MEDICAL OFFICE BUILDING
TRAFFIC IMPACT STUDY

ROCHESTER HILLS, MICHIGAN

MARCH 19, 2020

STATE OF MICHIGAN
JULIE M. KROLL
ENGINEER
No. 57356
LICENSED PROFESSIONAL ENGINEER

Digitally signed by Julie M. Kroll
Date: 2020.03.19 16:46:28 -04'00'

PREPARED FOR:

THE ALAN GROUP
1800 BRINSTON DR
TROY, MI 48083

PREPARED BY:

FLEIS & VANDENBRINK, INC.
27725 STANSBURY BLVD., SUITE 195
FARMINGTON HILLS, MI 48834

#843670

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Agency Review	Date	Comments

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1 INTRODUCTION

The project site is located adjacent to the north side of South Boulevard, approximately ½ mile west of Dequindre Road in Rochester Hills, Michigan. The project site location is shown on **Figure 1**. The proposed project includes the development of a 60,000 SF medical office building that includes an ambulatory and surgery center. Access for the site is proposed via one driveway to South Boulevard. South Boulevard is under the jurisdiction of the Road Commission for Oakland County (RCOC). F&V proposes to complete a Traffic Impact Study (TIS) consistent with accepted traffic engineering practice and pursuant to the requests of the City of Rochester Hills and the Road Commission for Oakland County (RCOC).

The purpose of this study is to identify the traffic related impacts, if any, of the proposed development project on the adjacent road network. 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). Specific tasks undertaken for this study include the following:

1. Study Area

a. Provide a description of the study area including: surrounding land uses, intersection and roadway geometries, speed limits, functional classifications and traffic volume data (where available). In addition, a study area site map showing the site location and the study intersections will also be provided.

2. Proposed Land Use

a. Obtain and review the proposed site plan which includes the proposed land uses, densities, and desired site access locations. A description of the current and proposed land uses will be accompanied with a complete project site plan (with buildings identified as to proposed use). A schedule for construction of the development and proposed development stages (if any) will also be provided.

3. Existing Conditions

a. Provide an analysis of the traffic-related impacts of the proposed development at the following study intersections:
   - South Boulevard & M-59 Off Ramp
   - South Boulevard & Dequindre Road
   - South Boulevard & John R Road
   - South Boulevard & Proposed Site Driveway

b. Obtain existing SCATS count data at the study intersections for use in this study. Existing traffic count data used in the study will be obtained for a typical weekday with fair weather conditions when school is in session.

c. Identify the Existing AM and PM peak hour traffic volumes at the study intersections based on turning movement count data.

d. Calculate the Existing vehicle delays, LOS, and vehicle queues at the study intersections during the AM and PM. The analysis will be performed at each of the study intersections. Intersection analysis shall include LOS determination for all approaches and movements. The LOS will be based on the procedures outlined in the HCM 6th Edition, the latest edition of Transportation Research Board's Highway Capacity Manual.

e. Identify improvements (if any) for the study road network that would be required to accommodate the existing traffic volumes.

4. Future Background Growth

a. If the planned completion date for the project or the last phase of the project is beyond one year of the study, an estimate of background traffic growth for the adjacent street network will be made and included in the analysis.

b. Calculate the future background traffic volumes based on an appropriate traffic growth determined from local or statewide data to the project build-out year and/or any applicable background developments in the vicinity of this project as identified by the City of Rochester Hills Traffic Engineer.

FIGURE 1
SITE LOCATION MAP

AMBULATORY AND SURGERY CENTER DEVELOPMENT - ROCHESTER HILLS, MI

LEGEND

SITE — SITE LOCATION

NORTH

SCALE: NOT TO SCALE

5. Background Conditions (No Build)

a. Calculate the **Background *(without the proposed development)*** vehicle delays, LOS, and vehicle queues at the study intersections during the AM and PM peak periods. Intersection analysis shall include LOS determination for all approaches and movements. The LOS will be based on the procedures outlined in the HCM 6th Edition, the latest edition of Transportation Research Board's Highway Capacity Manual.

b. Any state, local, or private transportation improvement projects in the project study area that will be underway in the build-out year and traffic that is generated by other proposed developments in the study area will be included as background conditions.

c. Identify improvements (if any) for the study road network that would be required to accommodate the background traffic volumes.

6. Trip Generation

a. Forecast the number of AM and 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* and/or local development data as approved for use in the study by the City of Rochester Hills Traffic Engineer.

b. A table will be provided in the report outlining the categories and quantities of land uses, with the corresponding trip generation rates or equations, and the resulting number of trips.

7. Trip Distribution and Traffic Assignment

a. Assign the trips that would be generated by the proposed development to the adjacent road network based on existing traffic patterns. The distribution of the estimated trip generation to the adjacent street network and nearby intersections shall be included in the report and the basis will be explained. The distribution percentages with the corresponding volumes will be provided in a graphical format.

b. Combine the site-generated traffic assignments with the background traffic forecasts to establish the Future AM and PM peak hour traffic volumes.

8. Future Conditions

a. Calculate the **Future (with the proposed development)** vehicle delays, LOS, and vehicle queues at the study intersections. Intersection analysis shall include LOS determination for all approaches and movements. The LOS will be based on the procedures outlined in the HCM 6th Edition, the latest edition of Transportation Research Board's Highway Capacity Manual.

b. Identify improvements (if any) for the study road network that would be required to accommodate the site-generated traffic volumes.

9. Auxiliary Lanes

a. Evaluate the RCOC auxiliary lane warranting criteria to determine the need for left and right-turn treatments at the proposed site driveway.

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

2 BACKGROUND DATA

2.1 EXISTING ROAD NETWORK

Access for the proposed development is provided via access on South Boulevard. The lane use and traffic control at the study intersections are shown on **Figure 2** and the additional 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).

South Boulevard runs in the east and west directions with a posted speed limit of 45 mph. South Boulevard is under the jurisdiction of the Road Commission for Oakland County (RCOC) and is classified a *Minor Arterial.* South Boulevard adjacent to the project site has an AADT of 8,500 vehicles per day (SEMCOG 2016).

The study segment of South Boulevard has a typical 5-lane cross section with a center left-turn lane for approximately 1,400 ft west of Dequindre Road. The remainder of the study section has a typical 3-lane cross section with a center left-turn lane, except the section adjacent to the site that has a two-lane section. As part of the site driveway permitting, RCOC has required a center left-turn lane be constructed adjacent to the site. Therefore, this center left-turn lane was assumed as a baseline condition in the future analysis.

2.2 EXISTING TRAFFIC VOLUMES

RCOC provided SCATS counts that were collected on Thursday, March 5, 2020 at the study intersections. Intersection turning movement counts were provided for a period of 24-hours during the weekday. 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 existing AM and PM peak hour traffic volumes were identified based on the data provided.

This data was 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, and through volumes were carried along the main study roadways. At locations where access is provided between study intersections, “dummy” intersections were used to account for sink and source volumes, and through volumes were carried along the main study roadways. The peak hours of existing network traffic varied at each intersection and were identified to occur between 7:30 AM to 9:00 AM and 4:30 PM to 6:00 PM.

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

3 ANALYSIS

3.1 EXISTING CONDITIONS

The existing AM and 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 existing conditions analysis 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 (6th Edition). In addition, the signals included in the analysis operate on the RCOC SCATS system which continually optimizes the cycle length and splits based on traffic volume demand. Therefore, the signal timings were optimized for this analysis to replicate the operations of this intersection in the field.

Descriptions of LOS “A” through “F” as defined in the HCM are provided in **Appendix B** 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.

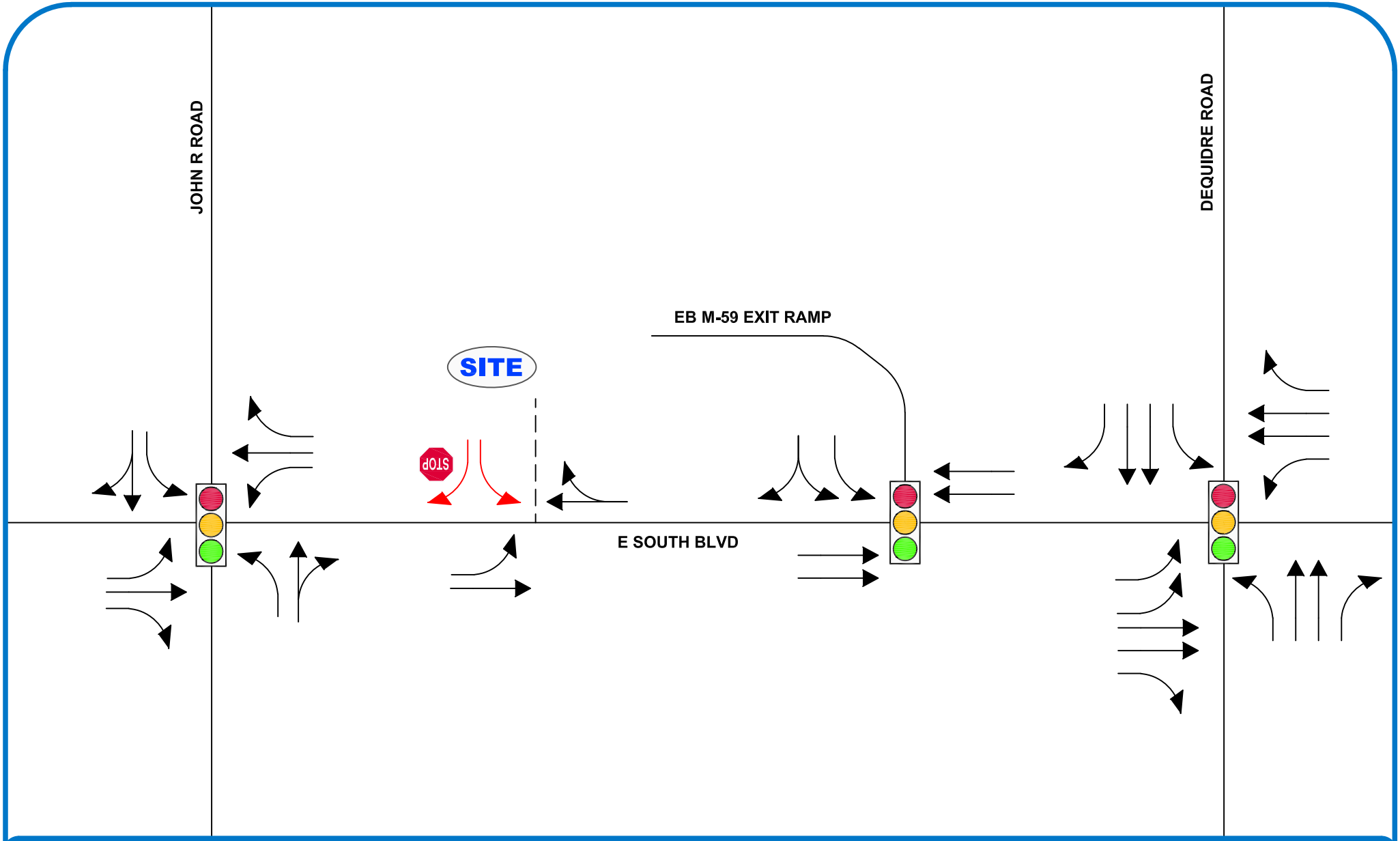


FIGURE 2
LANE USE AND TRAFFIC CONTROL

AMBULATORY AND SURGERY CENTER DEVELOPMENT -
ROCHESTER HILLS, MI

LEGEND

- ROADS
- PROPOSED ROADS
- LANE USE
- PROPOSED LANE USE
- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- ROUNDABOUT INTERSECTION

NORTH
SCALE: NOT TO SCALE

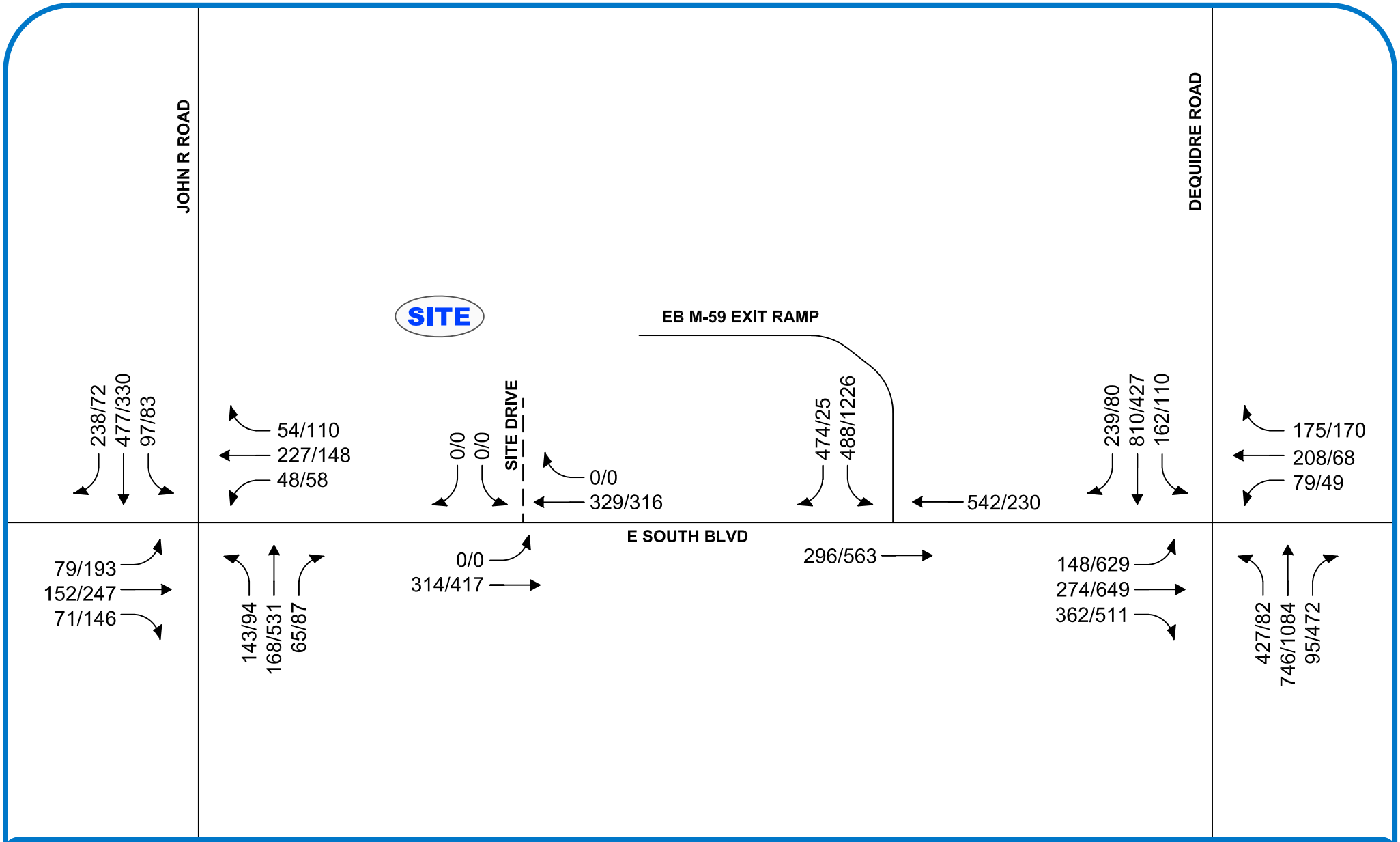


FIGURE 3
EXISTING TRAFFIC VOLUMES

AMBULATORY AND SURGERY CENTER DEVELOPMENT -
ROCHESTER HILLS, MI

LEGEND

- ROADS
- PROPOSED ROADS
- TRAFFIC VOLUMES (AM/PM)

NORTH
SCALE: NOT TO SCALE

Table 1: Existing Intersection Operations

Intersection		Control	Approach	Existing Conditions (2020)			
				AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS
1	Dequindre Road & South Boulevard	Signalized	EBL	53.3	D	48.0	D
			EBT	44.2	D	33.5	C
			EBR	53.1	D	83.6	F
			WBL	49.5	D	46.2	D
			WBT	33.9	C	37.3	D
			WBR	29.3	C	50.8	D
			NBL	31.4	C	18.4	B
			NBT	48.5	D	48.7	D
			NBR	38.3	D	35.4	D
			SBL	40.8	D	32.4	C
			SBT	39.8	D	23.2	C
			SBR	22.1	C	9.8	A
			Overall	41.8	D	44.5	D
2	M-59 Exit Ramp & South Boulevard	Signalized	EB	34.1	C	40.8	D
			WB	34.3	C	33.8	C
			SBL	15.4	B	19.4	B
			SBR	16.5	B	19.4	B
			Overall	25.1	C	27.3	C
3	John R Road & South Boulevard	Signalized	EBL	33.0	C	41.1	D
			EBT	38.8	D	37.8	D
			EBR	29.6	C	11.4	B
			WBL	31.6	C	36.2	D
			WBT	45.5	D	32.9	C
			WBR	31.1	C	11.0	B
			NBL	33.8	C	15.9	B
			NBTR	19.4	B	47.1	D
			SBL	15.0	B	19.6	B
			SBTR	50.7	D	28.8	C
			Overall	39.1	D	33.4	C

The results of the existing conditions analysis indicate that all approaches and movements at the study intersections currently operate at LOS D or better during both peak hours, with the following exception:

Dequindre Road & South Boulevard:

- The eastbound right-turn movement currently operates at LOS F during the PM peak hour. A review of SimTraffic network simulations indicates peak vehicle queue lengths of approximately 200 ft which exceeds the right-turn lane storage lane during the peak operations.

3.2 BACKGROUND CONDITIONS

In order to determine the applicable traffic growth rate for the existing traffic volumes to the project buildout year of 2021, The traffic volume projections on the adjacent roadway network were obtained from the Southeast Michigan Council of Governments (SEMCOG) from 2020 to 2025 and show a weighted annual growth of 1.44% annually. Therefore, a conservative background growth rate of **1.5%** per year was assumed for this study in the analysis of background conditions ***without the proposed development.***

Table 2: Background Growth Rate Calculations

SEMCOG Regional Growth	Year 2020	Year 2025	Annual Growth Rate
South Blvd. (John R to Dequindre)	7,046	9,910	7.06%
Dequindre Road (North)	35,170	39,530	2.36%
Dequindre Road (South)	28,080	29,530	1.01%
John R Road (North)	21,310	20,420	-0.85%
John R Road (South)	12,580	12,540	-0.06%
Weighted Average Annual Growth Rate	104,186	111,930	1.44%

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. No background developments were identified near the study area that are expected to be completed prior to the site buildout of the proposed development. Background peak hour traffic volumes are shown in **Figure 4.**

3.3 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 (6th Edition). The results of the analysis of background conditions and vehicle queues are presented in **Appendix C** and are summarized in **Table 3**, respectively.

Table 3: Background Intersection Operations

Intersection		Control	Approach	Existing Conditions (2020)				Background Conditions (2021)				Difference			
				AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM 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	Dequindre Road & South Boulevard	Signalized	EBL	53.3	D	48.0	D	53.6	D	41.8	D	0.3	-	-6.2	-
			EBT	44.2	D	33.5	C	44.4	D	44.7	D	0.2	-	11.2	C→D
			EBR	53.1	D	83.6	F	54.0	D	118.4	F	0.9	-	34.8	-
			WBL	49.5	D	46.2	D	50.0	D	50.5	D	0.5	-	4.3	-
			WBT	33.9	C	37.3	D	34.0	C	51.7	D	0.1	-	14.4	-
			WBR	29.3	C	50.8	D	29.3	C	70.8	E	0.0	-	20.0	D→E
			NBL	31.4	C	18.4	B	31.9	C	23.3	C	0.5	-	4.9	B→C
			NBT	48.5	D	48.7	D	50.6	D	52.2	D	2.1	-	3.5	-
			NBR	38.3	D	35.4	D	40.4	D	31.7	C	2.1	-	-3.7	D→C
			SBL	40.8	D	32.4	C	43.5	D	42.4	D	2.7	-	10.0	C→D
			SBT	39.8	D	23.2	C	40.6	D	28.2	C	0.8	-	5.0	-
			SBR	22.1	C	9.8	A	22.4	C	8.3	A	0.3	-	-1.5	-
			Overall	41.8	D	44.5	D	43.0	D	51.8	D	1.2	-	7.3	-
2	M-59 Exit Ramp & South Boulevard	Signalized	EB	34.1	C	35.7	D	34.3	C	37.1	D	0.2	-	1.4	-
			WB	34.3	C	29.7	C	34.8	C	16.1	B	0.5	-	-13.6	C→B
			SBL	15.4	B	20.4	C	15.7	B	20.1	C	0.3	-	-0.3	-
			SBR	16.5	B	20.4	C	16.9	B	20.1	C	0.4	-	-0.3	-
			Overall	25.1	C	26.0	C	25.4	C	24.8	C	0.3	-	-1.2	-
3	John R Road & South Boulevard	Signalized	EBL	33.0	C	41.1	D	36.0	D	42.7	D	3.0	C→D	1.6	-
			EBT	38.8	D	37.8	D	43.0	D	38.5	D	4.2	-	0.7	-
			EBR	29.6	C	11.4	B	30.5	C	12.1	B	0.9	-	0.7	-
			WBL	31.6	C	36.2	D	34.0	C	36.8	D	2.4	-	0.6	-
			WBT	45.5	D	32.9	C	53.7	D	33.2	C	8.2	-	0.3	-
			WBR	31.1	C	11.0	B	31.8	C	11.6	B	0.7	-	0.6	-
			NBL	33.8	C	15.9	B	30.8	C	16.1	B	-3.0	-	0.2	-
			NBTR	19.4	B	47.1	D	19.0	B	46.4	D	-0.4	-	-0.7	-
			SBL	15.0	B	19.6	B	13.5	B	20.2	C	-1.5	-	0.6	B→C
			SBTR	50.7	D	28.8	C	53.0	D	27.8	C	2.3	-	-1.0	-
			Overall	39.1	D	33.4	C	41.2	D	33.4	C	2.1	-	0.0	-

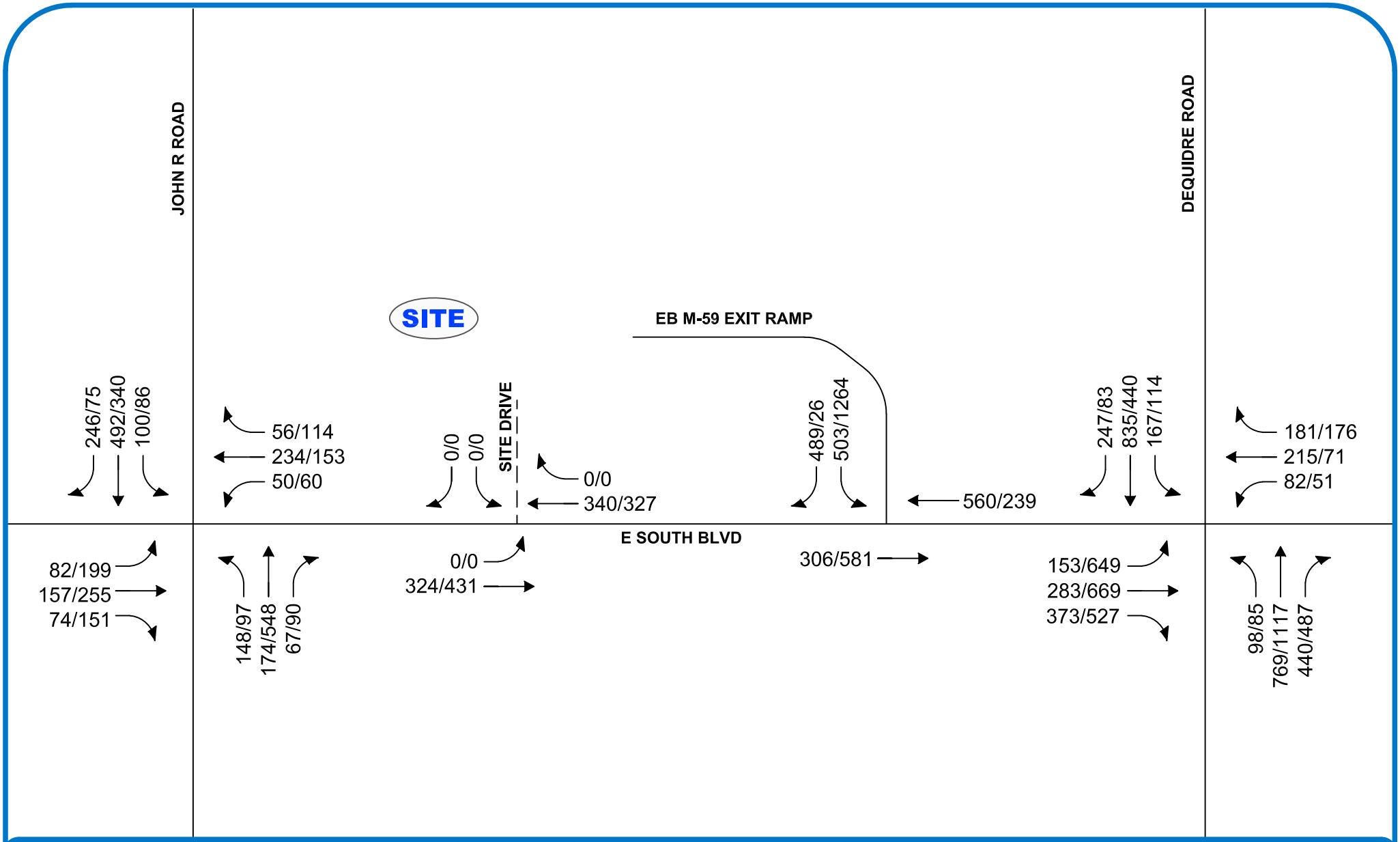


FIGURE 4
BACKGROUND TRAFFIC VOLUMES

AMBULATORY AND SURGERY CENTER DEVELOPMENT -
ROCHESTER HILLS, MI

LEGEND

ROADS

PROPOSED ROADS

TRAFFIC VOLUMES (AM/PM)

NORTH

SCALE: NOT TO SCALE

The results of the background conditions analysis indicate that all study intersection approaches and movements will continue to operate in a manner similar to existing conditions, at LOS D or better during both peak hours, with exception of the following:

Dequindre Road & South Boulevard:

- The eastbound right-turn movement is expected to continue operating at LOS F during the PM peak hour. A review of SimTraffic network simulations indicates peak vehicle queue lengths of approximately 200 ft which exceeds the right-turn lane storage lane during the peak operations.
- The westbound right-turn movement is expected to operate at LOS E during the PM peak hour with the addition of background traffic. A review of SimTraffic network simulations indicates peak vehicle queue lengths of approximately 130 ft which will *not* exceed the available right-turn lane storage lane during the peak operations.

