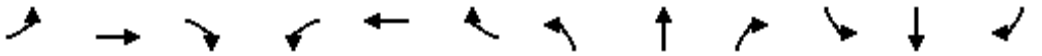
Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑↑↱			↱
Traffic Vol, veh/h	0	997	555	14	0	13
Future Vol, veh/h	0	997	555	14	0	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	1084	603	15	0	14

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	-	309
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.93
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.319
Pot Cap-1 Maneuver	0	-	-	-	0	688
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	-	-	-	-	-	688
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	10.3
HCM LOS			B

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	688
HCM Lane V/C Ratio	-	-	-	0.021
HCM Control Delay (s)	-	-	-	10.3
HCM Lane LOS	-	-	-	B
HCM 95th %tile Q(veh)	-	-	-	0.1



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	235	524	54	115	296	128	60	430	171	136	299	60
Future Volume (veh/h)	235	524	54	115	296	128	60	430	171	136	299	60
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1900	1900	1900	1900	1900	1900	1900	1900	1900
Adj Flow Rate, veh/h	264	589	61	126	325	141	69	494	197	156	344	69
Peak Hour Factor	0.89	0.89	0.89	0.91	0.91	0.91	0.87	0.87	0.87	0.87	0.87	0.87
Percent Heavy Veh, %	1	1	1	0	0	0	0	0	0	0	0	0
Cap, veh/h	388	646	606	181	512	514	352	674	648	248	699	787
Arrive On Green	0.12	0.34	0.34	0.05	0.27	0.27	0.04	0.35	0.35	0.05	0.37	0.37
Sat Flow, veh/h	1795	1885	1598	1810	1900	1610	1810	1900	1610	1810	1900	1610
Grp Volume(v), veh/h	264	589	61	126	325	141	69	494	197	156	344	69
Grp Sat Flow(s),veh/h/ln	1795	1885	1598	1810	1900	1610	1810	1900	1610	1810	1900	1610
Q Serve(g_s), s	12.3	35.8	3.0	5.7	18.1	7.8	2.9	27.2	10.0	6.0	16.8	2.7
Cycle Q Clear(g_c), s	12.3	35.8	3.0	5.7	18.1	7.8	2.9	27.2	10.0	6.0	16.8	2.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	388	646	606	181	512	514	352	674	648	248	699	787
V/C Ratio(X)	0.68	0.91	0.10	0.70	0.64	0.27	0.20	0.73	0.30	0.63	0.49	0.09
Avail Cap(c_a), veh/h	441	734	680	181	543	541	361	674	648	248	699	787
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	27.1	37.7	24.0	35.3	38.7	30.5	24.1	33.8	24.4	29.4	29.3	16.4
Incr Delay (d2), s/veh	3.6	15.1	0.1	11.0	2.7	0.4	0.3	6.9	1.2	5.0	2.5	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.4	18.4	1.1	3.1	8.5	3.0	1.2	13.1	3.9	3.1	7.7	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	30.6	52.8	24.1	46.3	41.3	30.9	24.4	40.7	25.6	34.4	31.7	16.6
LnGrp LOS	C	D	C	D	D	C	C	D	C	C	C	B
Approach Vol, veh/h		914			592			760			569	
Approach Delay, s/veh		44.5			39.9			35.3			30.6	
Approach LOS		D			D			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.0	48.6	20.8	38.6	10.4	50.2	12.0	47.4
Change Period (Y+Rc), s	* 6	* 6	* 6.3	* 6.3	* 6	* 6	* 6.3	* 6.3
Max Green Setting (Gmax), s	* 6	* 37	* 18	* 34	* 5	* 38	* 5.7	* 47
Max Q Clear Time (g_c+I1), s	8.0	29.2	14.3	20.1	4.9	18.8	7.7	37.8
Green Ext Time (p_c), s	0.0	2.1	0.3	2.7	0.0	1.9	0.0	3.3

Intersection Summary	
HCM 6th Ctrl Delay	38.3
HCM 6th LOS	D

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection	
Int Delay, s/veh	3.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↰	↗		↕			↕	
Traffic Vol, veh/h	23	797	11	4	521	18	5	0	4	32	0	14
Future Vol, veh/h	23	797	11	4	521	18	5	0	4	32	0	14
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	100	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	93	93	93	65	65	65	65	65	65
Heavy Vehicles, %	1	1	1	0	0	0	0	0	0	0	0	0
Mvmt Flow	25	866	12	4	560	19	8	0	6	49	0	22

