

CHAMBERS AND HESS DEVELOPMENT

TRAFFIC IMPACT STUDY (TIS)

TOWN OF PARKER, CO

JUNE 25, 2020

JOB NUMBER: 18633

RICK

RICK ENGINEERING COMPANY

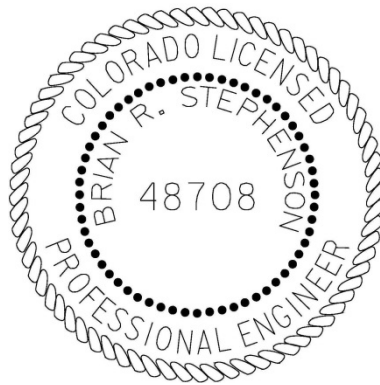


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TOWN OF PARKER, CO**

**ORIGINAL JANUARY 23, 2020
REVISED JUNE 25, 2020**

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1.0- INTRODUCTION AND PROJECT DESCRIPTION

1.1- INTRODUCTION

The following Traffic Impact Study (TIS) has been prepared to determine any traffic related impacts within the project area intersections and roadways due to the proposed Chambers and Hess Development, based on the Town of Parker's Traffic Impact Study Guidelines outlined within the Town's Roadway Design and Construction Manual Section 5. The project is located on the northeast corner of S. Chambers Road and E. Hess Road in the Town of Parker, Colorado.

Exhibit 1 shows the project vicinity map.

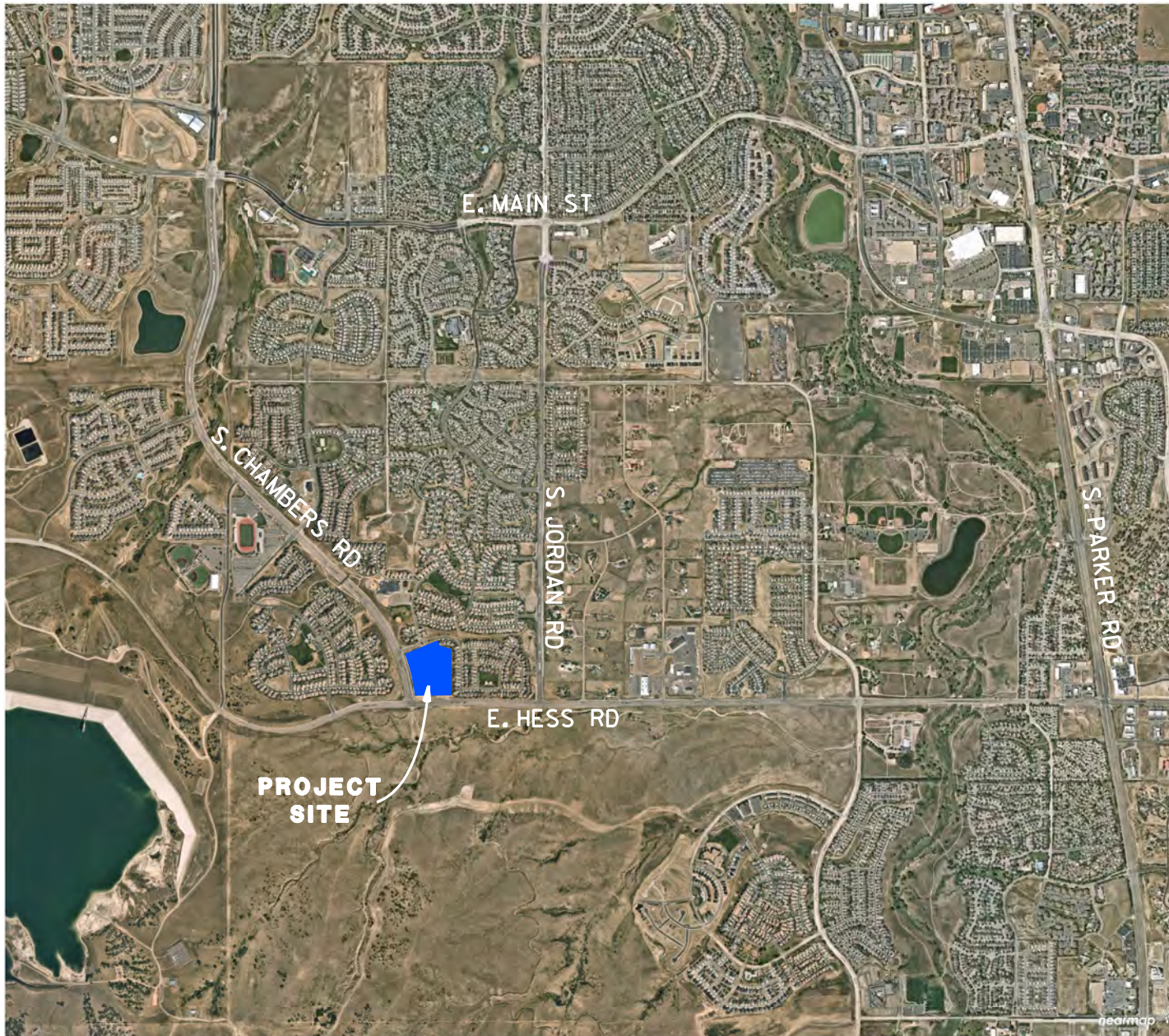
1.2- PROJECT DESCRIPTION

In coordination with the Town of Parker, Rick Engineering Company (RICK) developed the scope of the TIS, including the project study area, project trip generation rates, and trip distribution assumptions. The project proposes to construct a commercial development on a currently vacant 14 acre parcel, consisting of fast food restaurants, a gas station with convenience store, auto care center, quick lubrication shop, a car wash, a pharmacy/drug store, a drive-in bank, a general office building, and a day care center. The project proposes one full and one right-in only access at S. Red Sky Drive, and one right-in/right-out access at E. Hess Road. The Project opening year is assumed to be in 2021 and with no phasing of development.

Exhibit 2 shows the project site plan.

The intersections and roadways within the project were analyzed for the following scenarios:

- Existing (2019)
- Opening Year (2021) without Project (Short-Term Background)
- Opening Year (2021) with Project (Short-Term Background + Project)
- Project Design Year (20 years from project opening) without Project (Long-Term Background)
- Project Design Year (20 years from project opening) with Project (Long-Term Background + Project)



**PROJECT
SITE**

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NOT TO SCALE



EXHIBIT 1
VICINITY MAP
CHAMBERS AND HESS DEVELOPMENT

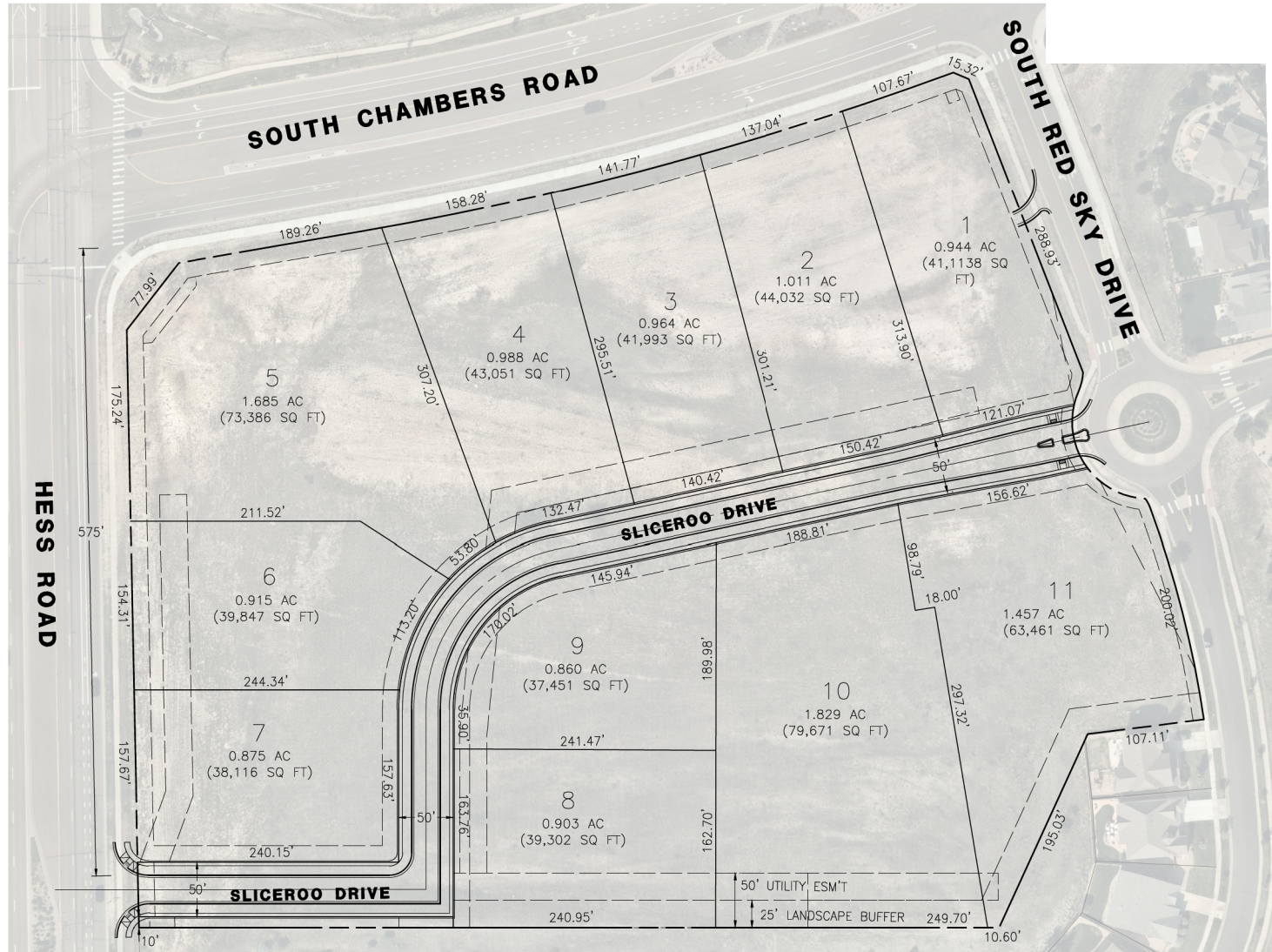


EXHIBIT 2
PROJECT SITE PLAN

CHAMBERS AND HESS DEVELOPMENT

2.0 EXISTING CONDITIONS

The following is a brief description of the existing roadways and intersections as identified in the Town of Parker Transportation Master Plan, dated December 2018.

Existing Roadways

S. Chambers Road is a north-south roadway that is classified as a Principal Arterial. In the project vicinity, it is currently built as a four-lane divided roadway providing two travel lanes with acceleration/deceleration lanes and bicycle lanes in each direction. The posted speed limit is 45 miles per hour (MPH). Per the Town of Parker's 2035 Transportation Master Plan, this roadway segment is ultimately a six-lane roadway.

E. Hess Road is an east-west roadway that is classified as a four-lane Arterial and currently built as a four-lane divided roadway providing two travel lanes with acceleration/deceleration lanes as well as bicycle lanes in each direction. The posted speed limit is 45 miles per hour (MPH).

S. Red Sky Drive is an east-west roadway that is functioning as an undivided two-lane Residential Collector that provides access to residential homes with one travel lane in each direction and a Roundabout at its intersection with S. Swift Fox Way. The posted speed limit is 25 miles per hour (MPH).

Existing Intersections

S. Chambers Road/E. Hess Road is currently built as a three-legged signalized intersection, consisting of the following lane configurations; two left turn lanes, and an exclusive right turn lane for the southbound approach; exclusive left turn lane and two through lanes for the eastbound approach; and two through lanes and exclusive right-turn lane for the westbound approach. Per the Town's 2035 Transportation Plan, this intersection will ultimately become a 4-legged intersection.

S. Chambers Road/S. Red Sky Drive is currently built as a three-legged unsignalized intersection with stop control for the westbound approach consisting of the following lane configurations; two through lanes and an exclusive right-turn lane for the northbound approach; three through lanes and exclusive left turn lane for the southbound approach; and exclusive left and right turn lanes for the westbound approach.

S. Red Sky Drive/S. Swift Fox Way is currently built as a three-legged roundabout intersection with single travel lanes for the eastbound, westbound and southbound approaches. This intersection is proposed to serve as a full 4-legged access to the project site.

E. Hess Road/Firefly Lane is currently built as a three-legged unsignalized intersection with stop control for the southbound approach, consisting of the following lane configurations; two through lanes and exclusive left turn lane for the eastbound approach; two through lanes and exclusive right turn lane for the westbound approach; and a shared left-right turn lane for the southbound approach.

Exhibit 3 illustrates the existing transportation conditions within the project area as described above.

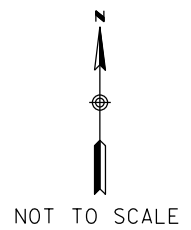
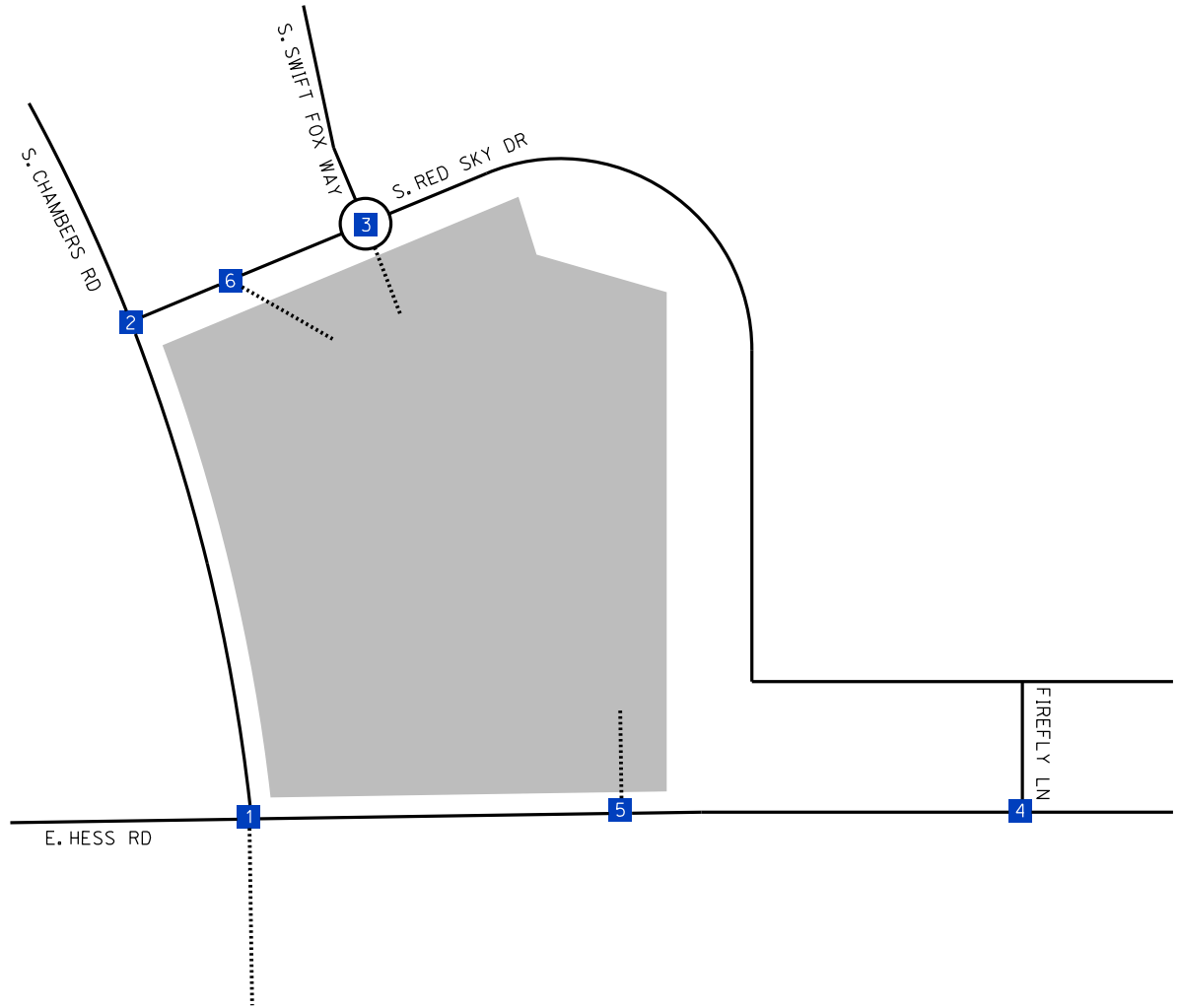
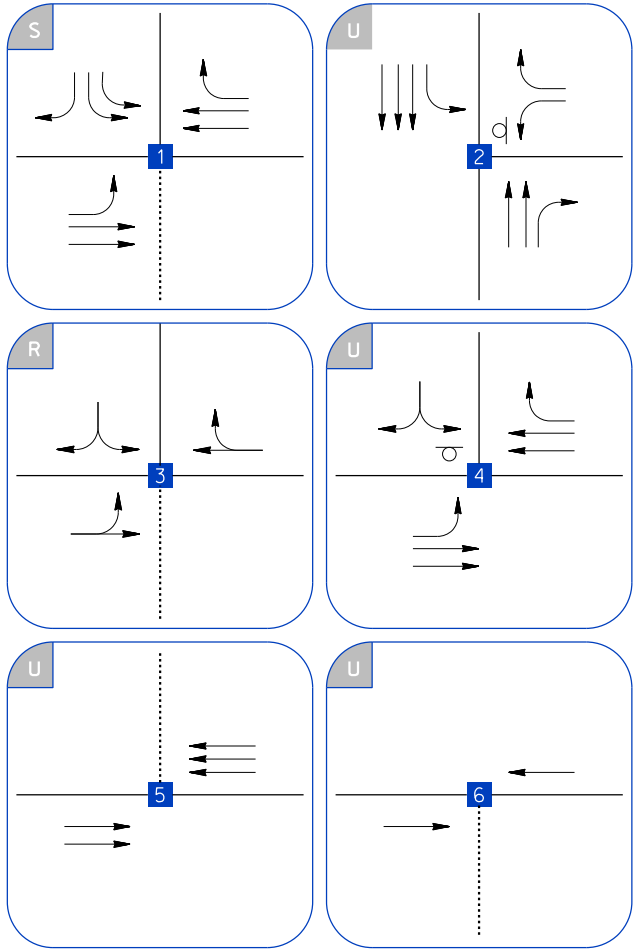


EXHIBIT 3
EXISTING CONDITIONS
CHAMBERS AND HESS DEVELOPMENT

LEGEND

- U** = UNSIGNALIZED
- S** = SIGNALIZED
- R** = ROUNDABOUT
- 1** = INTERSECTION NUMBER
- = PROJECT SITE
- = STOP CONTROLLED
-** = FUTURE ROAD/DRIVEWAY

2.1- EXISTING TRAFFIC VOLUMES

The traffic study was analyzed for the following intersections within the project area:

1. S. Chambers Road and E. Hess Road
2. S. Chambers Road and S. Red Sky Drive
3. S. Red Sky Drive and S. Swift Fox Way
4. E. Hess Road and Firefly Lane

The following roadway segments were also analyzed:

1. S. Chambers Road between S. Red Sky Drive and E. Hess Road
2. E. Hess Road between S. Chambers Road and Firefly Lane
3. S. Red Sky Drive east of S. Chambers Road

Existing traffic data at the study intersections and roadways was obtained from traffic counts conducted by All Traffic Data Services, Inc. on Wednesday, August 21st, 2019. The turning movement counts were conducted during the weekday AM (7-9) and PM (4-6) peak periods. During the same day, twenty-four-hour tube counts were conducted in order to document the average daily traffic (ADT) and 85th percentile speeds along the studied roadways.

Exhibit 4 shows the existing intersection turning movement counts and ADT's within the study area.

Appendix A contains the intersection turning movement and roadway segment count sheets.