3.4 SITE TRIP GENERATION

The number of AM and PM 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 proposed development includes a 60,000 GSF (48,000 gross floor area) medical office building that will be used as an ambulatory surgery center, cardiology office with cath labs, and various other doctor's offices with endoscopy suite and procedure rooms for ENT. The parking data for this site was reviewed with the various applicable medical ITE Land Uses and it was determined the Medical/Dental Office Building (ITE LUC 720) best fit land use code for use in this study. The site trip generation forecast used in this analysis is summarized in **Table 4**.

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
Medical-Dental Office Building	720	48,000	GFA	1,757	90	26	116	46	119	165

3.5 SITE TRIP DISTRIBUTION

The vehicular trips that would be generated by the proposed development were assigned to the study roads based on existing peak hour traffic patterns in the adjacent roadway network and the methodologies published by ITE. To determine trips distribution for office developments using the adjacent street traffic it is assumed that the trips in the AM are home-to-work based trips, and in the PM are work-to-home based trips. Therefore, the global trip generation is based on trips in the AM entering the study network and traveling to the development and exiting the study network in the PM. The ITE trip distribution methodology assumes that new trips will return to their direction of origin. The site trip distributions used in the analysis are summarized in **Table 5**.

Table 5: Site Trip Distribution Summary

To/From	via	AM	PM
North	Dequindre Road	21%	33%
	John R	14%	14%
South	Dequindre Road	22%	17%
	John R	7%	9%
East	South Blvd	14%	21%
West	South Blvd	5%	5%
	M-59 WB Off Ramp	17%	0.4%
Total		100%	100%

The site-generated traffic volumes in **Table 5** were distributed to the adjacent roadway network based on the distribution shown in **Table 6.** The site generated traffic volumes, as shown on **Figure 5**, 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.**

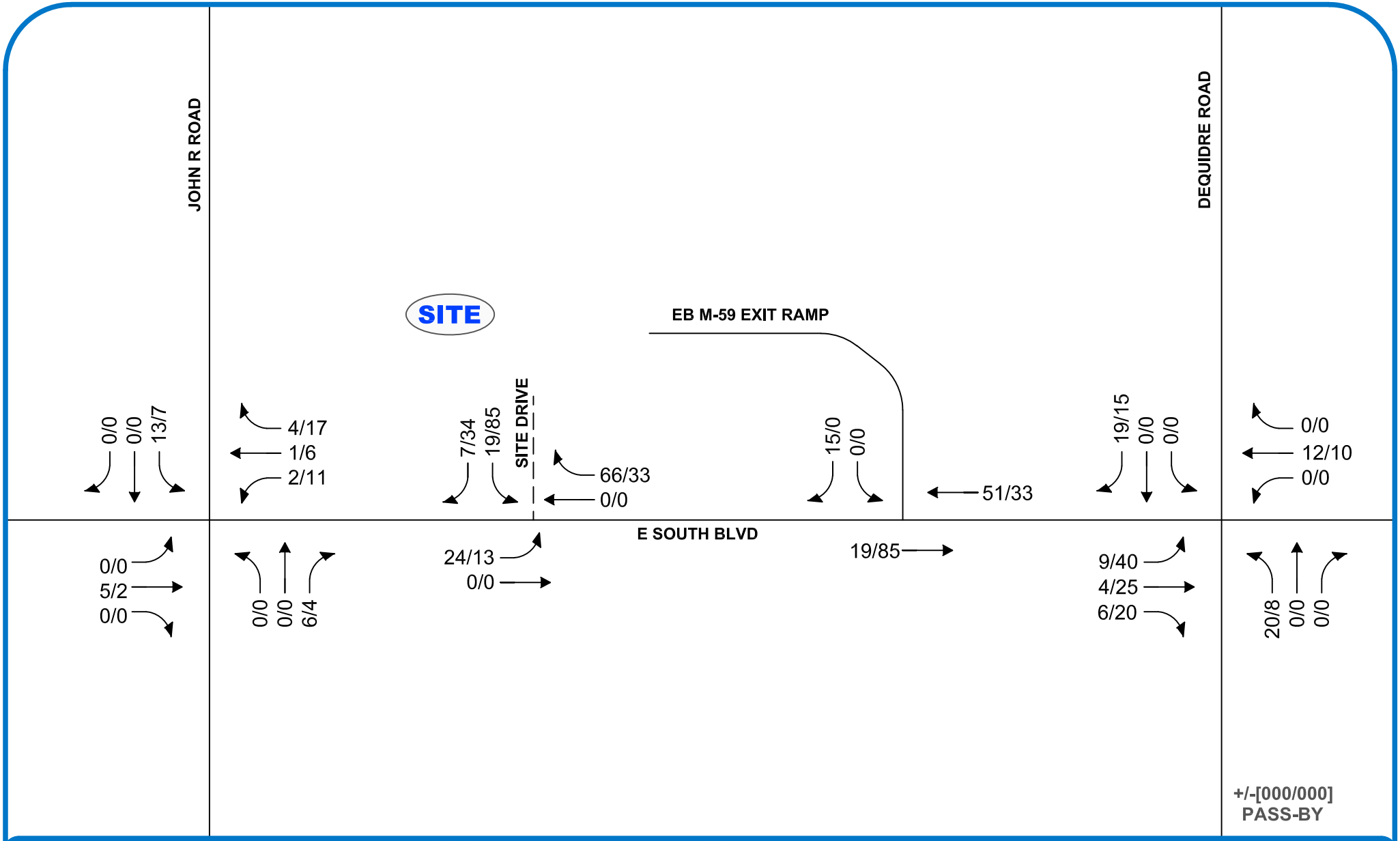


FIGURE 5
SITE-GENERATED TRAFFIC VOLUMES

AMBULATORY AND SURGERY CENTER DEVELOPMENT -
ROCHESTER HILLS, MI

LEGEND

ROADS

PROPOSED ROADS

TRAFFIC VOLUMES (AM/PM)

NORTH

SCALE: NOT TO SCALE

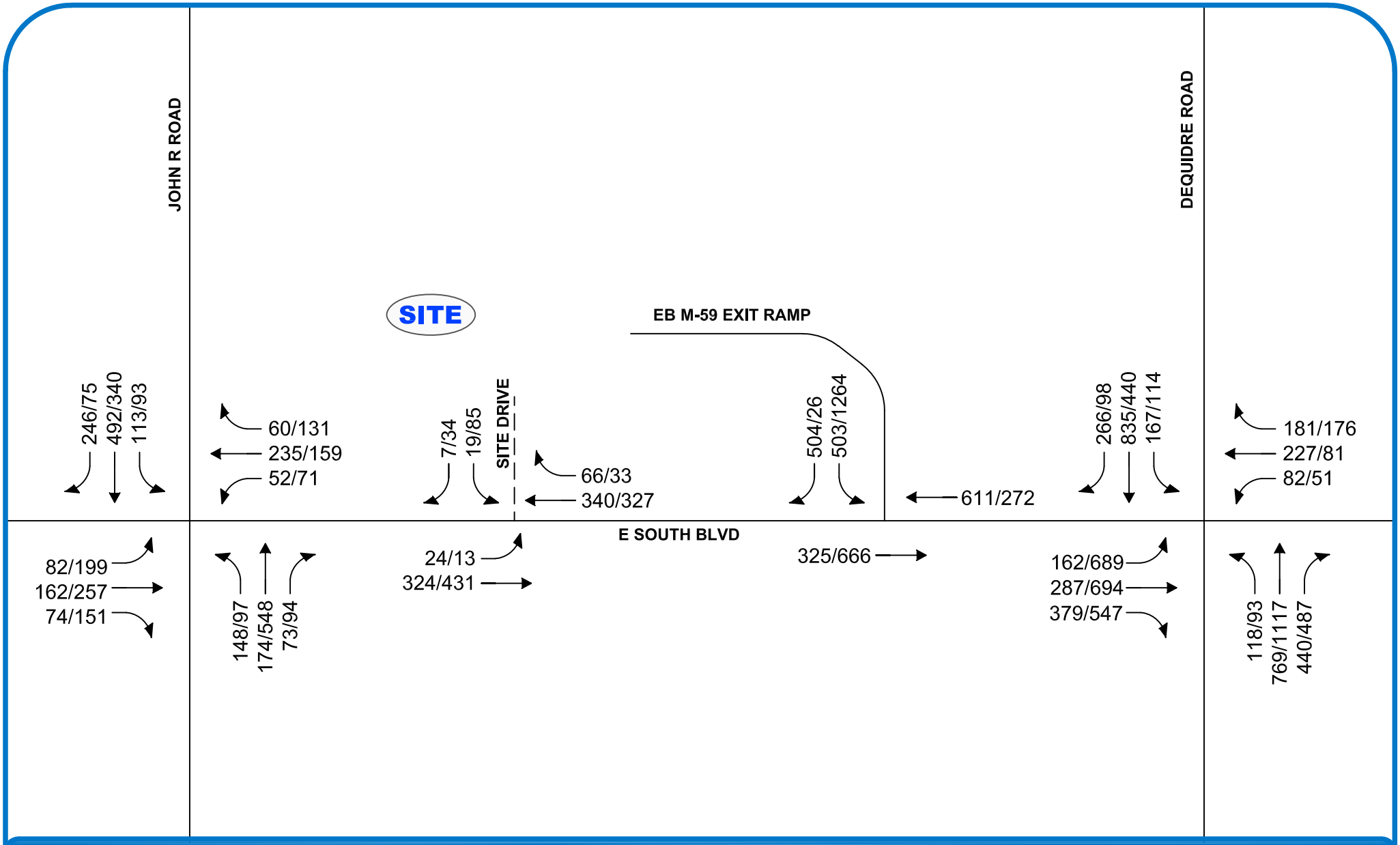


FIGURE 6
FUTURE TRAFFIC VOLUMES

AMBULATORY AND SURGERY CENTER DEVELOPMENT -
ROCHESTER HILLS, MI

LEGEND

ROADS

PROPOSED ROADS

TRAFFIC VOLUMES (AM/PM)

NORTH

SCALE: NOT TO SCALE

3.6 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 6th. The results of the future conditions analysis and vehicle queues are presented in **Appendix D** and are summarized in **Table 6**.

Table 6: Future Intersection Operations

Intersection		Control	Approach	Background Conditions (2021)				Future Conditions (2021)				Difference			
				AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM 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	Dequindre Road & South Boulevard	Signalized	EBL	53.6	D	41.8	D	53.7	D	41.4	D	0.1	-	-0.4	-
			EBT	44.4	D	44.7	D	44.6	D	45.0	D	0.2	-	0.3	-
			EBR	54.0	D	118.4	F	52.8	D	125.2	F	-1.2	-	6.8	-
			WBL	50.0	D	50.5	D	50.1	D	50.8	D	0.1	-	0.3	-
			WBT	34.0	C	51.7	D	34.6	C	53.8	D	0.6	-	2.1	-
			WBR	29.3	C	70.8	E	29.8	C	79.4	E	0.5	-	8.6	-
			NBL	31.9	C	23.3	C	33.6	C	23.3	C	1.7	-	0.0	-
			NBT	50.6	D	52.2	D	49.4	D	52.2	D	-1.2	-	0.0	-
			NBR	40.4	D	31.7	C	39.9	D	32.1	C	-0.5	-	0.4	-
			SBL	43.5	D	42.4	D	42.6	D	42.4	D	-0.9	-	0.0	-
			SBT	40.6	D	28.2	C	41.8	D	28.5	C	1.2	-	0.3	-
			SBR	22.4	C	8.3	A	23.1	C	8.1	A	0.7	-	-0.2	-
			Overall	43.0	D	51.8	D	42.8	D	53.0	D	-0.2	-	1.2	-
2	M-59 Exit Ramp & South Boulevard	Signalized	EB	34.3	C	37.1	D	32.9	C	36.0	D	-1.4	-	-1.1	-
			WB	34.8	C	16.1	B	22.1	C	13.5	B	-12.7	-	-2.6	-
			SBL	15.7	B	20.1	C	17.1	B	22.7	C	1.4	-	2.6	-
			SBR	16.9	B	20.1	C	18.5	B	22.7	C	1.6	-	2.6	-
			Overall	25.4	C	24.8	C	21.9	C	25.9	C	-3.5	-	1.1	-
3	John R Road & South Boulevard	Signalized	EBL	36.0	D	42.7	D	37.2	D	43.9	D	1.2	-	1.2	-
			EBT	43.0	D	38.5	D	44.1	D	38.7	D	1.1	-	0.2	-
			EBR	30.5	C	12.1	B	32.3	C	12.3	B	1.8	-	0.2	-
			WBL	34.0	C	36.8	D	36.2	D	37.7	D	2.2	C→D	0.9	-
			WBT	53.7	D	33.2	C	54.6	D	33.5	C	0.9	-	0.3	-
			WBR	31.8	C	11.6	B	34.4	C	12.1	B	2.6	-	0.5	-
			NBL	30.8	C	16.1	B	33.1	C	16.1	B	2.3	-	0.0	-
			NBTR	19.0	B	46.4	D	20.3	C	47.4	D	1.3	B→C	1.0	-
			SBL	13.5	B	20.2	C	14.6	B	20.5	C	1.1	-	0.3	-
			SBTR	53.0	D	27.8	C	51.0	D	27.5	C	-2.0	-	-0.3	-
			Overall	40.7	D	33.4	C	41.1	D	33.7	C	0.4	-	0.3	-
4	Proposed Site Drive & South Boulevard	Signalized	EBL					8.4	A	8.2	A	8.4	→A	8.2	→A
			EB					FREE		FREE		FREE		FREE	
			WB					FREE		FREE		FREE		FREE	
			SBL					13.6	B	15.8	C	13.6	→B	15.8	→C
			SBR					10.9	B	10.9	B	10.9	→B	10.9	→B

The results of the future conditions analysis indicate that all study intersection approaches and movements are expected to operate acceptably, at a LOS D or better, with exception of the following:

Dequindre Road & South Boulevard:

- The eastbound right-turn movement is expected to continue operating at LOS F during the PM peak hour. A review of SimTraffic network simulations indicate peak vehicle queue lengths of approximately 200 ft which exceeds the right-turn lane storage lane during the peak operations.
- The westbound right-turn movement is expected to operate at LOS E during the PM peak hour with the addition of background traffic. A review of SimTraffic network simulations indicate peak vehicle queue lengths of approximately 120 ft which will *not* exceed the available right-turn lane storage lane during the peak operations.

3.7 AUXILIARY LANE ANALYSIS

The RCOC "Permit Rules, Specifications and Guidelines" includes criteria for determining the need for left- and right-turn lanes at the proposed site driveway. The results of the analysis are provided in **Appendix E** and indicate the following:

1. A left-turn treatment (passing lane or center turn lane) is recommended on South Boulevard at the proposed Site Drive intersection.
2. A right-turn taper is recommended at the Site Drive.

4 CONCLUSIONS

The conclusions of this TIS are as follows:

1. The results of the **existing conditions** analysis indicate that all approaches and movements at the study intersections currently operate at LOS D or better during both peak hours, with the following exception:
    - Dequindre Road & South Boulevard**:** The eastbound right-turn movement currently operates at LOS F during the PM peak hour. A review of SimTraffic network simulations indicate peak vehicle queue lengths of approximately 200 ft which exceeds the right-turn lane storage lane during the peak operations.
2. The results of the **background conditions (No Build 2021)** analysis indicate that all approaches and movements at the study intersections will continue to operate at LOS D or better during both peak hours. In addition to the delays experienced during existing conditions, the follow impact to operations are expected.
    - Dequindre Road & South Boulevard**:** The westbound right-turn movement is expected to operate at LOS E during the PM peak hour with the addition of background traffic. A review of SimTraffic network simulations indicates peak vehicle queue lengths of approximately 130 ft which will *not* exceed the available right-turn lane storage lane during the peak operations.
3. The results of the **future conditions (with development 2021)** analysis indicate that all approaches and movements at the study intersections will continue to operate at LOS D or better during both peak hours. No additional decreases to LOS or significant impact to operations is expected with the addition of the site generated traffic.
4. The proposed site driveway is expected to operate well during both the AM and PM peak hours.
5. The RCOC criteria for left and right-turn lanes was evaluated and the results of the analysis indicate a left-turn treatment (passing lane or center turn lane) is recommended on South Boulevard at the proposed Site Drive intersection and a right-turn taper is recommended at the Site Drive. RCOC has indicated that a left-turn treatment would be required as part of the proposed development plan and was assumed in the future conditions analysis included herein.

5 RECOMMENDATIONS

The recommendations of this TIS are as follows:

1. A left-turn treatment (passing lane or center turn lane) is recommended on South Boulevard at the proposed Site Drive intersection.
2. A right-turn taper is recommended at the Site Drive. The driveway design standards should be in accordance with RCOC requirements.

Appendix A

BACKGROUND INFORMATION

ARCHITECT/PLANNER

BOWERS + ASSOCIATES, INC.
2400 S. HURON PARKWAY
ANN ARBOR, MI 48104
T: 734.975.2400
F: 734.975.2410

SITE/BUILDING DATA

PARCEL SIZE	3.344 ACRES
EXISTING ZONING	O-1 OFFICE BUSINESS
PROPOSED ZONING	O-1 OFFICE BUSINESS
PROPOSED USE	MEDICAL OFFICE
REQUIRED FRONT SETBACK	35'
PROPOSED FRONT SETBACK	35'-0"
REQUIRED SIDE SETBACK	0' EA. SIDE | 50' TOTAL
PROPOSED SIDE SETBACK	32'-4" + 211'-6"
REQUIRED REAR SETBACK	35'
PROPOSED REAR SETBACK	191'-9"
MAX. BUILDING HEIGHT	3 STORIES | 42'
PROPOSED BUILDING HEIGHT	3 STORIES
PROPOSED BUILDING AREA	60,000 GROSS SF

PARKING DATA

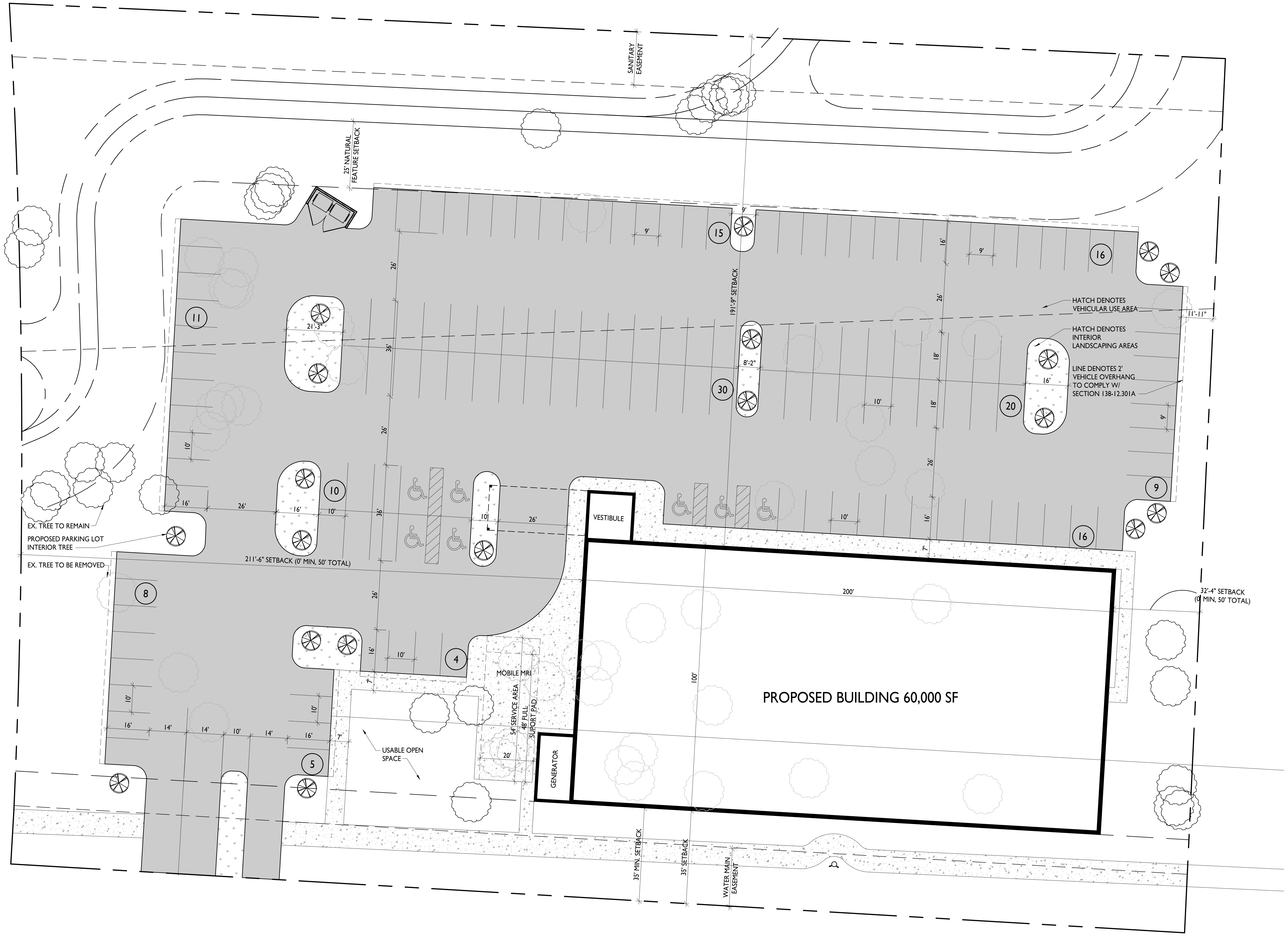
PARKING REQUIRED	1 SPACE PER 350 NET SF 60,000 SF * .8 = 48,000 SF 138 SPACES REQUIRED
PARKING PROVIDED	144 SPACES PROVIDED
9' WIDE SPACE PROVIDED	40 SPACES
10' WIDE SPACES PROVIDED	97 SPACES
11' WIDE ACC. SPACES PROVIDED	7 SPACES

LANDSCAPE DATA

LANDSCAPE BUFFERS	10' LANDSCAPE BUFFER W/ PARKING IN FRONT + SIDEYARD
PARKING INTERIOR LANDSCAPING	5% VEHICULAR USE AREA REQ'D VEHICULAR USE AREA = 54,356 SF 2,718 SF REQUIRED 3,163 SF PROVIDED
PARKING INTERIOR TREES	1 PER 150 SF REQ'D INTERIOR AREA 19 TREES REQUIRED 19 TREES PROVIDED
TREE PRESERVATION	40% OF EXISTING TREES > 6" Ø TO REMAIN EXCLUDING THOSE WITHIN BUILDING FOOTPRINT
REQUIRED TO REMAIN	52 TOTAL TREES = 21 TREES
PROPOSED TO REMAIN	25 TREES

GENERAL NOTES

1. ALL OUTDOOR LIGHTS SHALL BE SHIELDED TO REDUCE GLARE AND SHALL BE ARRANGED TO NOT INTERFERE WITH THE VISION OF PERSONS ON ADJACENT ROADWAYS OR ADJACENT PROPERTY.
2. ALL SIGNS SHALL MEET LOCAL MUNICIPALITY ORDINANCE REQUIREMENTS.