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	579	0	0	878	0	0	1511	1509	872	1493	1496	560
Stage 1	-	-	-	-	-	-	922	922	-	568	568	-
Stage 2	-	-	-	-	-	-	589	587	-	925	928	-
Critical Hdwy	4.11	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.209	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1000	-	-	778	-	-	100	122	353	103	124	532
Stage 1	-	-	-	-	-	-	327	352	-	511	510	-
Stage 2	-	-	-	-	-	-	498	500	-	325	349	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1000	-	-	778	-	-	92	115	353	97	117	532
Mov Cap-2 Maneuver	-	-	-	-	-	-	92	115	-	97	117	-
Stage 1	-	-	-	-	-	-	311	335	-	486	506	-
Stage 2	-	-	-	-	-	-	474	496	-	304	332	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.1	34.2	62.5
HCM LOS			D	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	137	1000	-	-	778	-	-	129
HCM Lane V/C Ratio	0.101	0.025	-	-	0.006	-	-	0.549
HCM Control Delay (s)	34.2	8.7	0	-	9.7	0	-	62.5
HCM Lane LOS	D	A	A	-	A	A	-	F
HCM 95th %tile Q(veh)	0.3	0.1	-	-	0	-	-	2.7

Intersection	
Int Delay, s/veh	0.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	13	25	767	26	21	482
Future Vol, veh/h	13	25	767	26	21	482
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	14	27	834	28	23	524

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1418	848	0	0	862	0
Stage 1	848	-	-	-	-	-
Stage 2	570	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	151	361	-	-	780	-
Stage 1	420	-	-	-	-	-
Stage 2	566	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	145	361	-	-	780	-
Mov Cap-2 Maneuver	145	-	-	-	-	-
Stage 1	402	-	-	-	-	-
Stage 2	566	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	23.2	0	0.4
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	239	780	-
HCM Lane V/C Ratio	-	-	0.173	0.029	-
HCM Control Delay (s)	-	-	23.2	9.8	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.6	0.1	-

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑↱			↱
Traffic Vol, veh/h	0	831	526	14	0	13
Future Vol, veh/h	0	831	526	14	0	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	903	572	15	0	14

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	-	294
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.93
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.319
Pot Cap-1 Maneuver	0	-	-	-	0	703
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	-	-	-	-	-	703
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	10.2
HCM LOS			B

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	703
HCM Lane V/C Ratio	-	-	-	0.02
HCM Control Delay (s)	-	-	-	10.2
HCM Lane LOS	-	-	-	B
HCM 95th %tile Q(veh)	-	-	-	0.1

Intersection: 1: Livernois Rd. & Auburn Rd. (Push Buttons)/Auburn Rd.

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	R	L	T	R
Maximum Queue (ft)	140	175	46	145	178	67	119	211	71	192	278	192
Average Queue (ft)	58	82	12	60	148	23	37	92	19	93	224	93
95th Queue (ft)	116	146	33	108	202	53	86	171	51	207	314	227
Link Distance (ft)		919	919	103	103	103		426	426		192	
Upstream Blk Time (%)				1	28	0				0	18	1
Queuing Penalty (veh)				3	58	0				0	142	0
Storage Bay Dist (ft)	180						65			130		130
Storage Blk Time (%)	0	0					2	19		1	31	0
Queuing Penalty (veh)	0	0					4	11		5	83	1

Intersection: 2: IAGD 1/Lower Ridge Dr. & Auburn Rd.

Movement	EB	WB	NB	SB
Directions Served	LTR	LT	LTR	LTR
Maximum Queue (ft)	61	24	48	83
Average Queue (ft)	6	1	14	32
95th Queue (ft)	30	11	41	65
Link Distance (ft)	373	666	442	512
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 4: Livernois Rd. & N Access

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	154	99	280
Average Queue (ft)	47	8	109
95th Queue (ft)	133	53	274
Link Distance (ft)	317	192	260
Upstream Blk Time (%)	1	0	4
Queuing Penalty (veh)	0	0	0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 5: Auburn Rd. & W Access

Movement	EB	WB	WB	SB
Directions Served	T	T	TR	R
Maximum Queue (ft)	10	5	225	46
Average Queue (ft)	1	0	50	10
95th Queue (ft)	9	4	157	36
Link Distance (ft)	103	373	373	186
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Zone Summary

Zone wide Queuing Penalty: 306

Intersection: 1: Livernois Rd. & Auburn Rd. (Push Buttons)/Auburn Rd.