2.2- EXISTING TRAFFIC OPERATIONS

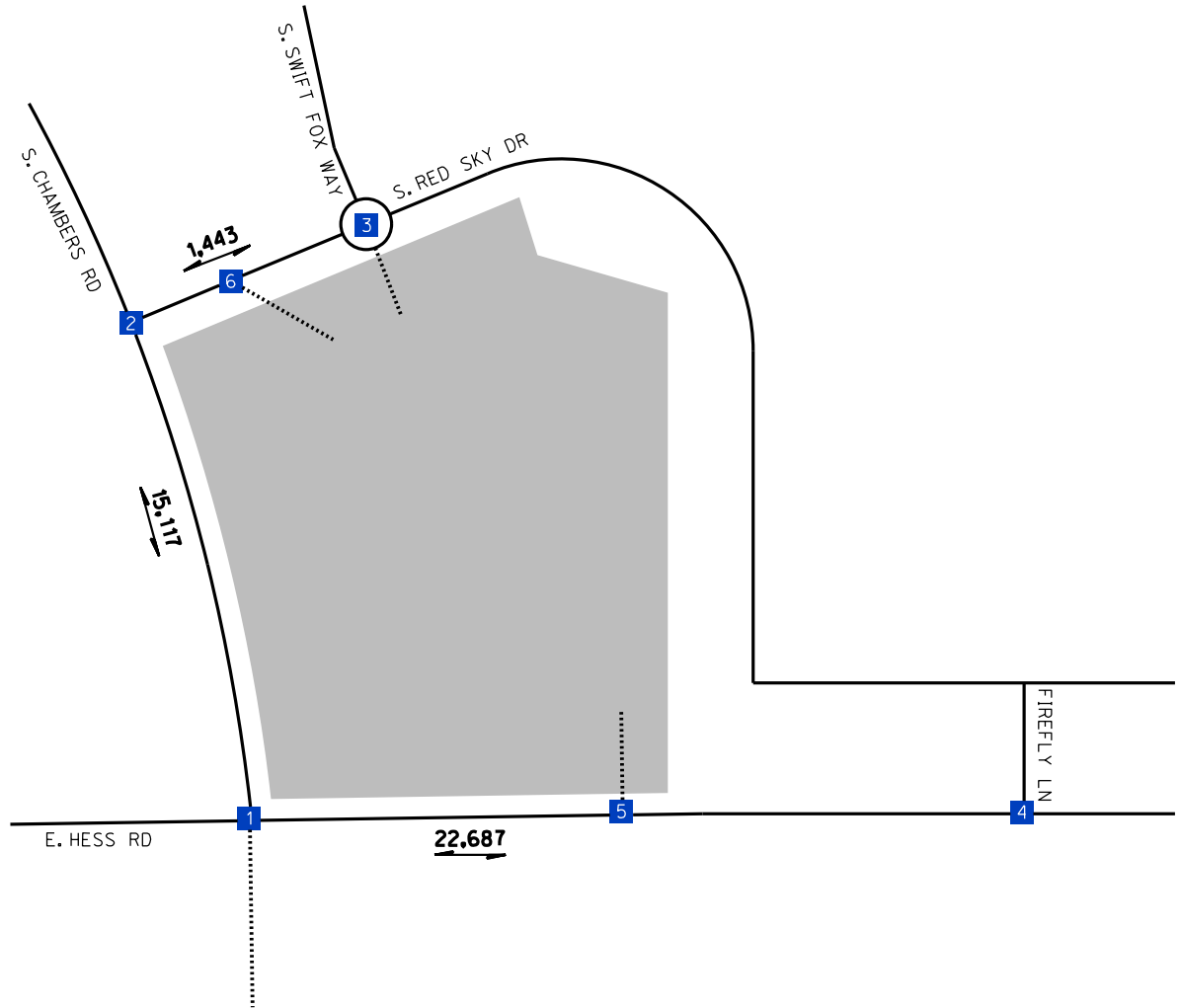
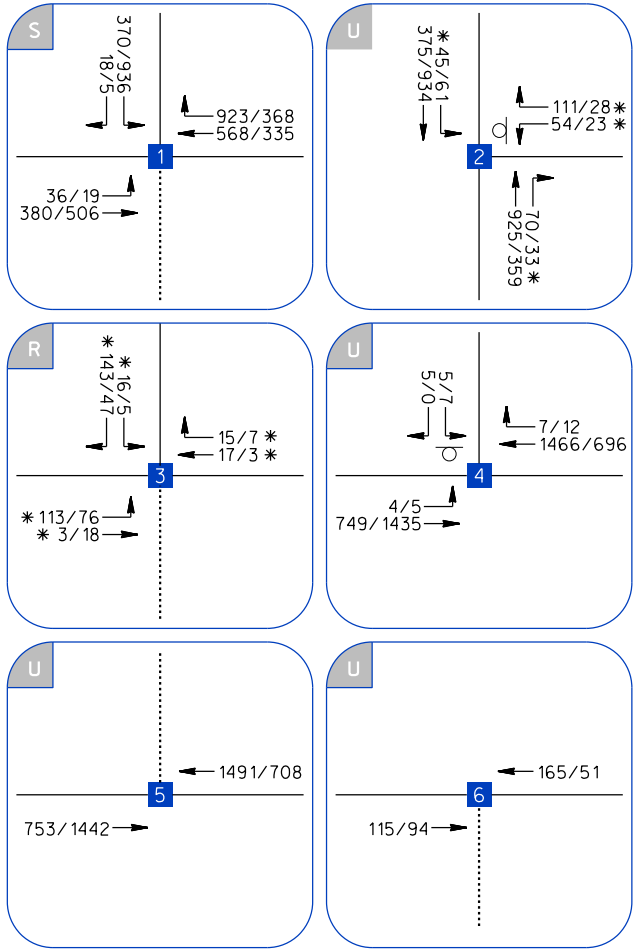
The Level of Service (LOS) for signalized intersections was calculated using the methodologies described in Chapter 19 of the 6th Edition Highway Capacity Manual (HCM 6). The LOS for signalized intersections is defined in terms of control delay, which is made up of several factors that relate to right-of-way control, geometrics and traffic volumes. The signalized intersection analysis also considers intersection spacing and coordination.

The LOS for two-way and all-way stop controlled intersections was calculated using the methodologies described in Chapters 20 and 21 of the 6th Edition HCM. The LOS for an unsignalized (two-way stop controlled) intersection is determined by the computed control delay for critical movement with corresponding LOS. The LOS for an unsignalized (all-way stop controlled) intersection is determined by the computed control delay for the intersection as a whole with corresponding LOS.

The operational conditions for the roadway segments were established utilizing Douglas County 2040 Transportation Plan's Recommended Traffic Volume Thresholds per Table 4, dated June 2019 to evaluate the overall performance.

LOS for roundabouts was calculated using SIDRA software which incorporates the methodologies described in Chapter 22 of the 6th Edition HCM. Roundabout LOS is defined in terms of control delay, similar to that of signalized or all-way stop-controlled intersections, while accounting for yield-controlled approaches.

Synchro 10 was used for the computation of the stop controlled, and signalized intersections per the methodologies described above.



7:00-8:00 A.M. PEAK HOUR
 * 7:45-8:45 A.M. PEAK HOUR
 5:00-6:00 P.M. PEAK HOUR
 * 4:30-5:30 P.M. PEAK HOUR



NOT TO SCALE



EXHIBIT 4
 EXISTING (2019) TRAFFIC VOLUMES
 CHAMBERS AND HESS DEVELOPMENT

LEGEND	
AM/PM=PEAK HOUR VOLUMES	1 = INTERSECTION NUMBER
X,XXX = TWO-WAY ADT	[Shaded Area] = PROJECT SITE
	[Dotted Line] = FUTURE ROAD/DRIVEWAY

The existing intersection and roadway operations results are based on existing traffic volumes collected and existing intersection and roadway geometry.

Table 1 shows that all the studied intersections currently operate at acceptable levels of service (LOS C or better) for existing conditions, and no approach or movement of an intersection fell below LOS E, with the exception of the following intersection:

- S. Chambers Road/S. Red Sky Drive (LOS E overall, AM peak hour)
- E. Hess Road/Firefly Lane (LOS F, AM peak hour for the southbound approach)

Table 2 shows that all the studied roadway segments currently operate at acceptable levels of service (LOS B or better) for existing conditions.

Appendix B contains the intersection capacity analysis worksheets for all scenarios.

Appendix C contains Douglas County's roadway segment thresholds.



**TABLE 1
EXISTING INTERSECTION OPERATIONS
CHAMBERS AND HESS DEVELOPMENT**

#	INTERSECTION	CONTROL	DIR.	EXISTING (2019)			
				AM Peak		PM Peak	
				DELAY ¹	LOS ²	DELAY ¹	LOS ²
1	S. Chambers Rd/E. Hess Rd	(S)	Overall	16.0	B	11.4	B
2	S. Chambers Rd/S. Red Sky Dr	(OWSC)	WB-L	45.1	E	18.0	C
			WB-R	15.2	C	9.5	A
			SB-L	11.7	B	8.3	A
3	S. Red Sky Dr/S. Swift Fox Way	(R)	Overall	3.7	A	3.2	A
4	E. Hess Rd/Firefly Ln	(OWSC)	EB-L	14.6	B	9.2	A
			SB-LR	>50	F	39.1	E

Footnotes:

Results calculated utilizing the methodologies described in Chapters 19, 20, 21, and 22 in the 6th edition of the HCM .

1) Delay is measured in seconds per vehicle.

2) Level of Service

(S)=Signalized, (TWSC)=Two-Way Stop Controlled, (OWSC)=One-Way Stop Controlled, (AWSC)=All-Way Stop Controlled, (R)=Roundabout.

NB=Northbound, WB=Westbound, etc.

L=Left-turn movement, T=Thru movement, R= Right-turn movement, etc.

LT=Left-Through lane, LTR=Left-Through-Right lane , etc.



**TABLE 2
EXISTING ROADWAY SEGMENT OPERATIONS
CHAMBERS AND HESS DEVELOPMENT**

ROADWAY SEGMENT	ULTIMATE ROADWAY CLASSIFICATION	ULTIMATE CAPACITY (LOS D) ¹	FUNCTIONAL CLASSIFICATION	CAPACITY (LOS D) ¹	EXISTING (2019)		
					ADT	V/C	LOS
S. Chambers Road between S. Red Sky Drive and E. Hess Road	Principal Arterial (6L)	55,000	Arterial (4L)	40,000	15,117	0.38	A
E. Hess Road between S. Chambers Road and Firefly Lane	Arterial (4L)	40,000	Arterial (4L)	40,000	22,687	0.57	B
S. Red Sky Drive east of S. Chambers Road	Residential Collector (2L)	12,000	Residential Collector (2L)	12,000	1,443	0.12	A

Footnote:

¹ Source: Douglas County 2040 Transportation Plan Table 4, Recommended Traffic Volume Thresholds Dated June 2019

3.0- PROPOSED CONDITIONS

The following is a brief description of the proposed Project characteristics such as intended access points and geometric layouts of the roadways being proposed. As illustrated in Exhibit 2, the project proposes three access points; one at S. Red Sky Drive, one at S. Chambers Road and one at E. Hess Road.

S. Red Sky Drive/S. Swift Fox Way-Future Project Dwy intersection will provide northerly access to the project, with a proposed fourth driveway at the existing roundabout and a yield control for the northbound approach matching the southbound, eastbound and westbound approaches. Lane configurations for this intersection are described under the short-term and long-term conditions sections within this report.

E. Hess Road/Future Project Dwy intersection will provide the southerly access to the project and is proposed as right-in/right-out intersection with stop control for the southbound approach. Lane configurations for this intersection are described under the short-term and long-term conditions sections within this report.

S. Red Sky Drive/Future Project Dwy intersection will provide the northerly right-in only access to the project prior to the existing roundabout, with the following lane configurations; one shared through-right turn lane for the eastbound approach; and one through lane for the westbound approach.

3.1- PROJECT TRIP GENERATION

The project traffic volumes generated by the proposed development were estimated using the nationally published trip generation rates from the Institute of Transportation Engineers (ITE), Trip Generation Manual, 10th Edition. The project is anticipated to generate a total of 9,202 daily weekday trips, of which 766 trips (413 inbound and 353 outbound) are anticipated to be generated during the AM peak hour, and 847 trips (416 inbound and 431 outbound) during the PM peak hour. These trips account for internal captures and bicycle and pedestrian modes trip reductions, as explained in a supplementary study conducted by Fehr and Peers for this project *MXD + Methodology and Validation Technical Memorandum, Dated May 06, 2020*. **Appendix D** contains this report.

Table 3 summarizes the calculated trips generated by the project.

3.2- PROJECT TRIP DISTRIBUTION

The project traffic distribution was estimated based on the site's proximity to the nearby major roadways, existing and future traffic patterns, as well as adjacent land uses. Based on the information contained within the Town of Parker's Transportation Plan, the various roadways and intersections analyzed are planned to be improved by the year 2035. With the anticipated improvements to the network circulation, it is important for the project distribution to accurately represent the study year conditions, for both short-term and long-term conditions.

Exhibit 5 illustrates the project distribution percentages.

Exhibit 6 shows the project traffic volumes for the short-term (2021) scenario.

Exhibit 7 shows the project traffic volumes for the long-term (2041) scenario.

**TABLE 3
PROJECT TRIP GENERATION SUMMARY
CHAMBERS AND HESS DEVELOPMENT**

LAND USE	QUANTITY		ITE Trip Gen. 10th Edition Code	ADT	AM PEAK HOUR			PM PEAK HOUR		
					VOLUMES			VOLUMES		
					IN	OUT	TOTAL	IN	OUT	TOTAL
Day Care Center	13	TSF	565	619	76	67	143	68	77	145
General Office Building	15	TSF	710	146	15	2	17	3	14	17
Pharmacy/Drugstore Without Drive-Through Window	12	TSF	880	1081	23	12	35	50	52	102
Drive-in Bank	2.5	TSF	912	250	14	10	24	26	26	51
Fast-Food Restaurant with Drive-Through Window	2.5	TSF	934	1177	51	49	100	43	39	82
Fast-Food Restaurant with Drive-Through Window	2	TSF	934	942	41	39	80	34	31	65
Coffee/Donut Shop with Drive-Through Window	2	TSF	937	1641	91	87	178	44	44	87
Quick Lubrication Vehicle Shop	3	TSF	941	209	13	4	17	11	15	26
Automobile Care Center	6	TSF	942	0	9	5	14	9	10	19
Gasoline/Service Station with Convenience Market	16	VFP	945	3286	102	98	200	114	110	224
Automated Car Wash	1	CWT	948	0	0	0	0	39	39	78
Sub Total				9,351	435	373	808	441	457	896
Internal Capture				72	18	16	34	22	22	44
External Walk, Bike				77	4	4	8	3	4	7
TOTAL NET NEW PROJECT TRIPS				9,202	413	353	766	416	431	847

Source : Fehr and Peers MXD + Methodology and Validation Technical Memorandum, Dated May 06, 2020

TSF = Thousand Square Feet

VFP = Vehicle Fueling Position

CWT = Car Wash Tunnels

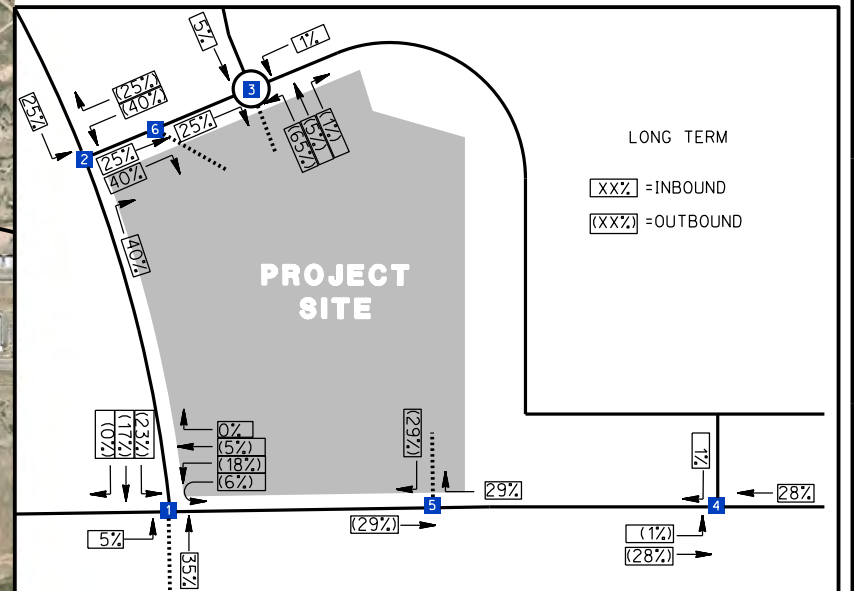
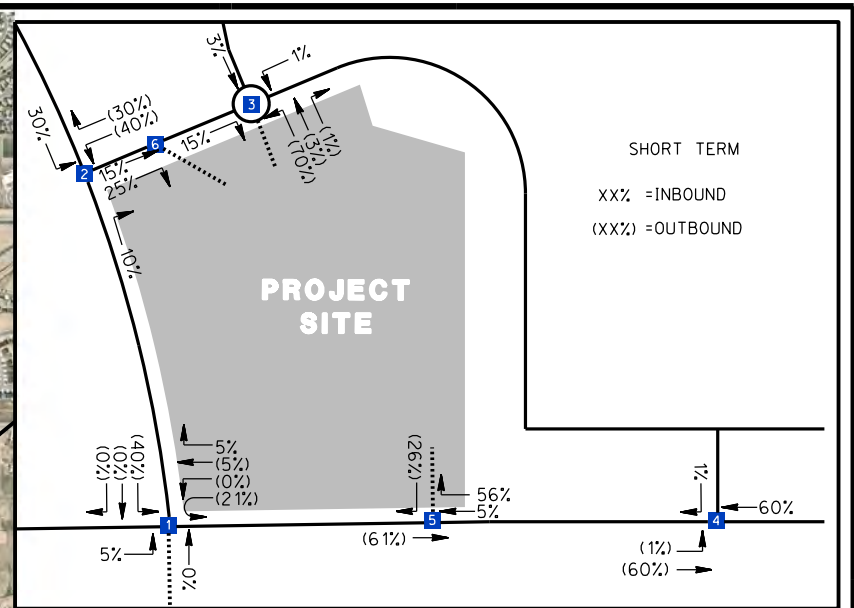
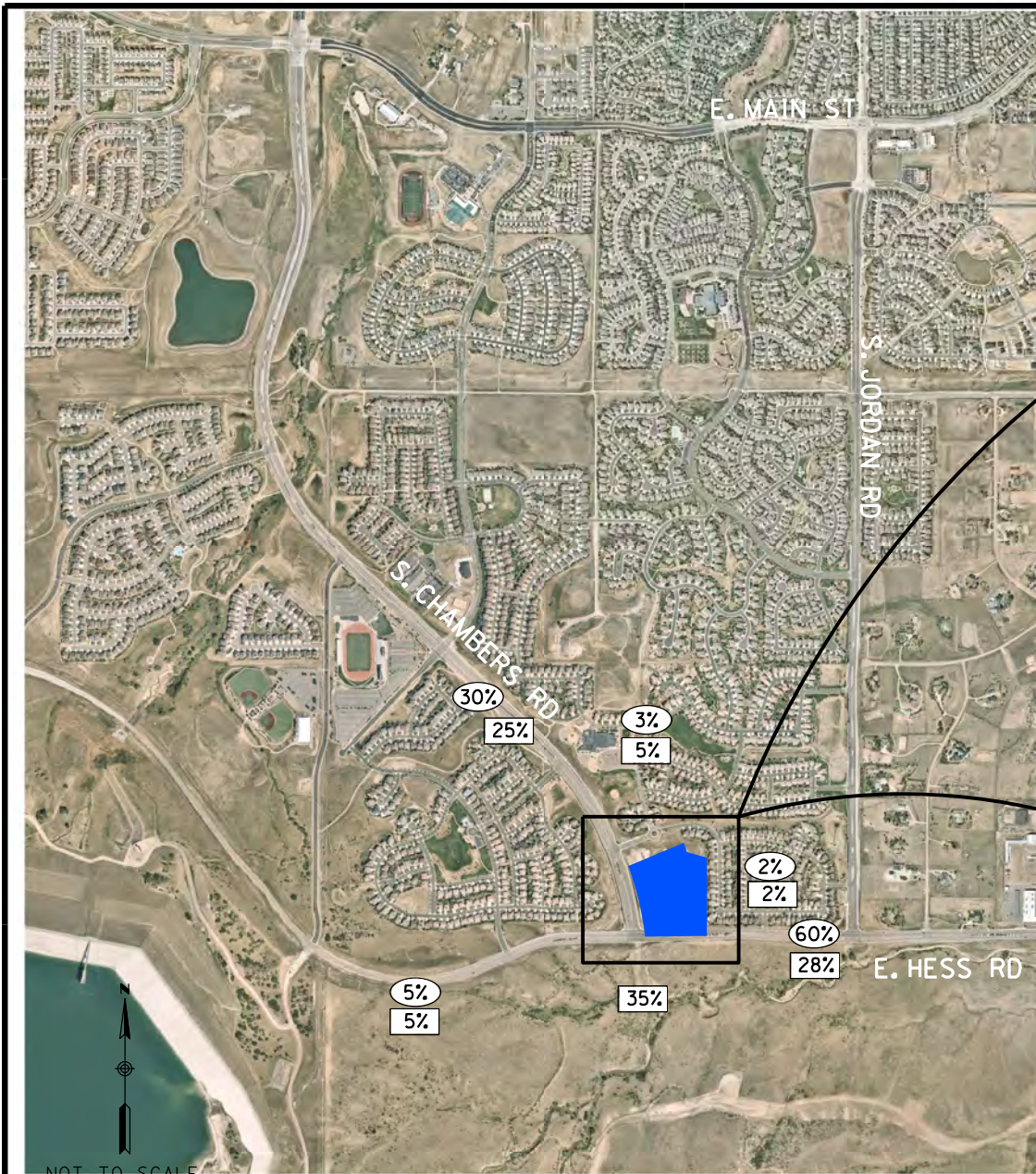


EXHIBIT 5
PROJECT TRIP DISTRIBUTION
CHAMBERS AND HESS DEVELOPMENT

LEGEND

XX%	=PERCENT DISTRIBUTION - SHORT TERM
(XX%)	=PERCENT DISTRIBUTION - LONG TERM

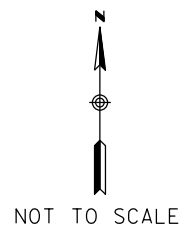
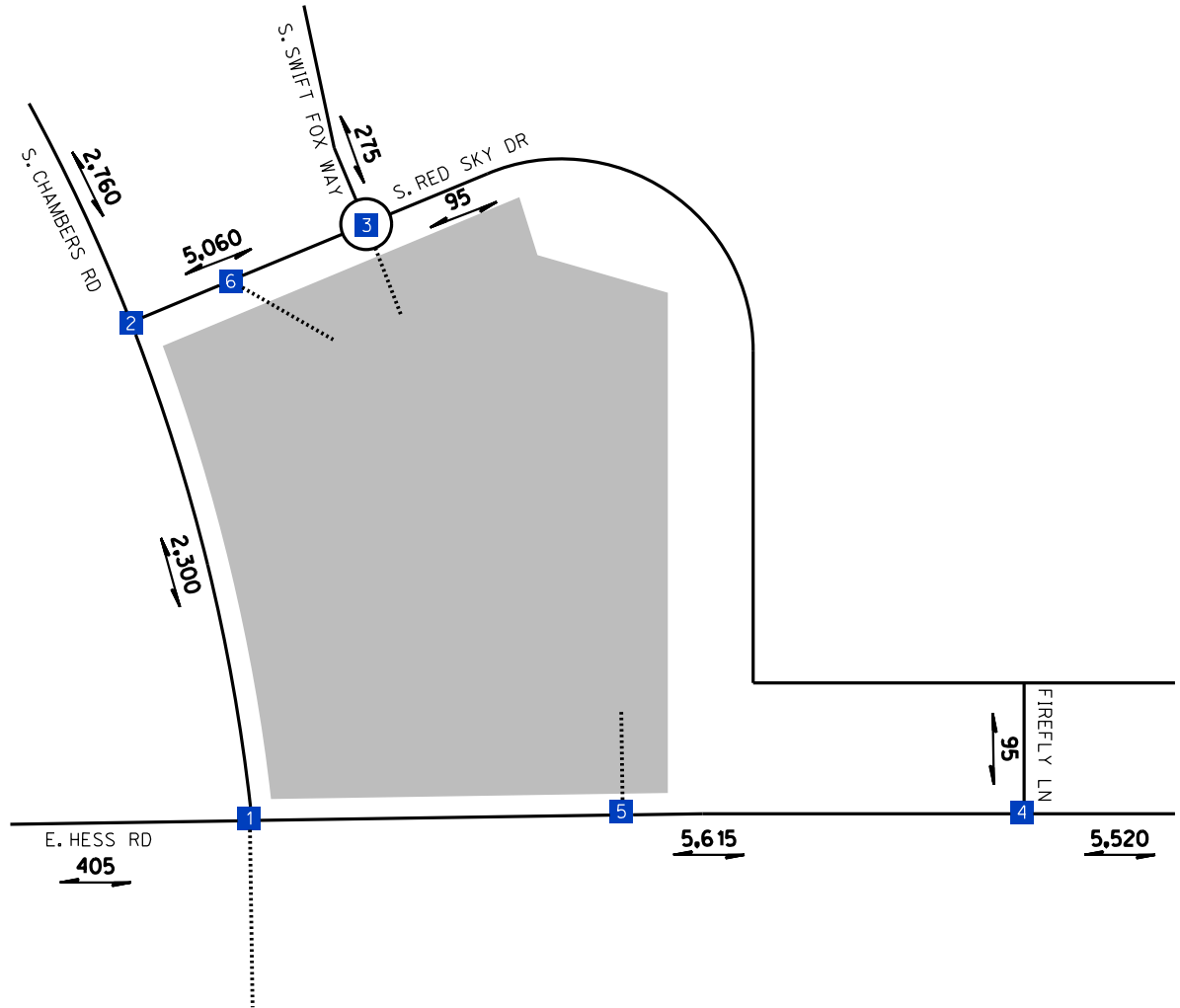
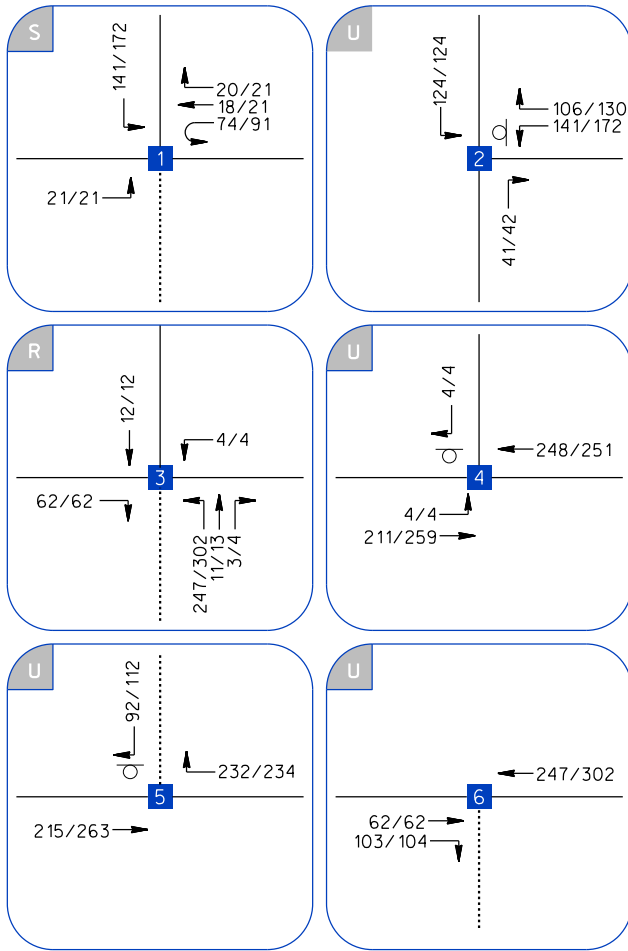