PRELIMINARY SITE PLAN

SCALE: 1" = 20'

LOCATION MAP

NO SCALE

BOWERS+ASSOCIATES
ARCHITECTURE DESIGN
2400 SOUTH HURON PARKWAY + ANN ARBOR, MI 48104
P: 734.975.2400 + F: 734.975.2410
WWW.BOWERSARCH.COM

CONSULTANT + NAME

PROJECT + INFORMATION

ROCHESTER HILLS DEVELOPMENT
EAST SOUTH BLVD
ROCHESTER HILLS, MI

PROJECT + NUMBER

19P-000

ISSUE + DATE

06 SEP 2019
09 SEP 2019
19 OCT 2019
29 OCT 2019
30 DEC 2019
20 JAN 2020
24 JAN 2020 CNCPT MTG

STATE OF MICHIGAN
SCOTT M. BOWERS
ARCHITECT
No. 1301032575
LICENSED ARCHITECT

SHEET + TITLE

PRELIMINARY SITE PLAN

19407Z100G.dwg

SHEET + NUMBER

SP.100

South Blvd & John R

March 5, 2020

	South Blvd Eastbound			South Blvd Westbound			John R Northbound			John R Southbound			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	**Total**
7:00 AM	6	31	27	7	23	5	19	20	6	33	111	26	**314**
7:15 AM	10	26	31	3	27	5	23	16	8	30	94	23	**296**
7:30 AM	9	30	17	11	37	9	22	22	16	30	130	45	**378**
7:45 AM	8	30	24	16	52	19	43	42	14	22	129	64	**463**
8:00 AM	20	44	18	15	64	18	30	31	23	31	127	68	**489**
8:15 AM	19	30	18	10	54	11	34	35	12	18	117	47	**405**
8:30 AM	15	36	21	7	58	14	37	51	15	31	113	50	**448**
8:45 AM	25	42	14	16	51	11	42	51	15	17	120	73	**477**

1451 1626 1735 1805 1819

Peak hour

Total	**79**	**152**	**71**	**48**	**227**	**54**	**143**	**168**	**65**	**97**	**477**	**238**	**1819**
PHF	0.92			0.85			0.87			0.90			

4:00 PM	37	47	35	14	38	21	24	95	18	15	62	19	**425**
4:15 PM	37	42	26	19	26	29	25	115	20	23	86	15	**463**
4:30 PM	47	44	34	17	38	23	19	135	23	21	83	26	**510**
4:45 PM	43	47	32	16	40	27	27	112	18	24	84	9	**479**
5:00 PM	48	53	29	16	39	30	22	139	14	18	92	19	**519**
5:15 PM	46	56	36	17	46	35	26	137	25	26	96	17	**563**
5:30 PM	47	68	45	13	29	23	21	138	29	24	75	14	**526**
5:45 PM	52	70	36	12	34	22	25	117	19	15	67	22	**491**

1877 1971 2071 2087 2099

Peak hour

Total	**193**	**247**	**146**	**58**	**148**	**110**	**94**	**531**	**87**	**83**	**330**	**72**	**2099**
PHF	0.92			0.81			0.95			0.87			

South Blvd & M-59 Ramp

March 5, 2020

	South Blvd Eastbound			South Blvd Westbound						M-59 Southbound			
Start Time	Left		Thru	Left	Thru	Thru				Left	Right		**Total**
7:00 AM			40			64				119	18		**241**
7:15 AM			54			87				105	47		**293**
7:30 AM			71			119				124	131		**445**
7:45 AM			90			173				136	128		**527**
8:00 AM			63			120				105	98		**386**
8:15 AM			72			129				123	117		**441**
8:30 AM			79			138				107	95		**419**
8:45 AM			69			130				135	97		**431**

1506 1651 1799 1773 1677

Peak hour

Total	**0**	**0**	**296**	**0**	**0**	**541**	**0**	**0**	**0**	**488**	**474**	**0**	**1799**
PHF		0.82			0.78			#DIV/0!			0.91		

4:00 PM			151			56				240	4		**451**
4:15 PM			130			87				229	5		**451**
4:30 PM			176			58				298	10		**542**
4:45 PM			115			63				290	6		**474**
5:00 PM			157			69				291	6		**523**
5:15 PM			115			61				347	3		**526**
5:30 PM			120			56				281	3		**460**
5:45 PM			114			43				226	6		**389**

1918 1990 2065 1983 1898

Peak hour

Total	**0**	**0**	**563**	**0**	**0**	**251**	**0**	**0**	**0**	**1226**	**25**	**0**	**2065**
PHF		0.80			0.91			#DIV/0!			0.89		

South Blvd & Dequindre

March 5, 2020

	South Blvd Eastbound			South Blvd Westbound			Dequindre Northbound			Dequindre Southbound			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	**Total**
7:00 AM	36	46	97	25	19	46	11	161	79	44	233	47	**844**
7:15 AM	30	46	83	17	23	44	6	152	83	37	223	41	**785**
7:30 AM	29	51	78	20	29	46	12	183	93	33	232	43	**849**
7:45 AM	32	58	88	22	52	50	20	155	118	42	202	55	**894**
8:00 AM	41	54	91	25	61	36	31	228	124	38	218	67	**1014**
8:15 AM	27	63	77	19	45	41	20	141	64	47	206	60	**810**
8:30 AM	48	61	106	13	50	48	24	222	121	35	184	57	**969**
8:45 AM	38	52	79	14	43	49	27	133	69	31	202	65	**802**

Peak hour													
Total	**148**	**236**	**362**	**79**	**208**	**175**	**95**	**746**	**427**	**162**	**810**	**239**	**3687**
PHF		0.87			0.93			0.83			0.94		

4:00 PM	137	113	114	12	14	37	22	242	130	29	113	27	**990**
4:15 PM	145	120	107	9	17	30	16	270	122	39	105	18	**998**
4:30 PM	149	126	87	7	17	33	18	249	131	26	106	21	**970**
4:45 PM	152	168	112	10	13	37	19	216	138	28	130	16	**1039**
5:00 PM	128	123	111	9	17	40	25	292	104	23	107	17	**996**
5:15 PM	160	147	123	14	22	44	22	290	122	25	95	22	**1086**
5:30 PM	126	146	115	16	16	49	16	286	108	34	95	25	**1032**
5:45 PM	169	134	123	15	20	33	16	240	111	32	119	17	**1029**

Peak hour	629	649	512	Balanced									
Total	**566**	**584**	**461**	**49**	**68**	**170**	**82**	**1084**	**472**	**110**	**427**	**80**	**4153**
PHF		0.93			0.89			0.94			0.89		

3372
3542
3567
3687
3595
3997
4003
4091
4153
4143

Crash and Road Data

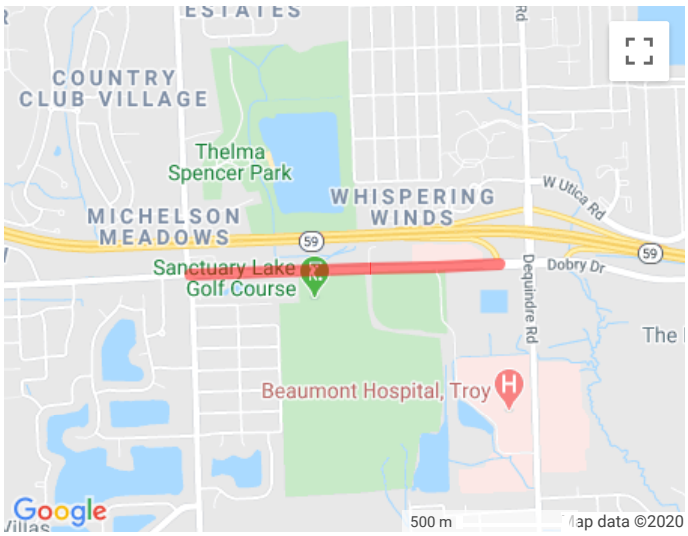
Road Segment Report

South Blvd E, (PR Number 616405)

From:	John R Rd 7.020 BMP
To:	E M 59/Dequindre Ramp 7.925 EMP
FALINK ID:	281
Community:	City of Rochester Hills , City of Troy
County:	Oakland
Functional Class:	4 - Minor Arterial
Direction:	1 Way
Length:	0.905 miles
Number of Lanes:	2
Posted Speed:	45 (source: TCO)
Route Classification:	Not a route
Annual Crash Average 2014-2018:	8
Traffic Volume (2016)*:	8,500 (Observed AADT)
Pavement Type (2017):	Asphalt
Pavement Rating (2017):	Good
Short Range (TIP) Projects:	No TIP projects for this segment.
Long Range (RTP) Projects:	No long-range projects for this segment.

* AADT values are derived from **Traffic Counts**

Street View



SEMCOG | Southeast Michigan Council of Governments

Crash and Road Data

Road Segment Report

Dequindre Rd, (PR Number 799402)

From:	South Blvd E 12.235 BMP
To:	E M 59 12.313 EMP
FALINK ID:	3633
Community:	City of Rochester Hills , Shelby Township
County:	Oakland, Macomb
Functional Class:	3 - Other Principal Arterial
Direction:	1 Way
Length:	0.078 miles
Number of Lanes:	4
Posted Speed:	45 (source: TCO)
Route Classification:	Not a route
Annual Crash Average 2014-2018:	9
Traffic Volume (2016)*:	24,300 (Observed AADT)
Pavement Type (2017):	Asphalt
Pavement Rating (2017):	Good
Short Range (TIP) Projects:	No TIP projects for this segment.
Long Range (RTP) Projects:	No long-range projects for this segment.

* AADT values are derived from **Traffic Counts**

Street View

SEMCOG | Southeast Michigan Council of Governments

Crash and Road Data

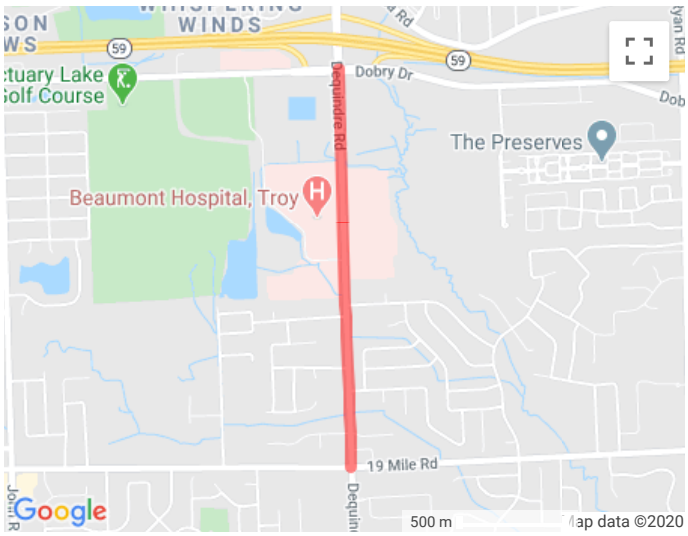
Road Segment Report

Dequindre Rd, (PR Number 799402)

From:	Square Lake Rd E 11.079 BMP
To:	South Blvd E 12.235 EMP
FALINK ID:	3632
Community:	City of Troy , City of Sterling Heights
County:	Oakland, Macomb
Functional Class:	3 - Other Principal Arterial
Direction:	1 Way
Length:	1.156 miles
Number of Lanes:	5
Posted Speed:	45 (source: TCO)
Route Classification:	Not a route
Annual Crash Average 2014-2018:	48
Traffic Volume (2016)*:	24,800 (Observed AADT)
Pavement Type (2017):	Asphalt
Pavement Rating (2017):	Good
Short Range (TIP) Projects:	No TIP projects for this segment.
Long Range (RTP) Projects:	No long-range projects for this segment.

* AADT values are derived from **Traffic Counts**

Street View



SEMCOG | Southeast Michigan Council of Governments

Crash and Road Data

Road Segment Report

John R Rd, (PR Number 646806)

From:	South Blvd E 12.203 BMP
To:	E M 59 12.282 EMP
FALINK ID:	1571
Community:	City of Rochester Hills
County:	Oakland
Functional Class:	4 - Minor Arterial
Direction:	1 Way
Length:	0.079 miles
Number of Lanes:	3
Posted Speed:	45 (source: TCO)
Route Classification:	Not a route
Annual Crash Average 2014-2018:	3
Traffic Volume (2016)*:	14,800 (Observed AADT)
Pavement Type (2017):	Asphalt
Pavement Rating (2017):	Poor
Short Range (TIP) Projects:	(1341) Capacity Improvement
Long Range (RTP) Projects:	No long-range projects for this segment.

* AADT values are derived from **Traffic Counts**

Street View

SEMCOG | Southeast Michigan Council of Governments

Crash and Road Data

Road Segment Report

John R Rd, (PR Number 646806)

From:	Square Lake Rd E 11.077 BMP
To:	South Blvd E 12.203 EMP
FALINK ID:	1570
Community:	City of Troy
County:	Oakland
Functional Class:	4 - Minor Arterial
Direction:	1 Way
Length:	1.126 miles
Number of Lanes:	2
Posted Speed:	45 (source: TCO)
Route Classification:	Not a route
Annual Crash Average 2014-2018:	17
Traffic Volume (2016)*:	14,400 (Observed AADT)
Pavement Type (2017):	Asphalt
Pavement Rating (2017):	Poor
Short Range (TIP) Projects:	(1341) Capacity Improvement
Long Range (RTP) Projects:	No long-range projects for this segment.

* AADT values are derived from **Traffic Counts**

Street View

OAKLAND COUNTY ROAD COMMISSION
TRAFFIC - SAFETY DEPARTMENT
SIGNAL WORK ORDER

LOCATION: Dequindre & South Blvd DATE: 1-31-20

CITY/TOWNSHIP: Rochester Hills BY: T CREECH

COUNTY#: 483 STATE#: — CHARGES: 004836

PLEASE PERFORM THE FOLLOWING:

_____ ELECTRICAL DEVICE: ____ INSTALL _____ MODERNIZE _____ MAINTENANCE

_____ UNDERGROUND: _____

_____ EDISON OK: _____ YES _____ NO JOB#: _____

_____ COORDINATE W/DISTRICT 7: _____

DIAL..	1	1	1	1		2	2	2	2		3	3	3	3		4	4	4	4
SPLIT.	1	2	3	4		1	2	3	4		1	2	3	4		1	2	3	4
_____ CHANGE TIMING.....																			
_____ CHANGE OFFSET.....																			
_____ CHANGE CYCLE LENGTH.....																			
_____ ADD DIAL/SPLIT.....																			

X CHANGE BREAKOUT OR EPROM: Change pers → REV 2 (schedule change)

_____ CHANGE HOURS OF OPERATION:

OLD: _____

NEW: _____

ROAD COMMISSION OAKLAND COUNTY

_____ REPROGRAM TBC

_____ INSTALL INTERCONNECT: _____ TBC _____ MINITROL _____ TONE

FEB 21 2020

_____ MBT OK: _____ YES _____ NO

TRAFFIC OPERATIONS

_____ NO CHANGE - RECORD CORRECTION

X OTHER: Requires a checksum change

APPROVED BY: _____ DATE: 2/18/20

DATE INSTALLED: 2/19/2020

INSTALLED BY: Richardson Controller

INTERSECTION :- 483 DEQUINDRE & SOUTH BLVD.
DESCRIPTION PROMS :- X00483R / F4808
CONTROLLER TYPE :- STANDARD PERSONALITY CONTROLLER
SOFTWARE TYPE :- MOD 52 SCATS S30 **(TS2)**
INPUTS :-

1. SB Dequindre LT (NL)
2. SB Dequindre LT ADV(NL)
3. SB Dequindre L (LK)
4. SB Dequindre R (LK)
5. SB Dequindre RT (LK)
6. EB SOUTH Blvd LLT (LK)
7. EB SOUTH Blvd LLT ADV(LK)
8. EB SOUTH Blvd RLT (LK)
9. EB SOUTH Blvd RLT ADV(LK)
10. EB SOUTH Blvd L (LK)
11. EB SOUTH Blvd R (LK)
12. EB SOUTH Blvd RT (3sec,LK)
13. NB Dequindre LT (NL)
14. NB Dequindre LT ADV (NL)
15. NB Dequindre L (LK)
16. NB Dequindre R (LK)
17. NB Dequindre RT (LK)
18. WB SOUTH Blvd LT (LK)
19. WB SOUTH Blvd LT ADV(LK)
20. WB SOUTH Blvd L (LK)
21. WB SOUTH Blvd R (LK)
22. WB SOUTH Blvd RT (3sec,LK)

NOTE: ALL DETECTORS ARE LOOPS

Opticom 1: TB2 PREEMPT INPUT 3 (CALLS NB & SB DEQUINDRE).
Opticom 2: TB2 PREEMPT INPUT 4 (CALLS EB & WB S BLVD).

PED 2: NB DEQUINDRE PED ELeg P.B. (WA)
PED 4: WB SOUTH BLVD. PED NLeg P.B. (WB)
PED 6: SB DEQUINDRE PED WLeg P.B. (WC)
PED 8: EB SOUTH BLVD. PED SLeg P.B. (WD)

APPROACHES :-

A APP 1 : NB DEQUINDRE L,R,RT	A APP 2 : SB DEQUINDRE L,R,RT
B APP 1 : EB SBLVD LT LLT,LLT ADV,RLT,RLT ADV,	B APP 2 : WB SOUTH BLVD. LT LT,LT ADV
B APP 3 : WB SOUTH BLVD. L,R,RT	B APP 4 : WB SOUTH BLVD. L,R,RT
C APP 1 : WB SOUTH BLVD. L,R,RT	C APP 2 : EB SOUTH BLVD. L,R,RT
D APP 1 : SB DEQUINDRE LT LT,LT ADV	D APP 2 : NB DEQUINDRE LT LT,LT ADV
D APP 3 : NB DEQUINDRE L,R,RT	D APP 4 : SB DEQUINDRE L,R,RT

FLEXIDATA:-

SEQUENCE	A,B,C,D	A,B,C,D
AUTO REL		
R- REL	A	A
R+ REL	B	B
Q- REL	C	C
Q+ REL	D	D
LOOKAHEAD		
LOOK B->	A,C,D	A,C,D
LOOK C->	A,D	A,D
LOOK D->	A	A

PEDESTRIANS:-

1. P1 (UNUSED)
2. P2 NB DEQUINDRE PED EAST P.B.
3. P3 (UNUSED)
4. P4 WB SOUTH BLVD. PED NORTH P.B.
5. P5 (UNUSED)
6. P6 SB DEQUINDRE PED WEST P.B.
7. P7 (UNUSED)
8. P8 EB SOUTH BLVD. PED SOUTH P.B.

SPECIAL FEATURES :-

Controller Software must be 2070/M52 S30 or later (VC=5).
The personality revision number is currently 2 (=B).
Ped outputs mapped to phases as follows: ped 2 = 9, ped 4 = 10, ped 6 = 11 and ped 8 = 12. VC5 software reports them as mapped.

Left turns are permissive to NCHRP flashing yellow recommendation.
Signal groups 13,15 provide flashing yellow (green aspect), yellow and red, i.e. upper aspects of 4 section turn display. Signal groups 1,5 provide the green (bottom) aspect, i.e. turn arrow.
A STAGE HAS A PERMANENT DEMAND. DEMAND FOR STAGES B, C, D IN FLEXI AND ISOLATED. SET ZNEG TO DISABLE.
Pedestrians have automatic introduction using SCATS Y-.

WB SOUTH BLVD. PED Nleg & EB SOUTH BLVD. PED Sleg introduction is suppressed when OPTICOM is active.
SB Dequindre PED Wleg & NB Dequindre PED Eleg introduction is suppressed when OPTICOM is active.
Opticom 1 CALLS NB & SB Dequindre. Opticom 2 CALLS EB & WB SOUTH BLVD.

Night Flash code: Set Y+ to activate the night flash in Flexilink
Signal Group 1 and 5 non-locked detectors will not call stage D directly.
If XSF7 is set signal Group 1 and 5 detectors will call stage C and then stage D.

IN MASTERLINK AND FLEXILINK:
XSF09 (XH Value = 01) sets MAX recall for SG1 left turn.
XSF10 (XH Value = 02) sets min recall for SG1 left turn.
XSF11 (XH Value = 04) sets MAX recall for SG3 left turn.
XSF12 (XH Value = 08) sets min recall for SG3 left turn.
XSF13 (XH Value = 10) sets MAX recall for SG5 left turn.
XSF14 (XH Value = 20) sets min recall for SG5 left turn.
XSF15 (XH Value = 40) sets MAX recall for SG7 left turn.
XSF16 (XH Value = 80) sets min recall for SG7 left turn.

B1-C O/L OR B2-C O/L MAY APPEAR IN B1 OR B2 RESPECTIVELY
HOWEVER IF THE OVERLAP TERMINATES IN B THEN THE C AMBER AND C RED TIMES ARE USED FOR B STAGE

Set BT = nS in SCATS data to enable Z5 flag in B stage to C.
This allows termination of o/lap phase minimum timer if the appropriate phase o/lap is to occur and C is next, otherwise phase minimum is guaranteed by phase minimum timer.

Flash rate for FYA is set with Timesettings 28 and 29.
TSM28=0.6 (on rate), TSM29=0.4 (off rate)

BACKPANEL :- SIZE P44-16 **TS2** CABINET

LOAD SWITCH 1:	SB DEQUINDRE LT & WB RT	CL & BR	-
	G: SB LT green arrow and WB RT green arrow		
	Y: WB RT yellow arrow		
LOAD SWITCH 2:	NB DEQUINDRE	A	FLR
LOAD SWITCH 3:	EB SOUTH BLVD. LT & SB RT (G,A)	DL & CR	-
LOAD SWITCH 4:	WB SOUTH BLVD.	B	FLR
LOAD SWITCH 5:	NB DEQUINDRE LT & EB RT	AL & DR	-
	G: NB LT green arrow and EB RT green arrow		
	Y: EB RT yellow arrow		
LOAD SWITCH 6:	SB DEQUINDRE	C	FLR
LOAD SWITCH 7:	WB SOUTH BLVD. LT & SB RT (G,A)	BL & AR	-
LOAD SWITCH 8:	EB SOUTH BLVD.	D	FLR
LOAD SWITCH 9:	NB DEQUINDRE PED EAST	WA	
LOAD SWITCH 10:	WB SOUTH BLVD. PED NORTH	WB	
LOAD SWITCH 11:	SB DEQUINDRE PED WEST	WC	
LOAD SWITCH 12:	EB SOUTH BLVD. PED SOUTH	WD	
LOAD SWITCH 13(OLA):	SB DEQUINDRE LT	CL	FLR
	G: flashing yellow arrow, Y: yellow arrow, R: red arrow		
LOAD SWITCH 15(OLC):	NB DEQUINDRE LT	AL	FLR
	G: flashing yellow arrow, Y: yellow arrow, R: red arrow		

MMU 2 :- (MENU : SET/VIEW CONFIG)

Field Check Enable	Channel 1: G Channel 2: G, Y, R Channel 3: G, Y, R Channel 4: G, Y, R Channel 5: G Channel 6: G, Y, R Channel 7: G, Y, R Channel 8: G, Y, R Channel 13: G, Y, R Channel 15: G, Y, R
Dual Indication Enable:	R+G: Channel 2,3,4,6,7,8,13,15 R+Y: Channel 2,3,4,6,7,8,13,15 G+Y: Channel 1,2,3,4,5,6,7,8,13,15
Red Fail Enable:	Enable: Channel 2,3,4,6,7,8,13,15
Y & R Clearance Disable:	Channel 2,3,4,6,7,8,13,15 Enabled
Flashing Yellow Arrow:	Select mode B Enable: Channel Pair 1-13,5-15,
Unit Options:	All OFF except: Recurrent pulse Program Memory Card
Program Card:	Compatible Channels: 1-5, 1-6, 1-11, 1-13, 1-15, 2-5, 2-6, 2-9, 2-11, 2-13, 2-15, 3-7, 3-8, 3-12, 4-7, 4-8, 4-10, 4-12, 5-9, 5-13, 5-15, 6-9, 6-11, 6-13, 6-15, 7-10, 8-10, 8-12, 9-11, 9-13, 9-15, 10-12,11-13, 11-15, 13-15. Min Flash Time: 4+2+1 Min Yellow Change Disable: 9,10,11,12 Voltage Monitor Latch: NONE

Note :- Add Jumper 16 MMU Flash - 116 Monitor ST Out

```
**********************************
* CONTROLLER INFORMATION SHEET *
*     FOR SITE NO.  483        *
*          T CREECH            *
*        31-JAN-2020           *
**********************************
```

CHECKSUMS
TIMES AF / 257
PERS 6E / 156
TOTAL C1 / 301

FLEXILINK PLAN DATA

Intersection # 483 **State #** _____ **Date:** 01/31/20 **Prepared By:** T. Creech

Intersection: Dequindre & South Blvd **City:** Rochester Hills

Hours of Operation: 7 Days: 24 Hours **Approved By:** R. Jones

Hours of Flashing: None

		PL0	PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8
0	CL		90	120	130	80				
1	A		0	0	0	0				
2	B		42	50	55	27				
3	C		56	66	83	41				
4	D		76	104	112	66				
5	E									
6	F									
7	G									
8	R-									
9	R+									
10	Of (Y-)		24	14	7	32				
11	Y+	C								
12	Z-									
13	Z+									
14	Q-									
15	Q+									
16	XH									
17	XL									

NOTE: Stages with 1 second of phase time are skipped. Blank entries are default values equal to 0. Except for an AWA controller, entries #8 to #15 (=254) and 'C' entry means continuous (=255).

							Timers		
Phase	**Direction**	**Min**	**Max**	**ECO**	**Amber**	**All Red**	**Gap**	**Hdwy**	**Waste**
A	Dequindre	10.0	40.0		4.3	2.1	3.0	1.2	10.0
B	South Blvd LT	5.0	15.0		4.3	2.1	4.0	1.2	10.0
C	South Blvd	10.0	40.0		4.3	2.1	3.0	1.2	10.0
D	Dequindre LT	4.0	15.0		4.3	2.1	3.0	1.2	10.0
E									
F									
G									

	Day	Hours	Plan#
SC1	14	0:00	4
SC2	13	5:00	1
SC3	13	20:00	4
SC4	8	5:00	2
SC5	8	10:00	1
SC6	8	15:00	3
SC7	8	20:00	1
SC8			
SC9			
SC10			

Pedestrian Crossing Times

Direction	Walk	CL 1	CL 2
NB Dequindre Ped Eleg (Ped 2)	7.0	22.0	3.4
WB South Blvd Ped Nleg (Ped 4)	7.0	20.0	3.4
SB Dequindre Ped Wleg (Ped 6)	7.0	20.0	3.4
EB South Blvd Ped Sleg (Ped 8)	7.0	19.0	3.4

Flash Rate Timesettings TSM28=0.6 (on rate); TSM29=0.4 (off rate)

Normal Operating Mode

Isolated	Flexilink	Masterlink	Master Isolated	Flexi Isolated
		X		

DAY OF WEEK CODE NUMBER

0	End of Schedule	4	WED	8	MON-FRI	12	MON,FRI,SAT
1	SUN	5	THUR	9	MON-SAT	13	SAT,SUN
2	MON	6	FRI	10	TUE,WED,THU	14	EVERY DAY
3	TUE	7	SAT	11	MON,FRI	15	NEVER

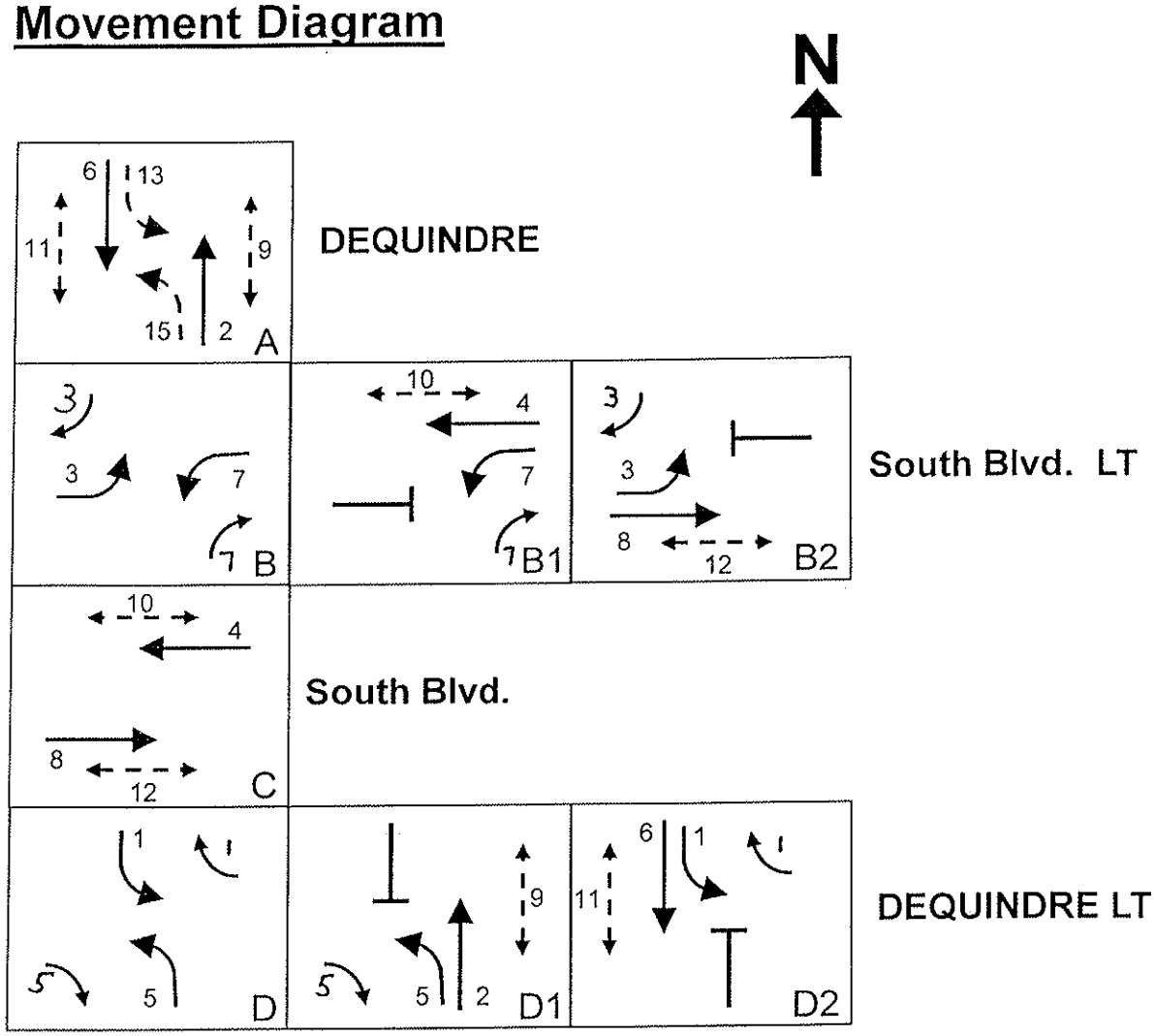
TS2 LOOP DETECTORS BIU #2

CO# 483

Detector # on print	Description	Phase	Output
17	NB Dequindre RT	2	17
18	WB South Blvd LT	7	18
19	WB South Blvd LT ADV	7	19
20	WB South Blvd L	4	20
21	WB South Blvd R	4	21
22	WB South Blvd RT	4	22

#483 – DEQUINDRE & South Blvd.