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	R	L	T	R
Maximum Queue (ft)	360	894	588	162	175	92	144	440	214	203	277	202
Average Queue (ft)	321	698	466	80	157	35	58	377	99	113	166	51
95th Queue (ft)	440	1154	1223	146	196	76	151	511	180	208	287	163
Link Distance (ft)		919	919	101	101	101		426	426		203	
Upstream Blk Time (%)		39	15	12	42	1		22		0	6	0
Queuing Penalty (veh)		0	0	24	79	1		79		0	36	0
Storage Bay Dist (ft)	180						65			130		130
Storage Blk Time (%)	33	46					5	66		7	16	
Queuing Penalty (veh)	214	167					23	35		34	43	

Intersection: 2: IAGD 1/Lower Ridge Dr. & Auburn Rd.

Movement	EB	WB	NB	SB
Directions Served	LTR	LT	LTR	LTR
Maximum Queue (ft)	242	158	80	188
Average Queue (ft)	29	9	20	67
95th Queue (ft)	127	76	60	159
Link Distance (ft)	376	666	442	512
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)		0		
Queuing Penalty (veh)		0		

Intersection: 4: Livernois Rd. & N Access

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	108	9	266
Average Queue (ft)	33	0	68
95th Queue (ft)	77	5	216
Link Distance (ft)	257	203	248
Upstream Blk Time (%)			2
Queuing Penalty (veh)			0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 5: Auburn Rd. & W Access

Movement	EB	WB	WB	SB
Directions Served	T	T	TR	R
Maximum Queue (ft)	16	48	282	59
Average Queue (ft)	1	6	100	11
95th Queue (ft)	16	55	264	39
Link Distance (ft)	101	376	376	180
Upstream Blk Time (%)			1	
Queuing Penalty (veh)			2	
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Zone Summary

Zone wide Queuing Penalty: 737

Intersection: 1: Livernois Rd. & Auburn Rd. (Push Buttons)/Auburn Rd.

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	R	L	T	R
Maximum Queue (ft)	359	532	48	151	172	98	144	423	205	203	276	170
Average Queue (ft)	147	272	12	67	139	37	64	267	70	93	153	33
95th Queue (ft)	303	432	32	123	189	76	156	424	148	184	264	125
Link Distance (ft)		919	919	101	101	101		426	426		203	
Upstream Blk Time (%)				3	27	0		1		0	4	0
Queuing Penalty (veh)				6	49	1		5		0	21	0
Storage Bay Dist (ft)	180						65			130		130
Storage Blk Time (%)	2	24					3	54		3	16	
Queuing Penalty (veh)	11	58					11	33		10	32	

Intersection: 2: IAGD 1/Lower Ridge Dr. & Auburn Rd.

Movement	EB	WB	NB	SB
Directions Served	LTR	LT	LTR	LTR
Maximum Queue (ft)	162	101	44	141
Average Queue (ft)	19	5	8	46
95th Queue (ft)	85	44	33	132
Link Distance (ft)	376	666	442	512
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)		0		
Queuing Penalty (veh)		0		

Intersection: 4: Livernois Rd. & N Access

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	69	17	206
Average Queue (ft)	27	1	34
95th Queue (ft)	55	8	120
Link Distance (ft)	257	203	248
Upstream Blk Time (%)			0
Queuing Penalty (veh)			0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 5: Auburn Rd. & W Access

Movement	EB	WB	WB	SB
Directions Served	T	T	TR	R
Maximum Queue (ft)	8	18	214	38
Average Queue (ft)	0	1	41	11
95th Queue (ft)	0	10	143	34
Link Distance (ft)	101	376	376	180
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Zone Summary