EXHIBIT 6
 SHORT-TERM (2021) PROJECT ONLY TRAFFIC VOLUMES
 CHAMBERS AND HESS DEVELOPMENT

- LEGEND**
- AM/PM=PEAK HOUR VOLUMES
 - x,xxx =TWO-WAY ADT
 - 1 =INTERSECTION NUMBER
 - [Grey Area] =PROJECT SITE
 - [Dotted Line] = FUTURE ROAD/DRIVEWAY

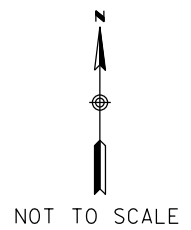
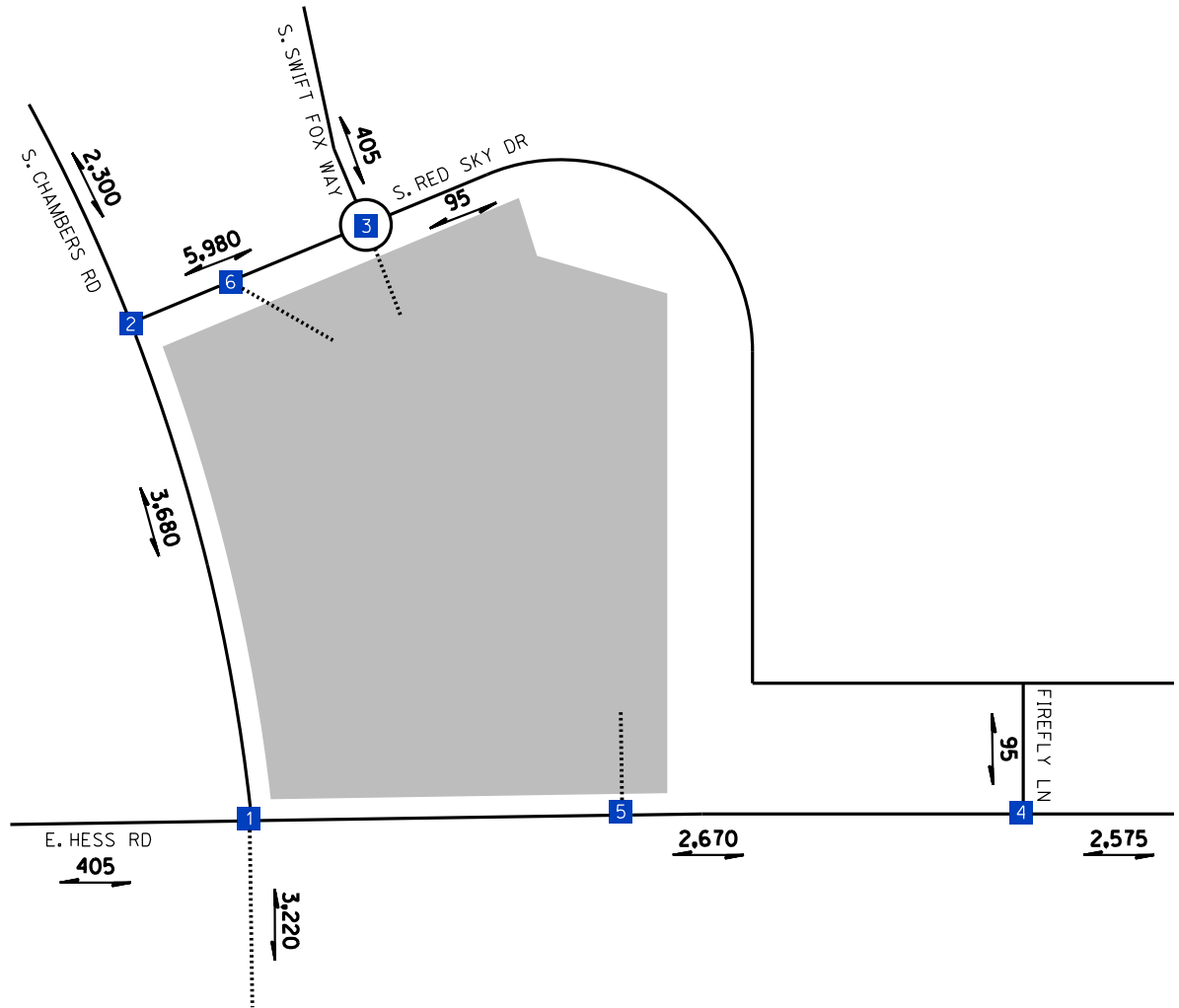
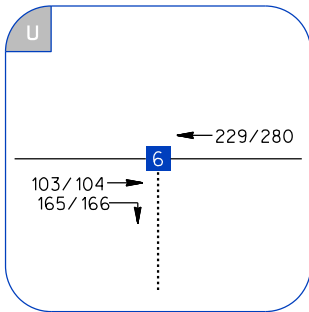
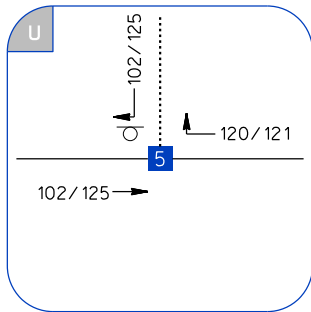
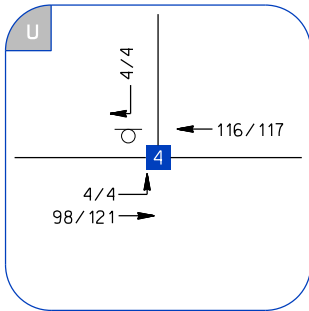
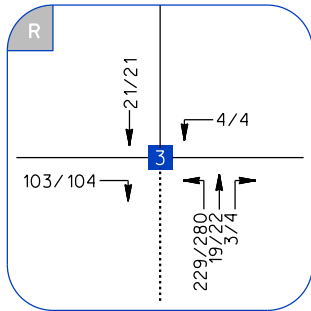
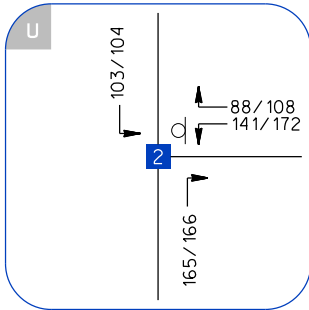
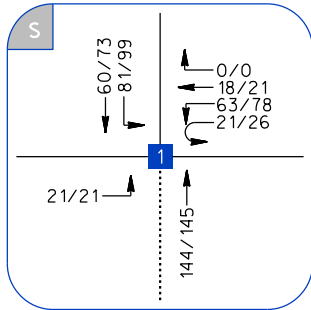


EXHIBIT 7
 LONG-TERM (2041) PROJECT ONLY TRAFFIC VOLUMES
 CHAMBERS AND HESS DEVELOPMENT

LEGEND

- AM/PM=PEAK HOUR VOLUMES
- x,xxx =TWO-WAY ADT
- 1 =INTERSECTION NUMBER
- [Grey Box] =PROJECT SITE
- [Dotted Line] = FUTURE ROAD/DRIVEWAY

4.0- FUTURE CONDITIONS

4.1- BACKGROUND TRAFFIC

Background traffic can be described as the ambient growth experienced on the roadway networks within the study area, plus any other applicable projects that are anticipated to be completed within the opening year and long-term scenario. To account for the projected increases in the background traffic, an annual growth rate of 4% was applied to the study area intersections and roadway segments consistent with the traffic volumes projected for this area per the Town of Parker for the short-term scenarios. For the long-term scenarios, background volumes projected in the Anthology study (Dated April, 2015) were utilized conservatively, as these volumes were higher than the volumes projected in the Town's Model for the year 2035. The 2035 Anthology total volumes were then increased by 2% per year at the study intersections and roadways to account for the 2041 base volumes.

Appendix E contains volumes from the Anthology study.

4.2 SHORT-TERM SCENARIO

SHORT-TERM TRANSPORTATION CONDITIONS

The short-term intersections and roadways are reflective of the existing (2019) transportation conditions as well as the proposed project intersections and roadways. All intersections and roadway segments are assumed to operate under the same classification and conditions as previously noted under the existing traffic conditions section of this report, except for the following:

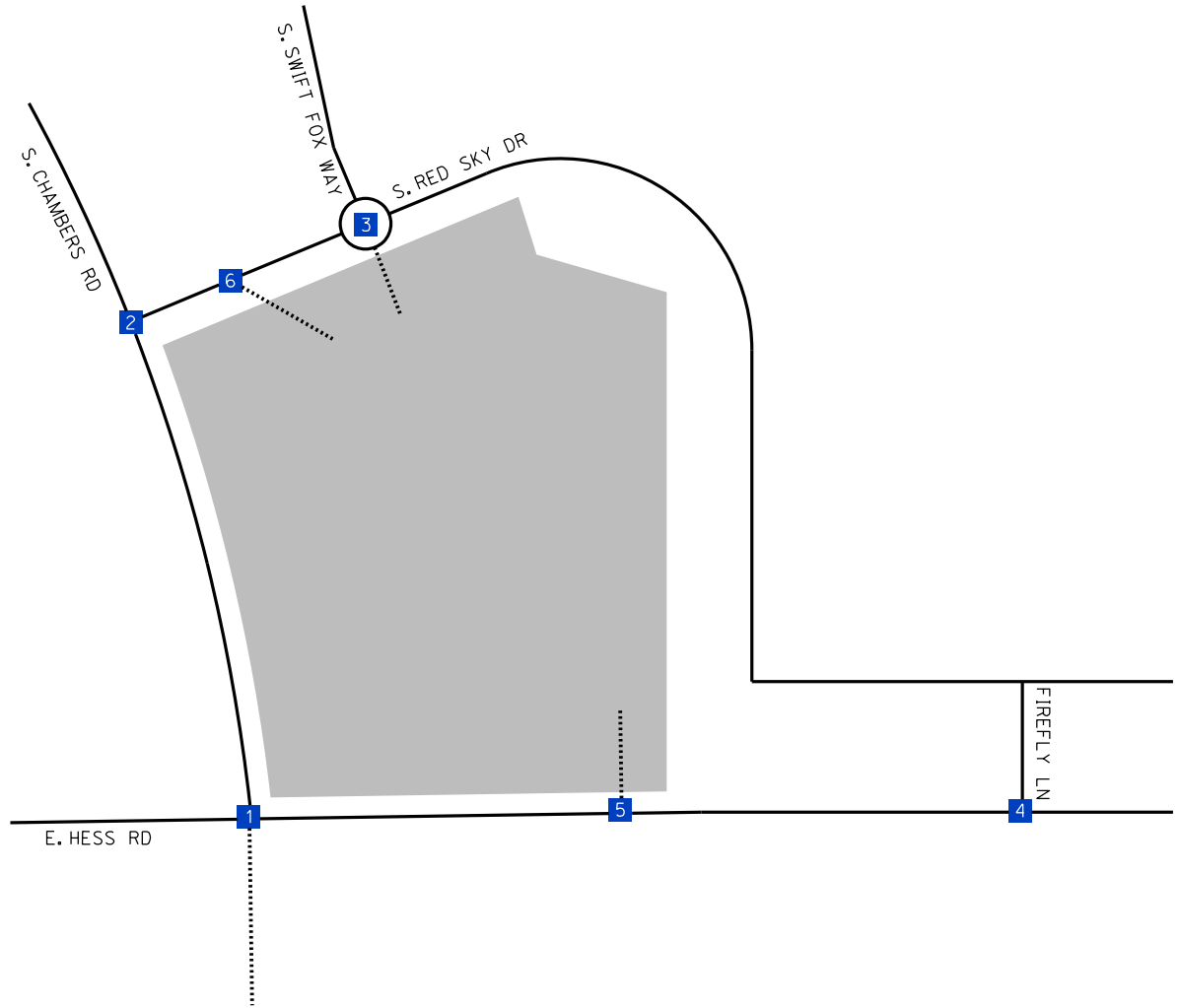
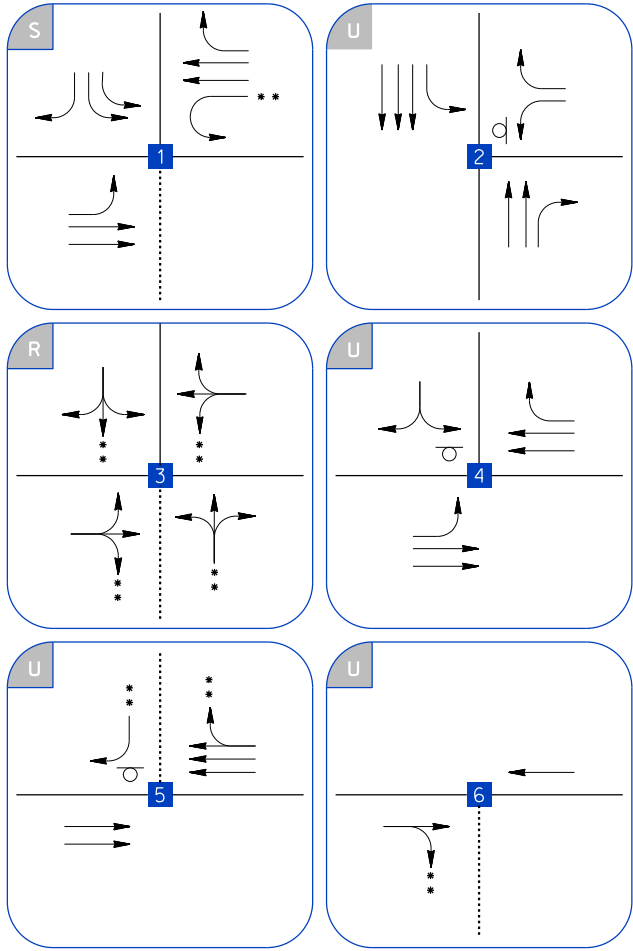
S. Chambers Road/E. Hess Road is currently built as a three-legged signalized intersection. For the Plus Project scenarios, it is assumed that the signal and striping could be modified to allow westbound U-turn movements and consisting of the following lane configurations; two left turn lanes, and an exclusive right turn lane for the southbound approach; exclusive left turn lane and two through lanes for the eastbound approach; and an exclusive U-turn lane, two through lanes and exclusive right-turn lane for the westbound approach.

S. Red Sky Drive/S. Swift Fox Way-Future Project Dwy is currently built as a three-legged roundabout intersection. For the Plus Project scenarios, a fourth leg/driveway is assumed to provide northerly access to the project, with the following lane configurations; shared left-through-right turn lane for all four approaches.

E. Hess Road/Future Project Dwy intersection will provide the southerly access to the project, and is proposed as right-in/right-out intersection with stop control for the southbound approach with the following lane configurations; two through lanes and one exclusive right turn lane for the westbound approach; two through lanes for the eastbound approach and one right turn lane for the southbound approach.

S. Red Sky Drive/Future Project Dwy intersection will provide the northerly right-in only access to the project west of the existing roundabout, with one shared through-right turn lane for the eastbound approach.

Exhibit 8 illustrates the anticipated short-term (2021) transportation conditions.



** ASSUMED FOR WITH PROJECT SCENARIOS ONLY

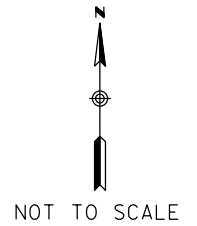


EXHIBIT 8

SHORT-TERM (2021) TRANSPORTATION CONDITIONS

CHAMBERS AND HESS DEVELOPMENT

LEGEND	
U	=UNSIGNALIZED
S	=SIGNALIZED
R	=ROUNDABOUT
1	= INTERSECTION NUMBER
■	= PROJECT SITE
○	= STOP CONTROLLED
.....	= FUTURE ROAD/DRIVEWAY

SHORT-TERM (2021) BACKGROUND AND TOTAL TRAFFIC VOLUMES

The short-term (2021) background intersection and roadway volumes include existing traffic volumes, and an average growth rate of 4% per year.

Exhibit 9 illustrates the short-term (2021) background traffic volumes.

The short-term total traffic intersection and roadway volumes are based on the forecasted traffic volumes for the year 2021 (short-term background) plus the project generated traffic volumes.

Exhibit 10 shows the short-term (2021) total traffic volumes.

4.3 LONG-TERM SCENARIO

LONG-TERM (2041) TRANSPORTATION CONDITIONS

The long-term transportation conditions assume the planned 2035 roadway configuration contained within the City's Transportation Plan, and anticipated improvements by the surrounding projects. The following is a brief description of the anticipated roadway for the long-term scenario:

S. Chambers Road, between S. Red Sky Drive and E. Hess Road is a north-south roadway that is ultimately classified as a six-lane Principal Arterial. For this study scenario, this roadway is assumed to be built to its ultimate configuration with three travel lanes and acceleration/deceleration lanes in each direction, consistent with the Town of Parker's 2035 Transportation Master Plan.

E. Hess Road between S. Chambers Road and Firefly Lane is an east-west roadway that is currently built to its ultimate four-lane divided roadway configuration providing two travel lanes and acceleration/deceleration lanes in each direction. No additional lane changes were assumed from the short-term scenario.

S. Red Sky Drive east of S. Chambers Road is an east-west roadway that is built to its ultimate two-lane Residential Collector that is assumed to continue to provide access to residential homes with one travel lane in each direction. No additional lane changes were assumed from the short-term scenario.

S. Chambers Road/E. Hess Road is assumed to be built to its ultimate four-legged signalized intersection consistent with the lane configurations proposed by the Anthology Study. The lane configurations are as follows; two left turn lanes, three through lanes and an exclusive right turn lane for both the southbound and northbound approaches; two left turn lanes, two through lanes and exclusive right turn lane for both the eastbound and westbound approaches.

S. Chambers Road/S. Red Sky Drive is assumed to remain as a stop-controlled intersection for the Background study scenario. However, it is assumed as a signalized intersection for the Plus Project scenario as warranted in 2021 with project scenario. The lane configurations are as follows; three through lanes and an exclusive right-turn lane for the northbound approach; three through lanes and exclusive left turn lane for the southbound approach; and exclusive left and right turn lanes for the westbound approach.