- **Movement Diagram**



PROJECT NO. 53071 PROJECT NAME: DEQUINDRE ROAD

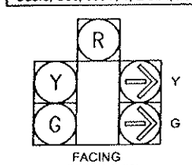
SCATS COMMUNICATIONS SHALL BE VIA AT&T CELLULAR MODEM. INSTALLATION SHALL BE COORDINATED BY THE R.C.O.C. FIELD ENGINEER.

FOR INSTALLATION OF 120V. SERVICE CONTACT MR. DENNIS MERCIER, DTE ENERGY, 248-427-2954. NO COST TO CONTRACTOR.

COORDINATE THE INSTALLATION OF PREFORMED TRAFFIC LOOPS WITH STAGE CONSTRUCTION. CONTACT RCOC FIELD ENGINEER FOR EXACT LOCATION. GIVE 5 DAYS NOTICE. SEE STAGING PLAN SHEETS FOR SUGGESTED SEQUENCE.

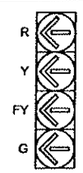
LIST OF MATERIALS

NO.	ITEM	QUANTITIES
(1)	Wood Pole, Fit Up, Sec Cable Pole	1 Ea
(2)	Hh, Square, RCOC	1 Ea
(3)	Hh, Round	7 Ea
(4)	Controller and Cabinet, Digital Type, RCOC	1 Ea
(5)	Controller and Cabinet, Digital Type, Delivered, RCOC	1 Ea
(6)	Controller Fdn, Base Mount	1 Ea
(7)	Digital Loop Detector	6 Ea
(8)	Pedestal, Alum	4 Ea
(9)	Pedestal, Fdn	4 Ea
(10)	Pushbutton and Sign	8 Ea
(11)	Serv Disconnect	1 Ea
(12)	TS, One Way, Mast Arm Mtd (LED)	7 Ea
(13)	TS, One Way, Mast Arm Mtd, FYA (LED)	2 Ea
(14)	TS, One Way, Mast Arm Mtd, Five Sect (LED)	4 Ea
(15)	Backplate, TS	13 Ea
(16)	TS, One Way Pedestal Mtd (LED)	4 Ea
(17)	TS, Pedestrian, One Way Bracket Arm Mtd (LED) Countdown	4 Ea
(18)	TS, Pedestrian, One Way Pedestal Mtd (LED) Countdown	4 Ea
(19)	Mast Arm Std, 21 foot, RCOC	4 Ea
(20)	Mast Arm, RCOC	4 Ea
(21)	Mast Arm Std, Fdn, RCOC	4 Ea
(22)	Traffic Loop, Presence (Preformed), RCOC	22 Ea
(23)	Case Sign, One Way, 12 inch by 24 inch, Non-Illuminated, RCOC	3 Ea
(24)	Optical Priority Control System, RCOC	1 Ea
(25)	Cellular Modem, Integrate, RCOC	1 Ea
(26)	Video Surveillance, Camera, RCOC	1 Ea
(27)	Bracket Arm, 18 foot, RCOC	1 Ea
(28)	Case Sign (LED), Disappearing Legend, One Way, 24 inch by 30	4 Ea
	Conduit, DB, 1, 1 1/4 inch	120 Ft
	Conduit, DB, 1, 3 inch	230 Ft
	Conduit, DB, 2, 3 inch	90 Ft
	Conduit, DB, 3, 4 inch	15 Ft
	Conduit, Directional Bore, 1, 4 inch	270 Ft
	Conduit, Directional Bore, 2, 4 inch	115 Ft
	Cable, Sec, 600V, 1, 2/C#4, #6 Ground, RCOC	75 Ft



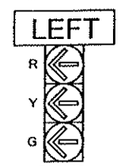
FACING
WEST (T.S.#5)
NORTH (T.S.#9)
EAST (T.S.#13)
SOUTH (T.S.#17)

INSTALL ONE-WAY, FIVE-SECTION T.S.



FACING
NORTH (T.S.#7)
SOUTH (T.S.#15)

INSTALL ONE-WAY, FYA LEFT TURN T.S.



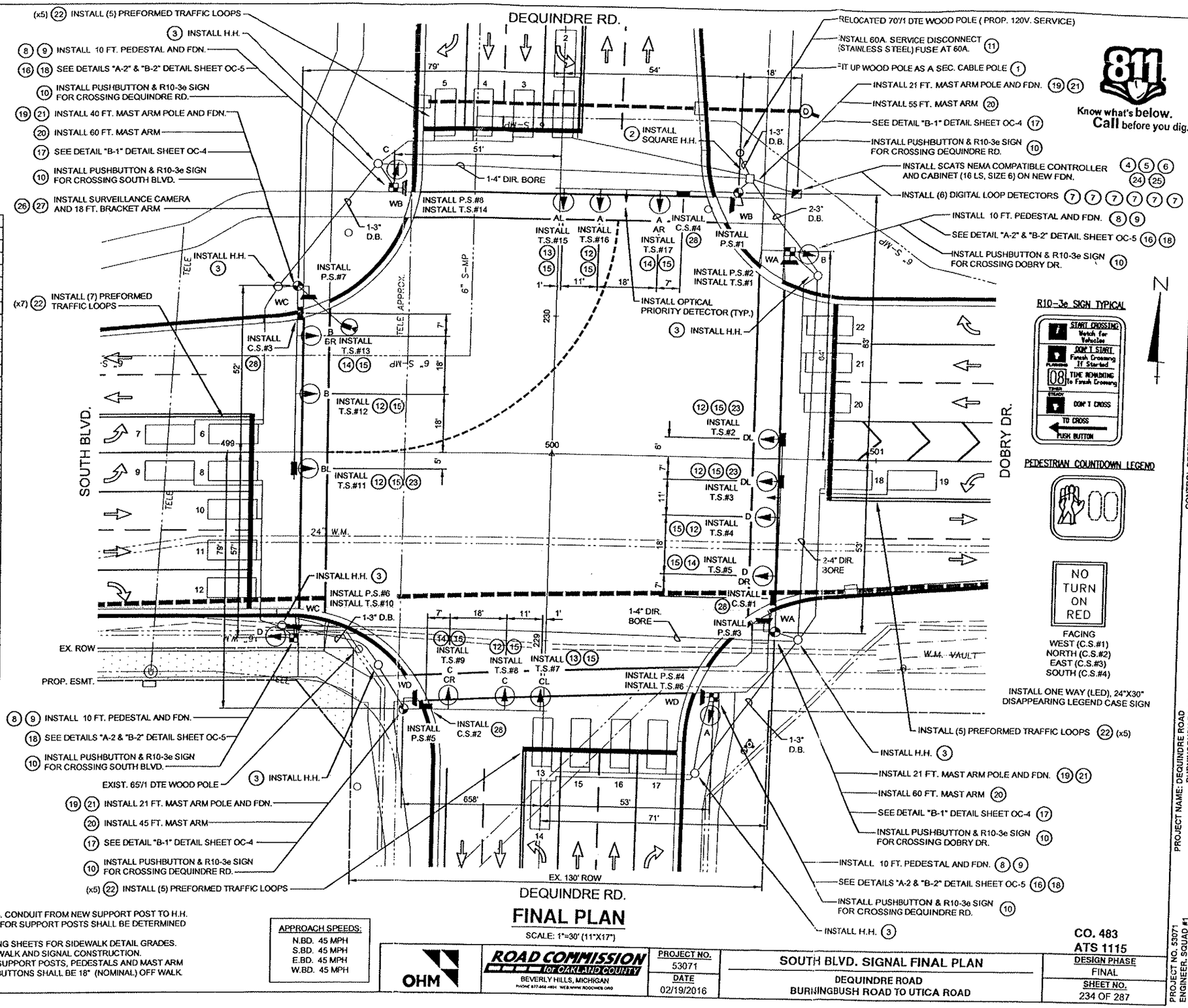
FACING
WEST (T.S.#2 & #3)
EAST (T.S.#11)

INSTALL ONE-WAY LEFT TURN T.S.

CONDUIT TYPICALS:

STEEL POLE TO H.H. ---------- 2-3" & 1-1 1/4"
WOOD POLE TO H.H. ---------- AS INDICATED
PEDESTAL TO H.H. ---------- 1-3" & 1-1 1/4"
SUPPORT POST TO H.H. ---------- 1-1 1/4"

CONTROLLER TO H.H. SHALL BE 3-4" D.B., 1-3" D.B. & 1-1 1/4" D.B. (CAP 1-3" CONDUIT IN H.H. & CABINET FOR R.C.O.C. USE ONLY)



NOTES:
1. INSTALL 1-1 1/4" D.B. CONDUIT FROM NEW SUPPORT POST TO H.H.
2. EXACT LOCATIONS FOR SUPPORT POSTS SHALL BE DETERMINED BY THE ENGINEER.
3. SEE DETAIL GRADING SHEETS FOR SIDEWALK DETAIL GRADES. COORDINATE SIDEWALK AND SIGNAL CONSTRUCTION.
4. ALL PUSHBUTTON SUPPORT POSTS, PEDESTALS AND MAST ARM POLES WITH PUSHBUTTONS SHALL BE 18" (NOMINAL) OFF WALK.

APPROACH SPEEDS:
N.BD. 45 MPH
S.BD. 45 MPH
E.BD. 45 MPH
W.BD. 45 MPH

FINAL PLAN

SCALE: 1"=30' (11"X17")

OHM

ROAD COMMISSION for OAKLAND COUNTY
BEVERLY HILLS, MICHIGAN
PHONE 877-963-4624 WEB WWW.ROCOMI.ORG

PROJECT NO.	SOUTH BLVD. SIGNAL FINAL PLAN	DESIGN PHASE
53071	DEQUINDRE ROAD	FINAL
DATE	BURNINGBUSH ROAD TO UTICA ROAD	SHEET NO.
02/19/2016		234 OF 287

CO. 483
ATS 1115

CONTROL SECTION EDCF 63544
MDOT JOB NO. 129601A

PROJECT NAME: DEQUINDRE ROAD
BURNINGBUSH ROAD TO UTICA ROAD

PROJECT NO. 53071
ENGINEER. SQUAD #1

P:\9188_OCC\2017\150030_DEQUINDRE_SIGNALS_AND_RAMPS\DRAWINGS\SIGNALS\150030SIG_FINAL Feb. 28, 16 - 8:52 AM

OAKLAND COUNTY ROAD COMMISSION
TRAFFIC - SAFETY DEPARTMENT
SIGNAL WORK ORDER

LOCATION: John R & South Blvd. DATE: 10-28-19

CITY/TOWNSHIP: Troy BY: T CREECH

COUNTY#: 537 STATE#: — CHARGES: 88 54181 1 (Materials)
54181.0981 (Labor

PLEASE PERFORM THE FOLLOWING:

_____ ELECTRICAL DEVICE: ____ INSTALL _____ MODERNIZE _____ MAINTENANCE

_____ UNDERGROUND: _____

_____ EDISON OK: _____ YES _____ NO JOB#: _____

_____ COORDINATE W/DISTRICT 7: _____

DIAL..	1	1	1	1		2	2	2	2		3	3	3	3		4	4	4	4
SPLIT.	1	2	3	4		1	2	3	4		1	2	3	4		1	2	3	4
_____ CHANGE TIMING.....																			
_____ CHANGE OFFSET.....																			
_____ CHANGE CYCLE LENGTH.....																			
_____ ADD DIAL/SPLIT.....																			

RECEIVED
BY ROAD COMMISSION FOR
OAKLAND COUNTY
NOV 5 2019
TRAFFIC OPERATIONS

X CHANGE BREAKOUT OR EPROM: Change Pers → REV 4

_____ CHANGE HOURS OF OPERATION: (Going to Final)

OLD: _____

NEW: _____

_____ REPROGRAM TBC

_____ INSTALL INTERCONNECT: _____ TBC _____ MINITROL _____ TONE

_____ MBT OK: _____ YES _____ NO

_____ NO CHANGE - RECORD CORRECTION

X OTHER: Meet Contractor on Wednesday 10-30 @ 9 AM.
See attached for cabinet changes sheet. Requires CSUM change.
(REV 4). * MMU CARD CHANGES & MMU CHANGES *

APPROVED BY: _____ DATE: 10/28/19

DATE INSTALLED: 11/1/19

INSTALLED BY: _____

Cabinet Changes – CO 537 rev 4

Load Switches – Per Paperwork

Add LS 1,5,7,9,10,11,12,13,14,15,16

Field Wiring – Hook up per Paperwork

Hook up SB John R LT & WB South Blvd RT on LS1.
Hook up NB John R LT & EB South Blvd RT on LS5.
Hook up WB South Blvd LT & NB John R RT on LS 7.
Hook up NB John R Ped East on LS9.
Hook up WB South Blvd Ped North on LS10.
Hook up SB John R Ped West on LS11.
Hook up EB South Blvd Ped South on LS12.
Hook up SB John R LT (OLA) on LS13.
Hook up EB South Blvd LT (OLB) on LS14.
Hook up NB John R LT (OLC) on LS15.
Hook up WB South Blvd LT (OLD) on LS16.

Unhook NB John R 4th level LTGA off LS 2.
Unhook EB South Blvd 4th level LTGA off LS3.
Unhook SB John R 4th level LTGA off LS6.

Flash Program – Wire per Paperwork

Wire LS 1, 3, 5, 7, 9, 10, 11, 12 for NO FLASH.
Wire LS 2, 4, 6, 8, 13, 14, 15, 16 for FLR.

MMU – Per Paperwork

Program MMU per paperwork.

INTERSECTION :- 537 JOHN R & SOUTH BLVD
DESCRIPTION PROMS :- X00020R / F4808
CONTROLLER TYPE :- STANDARD PERSONALITY CONTROLLER
SOFTWARE TYPE :- MOD 52 SCATS S30 (**TS2**)
INPUTS :-

1. WB SOUTH BLVD LT (NL)
2. WB SOUTH BLVD LT ADV (NL)
3. WB SOUTH BLVD (LK)
4. WB SOUTH BLVD RT (LK)
5. SB JOHN R LT (NL)
6. SB JOHN R LT ADV (NL)
7. SB JOHN R (LK)
8. SB JOHN R RT (LK)
9. EB SOUTH BLVD LT (NL)
10. EB SOUTH BLVD LT ADV (NL)
11. EB SOUTH BLVD (LK)
12. EB SOUTH BLVD RT (LK)
13. NB JOHN R LT (NL)
14. NB JOHN R LT ADV (NL)
15. NB JOHN R (LK)
16. NB JOHN R RT (LK)

NOTE: ALL DETECTORS ARE AUTOSCOPE (RACKVISION W/AIS-IV CAMERAS)

Opticom 1: TB2 PREEMPT INPUT 3 (CALLS NB & SB JOHN R).
Opticom 2: TB2 PREEMPT INPUT 4 (CALLS EB & WB SOUTH BLVD).

PED 2: NB JOHN R PED EAST P.B. (WA)
PED 4: WB SOUTH BLVD PED NORTH P.B. (WB)
PED 6: SB JOHN R PED WEST P.B. (WC)
PED 8: EB SOUTH BLVD PED SOUTH P.B. (WD)

APPROACHES :-

A APPR 1 : SB JOHN R	A APPR 2 : NB JOHN R
B APPR 1 : EB SOUTH BLVD LT	B APPR 2 : WB SOUTH BLVD LT
C APPR 1 : EB SOUTH BLVD	C APPR 2 : WB SOUTH BLVD
D APPR 1 : SB JOHN R LT	D APPR 2 : NB JOHN R LT

FLEXIDATA:-

SEQUENCE	A,B,C,D	A,B,C,D
AUTO REL		
R- REL	A	A
R+ REL	B	B
Q- REL	C	C
Q+ REL	D	D
LOOKAHEAD		

PEDESTRIANS:-

1. -
2. NB JOHN R PED EAST P.B.
3. -
4. WB SOUTH BLVD PED NORTH P.B.
5. -
6. SB JOHN R PED WEST P.B.
7. -
8. EB SOUTH BLVD PED SOUTH P.B.

SPECIAL FEATURES :-

Controller Software must be 2070/M52 S30 or later (VC=5).
The personality revision number is currently 4 (=D).

Ped outputs mapped to phases as follows: ped 2 = 9, ped 4 = 10, ped 6 = 11 and ped 8 = 12. VC5 software reports them as mapped.

Left turns are permissive to NCHRP flashing yellow recommendation. Signal groups 13,14,15,16 provide flashing yellow (green aspect), yellow and red, i.e. upper aspects of 4 section turn display. Signal groups 1,3,5,7 provide the green (bottom) aspect, i.e. turn arrow.

A STAGE HAS A PERMANENT DEMAND. DEMAND FOR STAGES B, C, D IN FLEXI AND ISOLATED. SET XSF8 (XL Value = 80) TO DISABLE.

Night Flash code: Set Y+ to activate the night flash in Flexilink
Signal Group 1 and 5 non-locked detectors will not call stage D directly.
If XSF7 is set signal Group 1 and 5 detectors will call stage C and then stage D.

IN MASTERLINK AND FLEXILINK:
Z- ON CAUSES D1 TURN TO APPEAR AND HOLD IN D STAGE
Z+ ON CAUSES D2 TURN TO APPEAR AND HOLD IN D STAGE
Z- & Z+ ON CAUSES BOTH TURNS TO APPEAR AND HOLD IN D
XSF09 (XH Value = 01) sets MAX recall for SG1 left turn.
XSF10 (XH Value = 02) sets min recall for SG1 left turn.
XSF11 (XH Value = 04) sets MAX recall for SG3 left turn.
XSF12 (XH Value = 08) sets min recall for SG3 left turn.
XSF13 (XH Value = 10) sets MAX recall for SG5 left turn.
XSF14 (XH Value = 20) sets min recall for SG5 left turn.
XSF15 (XH Value = 40) sets MAX recall for SG7 left turn.
XSF16 (XH Value = 80) sets min recall for SG7 left turn.

B1-C O/L OR B2-C O/L MAY APPEAR IN B1 OR B2 RESPECTIVELY
HOWEVER IF THE OVERLAP TERMINATES IN B THEN THE C AMBER
AND C RED TIMES ARE USED FOR B STAGE

Set BT = nS in SCATS data to enable Z5 flag in B stage to C.
This allows termination of o/lap phase minimum timer if the appropriate phase o/lap is to occur and C is next, otherwise phase minimum is guaranteed by phase minimum timer.

Flash rate for FYA is set with Timesettings 28 and 29.
TSM28=0.6 (on rate), TSM29=0.4 (off rate)

BACKPANEL :- SIZE P44-16 **TS2** CABINET

LOAD SWITCH 1:	SB JOHN R LT & WB SOUTH BLVD RT	CL & BR	-
	G: SB LT green arrow and WB RT green arrow		
	Y: WB RT yellow arrow		
LOAD SWITCH 2:	NB JOHN R	A	FLR
LOAD SWITCH 3:	EB SOUTH BLVD LT & SB JOHN R RT	DL & CR	-
	G: EB LT green arrow		
	Y: SB RT yellow arrow		
LOAD SWITCH 4:	WB SOUTH BLVD	B	FLR
LOAD SWITCH 5:	NB JOHN R LT & EB SOUTH BLVD RT	AL & DR	-
	G: NB LT green arrow		
	Y: EB RT yellow arrow		
LOAD SWITCH 6:	SB JOHN R	C	FLR
LOAD SWITCH 7:	WB SOUTH BLVD LT & NB JOHN R RT	BL & AR	-
	G: WB LT green arrow		
	Y: NB RT yellow arrow		
LOAD SWITCH 8:	EB SOUTH BLVD	D	FLR
LOAD SWITCH 9:	NB JOHN R PED EAST	WA	
LOAD SWITCH 10:	WB SOUTH BLVD PED NORTH	WB	
LOAD SWITCH 11:	SB JOHN R PED WEST	WC	
LOAD SWITCH 12:	EB SOUTH BLVD PED SOUTH	WD	
LOAD SWITCH 13(OLA):	SB JOHN R LT	CL	FLR
	G: flashing yellow arrow, Y: yellow arrow, R: red arrow		
LOAD SWITCH 14(OLB):	EB SOUTH BLVD LT	DL	FLR
	G: flashing yellow arrow, Y: yellow arrow, R: red arrow		
LOAD SWITCH 15(OLC):	NB JOHN R LT	AL	FLR
	G: flashing yellow arrow, Y: yellow arrow, R: red arrow		
LOAD SWITCH 16(OLD):	WB SOUTH BLVD LT	BL	FLR
	G: flashing yellow arrow, Y: yellow arrow, R: red arrow		

MMU 2 :- (MENU : SET/VIEW CONFIG)

Field Check Enable	Channel 1: G Channel 2: G, Y, R Channel 3: G Channel 4: G, Y, R Channel 5: G Channel 6: G, Y, R Channel 7: G Channel 8: G, Y, R Channel 13: G, Y, R Channel 14: G, Y, R Channel 15: G, Y, R Channel 16: G, Y, R
Dual Indication Enable:	R+G: Channel 2,4,6,8,13,14,15,16 R+Y: Channel 2,4,6,8,13,14,15,16 G+Y: Channel 1,2,3,4,5,6,7,8,13,14,15,16
Red Fail Enable:	Enable: Channel 2,4,6,8,13,14,15,16
Y & R Clearance Disable:	Channel 2,4,6,8,13,14,15,16 Enabled
Flashing Yellow Arrow:	Select mode B Enable: Channel Pair 1-13,3-14,5-15,7-16
Unit Options:	All OFF except: Recurrent pulse LED Guard Program Memory Card
Program Card:	Compatible Channels: 1-5, 1-6, 1-11, 1-13, 1-15, 2-5, 2-6, 2-9, 2-11, 2-13, 2-15, 3-7, 3-8, 3-12, 3-14,3-16, 4-7, 4-8, 4-10, 4-12, 4-14, 4-16, 5-9, 5-13, 5-15, 6-9, 6-11, 6-13, 6-15, 7-10, 7-14, 7-16, 8-10, 8-12, 8-14, 8-16, 9-11, 9-13, 9-15, 10-12, 10-14, 10-16, 11-13, 11-15, 12-14, 12-16, 13-15, 14-16. Min Flash Time: 4+2+1 Min Yellow Change Disable: 9,10,11,12 Voltage Monitor Latch: NONE

Note :- Add Jumper 16 MMU Flash - 116 Monitor ST Out

```
*********************************
* CONTROLLER INFORMATION SHEET *
*     FOR SITE NO. 537         *
*          T CREECH            *
*        28-Oct-2019           *
*********************************
```

CHECKSUMS
TIMES 3C / 074
PERS 9D / 235
TOTAL A1 / 241

FLEXILINK PLAN DATA

Intersection # 537 **State #** _____ **Date:** 10/28/19 **Prepared By:** T. Creech

Intersection: John R & South Blvd **City:** Troy

Hours of Operation: 7 Days: 24 Hours **Approved By:** R. Jones

Hours of Flashing: None

		PL0	PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8
0	CL		80	120	120					
1	A		0	0	0					
2	B		33	54	54					
3	C		45	70	70					
4	D		68	104	104					
5	E									
6	F									
7	G									
8	R-									
9	R+									
10	Of (Y-)		40	100	100					
11	Y+	C								
12	Z-									
13	Z+									
14	Q-									
15	Q+									
16	XH									
17	XL									

NOTE: Stages with 1 second of phase time are skipped. Blank entries are default values equal to 0.
Except for an AWA controller, entries #8 to #15 (=254) and 'C' entry means continuous (=255).