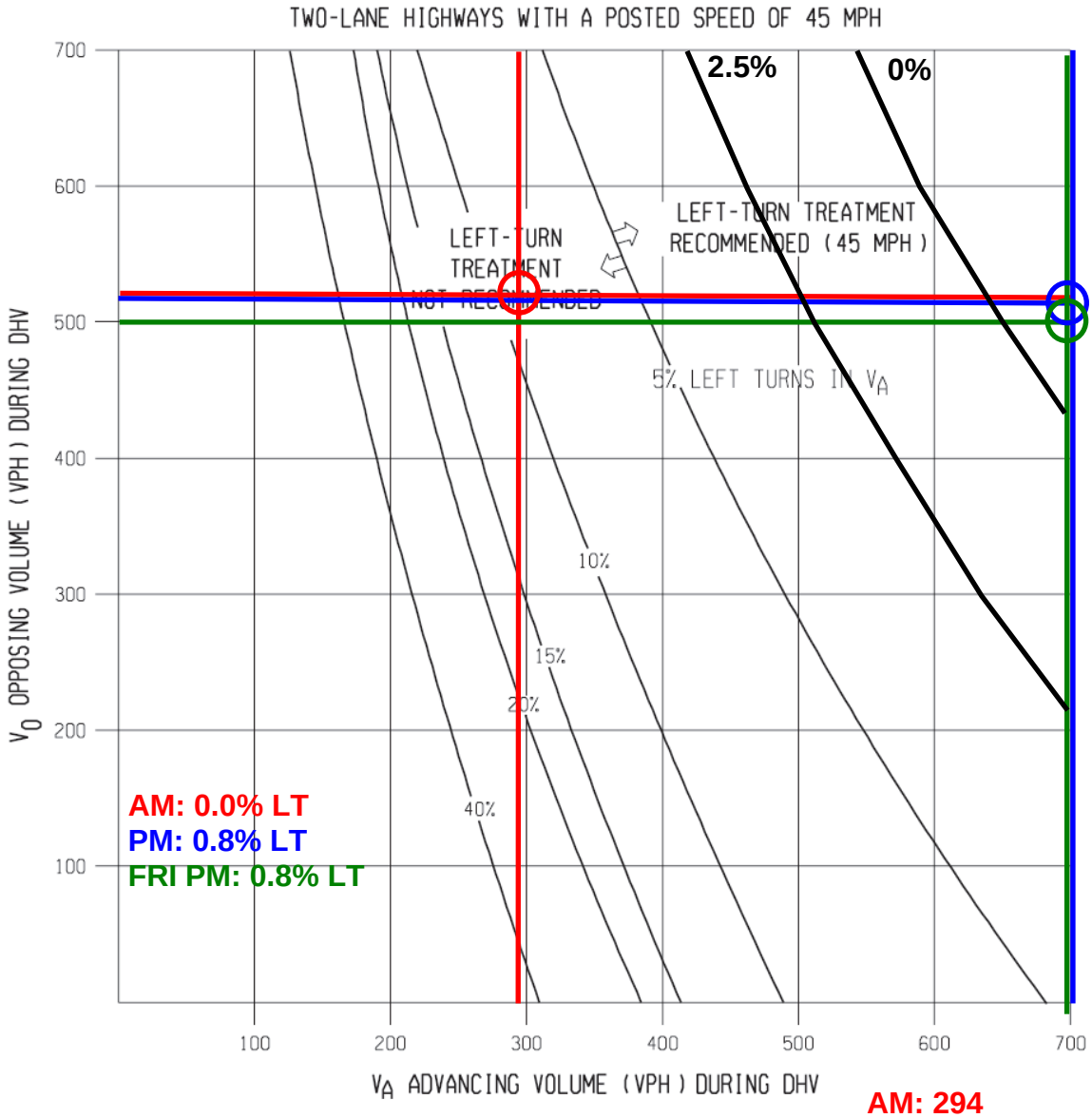
Zone wide Queuing Penalty: 236

Appendix E

WARRANT SUMMARIES

Left Turn Warrant Analysis
Auburn Road & Lower Ridge Drive - Existing Conditions

AM: 522
PM: 520
FRI PM: 496



AM: 294
PM: 922
FRI PM: 762

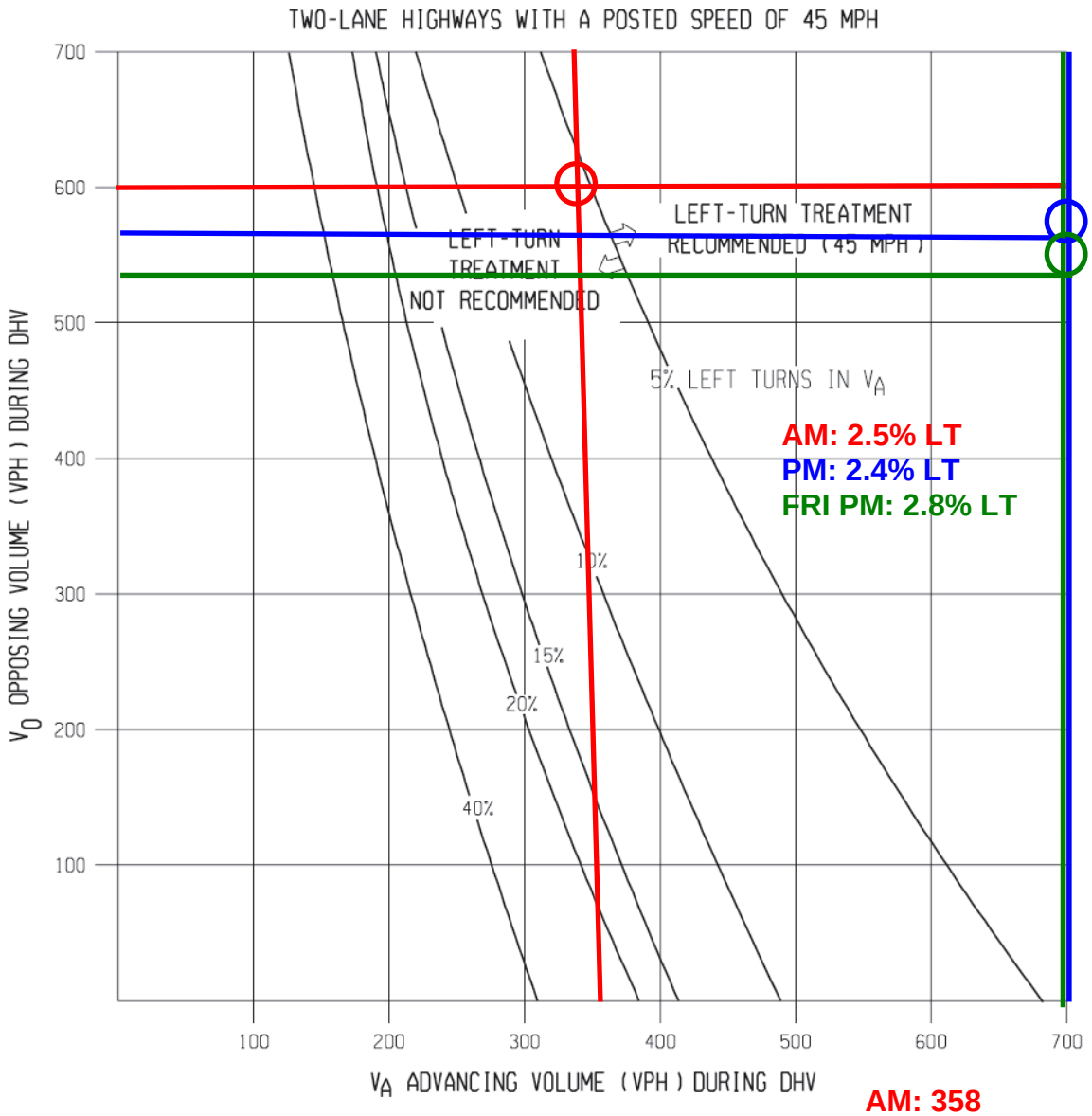
Instructions:

1. The family of curves represent the percentage of left turns in advancing volume (V_A). The designer should locate the curve for the actual percentage of left turns. When this is not an even increment of 5, the designer should estimate where the curve lies.
2. Read V_A and V_O into the chart and locate the intersection of the two volumes.
3. Note the location of the point in #2 relative to the line in #1. If the point is to the right of the line, then a left-turn lane is recommended. If the point is to the left of the line, then a left-turn is not recommended based on traffic volumes.