S. Red Sky Drive/S. Swift Fox Way-Future Project Dwy is assumed to remain as a three-legged roundabout intersection for the Background scenario and a fourth-leg/driveway providing northerly

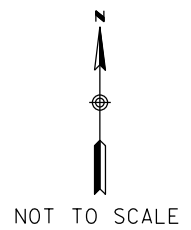
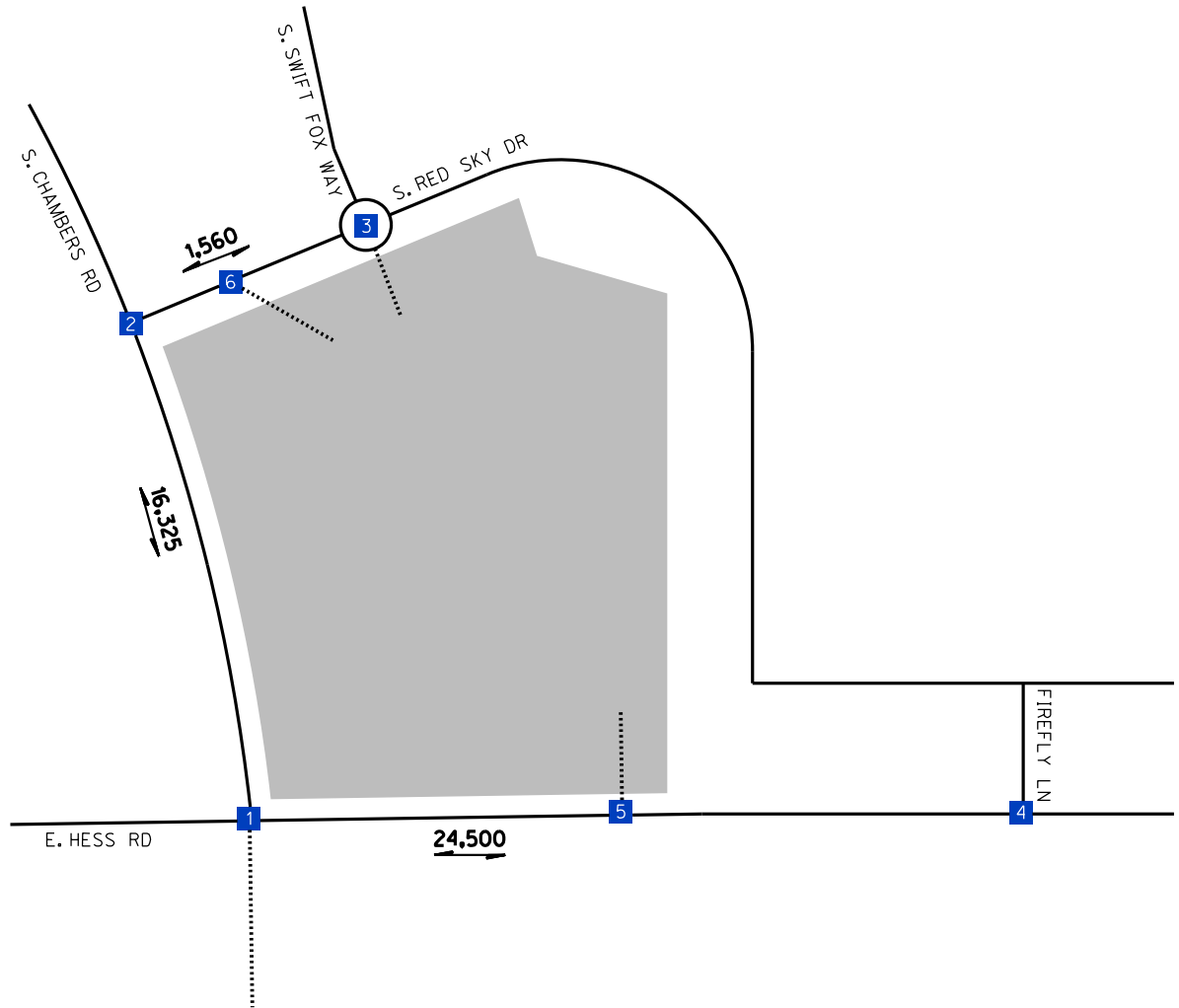
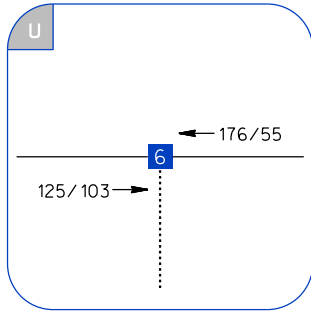
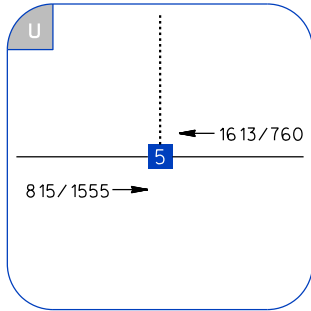
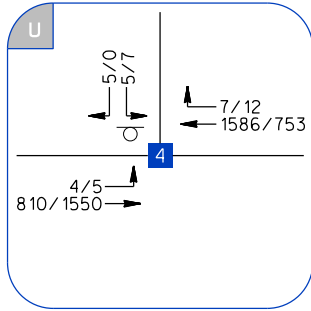
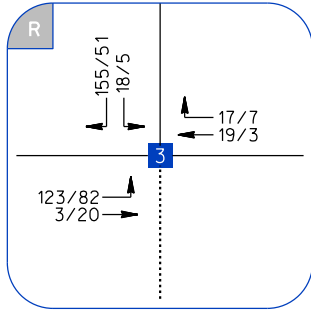
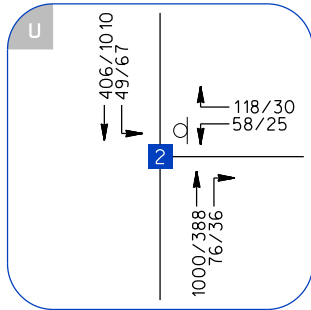
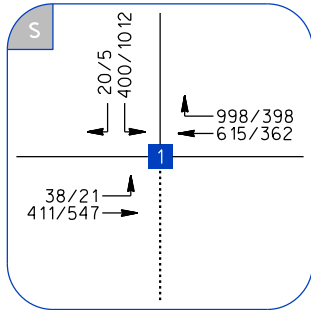


EXHIBIT 9
 SHORT-TERM (2021) BACKGROUND TRAFFIC VOLUMES
 CHAMBERS AND HESS DEVELOPMENT

LEGEND

- AM/PM=PEAK HOUR VOLUMES
- X,XXX =TWO-WAY ADT
- 1 =INTERSECTION NUMBER
- [Grey Box] =PROJECT SITE
- [Dotted Line] = FUTURE ROAD/DRIVEWAY

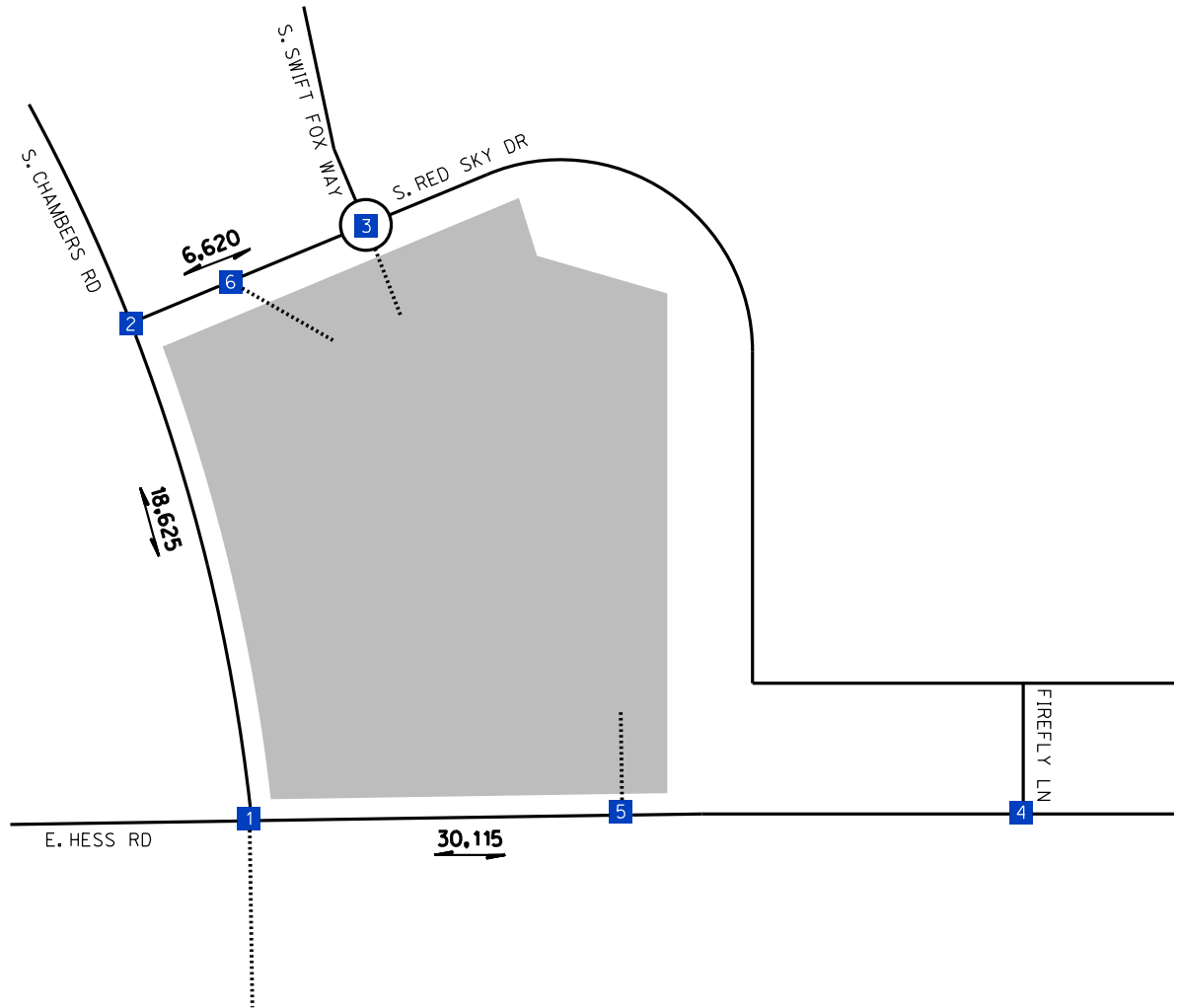
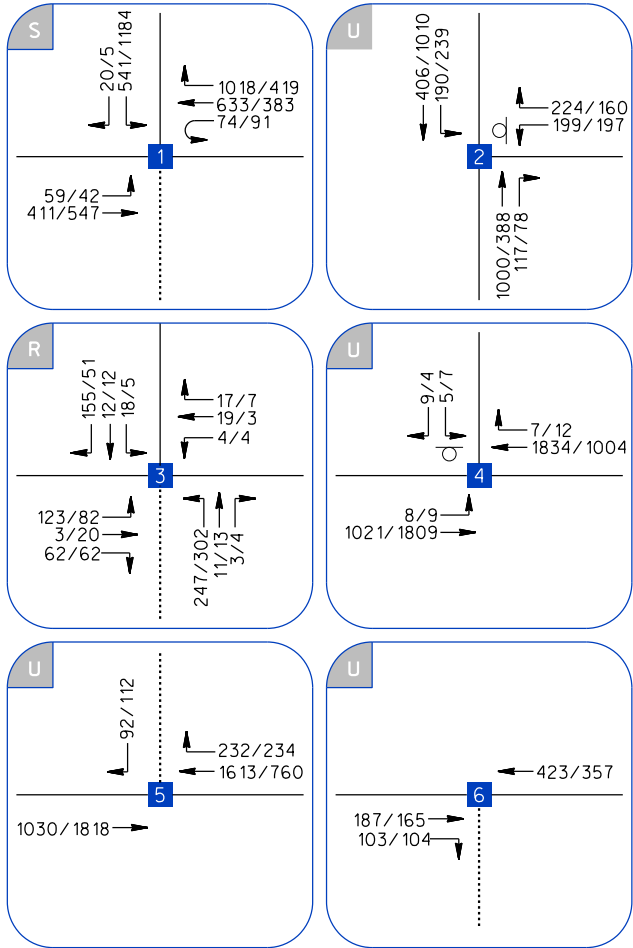


EXHIBIT 10
 SHORT-TERM (2021) BACKGROUND + PROJECT TRAFFIC VOLUMES
 CHAMBERS AND HESS DEVELOPMENT

LEGEND

- AM/PM=PEAK HOUR VOLUMES
- X,XXX** =TWO-WAY ADT
- 1 =INTERSECTION NUMBER
- =PROJECT SITE
- = FUTURE ROAD/DRIVEWAY

access to the project is assumed for the Plus Project scenario, with the following lane configurations; shared left-through-right turn lane for all four approaches.

E. Hess Road/Firefly Lane is assumed to be signalized in this study scenario per coordination with the Town. It is assumed to remain as a three-legged intersection consisting of the following lane configurations; two through lanes and exclusive left turn lane for the eastbound approach; two through lanes and exclusive right turn lane for the westbound approach; and a shared left-right turn lane for the southbound approach.

Exhibit 11 illustrates the anticipated long-term (2041) transportation conditions.

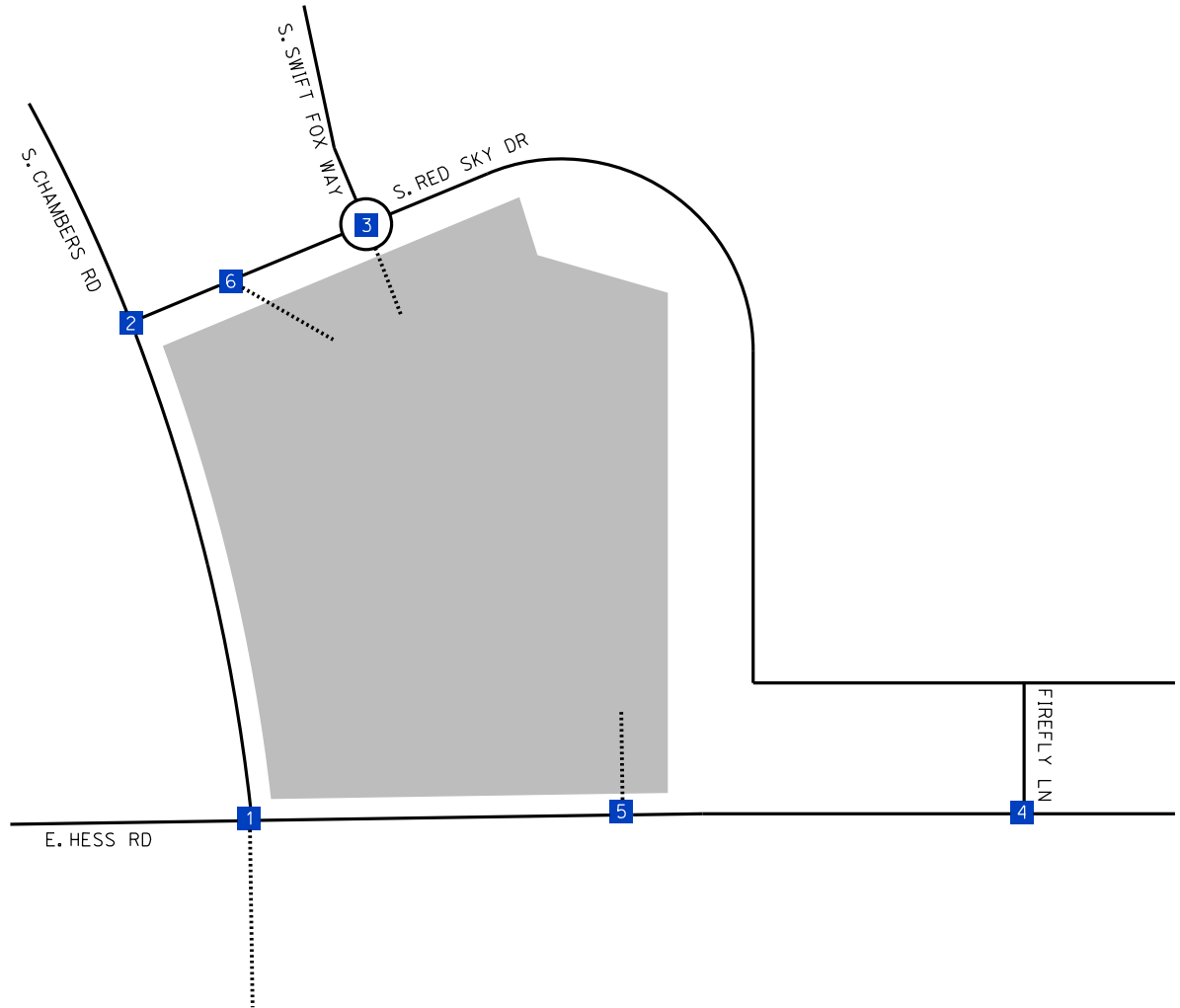
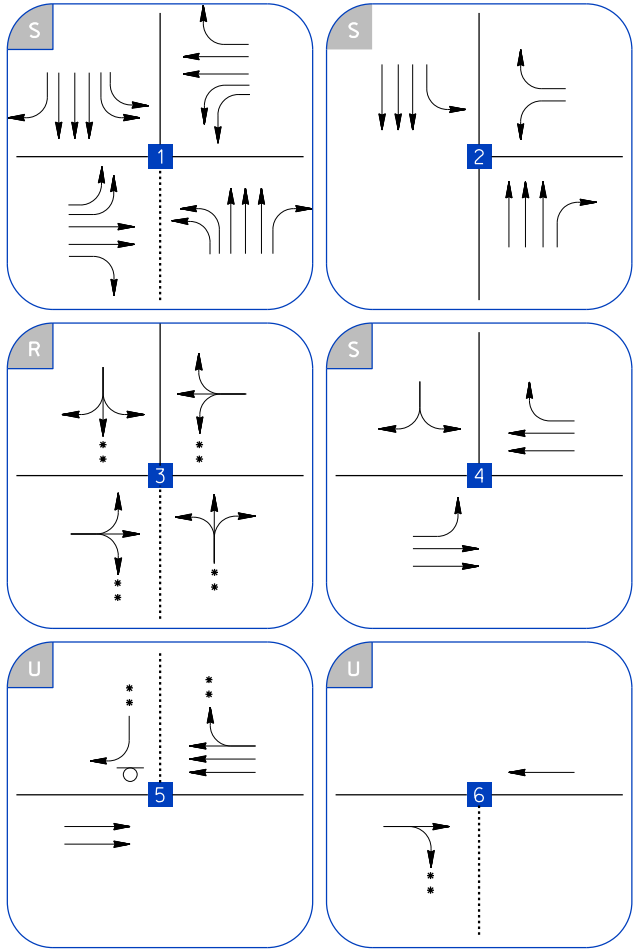
LONG-TERM (2041) BACKGROUND AND TOTAL TRAFFIC VOLUMES

The long-term background intersection and roadway operations volumes are based on the forecasted traffic volumes for the year 2041, other background projects anticipated to be developed, and the anticipated long-term transportation conditions as planned for the year 2035 under the Town of Parker Transportation Plan and the 2040 Douglas County Transportation Master Plan.

The long-term total traffic intersection and roadway volumes will be based on the forecasted traffic volumes for the year 2041 (long-term background) plus the project generated traffic volumes.

Exhibit 12 illustrates the long-term (2041) background traffic volumes.

Exhibit 13 illustrates the long-term (2041) total traffic volumes.



** ASSUMED FOR WITH PROJECT SCENARIOS ONLY

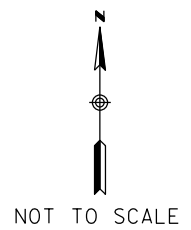


EXHIBIT 11
 LONG-TERM (2041) TRANSPORTATION CONDITIONS
 CHAMBERS AND HESS DEVELOPMENT

LEGEND

- = UNSIGNALIZED
- = SIGNALIZED
- = ROUNDABOUT
- = INTERSECTION NUMBER
- = PROJECT SITE
- = STOP CONTROLLED
- = FUTURE ROAD/DRIVEWAY

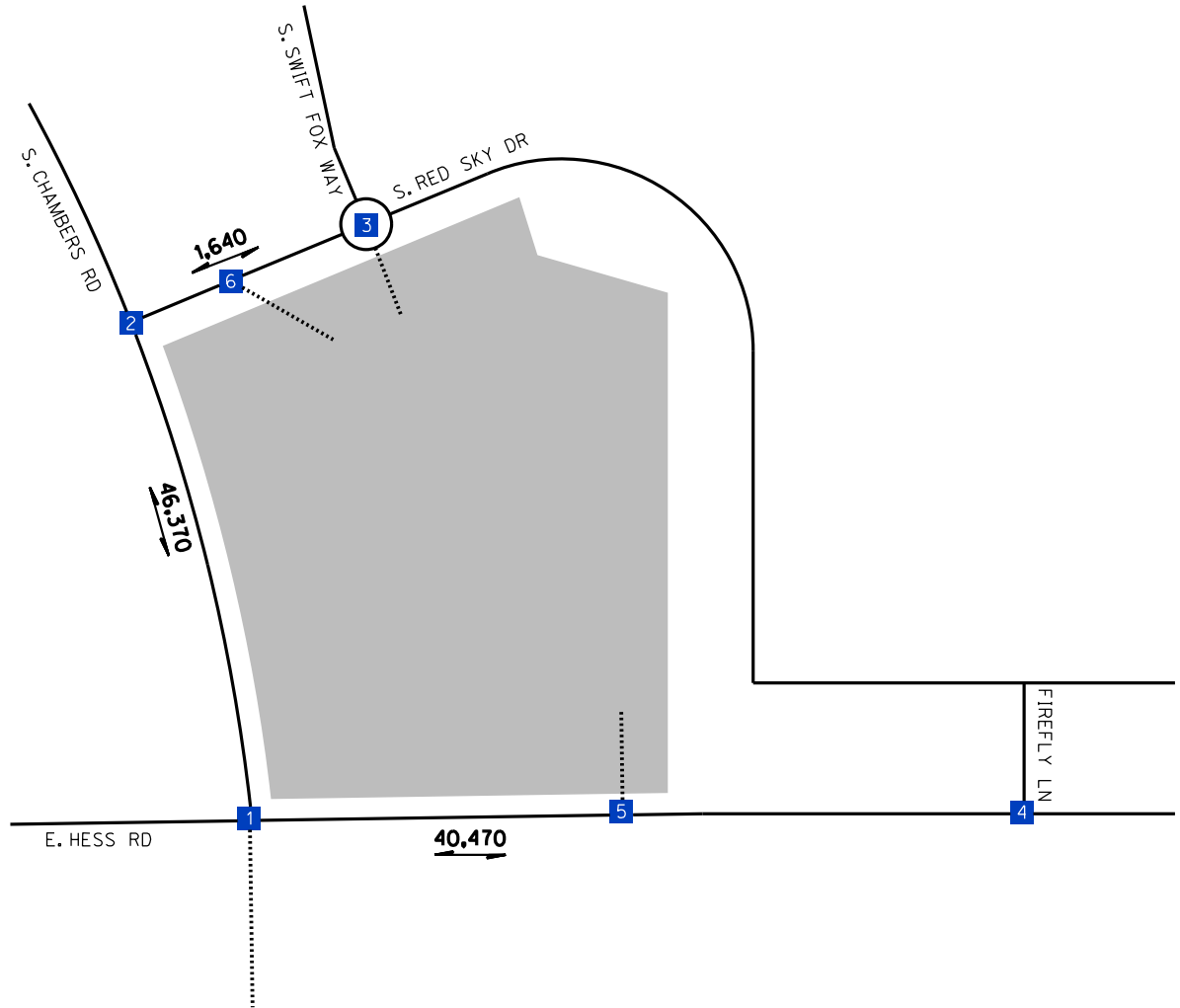
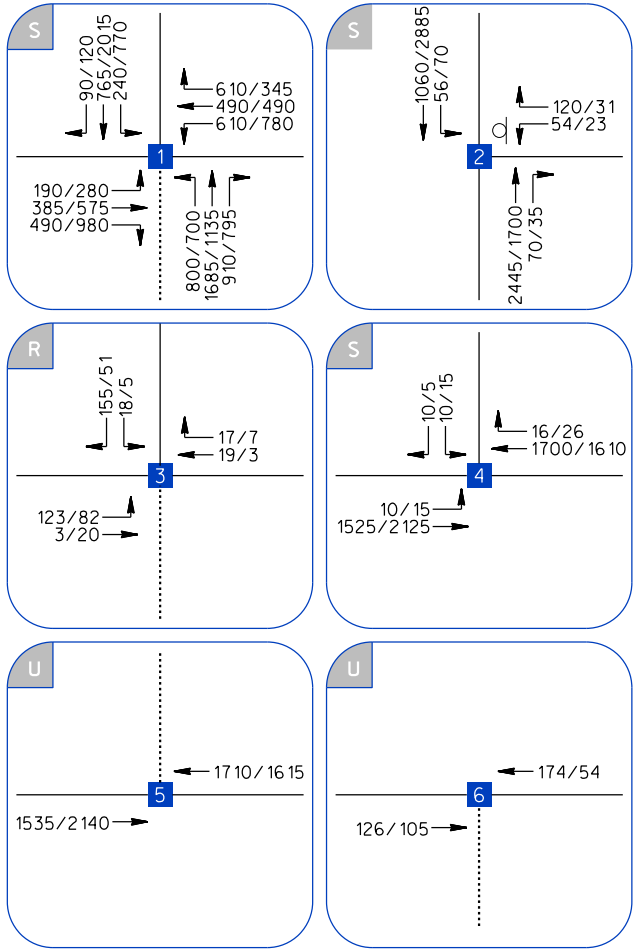