							Timers		
Phase	**Direction**	**Min**	**Max**	**ECO**	**Amber**	**All Red**	**Gap**	**Hdwy**	**Waste**
A	John R	10.0	40.0		4.3	1.7	3.0	1.2	10.0
B	South Blvd LT	4.0	15.0		4.3	1.7	3.0	1.2	10.0
C	South Blvd	10.0	40.0		4.3	1.7	3.0	1.2	10.0
D	John R LT	4.0	15.0		4.3	1.7	3.0	1.2	10.0
E									
F									
G									

	Day	Hours	Plan#
SC1	8	6:00	2
SC2	8	9:00	1
SC3	8	15:00	3
SC4	8	19:00	1
SC5	14	0:00	1
SC6			
SC7			
SC8			
SC9			
SC10			

Pedestrian Crossing Times

Direction	Walk	CL 1	CL 2
NB John R Ped East (Ped 2)	7.0	10.0	3.0
WB South Blvd Ped North (Ped 4)	7.0	10.0	3.0
SB John R Ped West (Ped 6)	7.0	10.0	3.0
EB South Blvd Ped South (Ped 8)	7.0	10.0	3.0

Flash Rate Timesettings TSM28=0.6 (on rate); TSM29=0.4 (off rate)
TSM15 = Opticom Min Alarm Time = 10
TSM16 = Opticom Max Alarm Time = 120

Normal Operating Mode

Isolated	Flexilink	Masterlink	Master Isolated	Flexi Isolated
		X		

DAY OF WEEK CODE NUMBER

0	End of Schedule	4	WED	8	MON-FRI	12	MON,FRI,SAT
1	SUN	5	THUR	9	MON-SAT	13	SAT,SUN
2	MON	6	FRI	10	TUE,WED,THU	14	EVERY DAY
3	TUE	7	SAT	11	MON,FRI	15	NEVER

TS2 Autoscope AIS-IV Cameras

CO#537 - JOHN R & SOUTH BLVD

Camera #	Rack Select Switch Position / Detector BIU	Input/Output LED	Description	Detector Number on Print	Phase
1	1	1	WB SOUTH BLVD LT	1	7
1	1	2	WB SOUTH BLVD LT ADV	2	7
1	1	3	WB SOUTH BLVD	3	4
1	1	4	WB SOUTH BLVD RT	4	4
2	1	5	SB JOHN R LT	5	1
2	1	6	SB JOHN R LT ADV	6	1
2	1	7	SB JOHN R	7	6
2	1	8	SB JOHN R RT	8	6
3	1	9	EB SOUTH BLVD LT	9	3
3	1	10	EB SOUTH BLVD LT ADV	10	3
3	1	11	EB SOUTH BLVD	11	8
3	1	12	EB SOUTH BLVD RT	12	8
4	1	13	NB JOHN R LT	13	5
4	1	14	NB JOHN R LT ADV	14	5
4	1	15	NB JOHN R	15	2
4	1	16	NB JOHN R RT	16	2
	2	17		17	
	2	18		18	
	2	19		19	
	2	20		20	
	2	21		21	
	2	22		22	
	2	23		23	
	2	24		24	

Input / Output Indicators

TS2 Rack Select Switch Position 1 - Detectors 1-16
TS2 Rack Select Switch Position 2 - Detectors 17-32
TS2 Rack Select Switch Position 3 - Detectors 33-48
TS2 Rack Select Switch Position 4 - Detectors 49-64
TS2 Rack Select Switch Position 5 - Red Phases
TS2 Rack Select Switch Position 6 - Green Phases
TS2 Rack Select Switch Position 7-10 - All OFF

MVP Status LEDs

TS2 Rack Select Switch Position 1-7 - Cameras 1-4
TS2 Rack Select Switch Position 8 - Cameras 5-8
TS2 Rack Select Switch Position 9-10 - NOT USED

AutoScope Detection Camera - IP Port Worksheet

Site: 537 John R & South Blvd

WWAN IP: 10.32.144.218

AutoScope Property Editor // Communications Tab

	Camera #1	Camera #2	Camera #3	Camera #4
Network Address:	10.32.45.164	10.32.45.165	10.32.45.166	10.32.45.167
Subnet Mask:	255.255.255.240	255.255.255.240	255.255.255.240	255.255.255.240
Default Gateway:	10.32.45.161	10.32.45.161	10.32.45.161	10.32.45.161

AutoScope Property Editor // Advanced Comm Tab

Supervisor IP Port (54321):	56011	56021	56031	56041
Detector IP Port (54322):	56012	56022	56032	56042
Video Streaming IP Port (554):	56013	56023	56033	56043
Web IP Port (80):	56014	56024	56034	56044
Traffic Data IP Port (54323):	56015	56025	56035	56045

AutoScope Property Editor // Communications Tab

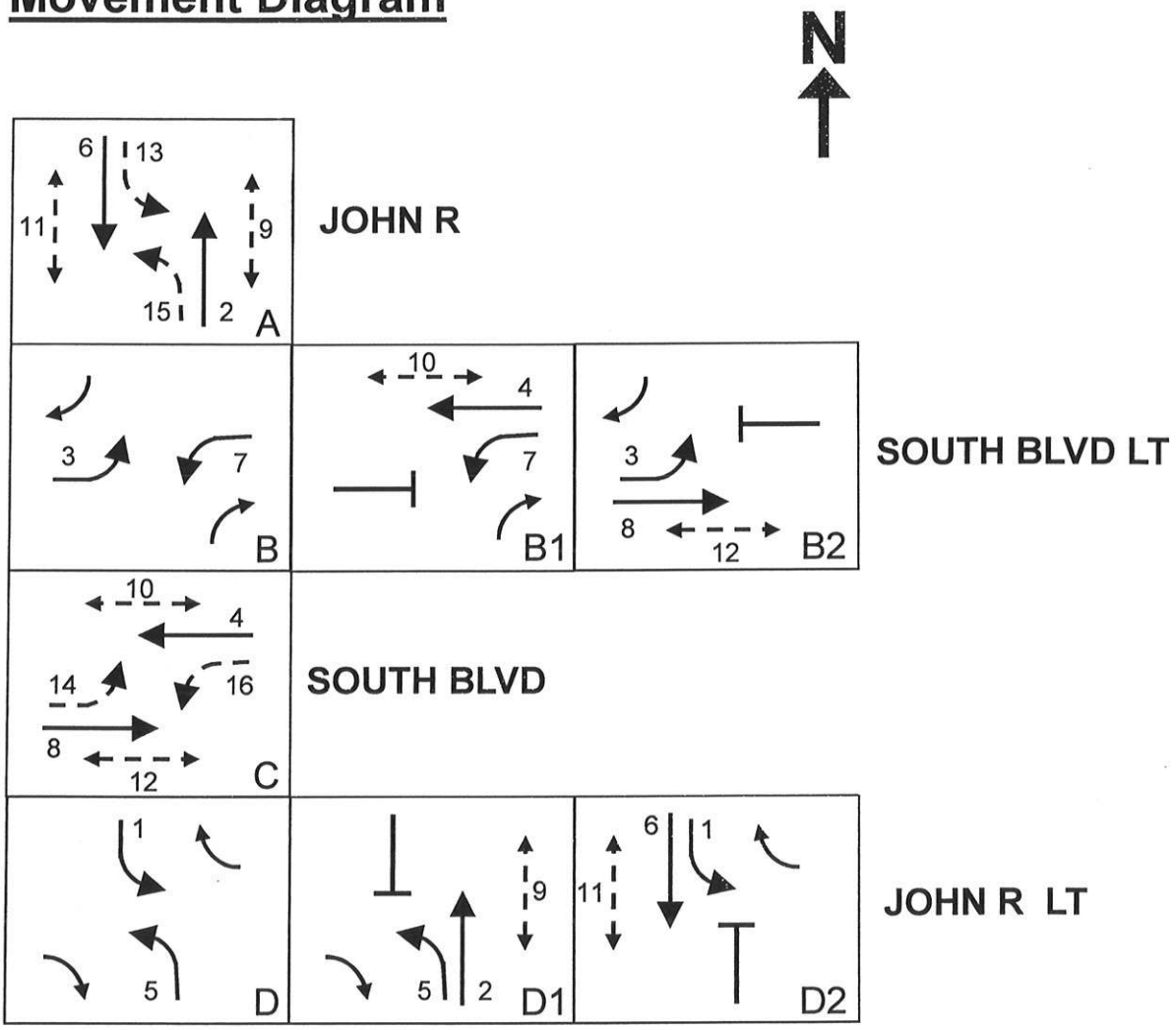
	Camera #5	Camera #6	Camera #7	Camera #8
Network Address:	10.32.45.168	10.32.45.169	10.32.45.170	10.32.45.171
Subnet Mask:	255.255.255.240	255.255.255.240	255.255.255.240	255.255.255.240
Default Gateway:	10.32.45.161	10.32.45.161	10.32.45.161	10.32.45.161

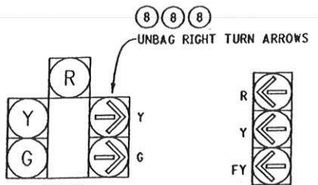
AutoScope Property Editor // Advanced Comm Tab

Supervisor IP Port (54321):	56051	56061	56071	56081
Detector IP Port (54322):	56052	56062	56072	56082
Video Streaming IP Port (554):	56053	56063	56073	56083
Web IP Port (80):	56054	56064	56074	56084
Traffic Data IP Port (54323):	56055	56065	56075	56085

#537 – JOHN R & SOUTH BLVD

- **Movement Diagram**



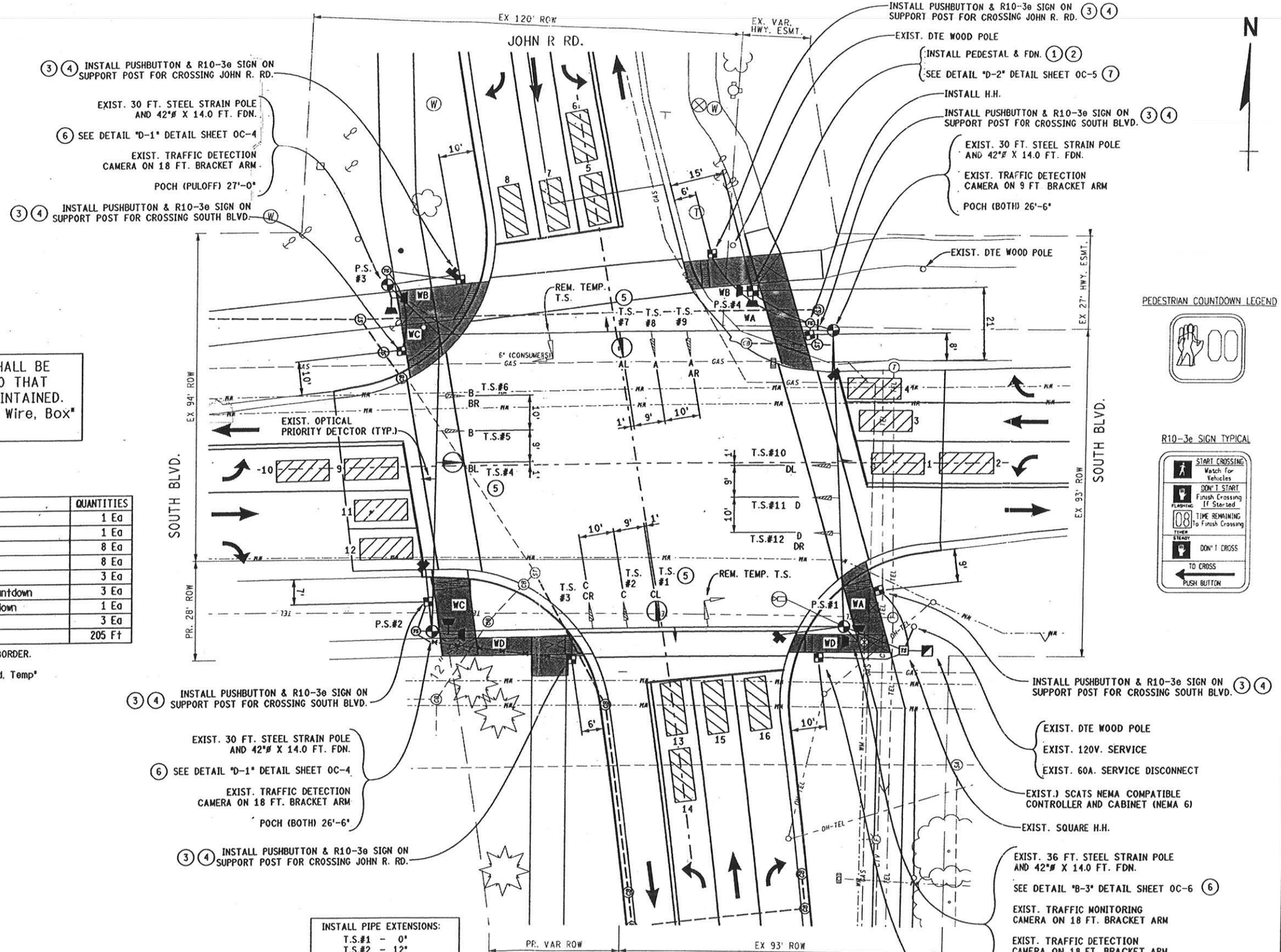


ALL SPAN WIRE POLE CONTACT HEIGHTS SHALL BE COORDINATED WITH THE FIELD ENGINEER SO THAT A MINIMUM 17 FT. UNDERCLEARANCE IS MAINTAINED. (INCLUDED IN THE INSTALLATION OF "Span Wire, Box" ON THIS CONTRACT.)

NO.	ITEM	QUANTITIES
(1)	Pedestal, Alum	1 Ea
(2)	Pedestal, Fdn	1 Ea
(3)	Pushbutton and Sign	8 Ea
(4)	Pushbutton Support Post, RCOC	8 Ea
* (5)	TS, One Way Span Wire Mtd, FYA (LED)	3 Ea
(6)	TS, Pedestrian, Two Way Bracket Arm Mtd (LED) Countdown	3 Ea
(7)	TS, Pedestrian, Two Way Pedestal Mtd (LED) Countdown	1 Ea
(8)	TS Face, Bag, Rem	3 Ea
◯	Conduit, DB, 1, 1 1/4 inch	205 Ft

* SHALL BE PROVIDED WITH BACKPLATE WITH RETROREFLECTIVE BORDER.

PAYMENT FOR REMOVAL OF TEMP T.S. IS INCLUDED IN "TS Head, Temp"



PEDESTRIAN COUNTDOWN LEGEND

R10-3e SIGN TYPICAL

INSTALL PIPE EXTENSIONS:

T.S.#1	0"
T.S.#2	12"
T.S.#3	12"
T.S.#4	0"
T.S.#5	12"
T.S.#6	12"
T.S.#7	0"
T.S.#8	12"
T.S.#9	12"
T.S.#10	0"
T.S.#11	12"
T.S.#12	12"

APPROACH SPEEDS:

N.BD.	45 MPH
S.BD.	45 MPH
E.BD.	45 MPH
W.BD.	45 MPH

CONDUIT TYPICALS:

STEEL POLE TO H.H. — — — —3-3" & 1-1 1/4"
WOOD POLE TO H.H. — — — —AS INDICATED
PEDESTAL TO H.H. — — — —1-3" & 1-1 1/4"
CONTROLLER TO H.H. — — — —AS INDICATED
SUPPORT POST TO H.H. — — — —1-1 1/4"

NOTES:
1. INSTALL 1-1 1/4" D.B. CONDUIT FROM THE NEW SUPPORT POSTS TO H.H.
2. EXACT LOCATIONS FOR SUPPORT POSTS SHALL BE DETERMINED BY THE ENGINEER.
3. SEE DETAIL GRADING SHEETS FOR SIDEWALK DETAIL GRADES. COORDINATE SIDEWALK AND SIGNAL CONSTRUCTION.
4. EXACT LOCATION OF VEHICLE DETECTORS SHALL BE DETERMINED BY THE ENGINEER.

FINAL PLAN
SCALE: 1"=30' (11"X17")

CO. 537
ATS 1186

OHM
ARCHITECTS ENGINEERS PLANNERS
34000 PLYMOUTH ROAD
LIVONIA, MI 48150
P: 734.522.6711
OHM-ADVISORS.COM

TROY MICHIGAN
ROCHESTER HILLS MICHIGAN
ROAD COMMISSION FOR OAKLAND COUNTY

REVISIONS: DESCRIPTION	DATE

DATE	JOB NUMBER	ENG.	PROJ MGR	CADD	COUNTY	CONTROLLING TOWNSHIP	HORIZ DATUM	VERT DATUM
09/02/2016	1332124	KR	SC	DM	OAKLAND	CITIES OF TROY & ROCHESTER HILLS	NAD83	NAVD88

SCALE: 1"

CITY OF TROY, CITY OF ROCHESTER HILLS, & ROAD COMMISSION FOR OAKLAND COUNTY
JOHN R ROAD

TRAFFIC SIGNAL CONSTRUCTION PLAN

SHEET 268 of 308

OAKLAND COUNTY ROAD COMMISSION
TRAFFIC - SAFETY DEPARTMENT
SIGNAL WORK ORDER

DEC - 6 2016

LOCATION: S. Blvd & M-59 EB OFF Ramp DATE: 9/19/16

CITY/TOWNSHIP: Rochester Hills BY: E Labiano

COUNTY#: 4314 STATE#: 63043-01-109 CHARGES: WO 170977

PLEASE PERFORM THE FOLLOWING:

_____ ELECTRICAL DEVICE: ____ INSTALL _____ MODERNIZE _____ MAINTENANCE

_____ UNDERGROUND: _____

_____ EDISON OK: _____ YES _____ NO JOB#: _____

_____ COORDINATE W/DISTRICT 7: _____

DIAL..	1	1	1	1		2	2	2	2		3	3	3	3		4	4	4	4
SPLIT.	1	2	3	4		1	2	3	4		1	2	3	4		1	2	3	4
_____ CHANGE TIMING.....																			
_____ CHANGE OFFSET.....																			
_____ CHANGE CYCLE LENGTH.....																			
_____ ADD DIAL/SPLIT.....																			

X CHANGE BREAKOUT OR EPROM: Rev 2 (Flexi changes & Ped 2 added)

_____ CHANGE HOURS OF OPERATION:

OLD: _____

NEW: _____

_____ REPROGRAM TBC

_____ INSTALL INTERCONNECT: _____ TBC _____ MINITROL _____ TONE

_____ MBT OK: _____ YES _____ NO

_____ NO CHANGE - RECORD CORRECTION

X OTHER: Requires a checksum change.
Add L.S. 13 and Hook up to Ped 2.
Add Jumpers: A28-A29; A34-A35; B52-B53
INSTALL PB EQUIPMENT.

APPROVED BY: _____ DATE: 12/1/16

DATE INSTALLED: 12/2/16

INSTALLED BY: Jordan

INTERSECTION :- 4314 M-59 EB OFF RAMP & SOUTH BLVD
DESCRIPTION PROMS :- X04314 / F2003
SOFTWARE :- MOD 52 SCATS
INPUTS :-

1. EB SOUTH BLVD L (LK)
2. EB SOUTH BLVD R (LK)
3. WB SOUTH BLVD L (LK)
4. WB SOUTH BLVD R (LK)
5. M-59 EB OFF RAMP L (LK)
6. M-59 EB OFF RAMP C (LK)
7. M-59 EB OFF RAMP R (LK)

NOTE : ALL DETECTORS ARE AUTOSCOPE (SOLO CAMERAS)

PED 2: WB SOUTH BLVD PED NLEG (WA) P.B.

APPROACHES :-
A APP 1 : WB SOUTH BLVD L,R
A APP 2 : EB SOUTH BLVD L,R
B APP 1 : M-59 EB OFF RAMP L,C,R

FLEXIDATA :-

SEQUENCE	A,B	A,B
AUTO REL		
R- REL	A	A
R+ REL	B	B
Q- REL		
Q+ REL		

PEDESTRIANS :-
1. NO PED 1
2. WB SOUTH BLVD NLEG PED (P-)
3. NO PED 3
4. NO PED 4
5. NO PED 5
6. NO PED 6
7. NO PED 7
8. NO PED 8

SPECIAL FEATURES :-
Personality revision is 2 (=B).
A Stage has a permanent demand.
B stage has demand set in flexi and isol, set ZNEG to disable.
Ped output mapped to phases as follows: ped 2 = 18.
VC5 software reports them as mapped.
Pedestrian has an automatic introduction using SCATS Y-.

Backpanel P44-16 Cabinet:

Load Switch 2	WB South Boulevard	A	FL A
Load Switch 4	EB M-59 OFF RAMP B	B	FL R
Load Switch 6	EB SOUTH BOULEVARD	C	FL A
Load Switch 13:	NB Dequindre ELEG Ped	WA	

JUMPERS:
A28-A29; A34-A35; B52-B53; C52-PB10, C56-PB10, D22-D26, D52-PB10, D56-PB10, 8RED-PB9, 9RED-PB9,10RED-PB9, 11RED-PB9, 12RED-PB9.

SIGNAL MONITOR: 2-6
ALL SWITCHES OFF EXCEPT DUAL SELECT A & B, GY ENABLE, SSM 2,4,6
MIN. FLASH = 4 + 2 + 1

```
*********************************
* CONTROLLER INFORMATION SHEET *
*     FOR SITE NO. 4314        *
*          E LABIANO           *
*        16-SEPT-2016          *
*********************************
```

CHECKSUMS:
TI: C9/311
PERS: DA/332
TOTAL: 13/23

FLEXILINK PLAN DATA

Intersection # 4314 **State #** 63043-01-109 **Date:** 09/19/16 **Prepared By:** E LABIANO

Intersection: South Blvd & M-59 EB Off Ramp **City:** Rochester Hills

Hours of Operation: 7 Days: 24 Hours **Approved By:** Rachel Jones

Hours of Flashing: None

		PL0	PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8
0	CL		90	120	130	80				
1	A		0	0	0	0				
2	B		55	75	78	35				
3	C									
4	D									
5	E									
6	F									
7	G									
8	R-									
9	R+									
10	Of (Y-)		78	79	67	39				
11	Y+	C								
12	Z-									
13	Z+									
14	Q-									
15	Q+									
16	XH									
17	XL									

NOTE: STAGES WITH ONE SECOND PHASE TIMES ARE SKIPPED
BLANK ENTRIES ARE DEFAULT VALUES = 0 FOR ENTRIES #0 - #7, #16 - #17
254 FOR ENTRIES #8 - #15 'C' ENTRY MEANS CONTINOUS = 255

							Timers		
Phase	**Direction**	**Min**	**Max**	**ECO**	**Amber**	**All Red**	**Gap**	**Hdwy**	**Waste**
A	South Blvd	10.0	40.0		4.3	2.7	3.0	1.2	10.0
B	M-59 EB Off Ramp	10.0	40.0		3.0	3.7	3.0	1.2	10.0
C									
D									
E									
F									
G									

	Day	Hours	Plan#
SC1	8	5:00	2
SC2	8	10:00	1
SC3	8	15:00	3
SC4	8	20:00	1
SC5	13	5:00	1
SC6	13	20:00	4
SC7	14	0:00	4
SC8			
SC9			
SC10			

Pedestrian Crossing Times

Direction	Walk	CL 1	CL 2
WB S. Blvd N LEG PED	7.0	19.0	4.0

Normal Operating Mode

Isolated	Flexilink	Masterlink	Master Isolated	Flexi Isolated
		X		

DAY OF WEEK CODE NUMBER

0	End of Schedule	4	WED	8	MON-FRI	12	MON,FRI,SAT
1	SUN	5	THUR	9	MON-SAT	13	SAT,SUN
2	MON	6	FRI	10	TUE,WED,THU	14	EVERY DAY
3	TUE	7	SAT	11	MON,FRI	15	NEVER

Autoscope SOLO

Mini-Hub II Detector Port Master
Front Panel Input/Output Pin Assignment

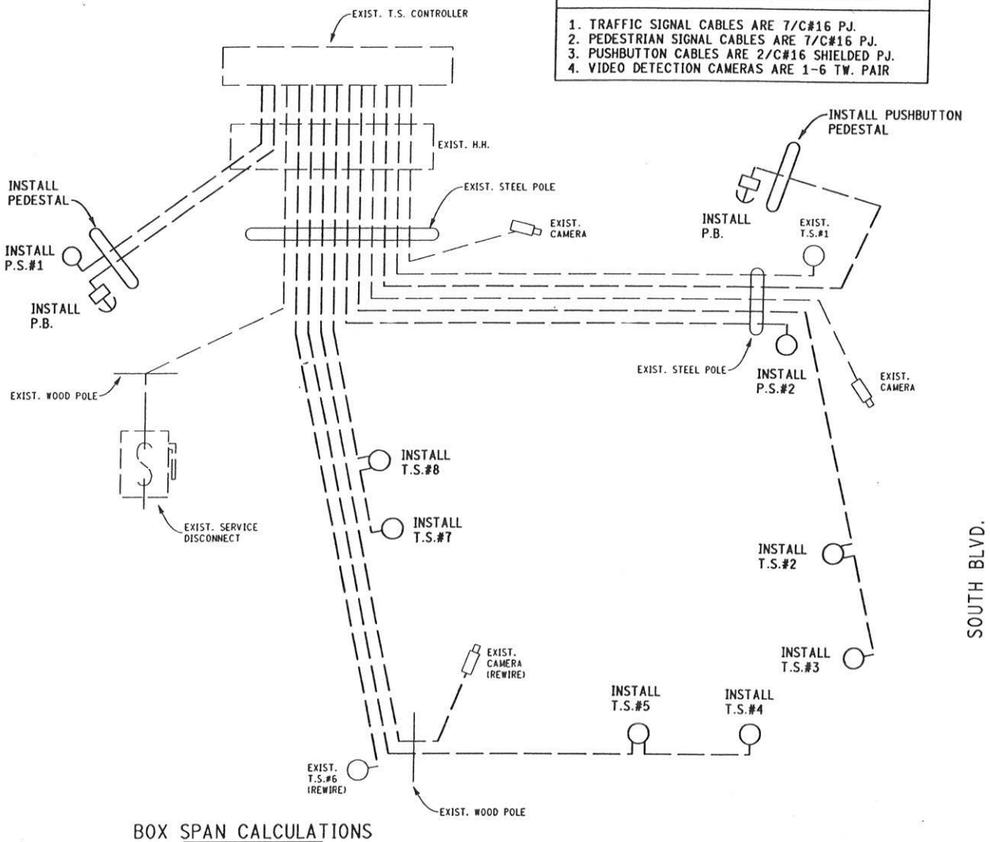
The Mini-Hub II has inputs and outputs available through the front panel Input/ Output connector and through the back edge connector. The pin assignments for the Mini-Hub II front connector are listed in the following table. Edge connector pins are identified by NUMBER on the component (front) side of the board. Edge connector pins are identified by LETTER on the backside of board.

Cam #	Mini-Hub II conn.	Edge conn.	Front Harness	Description	D-Conn. Term #	D- Conn. Detector Descript.	On Print Detector number	Phase
1	Output 1 LED	F	1	EB South Blvd. L	1	Det 9	1	6
1	Output 2 LED	W	14	EB South Blvd R	2	Det 10	2	6
2	Output 3 LED	S	2	WB South Blvd L	3	Det 11	3	2
2	Output 4 LED	Y	15	WB South Blvd R	4	Det 12	4	2
3	Output 5 LED	(JP1)4	3	M-59 EB OFF RAMP (L)	5	Det 13	5	4
3	Output 6 LED	(JP7)5	16	M-59 EB OFF RAMP (C)	6	Det 14	6	4
3	Output 7 LED	(JP2)8	4	M-59 EB OFF RAMP (R)	7	Det 15	7	4
	Output 8 LED	(JP8)9	17					
	Output 9 LED	(JP3)13	5					
	Output 10 LED	(JP9)14	18					
	Output 11 LED	(JP4)17	6					
	Output 12 LED	(JP10)18	19					
	Output 13 LED		7					
	Output 14 LED		20					
	Output 15 LED		8					
	Output 16 LED		21					
	Input 1 LED	(JP5)1	9					
	Input 2 LED	(JP11)2	22	LS 2 RED (C30)				
	Input 3 LED	(JP6)3	10					
	Input 4 LED	(JP12)10	23	LS4 RED (C36)				
	Input 5 LED		11					
	Input 6 LED		24	LS6 RED (D30)				
	Input 7 LED		12					
	Input 8 LED	(withJP14*)	25					

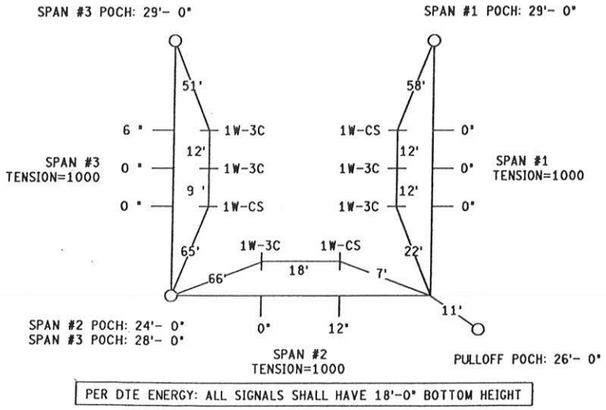
*Input 8 with JP14 inserted becomes 24VDC through Input/ Output Connector on front panel.
Logic Ground is the GREY (pin 13) wire form Input/ Output connector on front panel.