AM: LT Lane Not Recommended
PM: LT Lane Recommended
FRI PM: LT Lane Recommended

Left Turn Warrant Analysis
Auburn Road & Lower Ridge Drive - 2020 Build-Out

AM: 604
PM: 564
FRI PM: 539



AM: 2.5% LT
PM: 2.4% LT
FRI PM: 2.8% LT

AM: 358
PM: 997
FRI PM: 831

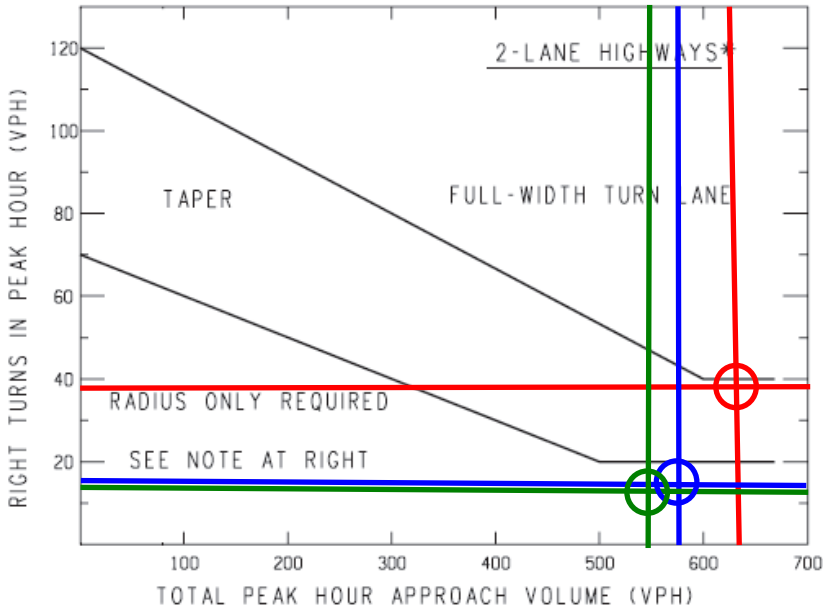
Instructions:

1. The family of curves represent the percentage of left turns in advancing volume (V_A). The designer should locate the curve for the actual percentage of left turns. When this is not an even increment of 5, the designer should estimate where the curve lies.
2. Read V_A and V_O into the chart and locate the intersection of the two volumes.
3. Note the location of the point in #2 relative to the line in #1. If the point is to the right of the line, then a left-turn lane is recommended. If the point is to the left of the line, then a left-turn is not recommended based on traffic volumes.

AM: LT Lane Not Recommended
PM: LT Lane Recommended
FRI PM: LT Lane Recommended

Right Turn Warrant Analysis
Auburn Road & Site Access - 2020 Build-Out

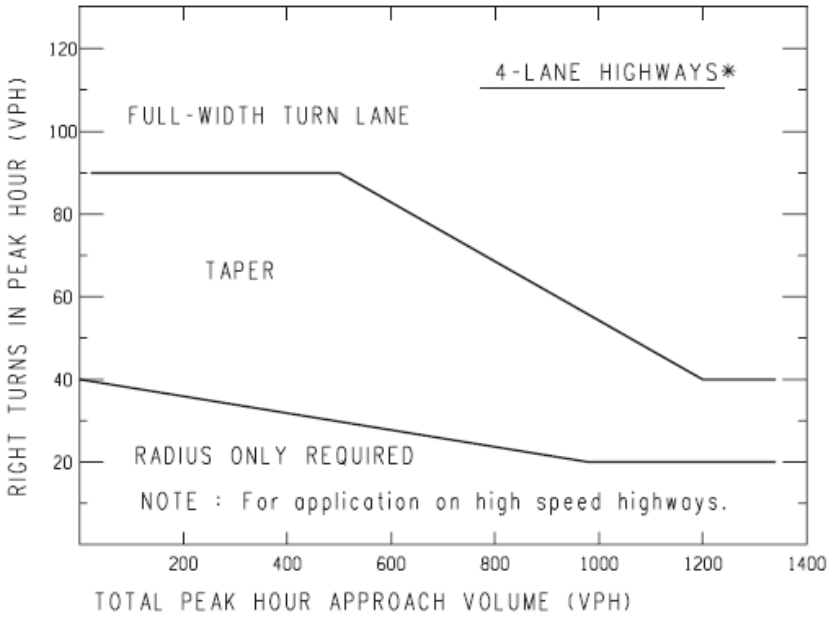
AM: 37
PM: 14
FRI PM: 14



NOTE: For posted speeds at or under 45 mph, peak hour right turns greater than 40 vph, and total peak hour approach less than 300 vph, adjust right turn volumes.

Adjust peak hour Right turns = Peak hour Right turns – 20

AM: 637
PM: 569
FRI PM: 540



*If a center left-turn lane exists (ie 3 or 5 lane roadway), subtract the number of left turns in approach volume form the total approach volume to get an adjusted total approach volume.