EXHIBIT 12
 LONG-TERM (2041) BACKGROUND TRAFFIC VOLUMES
 CHAMBERS AND HESS DEVELOPMENT

LEGEND

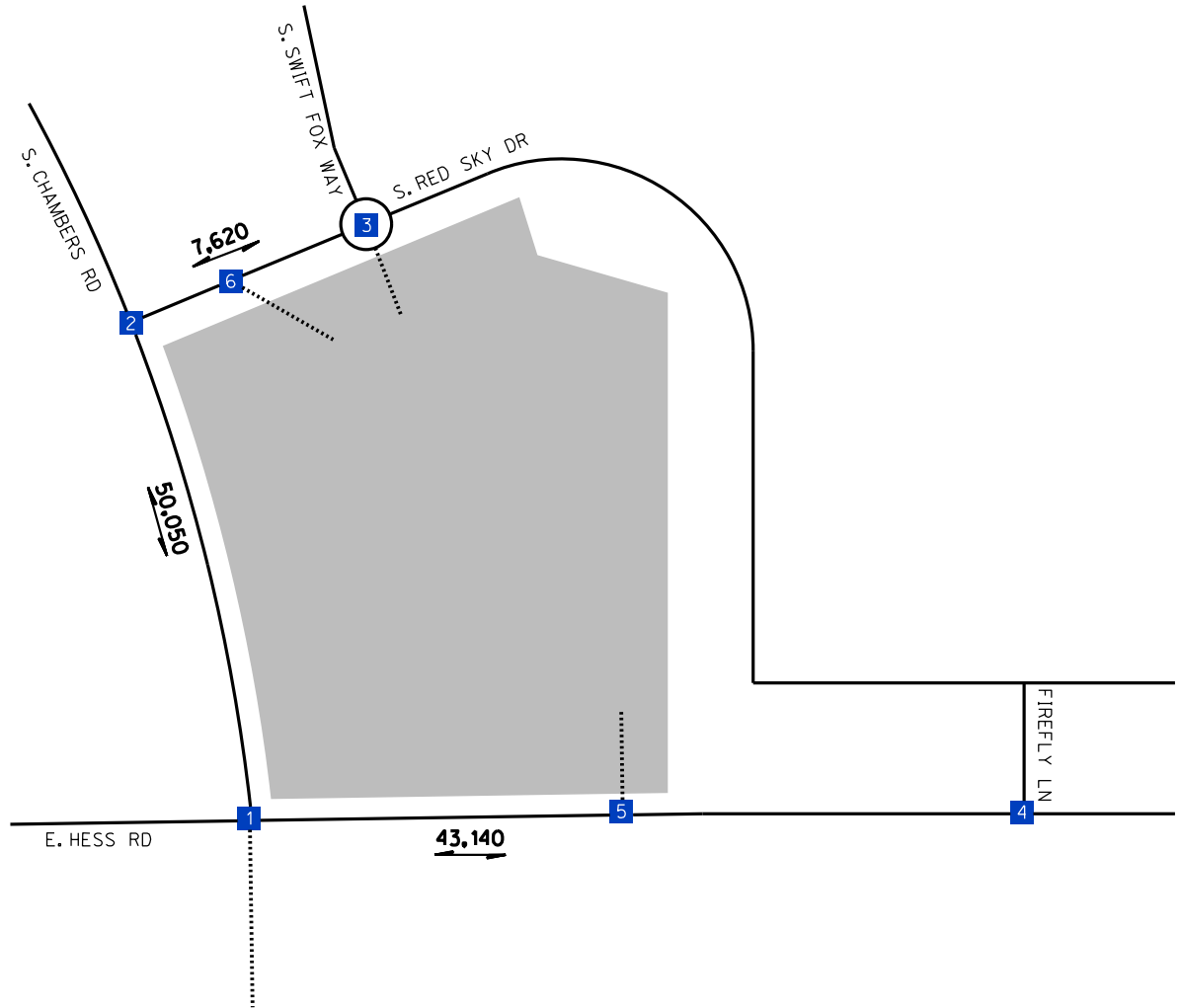
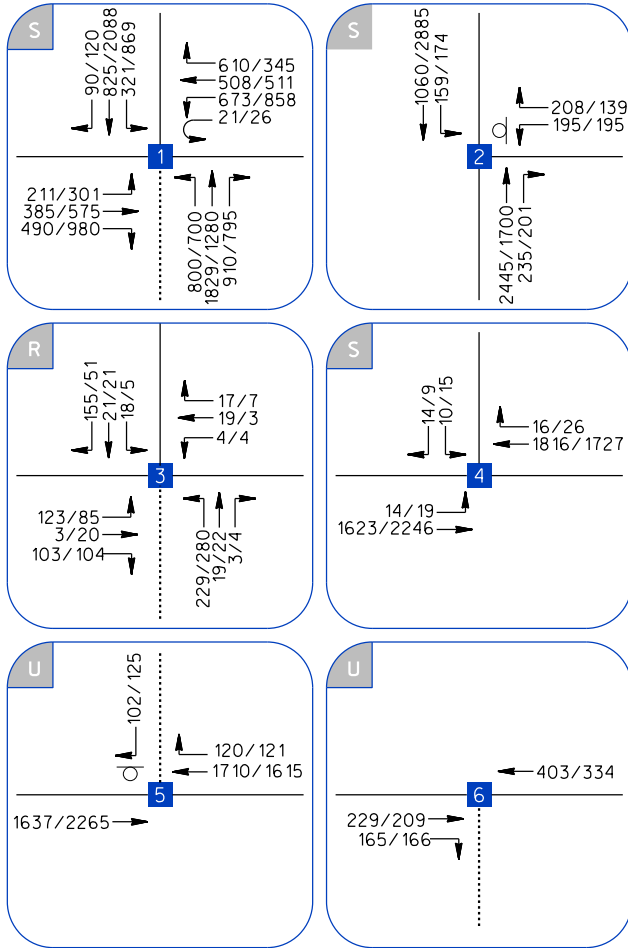
AM/PM=PEAK HOUR VOLUMES

X,XXX = TWO-WAY ADT

1 = INTERSECTION NUMBER

[Shaded Area] = PROJECT SITE

..... = FUTURE ROAD/DRIVEWAY



N
↑
○
↓
NOT TO SCALE



EXHIBIT 13
LONG-TERM (2041) BACKGROUND + PROJECT TRAFFIC VOLUMES
CHAMBERS AND HESS DEVELOPMENT

LEGEND

AM/PM=PEAK HOUR VOLUMES 1 = INTERSECTION NUMBER

X,XXX = TWO-WAY ADT [shaded] = PROJECT SITE

..... = FUTURE ROAD/DRIVEWAY

5.0- SITE CIRCULATION AND DESIGN EVALUATION

In accordance to the Town of Parker’s Roadway Design and Construction Criteria Manual Section 5.6.5.1 , the benchmark for overall intersection operation is LOS C or better for each peak period of every study year. If any study area intersections operate at LOS D or worse for the existing case, the appropriate future LOS requirements will need to be established through discussion with the Town. No approach or movement of an intersection shall fall below LOS E. For roadway segments, LOS D or better shall be maintained for all scenarios. Using the forecasted short-term and long-term background and total volumes with methodologies described in the 6th edition of the HCM and MUTCD, the following describes the anticipated intersection operations and warrants.

The operational conditions for the roadway segments were established utilizing Douglas County 2040 Transportation Plan’s Recommended Traffic Volume Thresholds per Table 4, dated June 2019 to evaluate the overall performance.

5.1- SHORT-TERM (2021) TRAFFIC OPERATIONS

Table 4 shows that all the studied intersections currently operate at acceptable levels of service (LOS C or better) for short-term (2021) background and short-term (2021) background plus project scenarios, and no approach or movement of an intersection fell below LOS E, with the exception of the following intersections:

- S. Chambers Road/S. Red Sky Drive (Background --WBL movement LOS F for AM peak hour; Total – WBL movement for both AM and PM peak hours)
- E. Hess Road/Firefly Lane (Background –SB-LR movement LOS F for AM peak hour; Total – SB-LR movement for both AM and PM peak hours)

Table 5 shows that all the studied roadway segments currently operate at acceptable levels of service (LOS C or better) for short-term (2021) background and short-term (2021) total scenarios.

5.2- LONG-TERM (2041) TRAFFIC OPERATIONS

Table 6 shows that all the studied intersections currently operate at acceptable levels of service (LOS C or better) for long-term (2041) background and long-term (2041) total scenarios, and no approach or movement of an intersection fell below LOS E, with the exception of the following intersections:

- S. Chambers Road/E. Hess Road (Background, LOS D overall for AM and LOS F overall for PM peak hours; Total – LOS E overall for AM and LOS F overall for PM peak hours)
- S. Chambers Road/S. Red Sky Drive (Background – LOS F for most of the movements)

Table 7 shows that all the studied roadway segments currently operate at acceptable levels of service (LOS D or better) for long-term (2041) background and short-term (2041) total scenarios with the exception of the following segment:

- E. Hess Road between S. Chambers Road and Firefly Lane (LOS E for Background and for Total scenarios)

Though this segment is classified as a four-lane arterial, this roadway includes an acceleration/deceleration lane on the north side of the street between Chambers Road and Jordan Road,



**TABLE 4
SHORT-TERM (2021) INTERSECTION OPERATIONS SUMMARY
CHAMBERS AND HESS DEVELOPMENT**

#	INTERSECTION	CONTROL	DIR.	BACKGROUND (2021)				TOTAL ³ (2021)			
				AM Peak		PM Peak		AM Peak		PM Peak	
				DELAY ¹	LOS ²	DELAY ¹	LOS ²	DELAY ¹	LOS ²	DELAY ¹	LOS ²
1	S. Chambers Rd/E. Hess Rd	(S)	Overall	23.2	C	11.9	B	28.5	C	18.1	B
2	S. Chambers Rd/S. Red Sky Dr	(OWSC)	WB-L	>50	F	19.6	C	>50	F	>50	F
			WB-R	16.5	C	9.6	A	23.5	C	10.6	B
			SB-L	12.4	B	8.4	A	17.0	C	9.3	A
	<i>With Recommended Improvements - Signal</i>	(S)	Overall	-	-	-	-	23.7	C	10.7	B
3	S. Red Sky Dr/S. Swift Fox Way	(R)	Overall	3.8	A	3.3	A	5.1	A	5.1	A
4	E. Hess Rd/Firefly Ln	(OWSC)	EB-L	15.9	C	9.5	A	19.3	C	10.6	B
			SB-LR	>50	F	47.0	E	>50	F	>50	F
			Overall	-	-	-	-	17.8	B	7.7	A
	<i>With Recommended Improvements - Signal (By Others)</i>	(S)	Overall	-	-	-	-	17.8	B	7.7	A
5	E. Hess Rd/Project Dwy	(OWSC)	SB-R	-	-	-	-	37.9	E	17.2	C
6	S. Red Sky Dr/Project Dwy	N/A	EB-R	-	-	-	-	*	*	*	*

Footnotes:

Results calculated utilizing the methodologies described in Chapters 19, 20, 21, and 22 in the 6th edition of the HCM .

1) Delay is measured in seconds per vehicle.

2) Level of Service

3) Total= 2021 with Project Traffic Operations

(S)=Signalized, (TWSC)=Two-Way Stop Controlled, (AWSC)=All-Way Stop Controlled, (R)=Roundabout.

NB=Northbound, WB=Westbound, etc.

L=Left-turn movement, R= Right-turn movement, LT=Left-Through lane, LTR=Left-Through-Right lane , etc.

* No conflicting movements. No Delays to report

**TABLE 5
SHORT-TERM (2021) ROADWAY SEGMENT OPERATIONS
CHAMBERS AND HESS DEVELOPMENT**

ROADWAY SEGMENT	ULTIMATE ROADWAY CLASSIFICATION	ULTIMATE CAPACITY (LOS D) ¹	FUNCTIONAL CLASSIFICATION	CAPACITY (LOS D) ¹	BACKGROUND (2021)			TOTAL (2021)		
					ADT	V/C	LOS	ADT	V/C	LOS
S. Chambers Road between S. Red Sky Drive and E. Hess Road	Principal Arterial (6L)	55,000	Arterial (4L)	40,000	16,325	0.41	A	18,625	0.466	A
E. Hess Road between S. Chambers Road and Firefly Lane	Arterial (4L)	40,000	Arterial (4L)	40,000	24,500	0.61	B	30,115	0.753	C
S. Red Sky Drive east of S. Chambers Road	Residential Collector (2L)	12,000	Residential Collector (2L)	12,000	1,560	0.13	A	6,620	0.552	A

Footnote:

¹ Source: Douglas County 2040 Transportation Plan *Table 4, Recommended Traffic Volume Thresholds* Dated June 2019



**TABLE 6
LONG-TERM (2041) INTERSECTION OPERATIONS SUMMARY
CHAMBERS AND HESS DEVELOPMENT**

#	INTERSECTION	CONTROL	DIR.	BACKGROUND (2041)				TOTAL ³ (2041)			
				AM Peak		PM Peak		AM Peak		PM Peak	
				DELAY ¹	LOS ²	DELAY ¹	LOS ²	DELAY ¹	LOS ²	DELAY ¹	LOS ²
1	S. Chambers Rd/E. Hess Rd	(S)	Overall	48.9	D	>80.0	F	56.3	E	>80.0	F
2	S. Chambers Rd/S. Red Sky Dr	(OWSC)	WB-L	>50	F	>50	F	-	-	-	-
			WB-R	>50	F	23.0	C	-	-	-	-
			SB-L	>50	F	>50	F	-	-	-	-
	<i>With Recommended Improvements - Signal</i>	(S)	Overall	-	-	-	-	9.3	A	14.8	B
3	S. Red Sky Dr/S. Swift Fox Way	(R)	Overall	3.8	A	3.3	A	5.1	A	5.0	A
4	E. Hess Rd/Firefly Ln	(S)	Overall	21.1	C	17.6	B	20.1	C	18.3	B
5	E. Hess Rd/Project Dwy	(OWSC)	SB-R	-	-	-	-	40.2	E	42.4	E
6	S. Red Sky Dr/Project Dwy	N/A	EB-R	-	-	-	-	*	*	*	*

Footnotes:

Results calculated utilizing the methodologies described in Chapters 19, 20, 21, and 22 in the 6th edition of the HCM .

1) Delay is measured in seconds per vehicle.

2) Level of Service

3) Total= 2041 with Project Traffic Operations

(S)=Signalized, (TWSC)=Two-Way Stop Controlled, (AWSC)=All-Way Stop Controlled, (R)=Roundabout.

NB=Northbound, WB=Westbound, etc.

L=Left-turn movement, R= Right-turn movement, LT=Left-Through lane, LTR=Left-Through-Right lane , etc.

* No conflicting movements. No Delays to report

**TABLE 7
LONG_TERM (2041) ROADWAY SEGMENT OPERATIONS
CHAMBERS AND HESS DEVELOPMENT**

ROADWAY SEGMENT	ULTIMATE ROADWAY CLASSIFICATION	ULTIMATE CAPACITY (LOS D) ¹	BACKGROUND (2041)			TOTAL (2041)		
			ADT	V/C	LOS	ADT	V/C	LOS
S. Chambers Road between S. Red Sky Drive and E. Hess Road	Principal Arterial (6L)	55,000	46,370	0.84	C	50,050	0.910	D
E. Hess Road between S. Chambers Road and Firefly Lane	Arterial (4L)	40,000	40,470	1.01	E	43,140	1.079	E
	Arterial (5L) ²	47,500	40,470	0.85	C	43,140	0.908	D
S. Red Sky Drive east of S. Chambers Road	Residential Collector (2L)	12,000	1,640	0.14	A	7,620	0.635	B

Footnote:

¹ Source: Douglas County 2040 Transportation Plan *Table 4, Recommended Traffic Volume Thresholds* Dated June 2019

allowing it to function as a five-lane roadway with higher capacity than a four-lane roadway. Assuming a higher capacity, this roadway will operate at LOS D or better as shown in Table 7.

5.3 QUEUING ANALYSIS

The 95th percentile queue lengths were analyzed to determine if the existing or proposed storage lengths at the intersections and roadways are sufficient. The long-term total (Year 2041) scenario queue lengths are used to calculate the anticipated queues at the intersection turn lanes, as this represents a “worst-case” scenario. The analysis is performed during the AM and PM peak hours, and the longer queue was then utilized for the recommendations presented in this report. Synchro 10 and SimTraffic, were used for the computation and modeling of the 95th percentile queue lengths.

Table 8 contains a summary of the anticipated queue lengths and the recommended minimum storage lengths for the turn lanes where existing or proposed show less than the calculated queue lengths.

As shown in Table 8, the project queues are anticipated to fall within the existing storage, and thus no impacts are anticipated. An impact was assumed to occur if the queue extended 25 feet or more of the available storage, which is the typical storage for one car.

Appendix F contains the 95th percentile queue results.

5.4 TRAFFIC SIGNAL WARRANT ANALYSIS

The studied intersections were analyzed under the Traffic Signal Warrants as noted in the *Manual of Uniform Traffic Control Devices (MUTCD)* based on the existing and forecasted intersection peak hour traffic volumes.

Based on existing traffic data and signal warrant methodologies contained within the MUTCD, the following intersection is warranted for signalization:

- S. Chambers Road/S. Red Sky Drive (Total scenario – eight hour (warrant 1), four-hour (warrant 2) and peak hour (warrant 3) met).

Based on the forecasted peak hour traffic volumes for the short-term (2021) background and short-term (2021) total scenarios and criteria found in the MUTCD, the same intersection as above is warranted for signalization. No other unsignalized study intersections were warranted for signalization.

Appendix G contains the signal warrant worksheets and a summary table of all the unsignalized intersections for all scenarios.

5.5 TRAFFIC SIGNAL PROGRESSION

A traffic signal progression analysis was conducted along Chambers Road and Hess Road utilizing Synchro 10 software, for the signals at the intersections of Chambers Road/Hess Road, Chambers Road/S. Red Sky Drive, and Hess Road/Firefly Lane. The study intersections were analyzed with 120 cycle lengths and coordinated for both the A.M. and P.M. peak periods and with a goal of at least a 40 second bandwidth. A minimum of 40 second bandwidth was achieved for the short-term scenarios, however, due to the high traffic volumes and the closely spaced intersections (less than half a mile) along the corridor in long-term conditions, the green time allowed for each movement is limited and achieving the 40 second



**TABLE 8
LONG TERM (2041) 95TH PERCENTILE QUEUE SUMMARY
CHAMBERS AND HESS DEVELOPMENT**

INTERSECTION	STORAGE ¹	TOTAL ³ (2041)			
		AM Peak	PM Peak	RECOMMENDED MIN. STORAGE ⁴	
		QUEUE ²	QUEUE ²		
1 S. Chambers Rd/E. Hess Rd (S)	EB-L	400	211	185	
	EB-R	400	253	425	*
	WB-L	485	262	234	-
	WB-R	1100	436	379	-
	NB-L	535	572	562	*
	NB-R	435	531	457	*
	SB-L	535	211	459	
	SB-R	550	48	449	*
2 S. Chambers Rd/S. Red Sky Dr (S)	WB-L	200	107	91	-
	WB-R	160	99	30	-
	NB-R	700+	174	542	-
	SB-L	450	230	492	**
3 S. Red Sky Dr/S. Swift Fox Way (R)	S	135 ⁵	197	363	-
	E	270	84	118	-
	N	50	71	93	100
	W	300+	35	81	-
4 E. Hess Rd/Firefly Ln (S)	EB-L	215	34	58	-
	SB-LR	110	57	53	-
	WB-R	220	15	81	-
5 E. Hess Rd/Project Dwy	SB-R	200	107	284	285
6 S. Red Sky Dr/Project Dwy	EB-TR	100	50	114	120

Footnotes:

- 1) Storage lengths based on existing storage or proposed storage lengths from project and near-by developments
- 2) Queue is equal to the 95th percentile queue length, in feet, based on SimTraffic software results.
- 3) Total= 2041 with Project Traffic Operations
- 4) Min. recommended storage lengths for turn lanes where existing or proposed lanes are less than calculated queue lengths
- 5) 135' to a small drive at E. Swift Fox Pl., however, over 350' is available until next intersection at E. Jackalope Dr.
- (S)=Signalized, (TWSC)=Two-Way Stop Controlled,
- (AWSC)=All-Way Stop Controlled, (R)=Roundabout.
- NB=Northbound, WB=Westbound, etc.
- L=Left-turn movement, T=Thru movement, R= Right-turn movement, etc.
- LT=Left-Through movement group, LTR=Left-Through-Right lane movement group, etc.
- * = Mitigation by others. Queuing issues occur based on background projects
- ** = Can be accommodated within transition area

bandwidth is challenging. Based on the results, while short term showed a minimum of 42 seconds, the long term scenarios showed between 24 – 48 seconds.

Appendix H contains the time space diagrams.

5.6 SAFETY

The traffic pattern proposed with this project presents few safety hazards. This project proposes three access locations, as mentioned in the previous sections and the entrances have approach grades meeting Town criteria and will be constructed with standard pedestrian crossings with appropriate signage and markings. In addition, each intersection has been reviewed for appropriate sight distance. Conflicts are also minimized at the driveways along Hess Road and S. Red Sky Drive, as the driveways are proposed as right-in/right-out onto Hess Road and right-in only onto S. Red Sky Drive, with less conflict points than a full-access intersection. Furthermore, these movements historically cause few traffic incidents, and therefore, not anticipated to have any significant or unusual safety concerns at these driveways. The S. Red Sky Dr. access will connect to the existing roundabout. Roundabouts are by nature safer than a standard four-way intersection due to reduced conflict points and a reduction in the severity of conflicts in the intersection. Additionally, the project proposes to install a traffic signal to mitigate the S. Chambers Road and S. Red Sky Drive intersection in the future. This will invariably improve the safety of traffic movements at the S. Red Sky Drive and S. Chambers Road intersection. As a result, it is assumed that this project will improve the overall safety of the traffic patterns in this area in the future.