CABLES TO BE USED UNLESS SPECIFIED OTHERWISE

1. TRAFFIC SIGNAL CABLES ARE 7/C#16 PJ.
2. PEDESTRIAN SIGNAL CABLES ARE 7/C#16 PJ.
3. PUSHBUTTON CABLES ARE 2/C#16 SHIELDED PJ.
4. VIDEO DETECTION CAMERAS ARE 1-6 TW. PAIR



BOX SPAN CALCULATIONS
NOT TO SCALE



PER DTE ENERGY: ALL SIGNALS SHALL HAVE 18'-0" BOTTOM HEIGHT

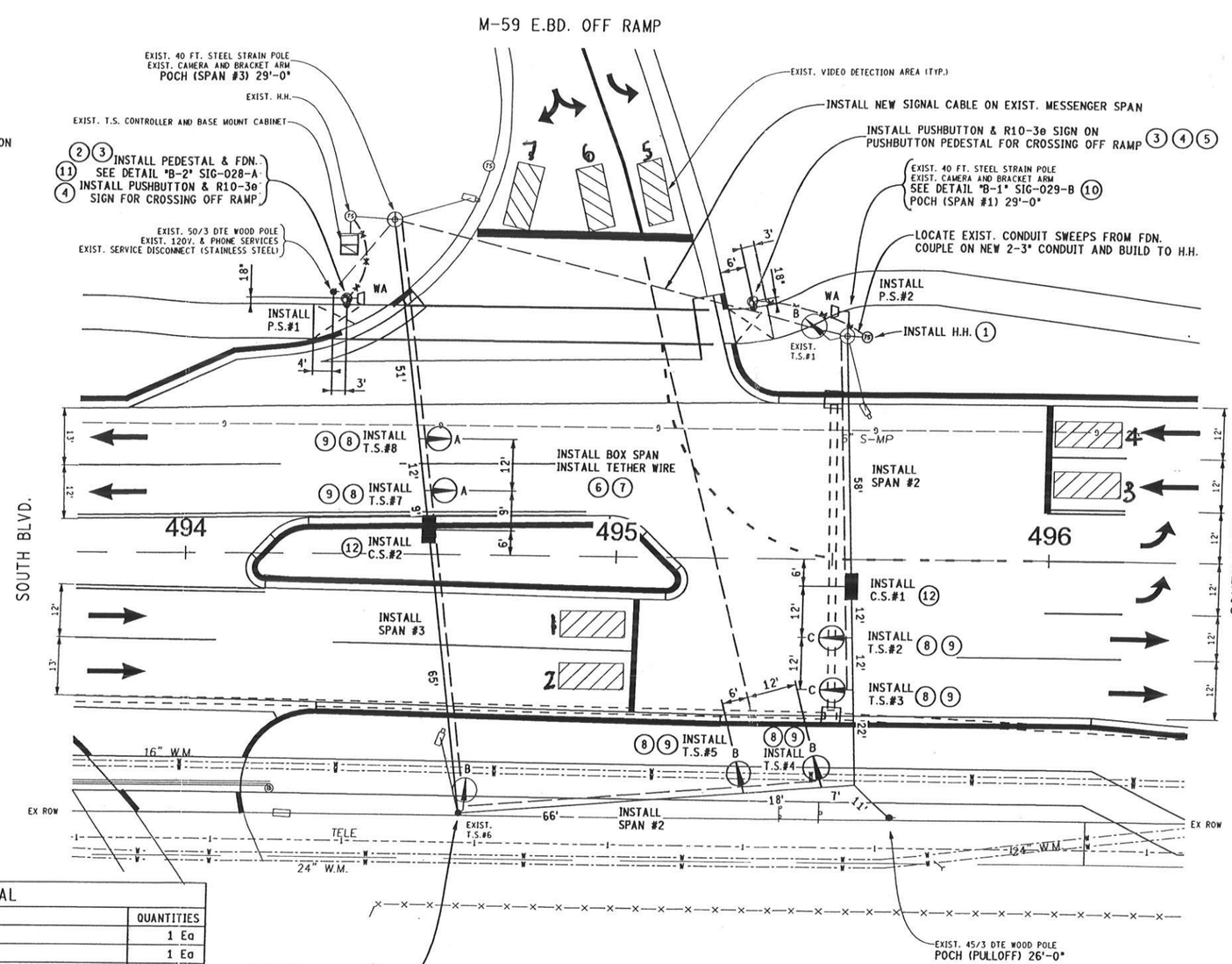
NOTE: REWIRE T.S.#6 AND CAMERA ON S.W. CORNER.

CONDUIT REQUIREMENTS (UNLESS OTHERWISE INDICATED)
PEDESTAL FDN. TO H.H. ——— 1-1 1/2" D.B.

LIST OF MATERIAL

	NO.	ITEM	QUANTITIES
	(1)	Hh, Round	1 Ea
	(2)	Pedestal, Alum	1 Ea
	(3)	Pedestal, Fdn	1 Ea
	(4)	Pushbutton and Sign	2 Ea
	(5)	Pushbutton Pedestal, Alum	1 Ea
	(6)	Span Wire, Box, RCOC	1 Ea
	(7)	Tether Wire, Box, RCOC	1 Ea
	(8)	TS, One Way Span Wire Mtd (LED)	6 Ea
	(9)	Backplate, TS	6 Ea
	(10)	TS, Pedestrian, One Way Bracket Arm Mtd (LED) Countdown	1 Ea
	(11)	TS, Pedestrian, One Way Pedestal Mtd (LED) Countdown	1 Ea
	(12)	Case Sign, One Way, 24 inch by 30 inch, Non-Illuminated, RCOC	2 Ea
	○	Conduit, DB, 1, 1 1/2 inch	50 Ft
	○	Conduit, DB, 2, 3 inch	10 Ft
*	○	Cable, P.J., 600V, 1, 7/C#16	200 Ft
*	○	Cable, Shielded, 300V, 1, 6 Twisted Pair	220 Ft

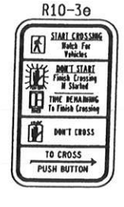
* QUANTITY INCLUDED FOR THE REWIRING OF EXIST. SIGNAL EQUIPMENT



NOTE: ATTACH NEW SPAN WIRES TO EXIST. GUY ANCHORS. (PAYMENT FOR THIS WORK IS INCLUDED IN THE ITEM "Span Wire, Box, RCOC")

NOTE: INSTALLATION OF PUSHBUTTON PEDESTALS SHALL BE COORDINATED WITH THE CONSTRUCTION OF SIDEWALKS. PUSHBUTTON LOCATIONS SHALL MEET CURRENT ADA REQUIREMENTS. SEE DETAIL GRADING SHEETS FOR DETAILED LOCATION.

L.E.D. COUNT DOWN HEAD



INSTALL 1-WAY, 24"X30" NON-ILLUMINATED CASE SIGN C.S.#1

FACING WEST

INSTALL 1-WAY, 24"x30" NON-ILLUMINATED CASE SIGN C.S.#2

FACING EAST

CO. 4314

SIGNALS	
OPENINGS:	26
CYCLIC WATTS:	366
STEADY WATTS:	0
PLAN: 63043-01-109	

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

OHM

MDOT Michigan Department of Transportation

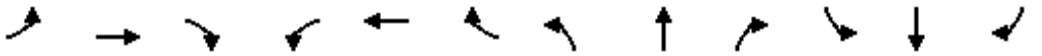
0 HORZ. (FT) 30

63043-01-109	DATE: 02/19/16	CS: EDCF 63544	FINAL PLAN
	DESIGN UNIT: SIGNALS	JN: 129601A	TRAFFIC SIGNAL PLAN SHEET
FILE: 6304301109_STG001.dgn	TSC: OAKLAND		M-59 E.BD. OFF RAMP TO SOUTH BLVD.
			CITY OF ROCHESTER HILLS, OAKLAND COUNTY

DRAWING	SHEET
SIG	SECT 1
001	248

Appendix B

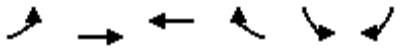
EXISTING TRAFFIC CONDITIONS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	148	274	362	79	208	175	95	746	427	162	810	239
Future Volume (veh/h)	148	274	362	79	208	175	95	746	427	162	810	239
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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	170	315	416	85	224	188	114	899	514	172	862	254
Peak Hour Factor	0.87	0.87	0.87	0.93	0.93	0.93	0.83	0.83	0.83	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	444	1007	546	220	989	573	217	1054	666	230	1133	709
Arrive On Green	0.04	0.09	0.09	0.12	0.28	0.28	0.06	0.30	0.30	0.08	0.32	0.32
Sat Flow, veh/h	3456	3554	1585	1781	3554	1585	1781	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	170	315	416	85	224	188	114	899	514	172	862	254
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	1585	1781	1777	1585	1781	1777	1585
Q Serve(g_s), s	5.7	9.9	28.6	5.3	5.8	10.3	5.3	28.6	33.4	8.0	26.2	12.7
Cycle Q Clear(g_c), s	5.7	9.9	28.6	5.3	5.8	10.3	5.3	28.6	33.4	8.0	26.2	12.7
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	444	1007	546	220	989	573	217	1054	666	230	1133	709
V/C Ratio(X)	0.38	0.31	0.76	0.39	0.23	0.33	0.53	0.85	0.77	0.75	0.76	0.36
Avail Cap(c_a), veh/h	444	1007	546	246	989	573	258	1054	666	256	1133	709
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.88	0.88	0.88	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	52.8	43.5	44.5	48.4	33.4	27.7	29.5	39.7	29.9	30.4	36.7	21.8
Incr Delay (d2), s/veh	0.5	0.7	8.6	1.1	0.5	1.5	2.0	8.7	8.5	10.4	3.1	0.3
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	2.5	4.7	13.4	2.4	2.5	4.0	2.3	13.2	13.6	3.9	11.4	4.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	53.3	44.2	53.1	49.5	33.9	29.3	31.4	48.5	38.3	40.8	39.8	22.1
LnGrp LOS	D	D	D	D	C	C	C	D	D	D	D	C
Approach Vol, veh/h		901			497			1527			1288	
Approach Delay, s/veh		50.0			34.8			43.8			36.5	
Approach LOS		D			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	21.2	40.4	13.7	44.7	21.8	39.8	16.4	42.0
Change Period (Y+Rc), s	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Max Green Setting (Gmax), s	16.6	30.4	10.1	37.3	13.6	33.4	11.8	35.6
Max Q Clear Time (g_c+I1), s	7.3	30.6	7.3	28.2	7.7	12.3	10.0	35.4
Green Ext Time (p_c), s	0.1	0.0	0.1	4.2	0.2	1.8	0.1	0.1

Intersection Summary	
HCM 6th Ctrl Delay	41.8
HCM 6th LOS	D



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↰↑↑	
Traffic Volume (veh/h)	0	296	542	0	488	474
Future Volume (veh/h)	0	296	542	0	488	474
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	0	1969	1969	0	1969	2000
Adj Flow Rate, veh/h	0	361	695	0	528	529
Peak Hour Factor	0.82	0.82	0.78	0.78	0.91	0.91
Percent Heavy Veh, %	0	2	2	0	2	0
Cap, veh/h	0	1091	1091	0	1109	1003
Arrive On Green	0.00	0.29	0.39	0.00	0.59	0.59
Sat Flow, veh/h	0	3938	3938	0	1875	1695
Grp Volume(v), veh/h	0	361	695	0	528	529
Grp Sat Flow(s),veh/h/ln	0	1870	1870	0	1875	1695
Q Serve(g_s), s	0.0	9.1	18.1	0.0	19.2	22.2
Cycle Q Clear(g_c), s	0.0	9.1	18.1	0.0	19.2	22.2
Prop In Lane	0.00			0.00	1.00	1.00
Lane Grp Cap(c), veh/h	0	1091	1091	0	1109	1003
V/C Ratio(X)	0.00	0.33	0.64	0.00	0.48	0.53
Avail Cap(c_a), veh/h	0	1091	1091	0	1109	1003
HCM Platoon Ratio	1.00	1.00	1.33	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	0.96	0.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	33.3	31.6	0.0	13.9	14.5
Incr Delay (d2), s/veh	0.0	0.8	2.7	0.0	1.5	2.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	4.1	7.6	0.0	7.8	8.3
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	34.1	34.3	0.0	15.4	16.5
LnGrp LOS	A	C	C	A	B	B
Approach Vol, veh/h		361	695		1057	
Approach Delay, s/veh		34.1	34.3		16.0	
Approach LOS		C	C		B	

Timer - Assigned Phs	2	4	6
Phs Duration (G+Y+Rc), s	42.0	78.0	42.0
Change Period (Y+Rc), s	* 7	* 7	* 7
Max Green Setting (Gmax), s	* 35	* 71	* 35
Max Q Clear Time (g_c+I1), s	20.1	24.2	11.1
Green Ext Time (p_c), s	3.8	3.9	2.1

Intersection Summary	
HCM 6th Ctrl Delay	25.1
HCM 6th LOS	C

Notes

User approved volume balancing among the lanes for turning movement.
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

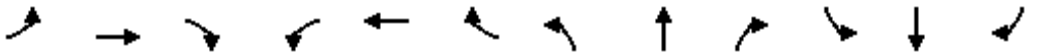
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	79	152	71	48	227	54	143	168	65	97	477	238
Future Volume (veh/h)	79	152	71	48	227	54	143	168	65	97	477	238
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	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	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	86	165	77	56	267	64	164	193	75	108	530	264
Peak Hour Factor	0.92	0.92	0.92	0.85	0.85	0.85	0.87	0.87	0.87	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	251	438	487	315	430	452	221	626	243	580	557	277
Arrive On Green	0.05	0.22	0.22	0.04	0.22	0.22	0.07	0.46	0.46	0.05	0.45	0.45
Sat Flow, veh/h	1875	1969	1668	1875	1969	1668	1875	1350	525	1875	1240	618
Grp Volume(v), veh/h	86	165	77	56	267	64	164	0	268	108	0	794
Grp Sat Flow(s),veh/h/ln	1875	1969	1668	1875	1969	1668	1875	0	1874	1875	0	1858
Q Serve(g_s), s	3.9	7.8	3.8	2.5	13.5	3.2	5.1	0.0	9.8	3.4	0.0	45.3
Cycle Q Clear(g_c), s	3.9	7.8	3.8	2.5	13.5	3.2	5.1	0.0	9.8	3.4	0.0	45.3
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.28	1.00		0.33
Lane Grp Cap(c), veh/h	251	438	487	315	430	452	221	0	869	580	0	834
V/C Ratio(X)	0.34	0.38	0.16	0.18	0.62	0.14	0.74	0.00	0.31	0.19	0.00	0.95
Avail Cap(c_a), veh/h	251	438	487	391	430	452	261	0	869	580	0	834
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	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	32.2	36.3	28.9	31.4	38.9	30.4	24.8	0.0	18.5	14.8	0.0	29.2
Incr Delay (d2), s/veh	0.8	2.5	0.7	0.3	6.6	0.7	9.0	0.0	0.9	0.2	0.0	21.5
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	3.9	1.6	1.1	7.1	1.3	2.6	0.0	4.2	1.4	0.0	23.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	33.0	38.8	29.6	31.6	45.5	31.1	33.8	0.0	19.4	15.0	0.0	50.7
LnGrp LOS	C	D	C	C	D	C	C	A	B	B	A	D
Approach Vol, veh/h		328			387			432			902	
Approach Delay, s/veh		35.1			41.1			24.8			46.4	
Approach LOS		D			D			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.0	57.0	10.5	30.5	13.6	55.4	11.0	30.0
Change Period (Y+Rc), s	* 6.2	* 6	* 6	* 6	* 6	* 6	* 6	* 6
Max Green Setting (Gmax), s	* 5.8	* 51	* 9	* 20	* 10	* 47	* 5	* 24
Max Q Clear Time (g_c+I1), s	15.4	11.8	4.5	9.8	7.1	47.3	5.9	15.5
Green Ext Time (p_c), s	0.0	1.5	0.0	0.7	0.1	0.0	0.0	1.0

Intersection Summary	
HCM 6th Ctrl Delay	39.1
HCM 6th LOS	D

Notes

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



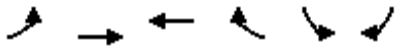
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	629	649	511	49	68	170	82	1084	472	110	427	80
Future Volume (veh/h)	629	649	511	49	68	170	82	1084	472	110	427	80
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	676	698	549	55	76	191	87	1153	502	124	480	90
Peak Hour Factor	0.93	0.93	0.93	0.89	0.89	0.89	0.94	0.94	0.94	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	733	956	514	99	399	266	364	1192	620	184	1192	868
Arrive On Green	0.21	0.27	0.27	0.06	0.11	0.11	0.06	0.34	0.34	0.06	0.34	0.34
Sat Flow, veh/h	3456	3554	1585	1781	3554	1585	1781	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	676	698	549	55	76	191	87	1153	502	124	480	90
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	1585	1781	1777	1585	1781	1777	1585
Q Serve(g_s), s	17.2	16.1	24.2	2.7	1.7	10.1	2.8	28.7	25.4	4.1	9.3	2.5
Cycle Q Clear(g_c), s	17.2	16.1	24.2	2.7	1.7	10.1	2.8	28.7	25.4	4.1	9.3	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	733	956	514	99	399	266	364	1192	620	184	1192	868
V/C Ratio(X)	0.92	0.73	1.07	0.56	0.19	0.72	0.24	0.97	0.81	0.68	0.40	0.10
Avail Cap(c_a), veh/h	733	956	514	158	399	266	529	1192	620	184	1192	868
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)	0.70	0.70	0.70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.7	29.9	30.4	41.4	36.2	35.4	18.1	29.4	24.4	23.0	23.0	9.8
Incr Delay (d2), s/veh	13.0	3.5	52.7	4.8	1.1	15.4	0.3	19.2	11.0	9.4	0.2	0.1
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	8.1	6.8	17.7	1.3	0.8	4.9	1.1	14.3	10.4	2.0	3.7	0.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	47.7	33.4	83.1	46.2	37.3	50.8	18.4	48.7	35.4	32.4	23.2	9.8
LnGrp LOS	D	C	F	D	D	D	B	D	D	C	C	A
Approach Vol, veh/h		1923			322			1742			694	
Approach Delay, s/veh		52.6			46.8			43.3			23.1	
Approach LOS		D			D			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.4	30.6	11.4	36.6	25.5	16.5	11.4	36.6
Change Period (Y+Rc), s	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Max Green Setting (Gmax), s	8.0	21.2	13.3	21.9	19.1	10.1	5.0	30.2
Max Q Clear Time (g_c+I1), s	4.7	26.2	4.8	11.3	19.2	12.1	6.1	30.7
Green Ext Time (p_c), s	0.0	0.0	0.1	2.3	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	44.4
HCM 6th LOS	D

Notes

User approved pedestrian interval to be less than phase max green.



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↰↑↑	
Traffic Volume (veh/h)	0	563	230	0	1226	25
Future Volume (veh/h)	0	563	230	0	1226	25
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	0	1969	1969	0	1969	2000
Adj Flow Rate, veh/h	0	704	253	0	1404	0
Peak Hour Factor	0.80	0.80	0.91	0.91	0.89	0.89
Percent Heavy Veh, %	0	2	2	0	2	0
Cap, veh/h	0	1216	1216	0	2094	946
Arrive On Green	0.00	0.32	0.32	0.00	0.56	0.00
Sat Flow, veh/h	0	3938	3938	0	3750	1695
Grp Volume(v), veh/h	0	704	253	0	1404	0
Grp Sat Flow(s),veh/h/ln	0	1870	1870	0	1875	1695
Q Serve(g_s), s	0.0	18.8	5.9	0.0	31.7	0.0
Cycle Q Clear(g_c), s	0.0	18.8	5.9	0.0	31.7	0.0
Prop In Lane	0.00			0.00	1.00	1.00
Lane Grp Cap(c), veh/h	0	1216	1216	0	2094	946
V/C Ratio(X)	0.00	0.58	0.21	0.00	0.67	0.00
Avail Cap(c_a), veh/h	0	1216	1216	0	2094	946
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	0.99	0.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	33.7	29.3	0.0	18.7	0.0
Incr Delay (d2), s/veh	0.0	2.0	0.4	0.0	1.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	8.6	2.6	0.0	13.0	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	35.7	29.7	0.0	20.4	0.0
LnGrp LOS	A	D	C	A	C	A
Approach Vol, veh/h		704	253		1404	
Approach Delay, s/veh		35.7	29.7		20.4	
Approach LOS		D	C		C	

Timer - Assigned Phs	2		4		6
Phs Duration (G+Y+Rc), s	46.0		74.0		46.0
Change Period (Y+Rc), s	* 7		* 7		* 7
Max Green Setting (Gmax), s	* 39		* 67		* 39
Max Q Clear Time (g_c+I1), s	7.9		33.7		20.8
Green Ext Time (p_c), s	1.5		6.7		4.2

Intersection Summary	
HCM 6th Ctrl Delay	26.0
HCM 6th LOS	C

Notes

User approved volume balancing among the lanes for turning movement.
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	193	247	146	58	148	110	94	531	87	83	330	72
Future Volume (veh/h)	193	247	146	58	148	110	94	531	87	83	330	72
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	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	210	268	159	72	183	136	99	559	92	95	379	83
Peak Hour Factor	0.92	0.92	0.92	0.81	0.81	0.81	0.95	0.95	0.95	0.87	0.87	0.87
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	314	438	536	259	438	534	420	605	100	296	575	126
Arrive On Green	0.04	0.22	0.22	0.04	0.22	0.22	0.10	0.37	0.37	0.10	0.37	0.37
Sat Flow, veh/h	1875	1969	1668	1875	1969	1668	1875	1649	271	1875	1565	343
Grp Volume(v), veh/h	210	268	159	72	183	136	99	0	651	95	0	462
Grp Sat Flow(s),veh/h/ln	1875	1969	1668	1875	1969	1668	1875	0	1920	1875	0	1907
Q Serve(g_s), s	0.0	11.0	4.1	0.0	7.2	3.5	2.7	0.0	29.2	2.6	0.0	18.2
Cycle Q Clear(g_c), s	0.0	11.0	4.1	0.0	7.2	3.5	2.7	0.0	29.2	2.6	0.0	18.2
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.14	1.00		0.18
Lane Grp Cap(c), veh/h	314	438	536	259	438	534	420	0	704	296	0	701
V/C Ratio(X)	0.67	0.61	0.30	0.28	0.42	0.25	0.24	0.00	0.92	0.32	0.00	0.66
Avail Cap(c_a), veh/h	335	438	536	280	438	534	420	0	704	296	0	701
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	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	36.5	31.5	10.0	35.6	30.0	9.8	15.6	0.0	27.3	19.0	0.0	23.7
Incr Delay (d2), s/veh	4.6	6.3	1.4	0.6	2.9	1.1	0.3	0.0	19.8	0.6	0.0	4.8
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	4.7	5.7	2.0	1.4	3.6	1.7	1.1	0.0	15.9	1.0	0.0	8.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.1	37.8	11.4	36.2	32.9	11.0	15.9	0.0	47.1	19.6	0.0	28.5
LnGrp LOS	D	D	B	D	C	B	B	A	D	B	A	C
Approach Vol, veh/h		637			391			750			557	
Approach Delay, s/veh		32.3			25.9			43.0			27.0	
Approach LOS		C			C			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.0	39.0	10.0	26.0	14.9	39.1	10.0	26.0
Change Period (Y+Rc), s	* 6.2	* 6	* 6	* 6	* 6	* 6	* 6	* 6
Max Green Setting (Gmax), s	* 7.8	* 33	* 5	* 20	* 7.9	* 33	* 5	* 20
Max Q Clear Time (g_c+I1), s	4.6	31.2	2.0	13.0	4.7	20.2	2.0	9.2
Green Ext Time (p_c), s	0.1	0.7	0.0	1.1	0.1	2.1	0.2	1.0

Intersection Summary	
HCM 6th Ctrl Delay	33.4
HCM 6th LOS	C

Notes

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

Intersection: 1: Dequindre Road & South Blvd. (Push Button)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	L	T	T	R	L	T	T	R	L	T	T
Maximum Queue (ft)	114	109	154	182	173	148	180	129	103	264	409	370
Average Queue (ft)	63	57	81	82	95	66	93	27	41	76	232	199
95th Queue (ft)	102	103	132	142	163	120	156	89	80	189	352	328
Link Distance (ft)	406	406	406	406			509	509			659	659
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)					150	160			100	240		
Storage Blk Time (%)				0	1	0	0	0	0		8	12
Queuing Penalty (veh)				0	2	0	0	0	0		8	55

Intersection: 1: Dequindre Road & South Blvd. (Push Button)

Movement	NB	SB	SB	SB	SB
Directions Served	R	L	T	T	R
Maximum Queue (ft)	165	260	431	438	125
Average Queue (ft)	114	134	262	239	88
95th Queue (ft)	202	267	383	372	165
Link Distance (ft)			537	537	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	140	235			100
Storage Blk Time (%)	1	0	12	27	0
Queuing Penalty (veh)	3	0	19	65	0

Intersection: 2: South Blvd. (Push Button) & M-59 SB Exit Ramp

Movement	EB	EB	WB	WB	SB	SB
Directions Served	T	T	T	T	L	LR
Maximum Queue (ft)	76	269	270	243	298	725
Average Queue (ft)	29	139	163	144	45	375
95th Queue (ft)	66	231	237	214	206	670
Link Distance (ft)	1262	1262	406	406	1713	1713
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 3: John R Road & South Blvd. (Push Button)

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	T	R	L	TR	L	TR
Maximum Queue (ft)	146	191	81	124	259	45	124	246	124	457
Average Queue (ft)	52	92	26	46	141	18	82	102	68	419
95th Queue (ft)	107	159	59	110	237	39	137	215	149	484
Link Distance (ft)		678			1222			297		413
Upstream Blk Time (%)								0		52
Queuing Penalty (veh)								0		0
Storage Bay Dist (ft)	150		460	100		300	100		100	
Storage Blk Time (%)		2		0	21		10	6	1	54
Queuing Penalty (veh)		2		1	22		24	9	6	52

Zone Summary

Zone wide Queuing Penalty: 271

Intersection: 1: Dequindre Road & South Blvd.(Push Button)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	L	T	T	R	L	T	T	R	L	T	T
Maximum Queue (ft)	375	365	296	355	175	106	80	70	112	265	606	617
Average Queue (ft)	211	211	170	188	139	36	28	11	54	88	342	325
95th Queue (ft)	344	332	259	316	216	79	62	62	105	246	556	562
Link Distance (ft)	406	406	406	406			509	509			659	659
Upstream Blk Time (%)	1	0									1	2
Queuing Penalty (veh)	4	1									0	0
Storage Bay Dist (ft)					150	160			100	240		
Storage Blk Time (%)				10	2	0			2	0	24	26
Queuing Penalty (veh)				52	8	0			1	0	19	121

Intersection: 1: Dequindre Road & South Blvd.(Push Button)

Movement	NB	SB	SB	SB	SB
Directions Served	R	L	T	T	R
Maximum Queue (ft)	165	154	222	189	108
Average Queue (ft)	151	59	124	65	16
95th Queue (ft)	205	118	196	147	49
Link Distance (ft)			537	537	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	140	235			100
Storage Blk Time (%)	4		0	2	0
Queuing Penalty (veh)	22		0	1	0