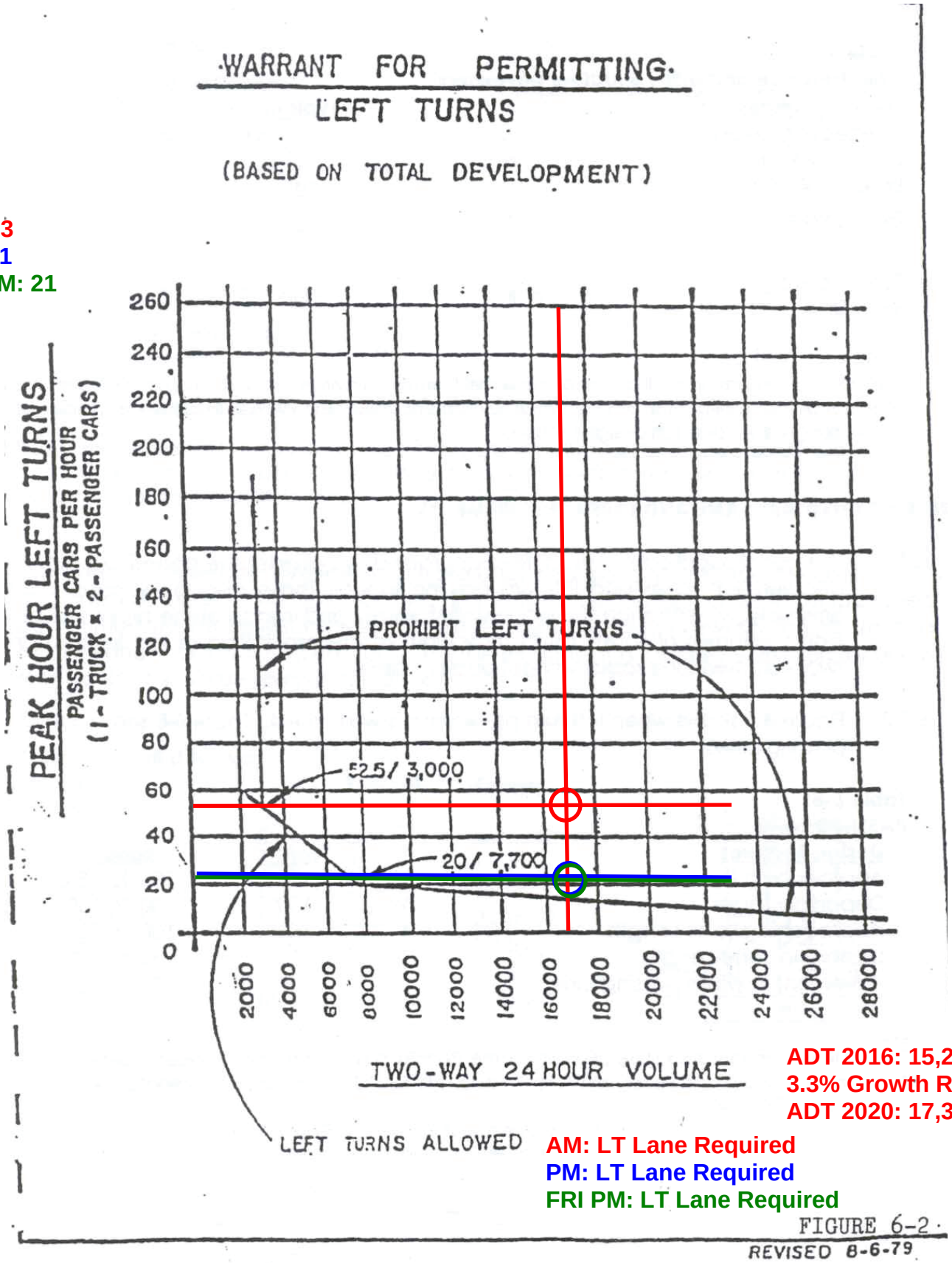
Sample Problem: The Design Speed is 55 mph. The Peak Hour Approach Volume is 300 vph. The Number of Right Turns in the Peak Hous is 100 vph. Determine if a right turn lane is recommended.

Solution: Figure indicates that the intersection of 300 vph and 100 vph is located above the upper trend line; thus, a right-turn lane may be recommended.