6.0- CONCLUSION AND MITIGATIONS/RECOMMENDATIONS

Based on the analysis and results contained within this report, the traffic study evaluated any potential traffic impacts due to the proposed construction of the Chambers and Hess Development. In coordination with the Town of Parker, the study analyzed the nearby intersections and roadways based on the operational capabilities for the different study scenarios with and without the project generated traffic.

Recommendations are made in accordance with the Town of Parker's benchmark for overall intersection to operate at LOS C or better for each peak period of every study year and that no approach or movement of an intersection shall fall below LOS E, and maintaining LOS D for all roadway segments. Based on the traffic generated by the project, and access roads requirements for the project site, the following are recommendations at the study area intersections and roadway segments:

- S. Chambers Road/E. Hess Road – Modify the traffic signal to allow for westbound U-turn movements for the short-term scenarios, until the ultimate four-legged intersection is installed (by others) in the future. However, due to the high volumes proposed by the near-by Anthology development assumed to be opened by 2041; this intersection operates at LOS F. The recommendations provided by the Anthology study to install free-right turns for the westbound and eastbound directions have minimal improvements to the level of service and the intersection is anticipated to continue to operate at LOS F in the long-term.

- S. Chambers Road/S. Red Sky Drive - Install a traffic signal as warranted in the existing scenario. The traffic signal will help mitigate this intersection to operate at an acceptable level of service (LOS C or better).
- S. Red Sky Drive/S. Swift Fox Way-Future Project Dwy - Install a yield controlled fourth-leg to provide a full northerly project access driveway at the existing roundabout, with a shared left-through-right lane for the northbound approach.
- E. Hess Road/Future Project Dwy – Install a right-in/right-out driveway with stop control for the southbound approach to provide a southerly access to the project.
- S. Red Sky Drive/ Future Project Dwy - Install a right-in only driveway along S. Red Sky Drive to provide a secondary northerly access to the project, west of the existing roundabout. This will also alleviate project trips from the roundabout.

The following are additional monitoring and coordination recommendations related to the nearby study area intersections to be installed by others:

- E. Hess Road/Fire Fly Lane – the installation of a traffic signal would mitigate this intersection to operate at acceptable levels of service.

APPENDIX A

TRAFFIC COUNTS



(303) 216-2439
www.alltrafficdata.net

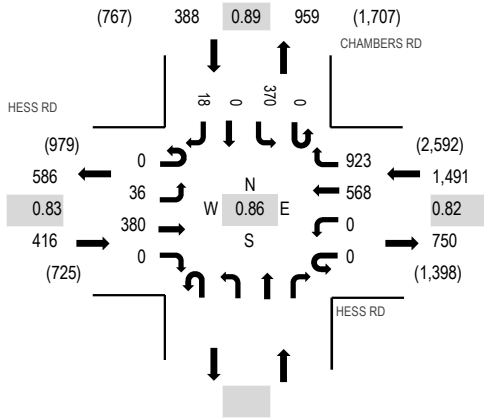
Location: 1 CHAMBERS RD & HESS RD AM

Date: Wednesday, August 21, 2019

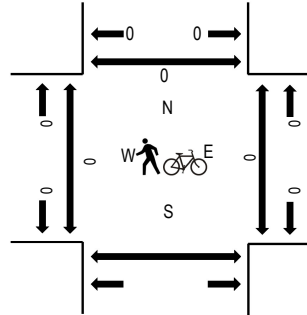
Peak Hour: 07:00 AM - 08:00 AM

Peak 15-Minutes: 07:15 AM - 07:30 AM

Peak Hour - All Vehicles



Peak Hour - Pedestrians/Bicycles on Crosswalk



Note: Total study counts contained in parentheses.

Traffic Counts

Interval Start Time	HESS RD Eastbound				HESS RD Westbound				Northbound			CHAMBERS RD Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru			Right	West	East	South
7:00 AM	0	9	86	0	0	0	106	214				0	96	0	4	515	2,295	0	0	0	
7:15 AM	0	9	97	0	0	0	171	286				0	104	0	2	669	2,271	0	0	0	
7:30 AM	0	10	116	0	0	0	173	228				0	88	0	9	624	2,122	0	0	0	
7:45 AM	0	8	81	0	0	0	118	195				0	82	0	3	487	1,931	0	0	0	
8:00 AM	0	7	69	0	0	0	111	200				0	101	0	3	491	1,789	0	0	0	
8:15 AM	0	7	84	0	0	0	103	214				0	106	0	6	520		0	0	0	
8:30 AM	0	5	64	0	0	0	94	180				0	84	0	6	433		0	0	0	
8:45 AM	0	2	71	0	0	0	66	133				0	69	0	4	345		0	0	0	
Count Total	0	57	668	0	0	0	942	1,650				0	730	0	37	4,084		0	0	0	
Peak Hour	0	36	380	0	0	0	568	923				0	370	0	18	2,295		0	0	0	



(303) 216-2439
www.alltrafficdata.net

Location: 2 CHAMBERS RD & RED SKY DR AM

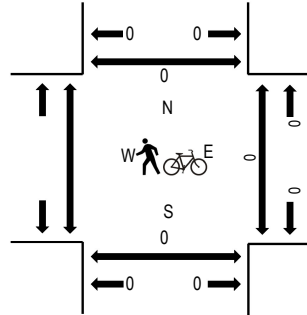
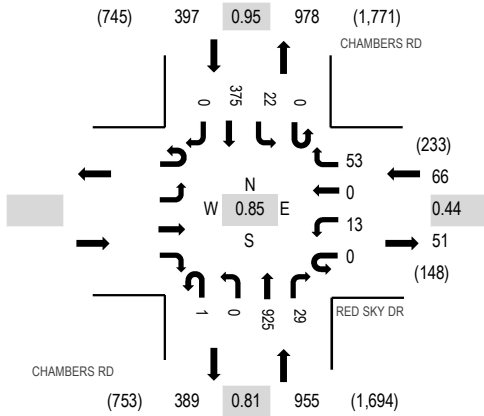
Date: Wednesday, August 21, 2019

Peak Hour: 07:00 AM - 08:00 AM

Peak 15-Minutes: 07:15 AM - 07:30 AM

Peak Hour - All Vehicles

Peak Hour - Pedestrians/Bicycles on Crosswalk



Note: Total study counts contained in parentheses.

Traffic Counts

Interval Start Time	RED SKY DR Westbound				CHAMBERS RD Northbound				CHAMBERS RD Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
7:00 AM	0	5	0	22	0	0	217	5	0	6	93	0	348	1,418	0	0	0	
7:15 AM	0	5	0	13	0	0	287	7	0	5	102	0	419	1,410	0	0	0	
7:30 AM	0	2	0	11	0	0	232	3	0	5	93	0	346	1,391	0	0	0	
7:45 AM	0	1	0	7	1	0	189	14	0	6	87	0	305	1,344	0	0	0	
8:00 AM	0	7	0	21	0	0	181	24	0	16	91	0	340	1,254	0	0	0	
8:15 AM	0	30	0	64	0	0	184	27	0	17	78	0	400		0	0	0	
8:30 AM	0	16	0	19	0	0	180	5	1	6	72	0	299		1	0	0	
8:45 AM	0	5	0	5	0	0	138	0	0	2	65	0	215		0	0	0	
Count Total	0	71	0	162	1	0	1,608	85	1	63	681	0	2,672		1	0	0	
Peak Hour	0	13	0	53	1	0	925	29	0	22	375	0	1,418		0	0	0	



(303) 216-2439
www.alltrafficdata.net

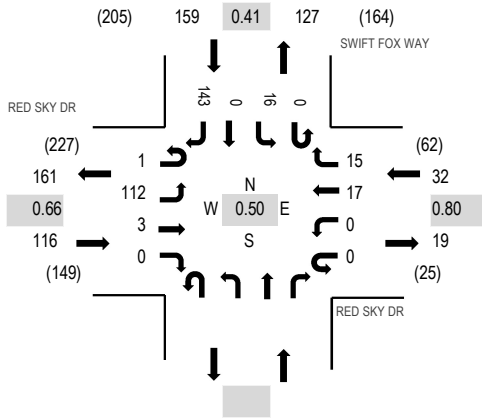
Location: 3 SWIFT FOX WAY & RED SKY DR AM

Date: Wednesday, August 21, 2019

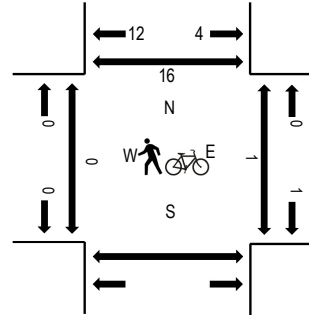
Peak Hour: 07:45 AM - 08:45 AM

Peak 15-Minutes: 08:15 AM - 08:30 AM

Peak Hour - All Vehicles



Peak Hour - Pedestrians/Bicycles on Crosswalk



Note: Total study counts contained in parentheses.

Traffic Counts

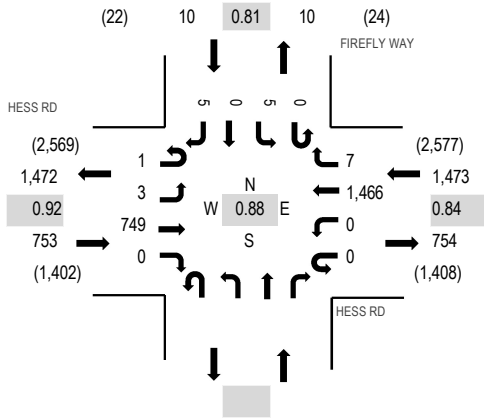
Interval Start Time	RED SKY DR Eastbound				RED SKY DR Westbound				Northbound			SWIFT FOX WAY Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru			Right	West	East	South
7:00 AM	0	9	2	0	0	0	9	3					0	0	0	17	40	127	0	0	0
7:15 AM	0	12	0	0	0	0	6	1					0	2	0	12	33	158	0	0	0
7:30 AM	0	8	0	0	0	0	4	4					0	0	0	9	25	279	0	0	0
7:45 AM	0	19	1	0	0	0	5	1					0	0	0	3	29	307	0	0	0
8:00 AM	0	39	1	0	0	0	7	4					0	1	0	19	71	289	0	0	2
8:15 AM	1	43	0	0	0	0	4	6					0	12	0	88	154		0	1	10
8:30 AM	0	11	1	0	0	0	1	4					0	3	0	33	53		0	0	1
8:45 AM	0	0	2	0	0	0	3	0					0	0	0	6	11		0	0	0
Count Total	1	141	7	0	0	0	39	23					0	18	0	187	416		0	1	13
Peak Hour	1	112	3	0	0	0	17	15					0	16	0	143	307		0	1	13



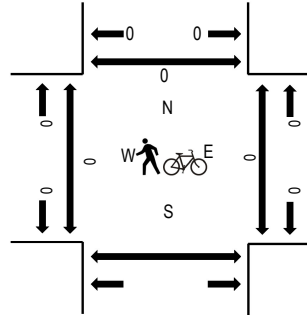
(303) 216-2439
www.alltrafficdata.net

Location: 4 FIREFLY WAY & HESS RD AM
Date: Wednesday, August 21, 2019
Peak Hour: 07:00 AM - 08:00 AM
Peak 15-Minutes: 07:15 AM - 07:30 AM

Peak Hour - All Vehicles



Peak Hour - Pedestrians/Bicycles on Crosswalk



Note: Total study counts contained in parentheses.

Traffic Counts

Interval Start Time	HESS RD Eastbound				HESS RD Westbound				Northbound			FIREFLY WAY Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru			Right	West	East	South
7:00 AM	0	2	183	0	0	0	344	1				0	1	0	2	533	2,236	0	0	0	0
7:15 AM	0	0	196	0	0	0	437	1				0	0	0	3	637	2,199	0	0	0	0
7:30 AM	0	1	203	0	0	0	384	5				0	1	0	0	594	2,058	0	0	0	0
7:45 AM	1	0	167	0	0	0	301	0				0	3	0	0	472	1,896	0	0	0	0
8:00 AM	0	0	171	0	0	0	317	5				0	0	0	3	496	1,765	0	0	0	0
8:15 AM	0	0	189	0	0	0	299	5				0	3	0	0	496		0	0	0	0
8:30 AM	0	0	148	0	0	0	278	2				0	2	0	2	432		0	0	0	1
8:45 AM	0	1	140	0	0	0	197	1				0	1	0	1	341		0	0	0	0
Count Total	1	4	1,397	0	0	0	2,557	20				0	11	0	11	4,001		0	0	0	1
Peak Hour	1	3	749	0	0	0	1,466	7				0	5	0	5	2,236		0	0	0	0



(303) 216-2439
www.alltrafficdata.net

Location: 2 CHAMBERS RD & RED SKY DR PM

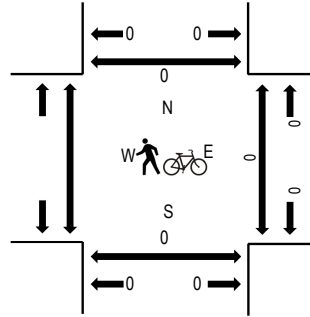
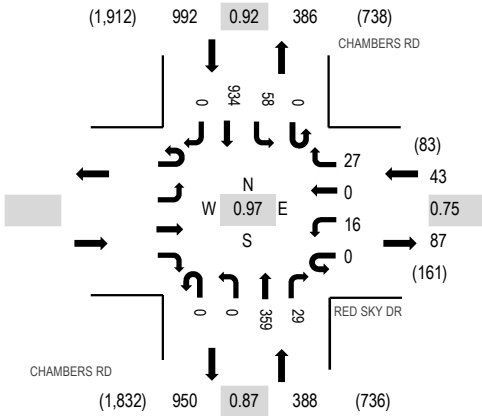
Date: Wednesday, August 21, 2019

Peak Hour: 05:00 PM - 06:00 PM

Peak 15-Minutes: 05:00 PM - 05:15 PM

Peak Hour - All Vehicles

Peak Hour - Pedestrians/Bicycles on Crosswalk



Note: Total study counts contained in parentheses.

Traffic Counts

Interval Start Time	RED SKY DR				CHAMBERS RD				CHAMBERS RD				Total	Rolling Hour	Pedestrian Crossings						
	Westbound				Northbound				Southbound						West	East	South	North			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right									
4:00 PM					0	8	0	8	1	0	68	3	0	10	195	0	293	1,308	0	0	0
4:15 PM					0	3	0	2	0	0	109	3	1	16	210	0	344	1,382	0	0	0
4:30 PM					0	4	0	4	0	0	78	5	2	22	218	0	333	1,396	0	0	0
4:45 PM					0	5	0	6	0	0	74	7	0	8	238	0	338	1,395	0	0	0
5:00 PM					0	8	0	9	0	0	100	12	0	15	223	0	367	1,423	0	0	0
5:15 PM					0	6	0	9	0	0	82	9	0	16	236	0	358		0	0	0
5:30 PM					0	1	0	6	0	0	87	6	0	18	214	0	332		0	0	0
5:45 PM					0	1	0	3	0	0	90	2	0	9	261	0	366		0	0	0
Count Total					0	36	0	47	1	0	688	47	3	114	1,795	0	2,731		0	0	0
Peak Hour					0	16	0	27	0	0	359	29	0	58	934	0	1,423		0	0	0



(303) 216-2439
www.alltrafficdata.net

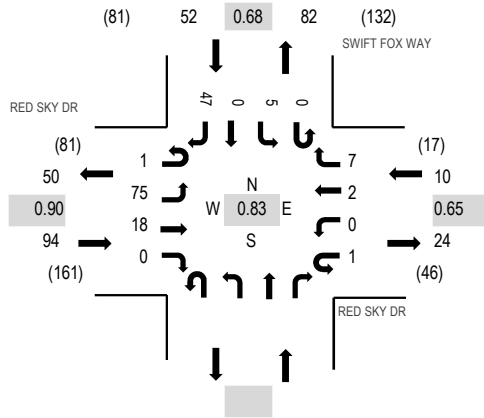
Location: 3 SWIFT FOX WAY & RED SKY DR PM

Date: Wednesday, August 21, 2019

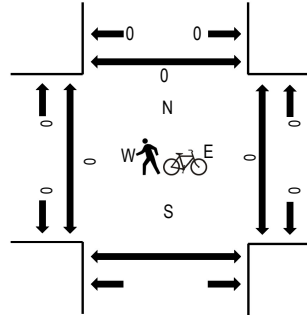
Peak Hour: 04:30 PM - 05:30 PM

Peak 15-Minutes: 05:00 PM - 05:15 PM

Peak Hour - All Vehicles



Peak Hour - Pedestrians/Bicycles on Crosswalk



Note: Total study counts contained in parentheses.

Traffic Counts

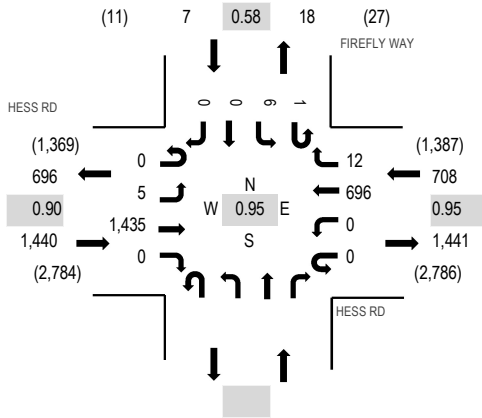
Interval Start Time	RED SKY DR Eastbound				RED SKY DR Westbound				Northbound			SWIFT FOX WAY Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru			Right	West	East	South
4:00 PM	0	8	5	0	0	0	1	0					1	0	0	14	29	116	0	0	0
4:15 PM	0	14	5	0	0	0	1	0					0	0	0	4	24	134	0	0	0
4:30 PM	0	19	7	0	0	0	1	0					0	1	0	7	35	156	0	0	0
4:45 PM	0	13	3	0	1	0	0	1					0	0	0	10	28	155	0	0	0
5:00 PM	1	22	3	0	0	0	0	2					0	3	0	16	47	143	0	0	0
5:15 PM	0	21	5	0	0	0	1	4					0	1	0	14	46		0	0	0
5:30 PM	1	18	5	0	0	0	2	2					0	1	0	5	34		0	0	0
5:45 PM	0	7	4	0	0	0	1	0					0	2	0	2	16		0	0	0
Count Total	2	122	37	0	1	0	7	9					1	8	0	72	259		0	0	0
Peak Hour	1	75	18	0	1	0	2	7					0	5	0	47	156		0	0	0



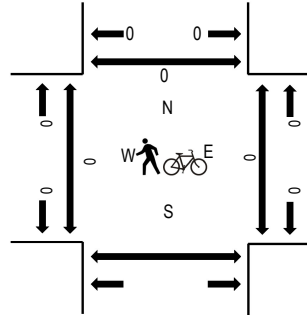
(303) 216-2439
www.alltrafficdata.net

Location: 4 FIREFLY WAY & HESS RD PM
Date: Wednesday, August 21, 2019
Peak Hour: 05:00 PM - 06:00 PM
Peak 15-Minutes: 05:15 PM - 05:30 PM

Peak Hour - All Vehicles



Peak Hour - Pedestrians/Bicycles on Crosswalk



Note: Total study counts contained in parentheses.

Traffic Counts

Interval Start Time	HESS RD Eastbound				HESS RD Westbound				Northbound				FIREFLY WAY Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
4:00 PM	0	0	306	0	0	0	161	0					0	0	0	0	467	2,027	0	0	0	
4:15 PM	0	2	311	0	0	0	188	2					0	0	0	0	503	2,089	0	0	0	
4:30 PM	0	0	324	0	0	0	175	3					0	2	0	0	504	2,153	0	0	0	
4:45 PM	0	0	401	0	0	0	148	2					0	1	0	1	553	2,144	0	0	0	
5:00 PM	0	1	343	0	0	0	182	2					0	1	0	0	529	2,155	0	0	0	
5:15 PM	0	0	380	0	0	0	180	6					0	1	0	0	567		0	0	0	
5:30 PM	0	2	317	0	0	0	172	1					1	2	0	0	495		0	0	0	
5:45 PM	0	2	395	0	0	0	162	3					0	2	0	0	564		0	0	0	
Count Total	0	7	2,777	0	0	0	1,368	19					1	9	0	1	4,182		0	0	0	
Peak Hour	0	5	1,435	0	0	0	696	12					1	6	0	0	2,155		0	0	0	

All Traffic Data Services
Wheat Ridge, CO 80033

Site Code: 6
Station ID: 6
RED SKY DR E.O. CHAMBERS RD

Start Time	21-Aug-19 Wed	EB	WB							Total
12:00 AM		1	1							2
01:00		1	0							1
02:00		0	0							0
03:00		0	0							0
04:00		1	7							8
05:00		2	10							12
06:00		19	77							96
07:00		53	66							119
08:00		92	161							253
09:00		11	23							34
10:00		18	19							37
11:00		32	34							66
12:00 PM		23	27							50
01:00		22	23							45
02:00		56	16							72
03:00		93	120							213
04:00		77	38							115
05:00		88	41							129
06:00		50	24							74
07:00		25	32							57
08:00		21	3							24
09:00		17	5							22
10:00		5	3							8
11:00		5	1							6
Total		712	731							1443
Percent		49.3%	50.7%							
AM Peak	-	08:00	08:00	-	-	-	-	-	-	08:00
Vol.	-	92	161	-	-	-	-	-	-	253
PM Peak	-	15:00	15:00	-	-	-	-	-	-	15:00
Vol.	-	93	120	-	-	-	-	-	-	213
Grand Total		712	731							1443
Percent		49.3%	50.7%							
ADT		ADT 1,443	AADT 1,443							

All Traffic Data Services
Wheat Ridge, CO 80033

Site Code: 7
Station ID: 7
HESS RD E.O. CHAMBERS RD

Start Time	21-Aug-19 Wed	EB	WB	Total						
12:00 AM		40	9	49						
01:00		22	7	29						
02:00		11	14	25						
03:00		10	19	29						
04:00		17	106	123						
05:00		99	487	586						
06:00		375	1018	1393						
07:00		772	1423	2195						
08:00		673	1101	1774						
09:00		463	677	1140						
10:00		420	586	1006						
11:00		482	519	1001						
12:00 PM		487	528	1015						
01:00		547	530	1077						
02:00		731	563	1294						
03:00		1274	744	2018						
04:00		1335	655	1990						
05:00		1420	695	2115						
06:00		934	462	1396						
07:00		605	365	970						
08:00		477	208	685						
09:00		309	132	441						
10:00		167	61	228						
11:00		87	21	108						
Total		11757	10930	22687						
Percent		51.8%	48.2%							
AM Peak	-	07:00	07:00	-	-	-	-	-	-	07:00
Vol.	-	772	1423	-	-	-	-	-	-	2195
PM Peak	-	17:00	15:00	-	-	-	-	-	-	17:00
Vol.	-	1420	744	-	-	-	-	-	-	2115
Grand Total		11757	10930							22687
Percent		51.8%	48.2%							
ADT		ADT 22,606	AADT 22,606							

APPENDIX B

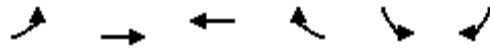
INTERSECTION CAPACITY ANALYSIS RESULTS

Timings

Existing AM

1: E. Hess Rd & S. Chambers Rd.