Intersection: 2: South Blvd.(Push Button) & M-59 SB Exit Ramp

Movement	EB	EB	WB	WB	SB	SB
Directions Served	T	T	T	T	L	LR
Maximum Queue (ft)	267	394	136	155	443	648
Average Queue (ft)	105	232	61	72	167	373
95th Queue (ft)	206	349	108	127	329	588
Link Distance (ft)	1257	1257	406	406	1427	1427
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 3: John R Road & South Blvd.(Push Button)

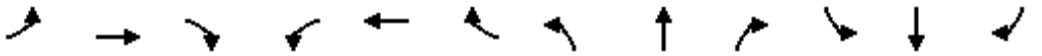
Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	T	R	L	TR	L	TR
Maximum Queue (ft)	174	286	86	123	203	118	124	348	124	349
Average Queue (ft)	106	144	34	48	81	41	72	300	56	164
95th Queue (ft)	180	251	66	105	160	90	144	367	120	294
Link Distance (ft)		678			1222			297		413
Upstream Blk Time (%)								37		0
Queuing Penalty (veh)								0		0
Storage Bay Dist (ft)	150		460	100		300	100		100	
Storage Blk Time (%)	3	8		1	5		0	52	1	19
Queuing Penalty (veh)	12	27		3	9		3	49	4	16

Zone Summary

Zone wide Queuing Penalty: 352

Appendix C

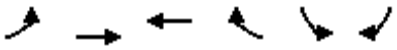
BACKGROUND TRAFFIC CONDITIONS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	153	283	373	82	215	181	98	769	440	167	835	247
Future Volume (veh/h)	153	283	373	82	215	181	98	769	440	167	835	247
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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	176	325	429	88	231	195	118	927	530	178	888	263
Peak Hour Factor	0.87	0.87	0.87	0.93	0.93	0.93	0.83	0.83	0.83	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	436	1007	548	216	989	577	215	1054	662	229	1136	706
Arrive On Green	0.04	0.09	0.09	0.12	0.28	0.28	0.06	0.30	0.30	0.09	0.32	0.32
Sat Flow, veh/h	3456	3554	1585	1781	3554	1585	1781	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	176	325	429	88	231	195	118	927	530	178	888	263
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	1585	1781	1777	1585	1781	1777	1585
Q Serve(g_s), s	6.0	10.3	29.5	5.5	6.0	10.7	5.5	29.8	35.1	8.2	27.2	13.2
Cycle Q Clear(g_c), s	6.0	10.3	29.5	5.5	6.0	10.7	5.5	29.8	35.1	8.2	27.2	13.2
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	436	1007	548	216	989	577	215	1054	662	229	1136	706
V/C Ratio(X)	0.40	0.32	0.78	0.41	0.23	0.34	0.55	0.88	0.80	0.78	0.78	0.37
Avail Cap(c_a), veh/h	436	1007	548	246	989	577	253	1054	662	252	1136	706
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.87	0.87	0.87	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	53.1	43.6	44.7	48.8	33.4	27.7	29.7	40.2	30.6	30.4	37.0	22.1
Incr Delay (d2), s/veh	0.5	0.7	9.4	1.2	0.6	1.6	2.2	10.4	9.8	13.0	3.6	0.3
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	2.6	4.8	13.9	2.5	2.6	4.2	2.4	14.0	14.4	4.2	11.9	4.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	53.6	44.4	54.0	50.0	34.0	29.3	31.9	50.6	40.4	43.5	40.6	22.4
LnGrp LOS	D	D	D	D	C	C	C	D	D	D	D	C
Approach Vol, veh/h		930			514			1575			1329	
Approach Delay, s/veh		50.6			34.9			45.8			37.4	
Approach LOS		D			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	20.9	40.4	13.9	44.8	21.5	39.8	16.7	42.0
Change Period (Y+Rc), s	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Max Green Setting (Gmax), s	16.6	30.4	10.1	37.3	13.6	33.4	11.8	35.6
Max Q Clear Time (g_c+I1), s	7.5	31.5	7.5	29.2	8.0	12.7	10.2	37.1
Green Ext Time (p_c), s	0.1	0.0	0.1	4.0	0.2	1.9	0.1	0.0

Intersection Summary	
HCM 6th Ctrl Delay	43.0
HCM 6th LOS	D



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	306	560	0	503	489
Future Volume (veh/h)	0	306	560	0	503	489
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	0	1969	1969	0	1969	2000
Adj Flow Rate, veh/h	0	373	718	0	545	546
Peak Hour Factor	0.82	0.82	0.78	0.78	0.91	0.91
Percent Heavy Veh, %	0	2	2	0	2	0
Cap, veh/h	0	1091	1091	0	1109	1003
Arrive On Green	0.00	0.29	0.39	0.00	0.59	0.59
Sat Flow, veh/h	0	3938	3938	0	1875	1695
Grp Volume(v), veh/h	0	373	718	0	545	546
Grp Sat Flow(s),veh/h/ln	0	1870	1870	0	1875	1695
Q Serve(g_s), s	0.0	9.4	18.9	0.0	20.1	23.3
Cycle Q Clear(g_c), s	0.0	9.4	18.9	0.0	20.1	23.3
Prop In Lane	0.00			0.00	1.00	1.00
Lane Grp Cap(c), veh/h	0	1091	1091	0	1109	1003
V/C Ratio(X)	0.00	0.34	0.66	0.00	0.49	0.54
Avail Cap(c_a), veh/h	0	1091	1091	0	1109	1003
HCM Platoon Ratio	1.00	1.00	1.33	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	0.95	0.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	33.4	31.8	0.0	14.1	14.8
Incr Delay (d2), s/veh	0.0	0.9	3.0	0.0	1.6	2.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	4.3	8.0	0.0	8.2	8.7
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	34.3	34.8	0.0	15.7	16.9
LnGrp LOS	A	C	C	A	B	B
Approach Vol, veh/h		373	718		1091	
Approach Delay, s/veh		34.3	34.8		16.3	
Approach LOS		C	C		B	

Timer - Assigned Phs	2	4	6
Phs Duration (G+Y+Rc), s	42.0	78.0	42.0
Change Period (Y+Rc), s	* 7	* 7	* 7
Max Green Setting (Gmax), s	* 35	* 71	* 35
Max Q Clear Time (g_c+I1), s	20.9	25.3	11.4
Green Ext Time (p_c), s	3.8	4.1	2.2

Intersection Summary	
HCM 6th Ctrl Delay	25.4
HCM 6th LOS	C

Notes

User approved volume balancing among the lanes for turning movement.
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

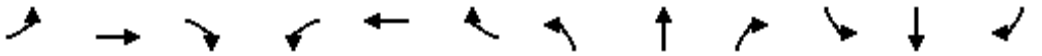
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	82	157	74	50	234	56	148	174	67	100	492	246
Future Volume (veh/h)	82	157	74	50	234	56	148	174	67	100	492	246
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		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	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	89	171	80	59	275	66	170	200	77	111	547	273
Peak Hour Factor	0.92	0.92	0.92	0.85	0.85	0.85	0.87	0.87	0.87	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	213	380	471	278	376	440	250	638	245	620	566	282
Arrive On Green	0.05	0.19	0.19	0.04	0.19	0.19	0.09	0.47	0.47	0.07	0.46	0.46
Sat Flow, veh/h	1875	1969	1668	1875	1969	1668	1875	1354	521	1875	1239	618
Grp Volume(v), veh/h	89	171	80	59	275	66	170	0	277	111	0	820
Grp Sat Flow(s),veh/h/ln	1875	1969	1668	1875	1969	1668	1875	0	1875	1875	0	1857
Q Serve(g_s), s	4.2	8.4	4.0	2.7	14.4	3.3	5.0	0.0	10.1	3.3	0.0	47.3
Cycle Q Clear(g_c), s	4.2	8.4	4.0	2.7	14.4	3.3	5.0	0.0	10.1	3.3	0.0	47.3
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.28	1.00		0.33
Lane Grp Cap(c), veh/h	213	380	471	278	376	440	250	0	883	620	0	848
V/C Ratio(X)	0.42	0.45	0.17	0.21	0.73	0.15	0.68	0.00	0.31	0.18	0.00	0.97
Avail Cap(c_a), veh/h	213	380	471	299	376	440	254	0	883	620	0	848
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	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	34.7	39.2	29.8	33.6	41.9	31.1	23.8	0.0	18.1	13.3	0.0	29.1
Incr Delay (d2), s/veh	1.3	3.8	0.8	0.4	11.9	0.7	7.0	0.0	0.9	0.1	0.0	23.9
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	1.9	4.3	1.6	1.2	8.0	1.4	2.4	0.0	4.3	1.3	0.0	24.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	36.0	43.0	30.5	34.0	53.7	31.8	30.8	0.0	19.0	13.5	0.0	53.0
LnGrp LOS	D	D	C	C	D	C	C	A	B	B	A	D
Approach Vol, veh/h		340			400			447			931	
Approach Delay, s/veh		38.2			47.2			23.5			48.3	
Approach LOS		D			D			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.2	57.8	10.7	27.3	15.8	56.2	11.0	27.0
Change Period (Y+Rc), s	* 6.2	* 6	* 6	* 6	* 6	* 6	* 6	* 6
Max Green Setting (Gmax), s	* 8	* 52	* 6	* 20	* 10	* 50	* 5	* 21
Max Q Clear Time (g_c+I1), s	15.3	12.1	4.7	10.4	7.0	49.3	6.2	16.4
Green Ext Time (p_c), s	0.1	1.6	0.0	0.7	0.1	0.4	0.0	0.7

Intersection Summary	
HCM 6th Ctrl Delay	41.2
HCM 6th LOS	D

Notes

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



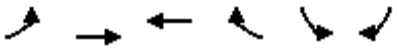
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	649	669	527	51	71	176	85	1117	487	114	440	83
Future Volume (veh/h)	649	669	527	51	71	176	85	1117	487	114	440	83
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	698	719	567	57	80	198	90	1188	518	128	494	93
Peak Hour Factor	0.93	0.93	0.93	0.89	0.89	0.89	0.94	0.94	0.94	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	947	943	499	188	344	250	356	1262	730	177	1302	1015
Arrive On Green	0.27	0.27	0.27	0.11	0.10	0.10	0.05	0.35	0.35	0.06	0.37	0.37
Sat Flow, veh/h	3456	3554	1585	1781	3554	1585	1781	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	698	719	567	57	80	198	90	1188	518	128	494	93
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	1585	1781	1777	1585	1781	1777	1585
Q Serve(g_s), s	22.1	22.4	31.8	3.5	2.5	11.6	3.8	38.9	31.4	5.4	12.3	2.7
Cycle Q Clear(g_c), s	22.1	22.4	31.8	3.5	2.5	11.6	3.8	38.9	31.4	5.4	12.3	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	947	943	499	188	344	250	356	1262	730	177	1302	1015
V/C Ratio(X)	0.74	0.76	1.14	0.30	0.23	0.79	0.25	0.94	0.71	0.72	0.38	0.09
Avail Cap(c_a), veh/h	947	943	499	232	344	250	627	1262	730	181	1302	1015
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)	0.68	0.68	0.68	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	39.6	40.6	41.1	49.6	50.1	48.6	23.0	37.5	26.0	29.5	28.0	8.2
Incr Delay (d2), s/veh	2.1	4.0	77.1	0.9	1.6	22.2	0.4	14.8	5.8	12.9	0.2	0.0
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	9.3	10.0	24.7	1.6	1.2	7.1	1.6	18.6	12.3	2.8	5.1	0.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.7	44.6	118.2	50.5	51.7	70.8	23.3	52.2	31.7	42.4	28.2	8.3
LnGrp LOS	D	D	F	D	D	E	C	D	C	D	C	A
Approach Vol, veh/h		1984			335			1796			715	
Approach Delay, s/veh		64.6			62.8			44.9			28.1	
Approach LOS		E			E			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	19.0	38.2	12.4	50.4	39.3	18.0	13.7	49.0
Change Period (Y+Rc), s	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Max Green Setting (Gmax), s	15.6	28.6	24.2	26.0	32.6	11.6	7.6	42.6
Max Q Clear Time (g_c+I1), s	5.5	33.8	5.8	14.3	24.1	13.6	7.4	40.9
Green Ext Time (p_c), s	0.1	0.0	0.2	2.5	1.8	0.0	0.0	1.4

Intersection Summary	
HCM 6th Ctrl Delay	51.8
HCM 6th LOS	D

Notes

User approved pedestrian interval to be less than phase max green.



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	581	239	0	1264	26
Future Volume (veh/h)	0	581	239	0	1264	26
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	0	1969	1969	0	1969	2000
Adj Flow Rate, veh/h	0	726	263	0	1447	0
Peak Hour Factor	0.80	0.80	0.91	0.91	0.89	0.89
Percent Heavy Veh, %	0	2	2	0	2	0
Cap, veh/h	0	1185	1185	0	2125	960
Arrive On Green	0.00	0.32	0.63	0.00	0.57	0.00
Sat Flow, veh/h	0	3938	3938	0	3750	1695
Grp Volume(v), veh/h	0	726	263	0	1447	0
Grp Sat Flow(s),veh/h/ln	0	1870	1870	0	1875	1695
Q Serve(g_s), s	0.0	19.7	3.6	0.0	32.7	0.0
Cycle Q Clear(g_c), s	0.0	19.7	3.6	0.0	32.7	0.0
Prop In Lane	0.00			0.00	1.00	1.00
Lane Grp Cap(c), veh/h	0	1185	1185	0	2125	960
V/C Ratio(X)	0.00	0.61	0.22	0.00	0.68	0.00
Avail Cap(c_a), veh/h	0	1185	1185	0	2125	960
HCM Platoon Ratio	1.00	1.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	0.99	0.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	34.8	15.7	0.0	18.3	0.0
Incr Delay (d2), s/veh	0.0	2.4	0.4	0.0	1.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	9.0	1.5	0.0	13.3	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	37.1	16.1	0.0	20.1	0.0
LnGrp LOS	A	D	B	A	C	A
Approach Vol, veh/h		726	263		1447	
Approach Delay, s/veh		37.1	16.1		20.1	
Approach LOS		D	B		C	

Timer - Assigned Phs	2	4	6
Phs Duration (G+Y+Rc), s	45.0	75.0	45.0
Change Period (Y+Rc), s	* 7	* 7	* 7
Max Green Setting (Gmax), s	* 38	* 68	* 38
Max Q Clear Time (g_c+I1), s	5.6	34.7	21.7
Green Ext Time (p_c), s	1.6	7.0	4.1

Intersection Summary	
HCM 6th Ctrl Delay	24.8
HCM 6th LOS	C

Notes

User approved volume balancing among the lanes for turning movement.
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	199	255	151	60	153	114	97	548	90	86	340	75
Future Volume (veh/h)	199	255	151	60	153	114	97	548	90	86	340	75
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	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	216	277	164	74	189	141	102	577	95	99	391	86
Peak Hour Factor	0.92	0.92	0.92	0.81	0.81	0.81	0.95	0.95	0.95	0.87	0.87	0.87
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	310	438	517	253	438	515	402	623	103	275	592	130
Arrive On Green	0.04	0.22	0.22	0.04	0.22	0.22	0.09	0.38	0.38	0.09	0.38	0.38
Sat Flow, veh/h	1875	1969	1668	1875	1969	1668	1875	1649	271	1875	1563	344
Grp Volume(v), veh/h	216	277	164	74	189	141	102	0	672	99	0	477
Grp Sat Flow(s),veh/h/ln	1875	1969	1668	1875	1969	1668	1875	0	1920	1875	0	1907
Q Serve(g_s), s	0.0	11.5	4.4	0.0	7.4	3.7	2.8	0.0	30.2	2.7	0.0	18.6
Cycle Q Clear(g_c), s	0.0	11.5	4.4	0.0	7.4	3.7	2.8	0.0	30.2	2.7	0.0	18.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.14	1.00		0.18
Lane Grp Cap(c), veh/h	310	438	517	253	438	515	402	0	725	275	0	723
V/C Ratio(X)	0.70	0.63	0.32	0.29	0.43	0.27	0.25	0.00	0.93	0.36	0.00	0.66
Avail Cap(c_a), veh/h	331	438	517	274	438	515	404	0	725	275	0	723
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	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	36.8	31.7	10.5	36.2	30.1	10.3	15.7	0.0	26.8	19.4	0.0	23.2
Incr Delay (d2), s/veh	5.8	6.8	1.6	0.6	3.1	1.3	0.3	0.0	19.6	0.8	0.0	4.7
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	4.9	5.9	2.1	1.5	3.7	1.8	1.1	0.0	16.3	1.1	0.0	8.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	42.7	38.5	12.1	36.8	33.2	11.6	16.1	0.0	46.4	20.2	0.0	27.8
LnGrp LOS	D	D	B	D	C	B	B	A	D	C	A	C
Approach Vol, veh/h		657			404			774			576	
Approach Delay, s/veh		33.3			26.3			42.4			26.5	
Approach LOS		C			C			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.0	40.0	10.0	26.0	13.9	40.1	10.0	26.0
Change Period (Y+Rc), s	* 6.2	* 6	* 6	* 6	* 6	* 6	* 6	* 6
Max Green Setting (Gmax), s	* 6.8	* 34	* 5	* 20	* 8	* 33	* 5	* 20
Max Q Clear Time (g_c+I1), s	11.7	32.2	2.0	13.5	4.8	20.6	2.0	9.4
Green Ext Time (p_c), s	0.0	0.8	0.0	1.1	0.1	2.2	0.2	1.0

Intersection Summary	
HCM 6th Ctrl Delay	33.4
HCM 6th LOS	C

Notes

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

Intersection: 1: Dequindre Road & South Blvd. (Push Button)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	L	T	T	R	L	T	T	R	L	T	T
Maximum Queue (ft)	133	119	166	230	175	139	172	145	114	265	564	587
Average Queue (ft)	65	58	83	85	102	65	98	31	46	100	281	257
95th Queue (ft)	105	104	144	171	171	117	159	99	91	243	470	482
Link Distance (ft)	406	406	406	406			509	509			659	659
Upstream Blk Time (%)											1	1
Queuing Penalty (veh)											0	0
Storage Bay Dist (ft)					150	160			100	240		
Storage Blk Time (%)				1	2	0	1	0	1	0	16	19
Queuing Penalty (veh)				4	3	0	1	0	1	0	17	85

Intersection: 1: Dequindre Road & South Blvd. (Push Button)

Movement	NB	SB	SB	SB	SB
Directions Served	R	L	T	T	R
Maximum Queue (ft)	165	260	468	460	125
Average Queue (ft)	129	145	285	250	89
95th Queue (ft)	211	288	425	390	165
Link Distance (ft)			537	537	
Upstream Blk Time (%)			0	0	
Queuing Penalty (veh)			0	0	
Storage Bay Dist (ft)	140	235			100
Storage Blk Time (%)	2	0	15	27	0
Queuing Penalty (veh)	9	1	25	68	0

Intersection: 2: South Blvd. (Push Button) & M-59 SB Exit Ramp

Movement	EB	EB	WB	WB	SB	SB
Directions Served	T	T	T	T	L	LR
Maximum Queue (ft)	116	285	282	273	375	892
Average Queue (ft)	36	151	174	155	42	429
95th Queue (ft)	85	254	253	239	185	819
Link Distance (ft)	1262	1262	406	406	1713	1713
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 3: John R Road & South Blvd. (Push Button)

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	T	R	L	TR	L	TR
Maximum Queue (ft)	154	197	70	124	279	54	124	292	124	459
Average Queue (ft)	59	93	23	50	152	20	93	116	61	404
95th Queue (ft)	114	168	53	122	256	43	142	259	140	512
Link Distance (ft)		678			1222			297		413
Upstream Blk Time (%)								5		38
Queuing Penalty (veh)								0		0
Storage Bay Dist (ft)	150		460	100		300	100		100	
Storage Blk Time (%)	0	2		0	23		23	5	0	49
Queuing Penalty (veh)	0	3		0	25		56	7	1	49

Zone Summary

Zone wide Queuing Penalty: 356

Intersection: 1: Dequindre Road & South Blvd.(Push Button)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	L	T	T	R	L	T	T	R	L	T	T
Maximum Queue (ft)	344	334	417	424	175	106	112	182	124	265	667	683
Average Queue (ft)	211	201	260	301	165	44	39	14	66	103	489	477
95th Queue (ft)	304	294	391	449	209	93	86	77	120	264	721	736
Link Distance (ft)	406	406	406	406			509	509			659	659
Upstream Blk Time (%)	0	0	0	1							6	8
Queuing Penalty (veh)	1	0	1	6							0	0
Storage Bay Dist (ft)					150	160			100	240		
Storage Blk Time (%)				27	6				6	0	38	36
Queuing Penalty (veh)				144	20				2	0	32	174

Intersection: 1: Dequindre Road & South Blvd.(Push Button)

Movement	NB	SB	SB	SB	SB
Directions Served	R	L	T	T	R
Maximum Queue (ft)	165	179	262	204	108
Average Queue (ft)	153	70	154	105	19
95th Queue (ft)	208	140	233	189	66
Link Distance (ft)			537	537	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	140	235			100
Storage Blk Time (%)	4	0	1	5	0
Queuing Penalty (veh)	22	0	1	5	0

Intersection: 2: South Blvd.(Push Button) & M-59 SB Exit Ramp

Movement	EB	EB	WB	WB	SB	SB
Directions Served	T	T	T	T	L	LR
Maximum Queue (ft)	334	458	162	165	394	527
Average Queue (ft)	133	266	81	94	164	354
95th Queue (ft)	268	400	136	151	298	496
Link Distance (ft)	1257	1257	406	406	1427	1427
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 3: John R Road & South Blvd.(Push Button)

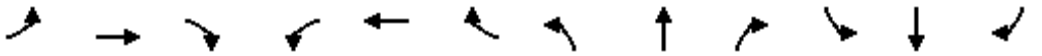
Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	T	R	L	TR	L	TR
Maximum Queue (ft)	174	280	84	124	204	108	124	343	124	345
Average Queue (ft)	120	144	34	46	86	40	73	305	65	169
95th Queue (ft)	194	249	65	108	174	85	148	359	129	285
Link Distance (ft)		678			1222			297		413
Upstream Blk Time (%)								48		0
Queuing Penalty (veh)								0		0
Storage Bay Dist (ft)	150		460	100		300	100		100	
Storage Blk Time (%)	4	8		1	8		1	56	1	18
Queuing Penalty (veh)	17	28		3	14		4	54	5	16

Zone Summary

Zone wide Queuing Penalty: 549

Appendix D

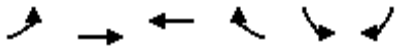
FUTURE TRAFFIC CONDITIONS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	162	287	379	82	227	181	118	769	440	167	835	266
Future Volume (veh/h)	162	287	379	82	227	181	118	769	440	167	835	266
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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	186	330	436	88	244	195	142	927	530	178	888	283
Peak Hour Factor	0.87	0.87	0.87	0.93	0.93	0.93	0.83	0.83	0.83	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	442	1000	559	214	971	569	226	1066	666	230	1115	700
Arrive On Green	0.04	0.09	0.09	0.12	0.27	0.27	0.07	0.30	0.30	0.09	0.31	0.31
Sat Flow, veh/h	3456	3554	1585	1781	3554	1585	1781	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	186	330	436	88	244	195	142	927	530	178	888	283
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	1585	1781	1777	1585	1781	1777	1585
Q Serve(g_s), s	6.3	10.4	29.6	5.5	6.4	10.8	6.5	29.6	35.0	8.2	27.4	14.6
Cycle Q Clear(g_c), s	6.3	10.4	29.6	5.5	6.4	10.8	6.5	29.6	35.0	8.2	27.4	14.6
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	442	1000	559	214	971	569	226	1066	666	230	1115	700
V/C Ratio(X)	0.42	0.33	0.78	0.41	0.25	0.34	0.63	0.87	0.80	0.77	0.80	0.40
Avail Cap(c_a), veh/h	442	1000	559	238	971	569	259	1066	666	256	1115	700
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.86	0.86	0.86	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	53.1	43.8	43.8	48.9	34.0	28.1	29.7	39.8	30.3	30.3	37.7	22.8
Incr Delay (d2), s/veh	0.5	0.8	9.0	1.3	0.6	1.6	3.8	9.7	9.6	12.3	4.1	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	2.8	4.9	13.9	2.5	2.8	4.2	2.9	13.8	14.3	4.1	12.1	5.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	53.7	44.6	52.8	50.1	34.6	29.8	33.6	49.4	39.9	42.6	41.8	23.1
LnGrp LOS	D	D	D	D	C	C	C	D	D	D	D	C
Approach Vol, veh/h		952			527			1599			1349	
Approach Delay, s/veh		50.1			35.4			44.9			38.0	
Approach LOS		D			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	20.8	40.2	15.0	44.0	21.8	39.2	16.6	42.4
Change Period (Y+Rc), s	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Max Green Setting (Gmax), s	16.0	30.4	10.8	37.2	13.6	32.8	12.0	36.0
Max Q Clear Time (g_c+I1), s	7.5	31.6	8.5	29.4	8.3	12.8	10.2	37.0
Green Ext Time (p_c), s	0.1	0.0	0.1	3.9	0.2	1.9	0.1	0.0

Intersection Summary	
HCM 6th Ctrl Delay	42.8
HCM 6th LOS	D



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↰↑↑	
Traffic Volume (veh/h)	0	325	611	0	503	504
Future Volume (veh/h)	0	325	611	0	503	504
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	0	1969	1969	0	1969	2000
Adj Flow Rate, veh/h	0	396	783	0	553	554
Peak Hour Factor	0.82	0.82	0.78	0.78	0.91	0.91
Percent Heavy Veh, %	0	2	2	0	2	0
Cap, veh/h	0	1153	1153	0	1078	975
Arrive On Green	0.00	0.31	0.62	0.00	0.57	0.57
Sat Flow, veh/h	0	3938	3938	0	1875	1695
Grp Volume(v), veh/h	0	396	783	0	553	554
Grp Sat Flow(s),veh/h/ln	0	1870	1870	0	1875	1695
Q Serve(g_s), s	0.0	9.8	16.6	0.0	21.3	24.8
Cycle Q Clear(g_c), s	0.0	9.8	16.6	0.0	21.3	24.8
Prop In Lane	0.00			0.00	1.00	1.00
Lane Grp Cap(c), veh/h	0	1153	1153	0	1078	975
V/C Ratio(X)	0.00	0.34	0.68	0.00	0.51	0.57
Avail Cap(c_a), veh/h	0	1153	1153	0	1078	975
HCM Platoon Ratio	1.00	1.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	0.94	0.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	32.1	19.1	0.0	15.4	16.1
Incr Delay (d2), s/veh	0.0	0.8	3.0	0.0	1.7	2.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	4.4	5.3	0.0	8.8	9.4
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	32.9	22.1	0.0	17.1	18.5
LnGrp LOS	A	C	C	A	B	B
Approach Vol, veh/h		396	783		1107	
Approach Delay, s/veh		32.9	22.1		17.8	
Approach LOS		C	C		B	