AM: RT Taper Required
PM: RT Radius Only Required
FRI PM: RT Radius Only Required

Left Turn Warrant Analysis
Livernois Road & Site Access - 2020 Build-Out

FIGURE 6-2



AM: 53
PM: 21
FRI PM: 21

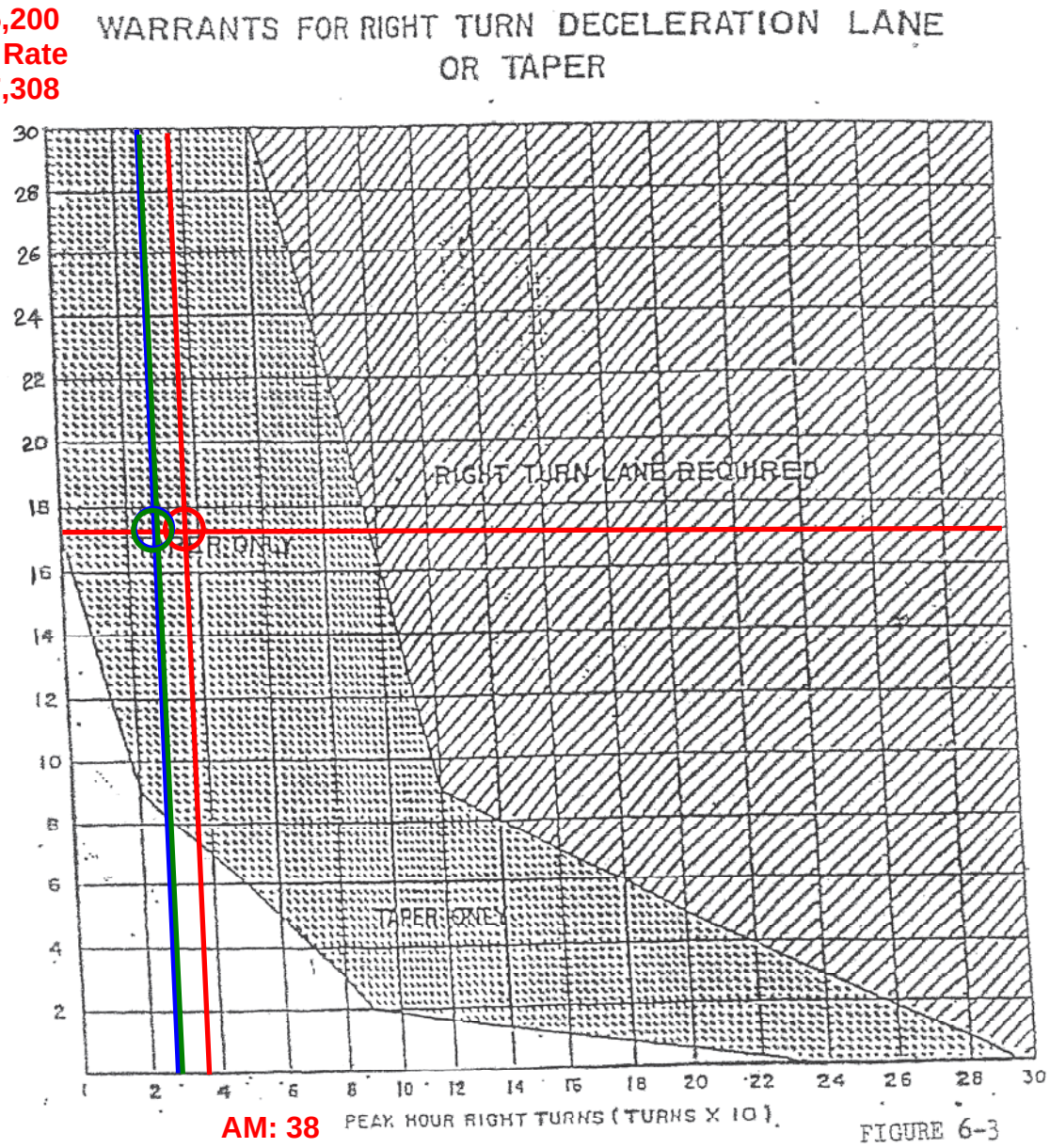
ADT 2016: 15,200
3.3% Growth Rate
ADT 2020: 17,308

AM: LT Lane Required
PM: LT Lane Required
FRI PM: LT Lane Required

Right Turn Warrant Analysis
Livernois Road & Site Access - 2020 Build-Out

FIGURE 6-3

ADT 2016: 15,200
3.3% Growth Rate
ADT 2020: 17,308



AM: 38
PM: 26
FRI PM: 26

AM: RT Taper Required
PM: RT Taper Required
FRI PM: RT Taper Required