11/05/2019

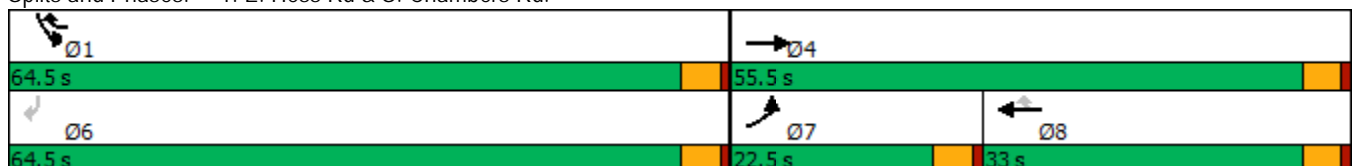


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↙	↑↑	↑↑	↗	↖↗	↗
Traffic Volume (vph)	36	380	568	923	370	18
Future Volume (vph)	36	380	568	923	370	18
Turn Type	Prot	NA	NA	pm+ov	Prot	Perm
Protected Phases	7	4	8	1	1	
Permitted Phases				8		6
Detector Phase	7	4	8	1	1	6
Switch Phase						
Minimum Initial (s)	11.0	15.0	15.0	11.0	11.0	4.0
Minimum Split (s)	22.5	20.5	20.5	15.5	15.5	20.0
Total Split (s)	22.5	55.5	33.0	64.5	64.5	64.5
Total Split (%)	18.8%	46.3%	27.5%	53.8%	53.8%	53.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Recall Mode	None	None	None	None	None	None
Act Effect Green (s)	11.9	22.4	17.8	41.6	15.5	15.5
Actuated g/C Ratio	0.25	0.47	0.37	0.87	0.33	0.33
v/c Ratio	0.09	0.25	0.47	0.68	0.36	0.04
Control Delay	20.8	7.8	15.0	3.8	15.0	8.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.8	7.8	15.0	3.8	15.0	8.2
LOS	C	A	B	A	B	A
Approach Delay		8.9	8.1		14.7	
Approach LOS		A	A		B	

Intersection Summary

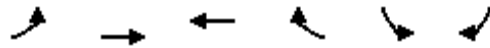
Cycle Length: 120
 Actuated Cycle Length: 47.6
 Natural Cycle: 65
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.68
 Intersection Signal Delay: 9.3
 Intersection LOS: A
 Intersection Capacity Utilization 73.8%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 1: E. Hess Rd & S. Chambers Rd.



HCM 6th Signalized Intersection Summary
 1: E. Hess Rd & S. Chambers Rd.

Existing AM
 11/05/2019



Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations							
Traffic Volume (veh/h)	36	380	568	923	370	18	
Future Volume (veh/h)	36	380	568	923	370	18	
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	1870	1870	1870	1870	1870	1870	
Adj Flow Rate, veh/h	39	413	617	1003	402	20	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Percent Heavy Veh, %	2	2	2	2	2	2	
Cap, veh/h	158	2332	1742	1077	653	300	
Arrive On Green	0.09	0.66	0.49	0.49	0.19	0.19	
Sat Flow, veh/h	1781	3647	3647	1585	3456	1585	
Grp Volume(v), veh/h	39	413	617	1003	402	20	
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1585	1728	1585	
Q Serve(g_s), s	1.2	2.6	6.2	28.5	6.2	0.6	
Cycle Q Clear(g_c), s	1.2	2.6	6.2	28.5	6.2	0.6	
Prop In Lane	1.00			1.00	1.00	1.00	
Lane Grp Cap(c), veh/h	158	2332	1742	1077	653	300	
V/C Ratio(X)	0.25	0.18	0.35	0.93	0.62	0.07	
Avail Cap(c_a), veh/h	552	3118	1742	1077	3567	1636	
HCM Platoon Ratio	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	
Uniform Delay (d), s/veh	24.7	3.9	9.1	8.1	21.6	19.4	
Incr Delay (d2), s/veh	0.8	0.0	0.1	14.0	0.9	0.1	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	0.5	0.5	1.8	4.2	2.3	0.0	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	25.5	3.9	9.3	22.1	22.6	19.5	
LnGrp LOS	C	A	A	C	C	B	
Approach Vol, veh/h		452	1620		422		
Approach Delay, s/veh		5.8	17.2		22.4		
Approach LOS		A	B		C		
Timer - Assigned Phs				4	6	7	8
Phs Duration (G+Y+Rc), s				42.6	15.5	9.6	33.0
Change Period (Y+Rc), s				4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s				51.0	60.0	18.0	28.5
Max Q Clear Time (g_c+I1), s				4.6	8.2	3.2	30.5
Green Ext Time (p_c), s				2.7	1.5	0.0	0.0
Intersection Summary							
HCM 6th Ctrl Delay			16.0				
HCM 6th LOS			B				

Intersection						
Int Delay, s/veh	2.9					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘	↗	↑↑	↗	↘	↑↑↑
Traffic Vol, veh/h	54	111	925	70	45	375
Future Vol, veh/h	54	111	925	70	45	375
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	135	-	0	400	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	64	131	1088	82	53	441

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	1370	544	0	0	1170
Stage 1	1088	-	-	-	-
Stage 2	282	-	-	-	-
Critical Hdwy	6.29	6.94	-	-	4.14
Critical Hdwy Stg 1	5.84	-	-	-	-
Critical Hdwy Stg 2	6.04	-	-	-	-
Follow-up Hdwy	3.67	3.32	-	-	2.22
Pot Cap-1 Maneuver	166	483	-	-	593
Stage 1	278	-	-	-	-
Stage 2	703	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	151	483	-	-	593
Mov Cap-2 Maneuver	151	-	-	-	-
Stage 1	278	-	-	-	-
Stage 2	640	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	25	0	1.2
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	151	483	593
HCM Lane V/C Ratio	-	-	0.421	0.27	0.089
HCM Control Delay (s)	-	-	45.1	15.2	11.7
HCM Lane LOS	-	-	E	C	B
HCM 95th %tile Q(veh)	-	-	1.9	1.1	0.3

DELAY (CONTROL)

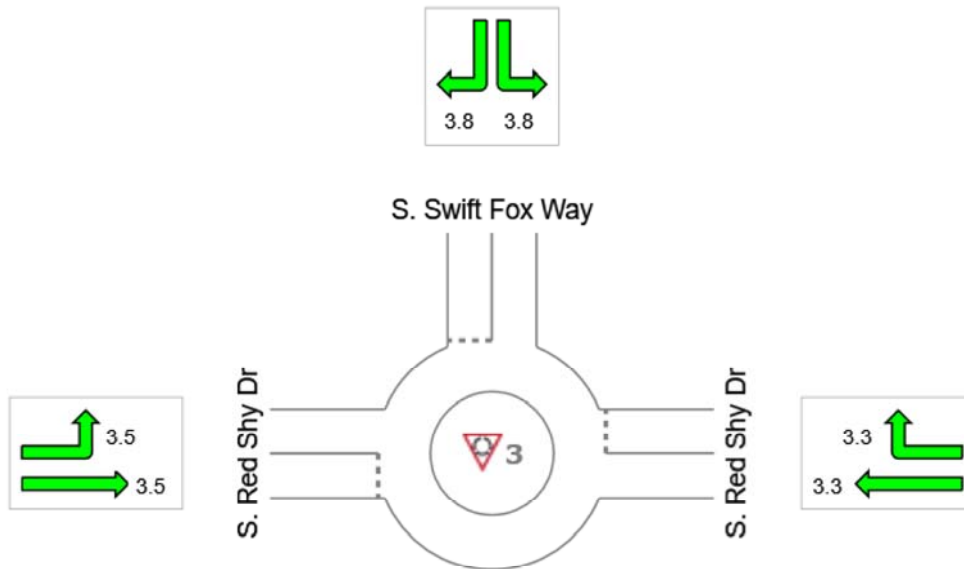
Average control delay per vehicle, or average pedestrian delay (seconds)

 Site: 3 [Ex_AM]

New Site
 Site Category: (None)
 Roundabout

All Movement Classes

	Approaches			Intersection
	East	North	West	
Delay (Control)	3.3	3.8	3.5	3.7
LOS	A	A	A	A



Colour code based on Level of Service



Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
 LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Roundabout Level of Service Method: Same as Sign Control

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Intersection						
Int Delay, s/veh	0.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↘	↑↑	↑↑	↗	↘	
Traffic Vol, veh/h	4	749	1466	7	5	5
Future Vol, veh/h	4	749	1466	7	5	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	215	-	-	215	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	88	88	88	88	88	88
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	851	1666	8	6	6

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	1674	0	-	0	2102 833
Stage 1	-	-	-	-	1666 -
Stage 2	-	-	-	-	436 -
Critical Hdwy	4.14	-	-	-	6.84 6.94
Critical Hdwy Stg 1	-	-	-	-	5.84 -
Critical Hdwy Stg 2	-	-	-	-	5.84 -
Follow-up Hdwy	2.22	-	-	-	3.52 3.32
Pot Cap-1 Maneuver	379	-	-	-	44 312
Stage 1	-	-	-	-	139 -
Stage 2	-	-	-	-	619 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	379	-	-	-	43 312
Mov Cap-2 Maneuver	-	-	-	-	43 -
Stage 1	-	-	-	-	137 -
Stage 2	-	-	-	-	619 -

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	60.5
HCM LOS			F

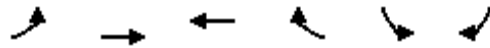
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	379	-	-	-	76
HCM Lane V/C Ratio	0.012	-	-	-	0.15
HCM Control Delay (s)	14.6	-	-	-	60.5
HCM Lane LOS	B	-	-	-	F
HCM 95th %tile Q(veh)	0	-	-	-	0.5

Timings

Existing PM

1: E. Hess Rd & S. Chambers Rd.

11/05/2019

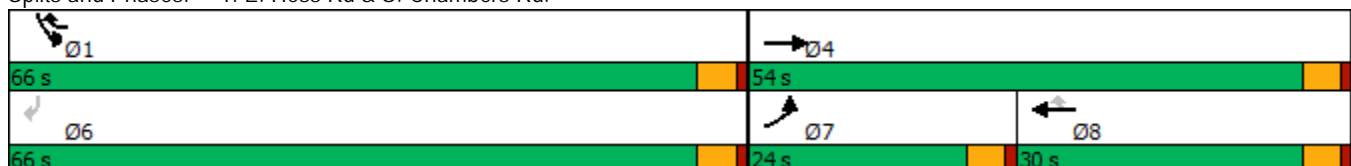


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↑↑	↑↑	↗	↖↗	↗
Traffic Volume (vph)	19	506	335	368	936	5
Future Volume (vph)	19	506	335	368	936	5
Turn Type	Prot	NA	NA	pm+ov	Prot	Perm
Protected Phases	7	4	8	1	1	
Permitted Phases				8		6
Detector Phase	7	4	8	1	1	6
Switch Phase						
Minimum Initial (s)	11.0	15.0	15.0	11.0	11.0	4.0
Minimum Split (s)	22.5	20.5	20.5	15.5	15.5	20.0
Total Split (s)	24.0	54.0	30.0	66.0	66.0	66.0
Total Split (%)	20.0%	45.0%	25.0%	55.0%	55.0%	55.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Recall Mode	None	None	None	None	None	None
Act Effect Green (s)	11.7	18.5	16.5	48.7	23.2	23.2
Actuated g/C Ratio	0.23	0.36	0.32	0.95	0.45	0.45
v/c Ratio	0.05	0.42	0.31	0.25	0.64	0.01
Control Delay	23.2	14.6	17.5	0.7	13.1	6.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.2	14.6	17.5	0.7	13.1	6.2
LOS	C	B	B	A	B	A
Approach Delay		14.9	8.7		13.1	
Approach LOS		B	A		B	

Intersection Summary

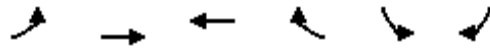
Cycle Length: 120	
Actuated Cycle Length: 51.3	
Natural Cycle: 70	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.64	
Intersection Signal Delay: 12.1	Intersection LOS: B
Intersection Capacity Utilization 50.0%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 1: E. Hess Rd & S. Chambers Rd.



HCM 6th Signalized Intersection Summary
 1: E. Hess Rd & S. Chambers Rd.

Existing PM
 11/05/2019



Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations	↖	↑↑	↑↑	↗	↖↗	↖	
Traffic Volume (veh/h)	19	506	335	368	936	5	
Future Volume (veh/h)	19	506	335	368	936	5	
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	1870	1870	1870	1870	1870	1870	
Adj Flow Rate, veh/h	20	533	353	387	985	5	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	
Percent Heavy Veh, %	2	2	2	2	2	2	
Cap, veh/h	95	1584	1073	1070	1289	591	
Arrive On Green	0.05	0.45	0.30	0.30	0.37	0.37	
Sat Flow, veh/h	1781	3647	3647	1585	3456	1585	
Grp Volume(v), veh/h	20	533	353	387	985	5	
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1585	1728	1585	
Q Serve(g_s), s	0.5	4.9	3.8	5.2	12.4	0.1	
Cycle Q Clear(g_c), s	0.5	4.9	3.8	5.2	12.4	0.1	
Prop In Lane	1.00			1.00	1.00	1.00	
Lane Grp Cap(c), veh/h	95	1584	1073	1070	1289	591	
V/C Ratio(X)	0.21	0.34	0.33	0.36	0.76	0.01	
Avail Cap(c_a), veh/h	699	3540	1824	1405	4277	1962	
HCM Platoon Ratio	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	
Uniform Delay (d), s/veh	22.5	9.0	13.4	3.5	13.7	9.8	
Incr Delay (d2), s/veh	1.1	0.1	0.2	0.2	1.0	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	0.2	1.3	1.2	7.1	3.7	0.1	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	23.6	9.1	13.6	3.7	14.6	9.8	
LnGrp LOS	C	A	B	A	B	A	
Approach Vol, veh/h		553	740		990		
Approach Delay, s/veh		9.6	8.4		14.6		
Approach LOS		A	A		B		
Timer - Assigned Phs				4	6	7	8
Phs Duration (G+Y+Rc), s				26.7	23.0	7.2	19.5
Change Period (Y+Rc), s				4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s				49.5	61.5	19.5	25.5
Max Q Clear Time (g_c+I1), s				6.9	14.4	2.5	7.2
Green Ext Time (p_c), s				3.6	4.1	0.0	3.3
Intersection Summary							
HCM 6th Ctrl Delay			11.4				
HCM 6th LOS			B				

Intersection						
Int Delay, s/veh	0.8					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↵	↵	↑↑	↵	↵	↑↑↑
Traffic Vol, veh/h	23	28	359	33	61	934
Future Vol, veh/h	23	28	359	33	61	934
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	135	-	0	400	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	24	29	370	34	63	963

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	881	185	0	0	404	0
Stage 1	370	-	-	-	-	-
Stage 2	511	-	-	-	-	-
Critical Hdwy	6.29	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	6.04	-	-	-	-	-
Follow-up Hdwy	3.67	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	319	826	-	-	1151	-
Stage 1	646	-	-	-	-	-
Stage 2	534	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	301	826	-	-	1151	-
Mov Cap-2 Maneuver	301	-	-	-	-	-
Stage 1	646	-	-	-	-	-
Stage 2	505	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13.3	0	0.5
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	301	826	1151
HCM Lane V/C Ratio	-	-	0.079	0.035	0.055
HCM Control Delay (s)	-	-	18	9.5	8.3
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0.1	0.2

DELAY (CONTROL)

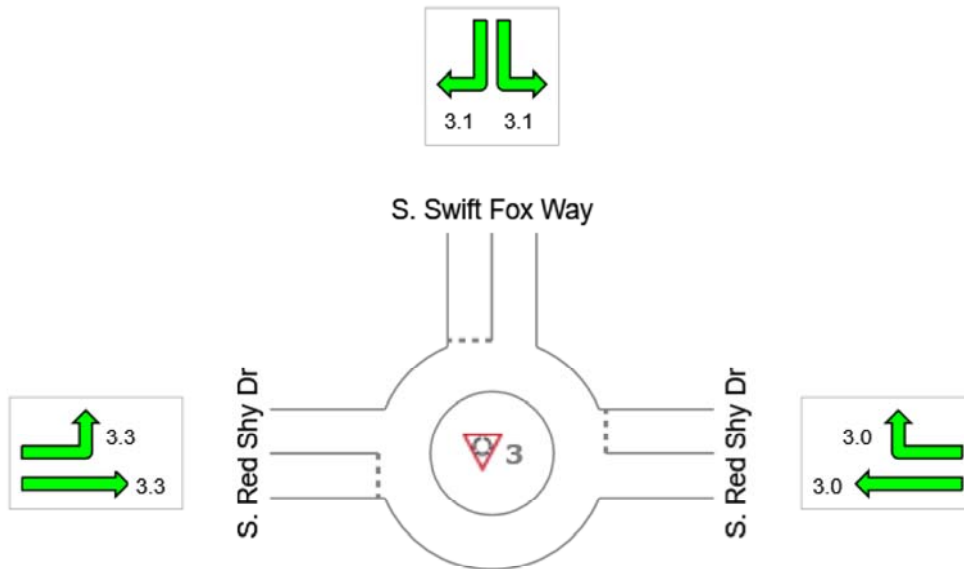
Average control delay per vehicle, or average pedestrian delay (seconds)

 Site: 3 [Ex_PM]

New Site
 Site Category: (None)
 Roundabout

All Movement Classes

	Approaches			Intersection
	East	North	West	
Delay (Control)	3.0	3.1	3.3	3.2
LOS	A	A	A	A



Colour code based on Level of Service



Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
 LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Roundabout Level of Service Method: Same as Sign Control

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Intersection						
Int Delay, s/veh	0.1					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↘	↑↑	↑↑	↗	↘	
Traffic Vol, veh/h	5	1435	696	12	6	0
Future Vol, veh/h	5	1435	696	12	6	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	215	-	-	215	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	1511	733	13	6	0

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	746	0	-	0	1499 367
Stage 1	-	-	-	-	733 -
Stage 2	-	-	-	-	766 -
Critical Hdwy	4.14	-	-	-	6.84 6.94
Critical Hdwy Stg 1	-	-	-	-	5.84 -
Critical Hdwy Stg 2	-	-	-	-	5.84 -
Follow-up Hdwy	2.22	-	-	-	3.52 3.32
Pot Cap-1 Maneuver	858	-	-	-	113 630
Stage 1	-	-	-	-	436 -
Stage 2	-	-	-	-	419 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	858	-	-	-	112 630
Mov Cap-2 Maneuver	-	-	-	-	112 -
Stage 1	-	-	-	-	433 -
Stage 2	-	-	-	-	419 -

Approach	EB	WB	SB
HCM Control Delay, s	0	0	39.1
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	858	-	-	-	112
HCM Lane V/C Ratio	0.006	-	-	-	0.056
HCM Control Delay (s)	9.2	-	-	-	39.1
HCM Lane LOS	A	-	-	-	E
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Timings
1: E. Hess Rd & S. Chambers Rd.

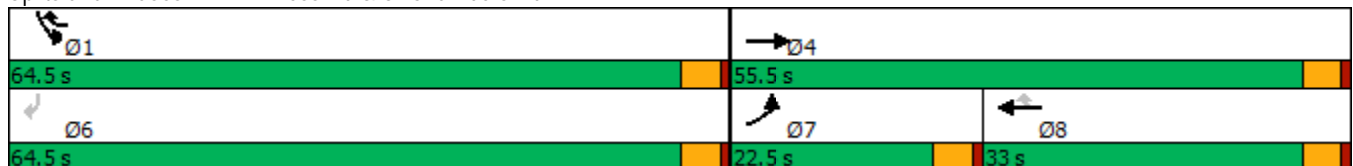


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↶	↷	↶	↷	↶	↷
Traffic Volume (vph)	38	411	615	998	400	20
Future Volume (vph)	38	411	615	998	400	20
Turn Type	Prot	NA	NA	pm+ov	Prot	Perm
Protected Phases	7	4	8	1	1	
Permitted Phases				8		6
Detector Phase	7	4	8	1	1	6
Switch Phase						
Minimum Initial (s)	11.0	15.0	15.0	11.0	11.0	4.0
Minimum Split (s)	22.5	20.5	20.5	15.5	15.5	20.0
Total Split (s)	22.5	55.5	33.0	64.5	64.5	64.5
Total Split (%)	18.8%	46.3%	27.5%	53.8%	53.8%	53.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Recall Mode	None	None	None	None	None	None
Act Effect Green (s)	12.5	27.6	19.8	46.9	19.1	19.1
Actuated g/C Ratio	0.22	0.49	0.35	0.82	0.34	0.34
v/c Ratio	0.11	0.26	0.54	0.75	0.38	0.04
Control Delay	28.3	9.6	20.0	5.5	16.5	7.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.3	9.6	20.0	5.5	16.5	7.4
LOS	C	A	B	A	B	A
Approach Delay		11.2	11.0		16.1	
Approach LOS		B	B		B	

Intersection Summary

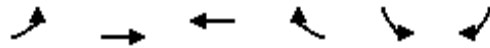
Cycle Length: 120
 Actuated Cycle Length: 56.9
 Natural Cycle: 65
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.75
 Intersection Signal Delay: 11.9
 Intersection LOS: B
 Intersection Capacity Utilization 78.5%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 1: E. Hess Rd & S. Chambers Rd.



HCM 6th Signalized Intersection Summary
1: E. Hess Rd & S. Chambers Rd.