Timer - Assigned Phs	2	4	6
Phs Duration (G+Y+Rc), s	44.0	76.0	44.0
Change Period (Y+Rc), s	* 7	* 7	* 7
Max Green Setting (Gmax), s	* 37	* 69	* 37
Max Q Clear Time (g_c+I1), s	18.6	26.8	11.8
Green Ext Time (p_c), s	4.7	4.2	2.4

Intersection Summary	
HCM 6th Ctrl Delay	21.9
HCM 6th LOS	C

Notes

User approved volume balancing among the lanes for turning movement.
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	82	162	74	52	235	60	148	174	73	113	492	246
Future Volume (veh/h)	82	162	74	52	235	60	148	174	73	113	492	246
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	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	89	176	80	61	276	71	170	200	84	126	547	273
Peak Hour Factor	0.92	0.92	0.92	0.85	0.85	0.85	0.87	0.87	0.87	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	233	416	487	290	394	447	240	627	264	606	577	288
Arrive On Green	0.05	0.21	0.21	0.04	0.20	0.20	0.08	0.48	0.48	0.07	0.47	0.47
Sat Flow, veh/h	1875	1969	1668	1875	1969	1668	1875	1316	553	1875	1239	618
Grp Volume(v), veh/h	89	176	80	61	276	71	170	0	284	126	0	820
Grp Sat Flow(s),veh/h/ln	1875	1969	1668	1875	1969	1668	1875	0	1869	1875	0	1857
Q Serve(g_s), s	4.5	9.3	4.3	3.1	15.7	3.9	5.4	0.0	11.3	4.0	0.0	50.7
Cycle Q Clear(g_c), s	4.5	9.3	4.3	3.1	15.7	3.9	5.4	0.0	11.3	4.0	0.0	50.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.30	1.00		0.33
Lane Grp Cap(c), veh/h	233	416	487	290	394	447	240	0	891	606	0	865
V/C Ratio(X)	0.38	0.42	0.16	0.21	0.70	0.16	0.71	0.00	0.32	0.21	0.00	0.95
Avail Cap(c_a), veh/h	241	416	487	367	394	447	276	0	891	606	0	865
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	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	36.2	41.0	31.6	35.9	44.7	33.6	26.2	0.0	19.4	14.5	0.0	30.7
Incr Delay (d2), s/veh	1.0	3.1	0.7	0.4	10.0	0.8	6.9	0.0	0.9	0.2	0.0	20.3
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	2.1	4.8	1.8	1.4	8.5	1.6	2.6	0.0	4.9	1.6	0.0	25.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	37.2	44.1	32.3	36.2	54.6	34.4	33.1	0.0	20.3	14.6	0.0	51.0
LnGrp LOS	D	D	C	D	D	C	C	A	C	B	A	D
Approach Vol, veh/h		345			408			454			946	
Approach Delay, s/veh		39.6			48.4			25.1			46.1	
Approach LOS		D			D			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.3	63.2	11.1	31.4	15.7	61.9	12.5	30.0
Change Period (Y+Rc), s	* 6.2	* 6	* 6	* 6	* 6	* 6	* 6	* 6
Max Green Setting (Gmax), s	* 7.6	* 57	* 10	* 21	* 12	* 53	* 7	* 24
Max Q Clear Time (g_c+I1), s	6.0	13.3	5.1	11.3	7.4	52.7	6.5	17.7
Green Ext Time (p_c), s	0.0	1.7	0.0	0.7	0.2	0.2	0.0	0.9

Intersection Summary	
HCM 6th Ctrl Delay	41.1
HCM 6th LOS	D

Notes

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

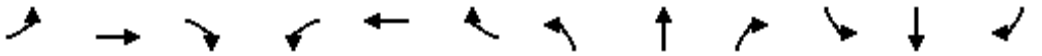
Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	24	324	340	66	19	7
Future Vol, veh/h	24	324	340	66	19	7
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	100	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	85	85	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	26	352	400	78	21	8

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	478	0	-	0	843	439
Stage 1	-	-	-	-	439	-
Stage 2	-	-	-	-	404	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1084	-	-	-	334	618
Stage 1	-	-	-	-	650	-
Stage 2	-	-	-	-	674	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1084	-	-	-	326	618
Mov Cap-2 Maneuver	-	-	-	-	441	-
Stage 1	-	-	-	-	634	-
Stage 2	-	-	-	-	674	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	12.9
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1084	-	-	-	441	618
HCM Lane V/C Ratio	0.024	-	-	-	0.047	0.012
HCM Control Delay (s)	8.4	-	-	-	13.6	10.9
HCM Lane LOS	A	-	-	-	B	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.1	0



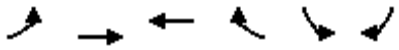
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	689	694	547	51	81	176	93	1117	487	114	440	98
Future Volume (veh/h)	689	694	547	51	81	176	93	1117	487	114	440	98
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	741	746	588	57	91	198	99	1188	518	128	494	110
Peak Hour Factor	0.93	0.93	0.93	0.89	0.89	0.89	0.94	0.94	0.94	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	981	952	509	183	308	234	356	1262	726	177	1290	1025
Arrive On Green	0.28	0.27	0.27	0.10	0.09	0.09	0.05	0.35	0.35	0.06	0.36	0.36
Sat Flow, veh/h	3456	3554	1585	1781	3554	1585	1781	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	741	746	588	57	91	198	99	1188	518	128	494	110
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	1585	1781	1777	1585	1781	1777	1585
Q Serve(g_s), s	23.5	23.3	32.1	3.6	2.9	10.4	4.2	38.9	31.6	5.4	12.3	3.2
Cycle Q Clear(g_c), s	23.5	23.3	32.1	3.6	2.9	10.4	4.2	38.9	31.6	5.4	12.3	3.2
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	981	952	509	183	308	234	356	1262	726	177	1290	1025
V/C Ratio(X)	0.76	0.78	1.16	0.31	0.30	0.85	0.28	0.94	0.71	0.72	0.38	0.11
Avail Cap(c_a), veh/h	981	952	509	246	308	234	619	1262	726	181	1290	1025
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)	0.64	0.64	0.64	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	39.2	40.7	40.7	49.9	51.4	49.8	22.9	37.5	26.2	29.5	28.3	8.0
Incr Delay (d2), s/veh	2.2	4.2	84.2	1.0	2.4	29.6	0.4	14.8	5.9	12.9	0.2	0.0
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	9.9	10.4	26.2	1.6	1.4	7.5	1.7	18.6	12.4	2.8	5.1	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.3	44.9	125.0	50.8	53.8	79.4	23.3	52.2	32.1	42.4	28.5	8.1
LnGrp LOS	D	D	F	D	D	E	C	D	C	D	C	A
Approach Vol, veh/h		2075			346			1805			732	
Approach Delay, s/veh		66.3			67.9			44.9			27.8	
Approach LOS		E			E			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	18.7	38.5	12.8	50.0	40.5	16.8	13.7	49.0
Change Period (Y+Rc), s	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Max Green Setting (Gmax), s	16.6	27.6	24.1	26.1	33.8	10.4	7.6	42.6
Max Q Clear Time (g_c+I1), s	5.6	34.1	6.2	14.3	25.5	12.4	7.4	40.9
Green Ext Time (p_c), s	0.1	0.0	0.2	2.6	1.9	0.0	0.0	1.4

Intersection Summary	
HCM 6th Ctrl Delay	53.0
HCM 6th LOS	D

Notes

User approved pedestrian interval to be less than phase max green.



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↰↑↑	
Traffic Volume (veh/h)	0	666	272	0	1264	26
Future Volume (veh/h)	0	666	272	0	1264	26
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	0	1969	1969	0	1969	2000
Adj Flow Rate, veh/h	0	832	299	0	1447	0
Peak Hour Factor	0.80	0.80	0.91	0.91	0.89	0.89
Percent Heavy Veh, %	0	2	2	0	2	0
Cap, veh/h	0	1278	1278	0	2031	918
Arrive On Green	0.00	0.34	0.68	0.00	0.54	0.00
Sat Flow, veh/h	0	3938	3938	0	3750	1695
Grp Volume(v), veh/h	0	832	299	0	1447	0
Grp Sat Flow(s),veh/h/ln	0	1870	1870	0	1875	1695
Q Serve(g_s), s	0.0	22.6	3.6	0.0	34.6	0.0
Cycle Q Clear(g_c), s	0.0	22.6	3.6	0.0	34.6	0.0
Prop In Lane	0.00			0.00	1.00	1.00
Lane Grp Cap(c), veh/h	0	1278	1278	0	2031	918
V/C Ratio(X)	0.00	0.65	0.23	0.00	0.71	0.00
Avail Cap(c_a), veh/h	0	1278	1278	0	2031	918
HCM Platoon Ratio	1.00	1.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	0.99	0.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	33.4	13.1	0.0	20.5	0.0
Incr Delay (d2), s/veh	0.0	2.6	0.4	0.0	2.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	10.3	1.4	0.0	14.4	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	36.0	13.5	0.0	22.7	0.0
LnGrp LOS	A	D	B	A	C	A
Approach Vol, veh/h		832	299		1447	
Approach Delay, s/veh		36.0	13.5		22.7	
Approach LOS		D	B		C	

Timer - Assigned Phs	2	4	6
Phs Duration (G+Y+Rc), s	48.0	72.0	48.0
Change Period (Y+Rc), s	* 7	* 7	* 7
Max Green Setting (Gmax), s	* 41	* 65	* 41
Max Q Clear Time (g_c+I1), s	5.6	36.6	24.6
Green Ext Time (p_c), s	1.8	6.8	4.8

Intersection Summary	
HCM 6th Ctrl Delay	25.9
HCM 6th LOS	C

Notes

User approved volume balancing among the lanes for turning movement.
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	199	257	151	71	159	131	97	548	94	93	340	75
Future Volume (veh/h)	199	257	151	71	159	131	97	548	94	93	340	75
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	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	216	279	164	88	196	162	102	577	99	107	391	86
Peak Hour Factor	0.92	0.92	0.92	0.81	0.81	0.81	0.95	0.95	0.95	0.87	0.87	0.87
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	303	438	513	252	438	515	400	619	106	272	596	131
Arrive On Green	0.04	0.22	0.22	0.04	0.22	0.22	0.09	0.38	0.38	0.09	0.38	0.38
Sat Flow, veh/h	1875	1969	1668	1875	1969	1668	1875	1637	281	1875	1563	344
Grp Volume(v), veh/h	216	279	164	88	196	162	102	0	676	107	0	477
Grp Sat Flow(s),veh/h/ln	1875	1969	1668	1875	1969	1668	1875	0	1918	1875	0	1907
Q Serve(g_s), s	0.0	11.6	4.4	0.0	7.7	4.3	2.8	0.0	30.5	2.9	0.0	18.6
Cycle Q Clear(g_c), s	0.0	11.6	4.4	0.0	7.7	4.3	2.8	0.0	30.5	2.9	0.0	18.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.15	1.00		0.18
Lane Grp Cap(c), veh/h	303	438	513	252	438	515	400	0	725	272	0	727
V/C Ratio(X)	0.71	0.64	0.32	0.35	0.45	0.31	0.25	0.00	0.93	0.39	0.00	0.66
Avail Cap(c_a), veh/h	324	438	513	273	438	515	400	0	725	272	0	727
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	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	37.1	31.7	10.6	36.8	30.2	10.5	15.8	0.0	26.9	19.6	0.0	23.0
Incr Delay (d2), s/veh	6.7	6.9	1.6	0.8	3.3	1.6	0.3	0.0	20.5	0.9	0.0	4.6
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	5.0	6.0	2.2	1.8	3.9	2.1	1.1	0.0	16.7	1.2	0.0	8.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	43.9	38.7	12.3	37.7	33.5	12.1	16.1	0.0	47.4	20.5	0.0	27.5
LnGrp LOS	D	D	B	D	C	B	B	A	D	C	A	C
Approach Vol, veh/h		659			446			778			584	
Approach Delay, s/veh		33.8			26.5			43.3			26.3	
Approach LOS		C			C			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.0	40.0	10.0	26.0	13.7	40.3	10.0	26.0
Change Period (Y+Rc), s	* 6.2	* 6	* 6	* 6	* 6	* 6	* 6	* 6
Max Green Setting (Gmax), s	* 6.8	* 34	* 5	* 20	* 7.4	* 34	* 5	* 20
Max Q Clear Time (g_c+I1), s	14.9	32.5	2.0	13.6	4.8	20.6	2.0	9.7
Green Ext Time (p_c), s	0.0	0.7	0.0	1.1	0.0	2.2	0.2	1.1

Intersection Summary	
HCM 6th Ctrl Delay	33.7
HCM 6th LOS	C

Notes

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

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	13	431	327	33	85	34
Future Vol, veh/h	13	431	327	33	85	34
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	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	85	85	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	14	468	385	39	92	37

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	424	0	-	0	901	405
Stage 1	-	-	-	-	405	-
Stage 2	-	-	-	-	496	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1135	-	-	-	309	646
Stage 1	-	-	-	-	673	-
Stage 2	-	-	-	-	612	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1135	-	-	-	304	646
Mov Cap-2 Maneuver	-	-	-	-	425	-
Stage 1	-	-	-	-	662	-
Stage 2	-	-	-	-	612	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	14.4
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1135	-	-	-	425	646
HCM Lane V/C Ratio	0.012	-	-	-	0.217	0.057
HCM Control Delay (s)	8.2	0	-	-	15.8	10.9
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0	-	-	-	0.8	0.2

Intersection: 1: Dequindre Road & South Blvd. (Push Button)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	L	T	T	R	L	T	T	R	L	T	T
Maximum Queue (ft)	131	125	153	244	174	139	196	155	116	265	544	585
Average Queue (ft)	69	64	82	84	108	67	107	38	48	108	275	247
95th Queue (ft)	114	112	132	167	175	120	171	115	98	245	455	466
Link Distance (ft)	406	406	406	406			509	509			659	659
Upstream Blk Time (%)				0							0	1
Queuing Penalty (veh)				0							0	0
Storage Bay Dist (ft)					150	160			100	240		
Storage Blk Time (%)				0	3	0	1	0	2	0	13	17
Queuing Penalty (veh)				2	5	0	1	0	2	0	17	78

Intersection: 1: Dequindre Road & South Blvd. (Push Button)

Movement	NB	SB	SB	SB	SB
Directions Served	R	L	T	T	R
Maximum Queue (ft)	165	260	484	480	125
Average Queue (ft)	124	141	292	264	87
95th Queue (ft)	214	283	430	410	166
Link Distance (ft)			537	537	
Upstream Blk Time (%)			0	0	
Queuing Penalty (veh)			0	0	
Storage Bay Dist (ft)	140	235			100
Storage Blk Time (%)	2	0	17	31	0
Queuing Penalty (veh)	10	1	28	81	0

Intersection: 2: South Blvd. (Push Button) & M-59 SB Exit Ramp

Movement	EB	EB	WB	WB	SB	SB
Directions Served	T	T	T	T	L	LR
Maximum Queue (ft)	104	313	292	282	721	1004
Average Queue (ft)	40	171	177	156	103	569
95th Queue (ft)	85	265	248	229	424	1017
Link Distance (ft)	1262	1262	406	406	1713	1713
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 3: John R Road & South Blvd. (Push Button)

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	T	R	L	TR	L	TR
Maximum Queue (ft)	146	252	86	124	318	104	124	252	124	458
Average Queue (ft)	58	102	23	43	144	24	84	99	60	407
95th Queue (ft)	121	191	57	109	285	99	132	203	133	506
Link Distance (ft)		678			1222			297		413
Upstream Blk Time (%)								0		35
Queuing Penalty (veh)								0		0
Storage Bay Dist (ft)	150		460	100		300	100		100	
Storage Blk Time (%)	0	4		1	23	0	10	4	1	46
Queuing Penalty (veh)	0	5		2	26	0	25	7	5	52

Intersection: 4: South Blvd. & Proposed Site Drive

Movement	EB	WB	SB	SB
Directions Served	L	TR	L	R
Maximum Queue (ft)	39	8	40	35
Average Queue (ft)	8	0	12	8
95th Queue (ft)	30	4	37	29
Link Distance (ft)		1157	340	340
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	100			
Storage Blk Time (%)				
Queuing Penalty (veh)				

Zone Summary

Zone wide Queuing Penalty: 348

Intersection: 1: Dequindre Road & South Blvd.(Push Button)

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	L	T	T	R	L	T	T	R	L	T	T
Maximum Queue (ft)	364	338	399	424	175	111	119	155	123	265	674	662
Average Queue (ft)	227	218	266	310	164	42	49	20	68	124	490	476
95th Queue (ft)	332	318	398	457	214	91	98	95	127	306	731	730
Link Distance (ft)	406	406	406	406			509	509			659	659
Upstream Blk Time (%)	0		0	2							4	7
Queuing Penalty (veh)	0		2	8							0	0
Storage Bay Dist (ft)					150	160			100	240		
Storage Blk Time (%)				28	5		0	0	6	0	35	34
Queuing Penalty (veh)				152	18		0	0	2	0	33	168

Intersection: 1: Dequindre Road & South Blvd.(Push Button)

Movement	NB	SB	SB	SB	SB
Directions Served	R	L	T	T	R
Maximum Queue (ft)	165	171	248	217	125
Average Queue (ft)	150	69	156	112	31
95th Queue (ft)	212	130	227	203	95
Link Distance (ft)			537	537	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	140	235			100
Storage Blk Time (%)	4		0	6	0
Queuing Penalty (veh)	22		0	5	0

Intersection: 2: South Blvd.(Push Button) & M-59 SB Exit Ramp

Movement	EB	EB	WB	WB	SB	SB
Directions Served	T	T	T	T	L	LR
Maximum Queue (ft)	551	678	176	184	432	583
Average Queue (ft)	221	371	94	108	158	367
95th Queue (ft)	486	611	152	166	317	548
Link Distance (ft)	1257	1257	406	406	1427	1427
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 3: John R Road & South Blvd.(Push Button)

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	T	R	L	TR	L	TR
Maximum Queue (ft)	175	366	87	124	206	120	125	341	124	315
Average Queue (ft)	118	164	33	47	86	50	75	303	66	160
95th Queue (ft)	198	312	67	103	169	97	147	364	131	280
Link Distance (ft)		678			1222			297		413
Upstream Blk Time (%)								45		
Queuing Penalty (veh)								0		
Storage Bay Dist (ft)	150		460	100		300	100		100	
Storage Blk Time (%)	6	9		1	7		1	54	2	19
Queuing Penalty (veh)	26	33		1	15		6	52	8	18

Intersection: 4: South Blvd. & Proposed Site Drive

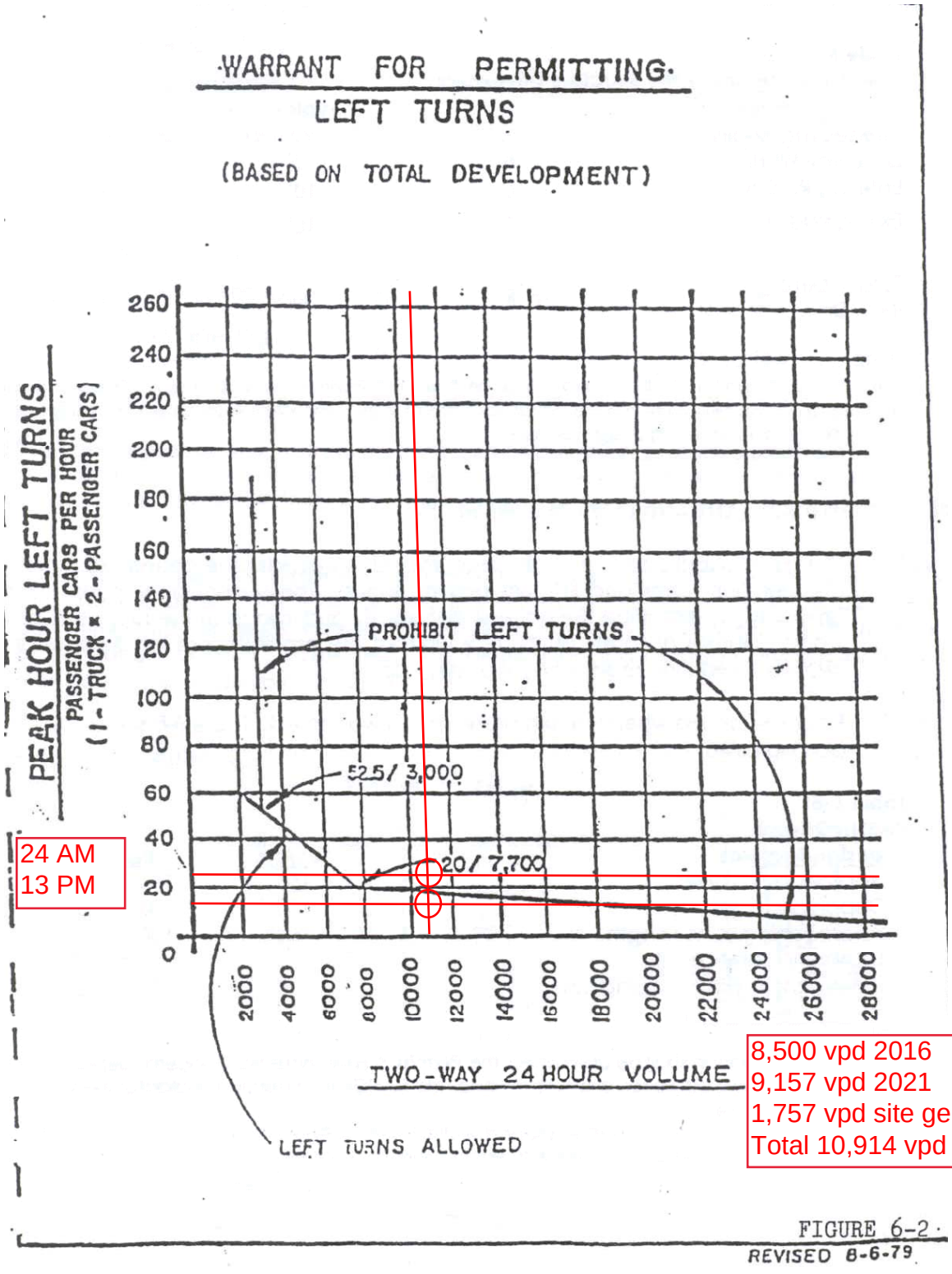
Movement	EB	SB	SB
Directions Served	LT	L	R
Maximum Queue (ft)	103	103	59
Average Queue (ft)	8	41	23
95th Queue (ft)	48	74	52
Link Distance (ft)	863	346	346
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Zone Summary

Zone wide Queuing Penalty: 571

Appendix E

AUXILIARY LANE ANALYSIS



Left-turn treatment required

WARRANTS FOR RIGHT TURN DECELERATION LANE OR TAPER

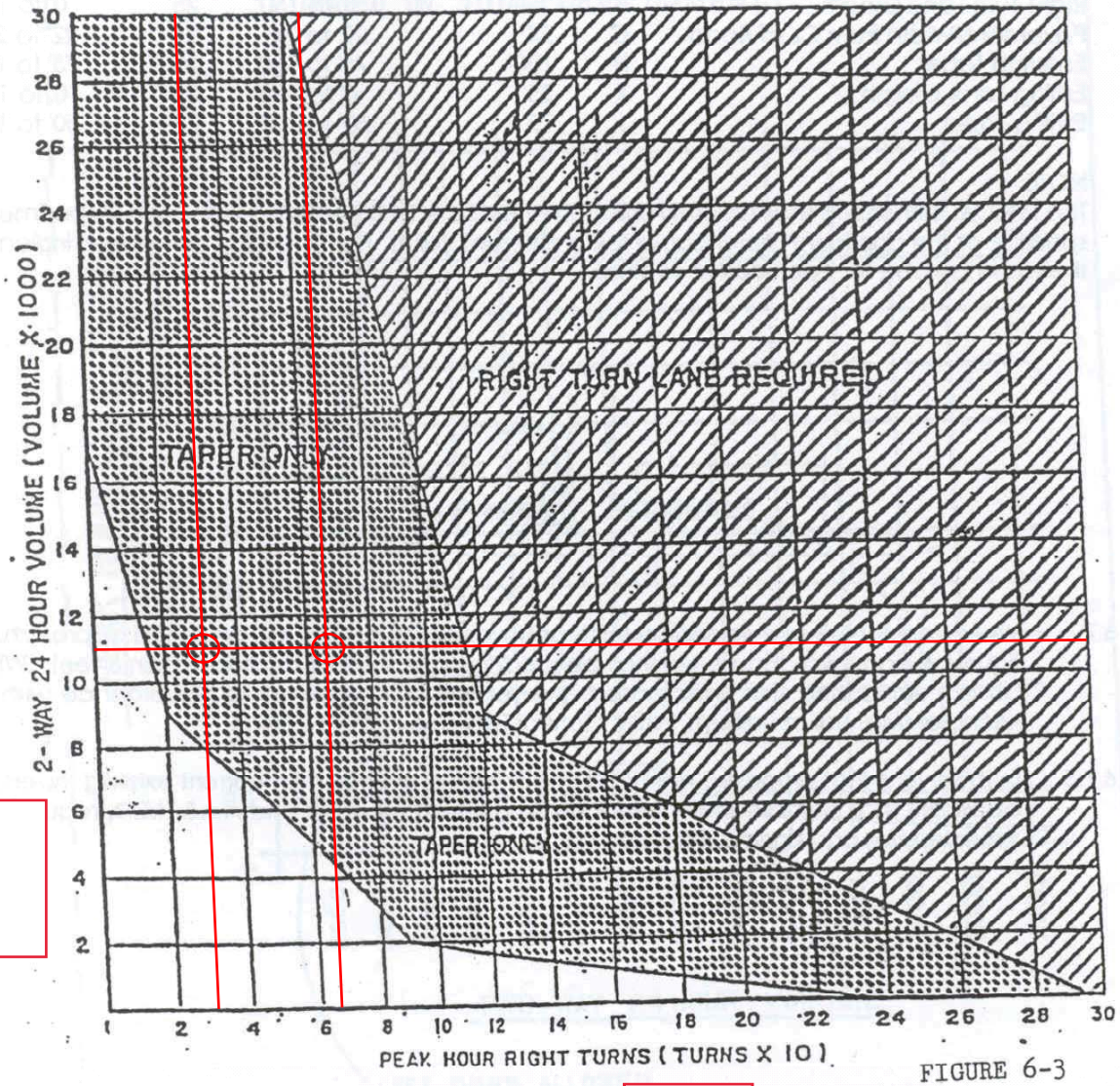


FIGURE 6-3

8,500 vpd 2016
9,157 vpd 2021
1,757 vpd site gen
Total 10,914 vpd

66 AM
33 PM

Right Turn Taper Only