Short-Term Background 2021 AM
01/20/2020



Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations							
Traffic Volume (veh/h)	38	411	615	998	400	20	
Future Volume (veh/h)	38	411	615	998	400	20	
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	1870	1870	1870	1870	1870	1870	
Adj Flow Rate, veh/h	41	447	668	1085	435	22	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Percent Heavy Veh, %	2	2	2	2	2	2	
Cap, veh/h	163	2336	1736	1073	651	299	
Arrive On Green	0.09	0.66	0.49	0.49	0.19	0.19	
Sat Flow, veh/h	1781	3647	3647	1585	3456	1585	
Grp Volume(v), veh/h	41	447	668	1085	435	22	
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1585	1728	1585	
Q Serve(g_s), s	1.2	2.9	6.9	28.5	6.8	0.7	
Cycle Q Clear(g_c), s	1.2	2.9	6.9	28.5	6.8	0.7	
Prop In Lane	1.00			1.00	1.00	1.00	
Lane Grp Cap(c), veh/h	163	2336	1736	1073	651	299	
V/C Ratio(X)	0.25	0.19	0.38	1.01	0.67	0.07	
Avail Cap(c_a), veh/h	550	3107	1736	1073	3554	1630	
HCM Platoon Ratio	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	
Uniform Delay (d), s/veh	24.6	3.9	9.4	9.4	22.0	19.5	
Incr Delay (d2), s/veh	0.8	0.0	0.1	30.2	1.2	0.1	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	0.5	0.5	2.0	9.0	2.5	0.0	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	25.4	4.0	9.5	39.6	23.2	19.6	
LnGrp LOS	C	A	A	F	C	B	
Approach Vol, veh/h		488	1753		457		
Approach Delay, s/veh		5.8	28.2		23.0		
Approach LOS		A	C		C		
Timer - Assigned Phs				4	6	7	8
Phs Duration (G+Y+Rc), s				42.8	15.5	9.8	33.0
Change Period (Y+Rc), s				4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s				51.0	60.0	18.0	28.5
Max Q Clear Time (g_c+I1), s				4.9	8.8	3.2	30.5
Green Ext Time (p_c), s				2.9	1.6	0.0	0.0
Intersection Summary							
HCM 6th Ctrl Delay			23.2				
HCM 6th LOS			C				

Intersection						
Int Delay, s/veh	3.6					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘	↗	↑↑	↗	↘	↑↑↑
Traffic Vol, veh/h	58	118	1000	76	49	406
Future Vol, veh/h	58	118	1000	76	49	406
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	135	-	0	400	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	68	139	1176	89	58	478

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	1483	588	0	0	1265	0
Stage 1	1176	-	-	-	-	-
Stage 2	307	-	-	-	-	-
Critical Hdwy	6.29	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	6.04	-	-	-	-	-
Follow-up Hdwy	3.67	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	143	452	-	-	545	-
Stage 1	250	-	-	-	-	-
Stage 2	683	-	-	-	-	-
Platoon blocked, %			-	-		
Mov Cap-1 Maneuver	128	452	-	-	545	-
Mov Cap-2 Maneuver	128	-	-	-	-	-
Stage 1	250	-	-	-	-	-
Stage 2	611	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	31.3	0	1.3
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	WBLn2	SBL	SBT	
Capacity (veh/h)	-	-	128	452	545	-
HCM Lane V/C Ratio	-	-	0.533	0.307	0.106	-
HCM Control Delay (s)	-	-	61.4	16.5	12.4	-
HCM Lane LOS	-	-	F	C	B	-
HCM 95th %tile Q(veh)	-	-	2.6	1.3	0.4	-

DELAY (CONTROL)

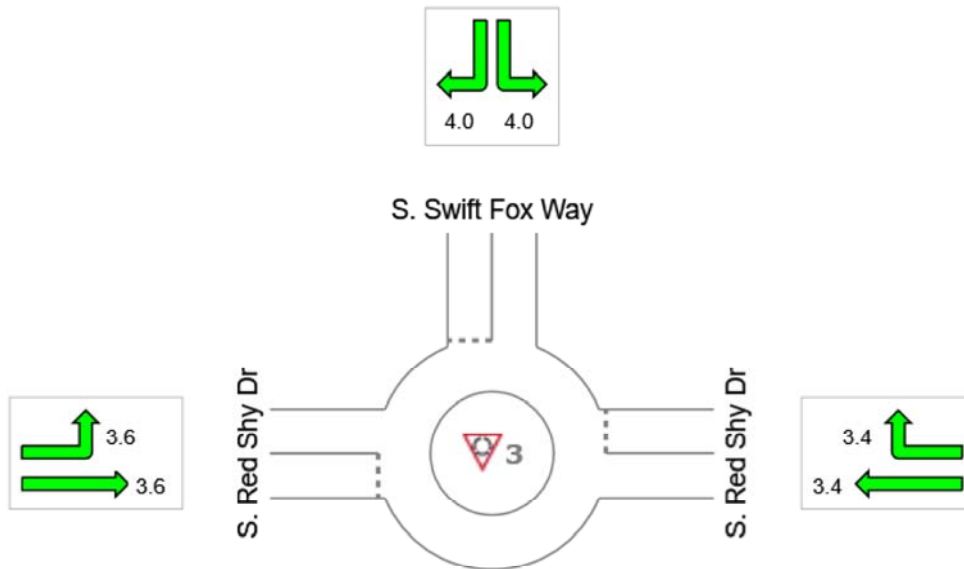
Average control delay per vehicle, or average pedestrian delay (seconds)

 Site: 3 [2021Background_AM]

New Site
 Site Category: (None)
 Roundabout

All Movement Classes

	Approaches			Intersection
	East	North	West	
Delay (Control)	3.4	4.0	3.6	3.8
LOS	A	A	A	A



Colour code based on Level of Service



Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
 LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Roundabout Level of Service Method: Same as Sign Control

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Intersection						
Int Delay, s/veh	0.4					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	4	810	1586	7	5	5
Future Vol, veh/h	4	810	1586	7	5	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	215	-	-	215	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	88	88	88	88	88	88
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	920	1802	8	6	6

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	1810	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.14	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.22	-	-
Pot Cap-1 Maneuver	336	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	336	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

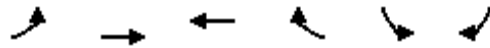
Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	80
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	336	-	-	-	59
HCM Lane V/C Ratio	0.014	-	-	-	0.193
HCM Control Delay (s)	15.9	-	-	-	80
HCM Lane LOS	C	-	-	-	F
HCM 95th %tile Q(veh)	0	-	-	-	0.6

Timings

1: E. Hess Rd & S. Chambers Rd.

01/20/2020

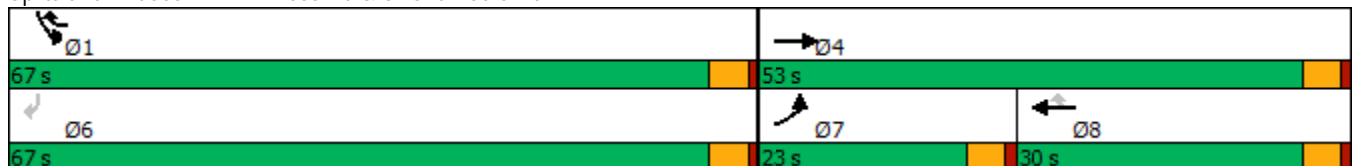


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↑↑	↑↑	↗	↖↗	↗
Traffic Volume (vph)	21	547	362	398	1012	5
Future Volume (vph)	21	547	362	398	1012	5
Turn Type	Prot	NA	NA	pm+ov	Prot	Perm
Protected Phases	7	4	8	1	1	
Permitted Phases				8		6
Detector Phase	7	4	8	1	1	6
Switch Phase						
Minimum Initial (s)	11.0	15.0	15.0	11.0	11.0	4.0
Minimum Split (s)	22.5	20.5	20.5	15.5	15.5	20.0
Total Split (s)	23.0	53.0	30.0	67.0	67.0	67.0
Total Split (%)	19.2%	44.2%	25.0%	55.8%	55.8%	55.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Recall Mode	None	None	None	None	None	None
Act Effect Green (s)	12.0	21.5	16.9	51.7	26.3	26.3
Actuated g/C Ratio	0.21	0.37	0.29	0.90	0.46	0.46
v/c Ratio	0.06	0.44	0.37	0.29	0.68	0.01
Control Delay	27.8	15.4	21.5	0.8	15.4	7.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.8	15.4	21.5	0.8	15.4	7.0
LOS	C	B	C	A	B	A
Approach Delay		15.9	10.7		15.4	
Approach LOS		B	B		B	

Intersection Summary

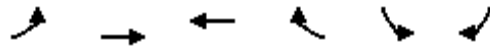
Cycle Length: 120
 Actuated Cycle Length: 57.6
 Natural Cycle: 70
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.68
 Intersection Signal Delay: 14.0
 Intersection LOS: B
 Intersection Capacity Utilization 53.8%
 ICU Level of Service A
 Analysis Period (min) 15

Splits and Phases: 1: E. Hess Rd & S. Chambers Rd.



HCM 6th Signalized Intersection Summary
 1: E. Hess Rd & S. Chambers Rd.

Short-Term Background PM
 01/20/2020



Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations							
Traffic Volume (veh/h)	21	547	362	398	1012	5	
Future Volume (veh/h)	21	547	362	398	1012	5	
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	1870	1870	1870	1870	1870	1870	
Adj Flow Rate, veh/h	22	576	381	419	1065	5	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	
Percent Heavy Veh, %	2	2	2	2	2	2	
Cap, veh/h	103	1534	1023	1083	1367	627	
Arrive On Green	0.06	0.43	0.29	0.29	0.40	0.40	
Sat Flow, veh/h	1781	3647	3647	1585	3456	1585	
Grp Volume(v), veh/h	22	576	381	419	1065	5	
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1585	1728	1585	
Q Serve(g_s), s	0.6	5.7	4.5	5.9	14.0	0.1	
Cycle Q Clear(g_c), s	0.6	5.7	4.5	5.9	14.0	0.1	
Prop In Lane	1.00			1.00	1.00	1.00	
Lane Grp Cap(c), veh/h	103	1534	1023	1083	1367	627	
V/C Ratio(X)	0.21	0.38	0.37	0.39	0.78	0.01	
Avail Cap(c_a), veh/h	632	3308	1739	1403	4145	1901	
HCM Platoon Ratio	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	
Uniform Delay (d), s/veh	23.4	10.0	14.8	3.6	13.8	9.6	
Incr Delay (d2), s/veh	1.0	0.2	0.2	0.2	1.0	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	0.3	1.6	1.5	0.1	4.2	0.0	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	24.5	10.2	15.0	3.8	14.8	9.6	
LnGrp LOS	C	B	B	A	B	A	
Approach Vol, veh/h		598	800		1070		
Approach Delay, s/veh		10.7	9.1		14.7		
Approach LOS		B	A		B		
Timer - Assigned Phs				4	6	7	8
Phs Duration (G+Y+Rc), s				27.0	25.1	7.5	19.5
Change Period (Y+Rc), s				4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s				48.5	62.5	18.5	25.5
Max Q Clear Time (g_c+I1), s				7.7	16.0	2.6	7.9
Green Ext Time (p_c), s				3.9	4.6	0.0	3.5
Intersection Summary							
HCM 6th Ctrl Delay			11.9				
HCM 6th LOS			B				

Intersection						
Int Delay, s/veh	0.8					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↵	↵	↕↕	↵	↵	↕↕↕
Traffic Vol, veh/h	25	30	388	36	67	1010
Future Vol, veh/h	25	30	388	36	67	1010
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	135	-	0	400	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	26	31	400	37	69	1041

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	954	200	0	0	437
Stage 1	400	-	-	-	-
Stage 2	554	-	-	-	-
Critical Hdwy	6.29	6.94	-	-	4.14
Critical Hdwy Stg 1	5.84	-	-	-	-
Critical Hdwy Stg 2	6.04	-	-	-	-
Follow-up Hdwy	3.67	3.32	-	-	2.22
Pot Cap-1 Maneuver	290	808	-	-	1119
Stage 1	624	-	-	-	-
Stage 2	507	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	272	808	-	-	1119
Mov Cap-2 Maneuver	272	-	-	-	-
Stage 1	624	-	-	-	-
Stage 2	476	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	14.1	0	0.5
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	272	808	1119	-
HCM Lane V/C Ratio	-	-	0.095	0.038	0.062	-
HCM Control Delay (s)	-	-	19.6	9.6	8.4	-
HCM Lane LOS	-	-	C	A	A	-
HCM 95th %tile Q(veh)	-	-	0.3	0.1	0.2	-

DELAY (CONTROL)

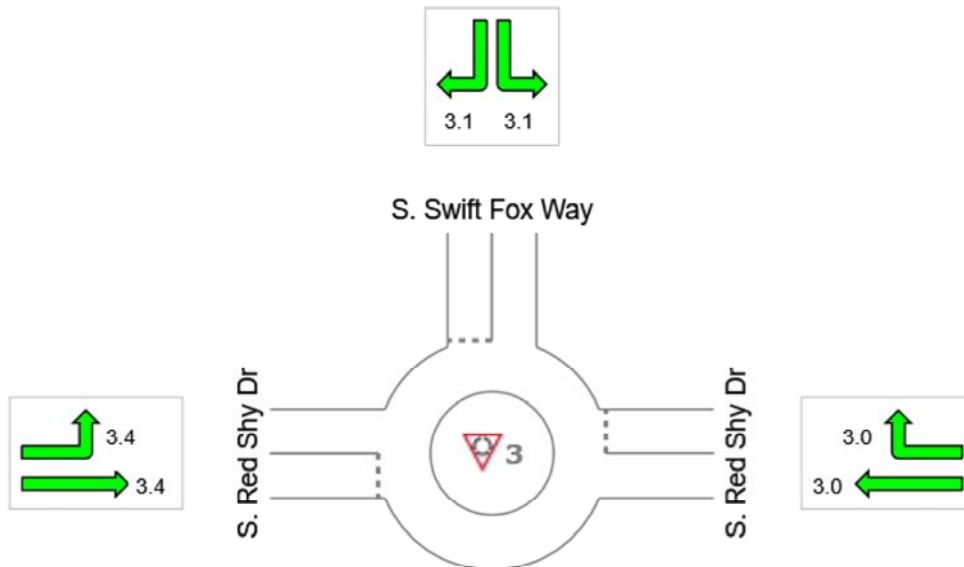
Average control delay per vehicle, or average pedestrian delay (seconds)

 Site: 3 [2021Background_PM]

New Site
 Site Category: (None)
 Roundabout

All Movement Classes

	Approaches			Intersection
	East	North	West	
Delay (Control)	3.0	3.1	3.4	3.3
LOS	A	A	A	A



Colour code based on Level of Service



Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
 LOS F will result if $v/c > 1$ irrespective of movement delay value (does not apply for approaches and intersection).

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Roundabout Level of Service Method: Same as Sign Control

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Intersection						
Int Delay, s/veh	0.1					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↘	↑↑	↑↑	↗	↘	
Traffic Vol, veh/h	5	1550	753	12	7	0
Future Vol, veh/h	5	1550	753	12	7	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	215	-	-	215	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	1632	793	13	7	0

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	806	0	-	0	1619 397
Stage 1	-	-	-	-	793 -
Stage 2	-	-	-	-	826 -
Critical Hdwy	4.14	-	-	-	6.84 6.94
Critical Hdwy Stg 1	-	-	-	-	5.84 -
Critical Hdwy Stg 2	-	-	-	-	5.84 -
Follow-up Hdwy	2.22	-	-	-	3.52 3.32
Pot Cap-1 Maneuver	814	-	-	-	94 602
Stage 1	-	-	-	-	406 -
Stage 2	-	-	-	-	390 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	814	-	-	-	93 602
Mov Cap-2 Maneuver	-	-	-	-	93 -
Stage 1	-	-	-	-	404 -
Stage 2	-	-	-	-	390 -

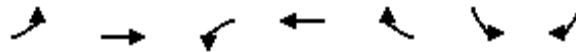
Approach	EB	WB	SB
HCM Control Delay, s	0	0	47
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	814	-	-	-	93
HCM Lane V/C Ratio	0.006	-	-	-	0.079
HCM Control Delay (s)	9.5	-	-	-	47
HCM Lane LOS	A	-	-	-	E
HCM 95th %tile Q(veh)	0	-	-	-	0.3

Timings

1: E. Hess Rd & S. Chambers Rd.

06/23/2020

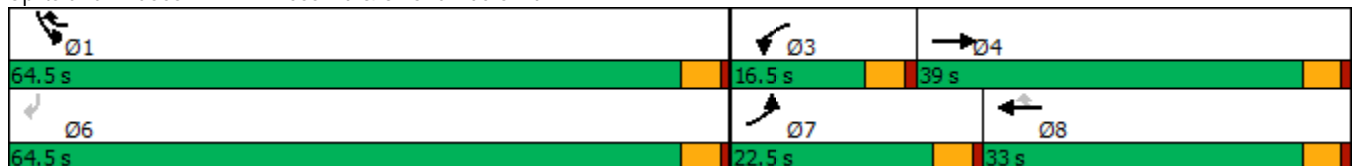


Lane Group	EBL	EBT	WBL	WBT	WBR	SBL	SBR
Lane Configurations	↖	↗	↖	↔	↖	↘	↗
Traffic Volume (vph)	59	411	74	633	1018	541	20
Future Volume (vph)	59	411	74	633	1018	541	20
Turn Type	Prot	NA	Prot	NA	pm+ov	Prot	Perm
Protected Phases	7	4	3	8	1	1	
Permitted Phases					8		6
Detector Phase	7	4	3	8	1	1	6
Switch Phase							
Minimum Initial (s)	11.0	15.0	11.0	15.0	15.0	15.0	4.0
Minimum Split (s)	22.5	20.5	15.5	20.5	19.5	19.5	20.0
Total Split (s)	22.5	39.0	16.5	33.0	64.5	64.5	64.5
Total Split (%)	18.8%	32.5%	13.8%	27.5%	53.8%	53.8%	53.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag			
Lead-Lag Optimize?	Yes	Yes	Yes	Yes			
Recall Mode	None	None	None	None	None	None	None
Act Effect Green (s)	12.7	21.8	12.5	21.7	55.1	26.7	26.7
Actuated g/C Ratio	0.18	0.31	0.18	0.31	0.78	0.38	0.38
v/c Ratio	0.20	0.41	0.26	0.63	0.81	0.45	0.03
Control Delay	35.7	24.3	36.7	27.8	8.0	18.0	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.7	24.3	36.7	27.8	8.0	18.0	0.1
LOS	D	C	D	C	A	B	A
Approach Delay		25.7		16.5			
Approach LOS		C		B			

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 70.7
 Natural Cycle: 65
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.81
 Intersection Signal Delay: 18.2
 Intersection LOS: B
 Intersection Capacity Utilization 79.7%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 1: E. Hess Rd & S. Chambers Rd.



HCM 6th Signalized Intersection Summary
1: E. Hess Rd & S. Chambers Rd.

Short-Term Background 2021 + Proj AM

06/23/2020



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗	↖				↖	↗	↖
Traffic Volume (veh/h)	59	411	0	74	633	1018	0	0	0	541	0	20
Future Volume (veh/h)	59	411	0	74	633	1018	0	0	0	541	0	20
Initial Q (Qb), veh	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
Parking Bus, Adj	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	
Adj Sat Flow, veh/h/ln	1870	1870	0	1870	1870	1870				1870	0	1870
Adj Flow Rate, veh/h	64	447	0	80	688	1107				588	0	22
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	2	2	0	2	2	2				2	0	2
Cap, veh/h	207	1522	0	231	1570	1069				804	0	369
Arrive On Green	0.12	0.43	0.00	0.13	0.44	0.44				0.23	0.00	0.23
Sat Flow, veh/h	1781	3647	0	1781	3554	1585				3456	0	1585
Grp Volume(v), veh/h	64	447	0	80	688	1107				588	0	22
Grp Sat Flow(s),veh/h/ln	1781	1777	0	1781	1777	1585				1728	0	1585
Q Serve(g_s), s	2.1	5.3	0.0	2.6	8.6	28.5				10.2	0.0	0.7
Cycle Q Clear(g_c), s	2.1	5.3	0.0	2.6	8.6	28.5				10.2	0.0	0.7
Prop In Lane	1.00		0.00	1.00		1.00				1.00		1.00
Lane Grp Cap(c), veh/h	207	1522	0	231	1570	1069				804	0	369
V/C Ratio(X)	0.31	0.29	0.00	0.35	0.44	1.04				0.73	0.00	0.06
Avail Cap(c_a), veh/h	497	1901	0	331	1570	1069				3214	0	1474
HCM Platoon Ratio	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	0.00	1.00	1.00	1.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	26.1	12.1	0.0	25.6	12.5	10.5				22.9	0.0	19.3
Incr Delay (d2), s/veh	0.8	0.1	0.0	0.9	0.2	37.2				1.3	0.0	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
%ile BackOfQ(50%),veh/ln	0.9	1.7	0.0	1.1	2.8	18.5				3.8	0.0	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	27.0	12.2	0.0	26.5	12.7	47.7				24.2	0.0	19.3
LnGrp LOS	C	B	A	C	B	F				C	A	B
Approach Vol, veh/h		511			1875						610	
Approach Delay, s/veh		14.0			33.9						24.0	
Approach LOS		B			C						C	
Timer - Assigned Phs			3	4		6	7	8				
Phs Duration (G+Y+Rc), s			12.9	32.1		19.5	12.0	33.0				
Change Period (Y+Rc), s			4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s			12.0	34.5		60.0	18.0	28.5				
Max Q Clear Time (g_c+I1), s			4.6	7.3		12.2	4.1	30.5				
Green Ext Time (p_c), s			0.1	2.7		2.2	0.1	0.0				
Intersection Summary												
HCM 6th Ctrl Delay			28.5									
HCM 6th LOS			C									

Intersection

Int Delay, s/veh	169.5					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘	↗	↑↑	↗	↘	↑↑↑
Traffic Vol, veh/h	199	224	1000	117	190	406
Future Vol, veh/h	199	224	1000	117	190	406
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	-	0	400	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	234	264	1176	138	224	478

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	1815	588	0	0	1314
Stage 1	1176	-	-	-	-
Stage 2	639	-	-	-	-
Critical Hdwy	6.29	6.94	-	-	4.14
Critical Hdwy Stg 1	5.84	-	-	-	-
Critical Hdwy Stg 2	6.04	-	-	-	-
Follow-up Hdwy	3.67	3.32	-	-	2.22
Pot Cap-1 Maneuver	~ 90	452	-	-	522
Stage 1	250	-	-	-	-
Stage 2	457	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	~ 51	452	-	-	522
Mov Cap-2 Maneuver	~ 51	-	-	-	-
Stage 1	250	-	-	-	-
Stage 2	261	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s\$	848.4	0	5.4
HCM LOS	F		


Minor Lane/Major Mvmt	NBT	NBRWBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	51	452	522
HCM Lane V/C Ratio	-	-	4.591	0.583	0.428
HCM Control Delay (s)	-	-	\$ 1777	23.5	17
HCM Lane LOS	-	-	F	C	C
HCM 95th %tile Q(veh)	-	-	26.2	3.6	2.1

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

DELAY (CONTROL)

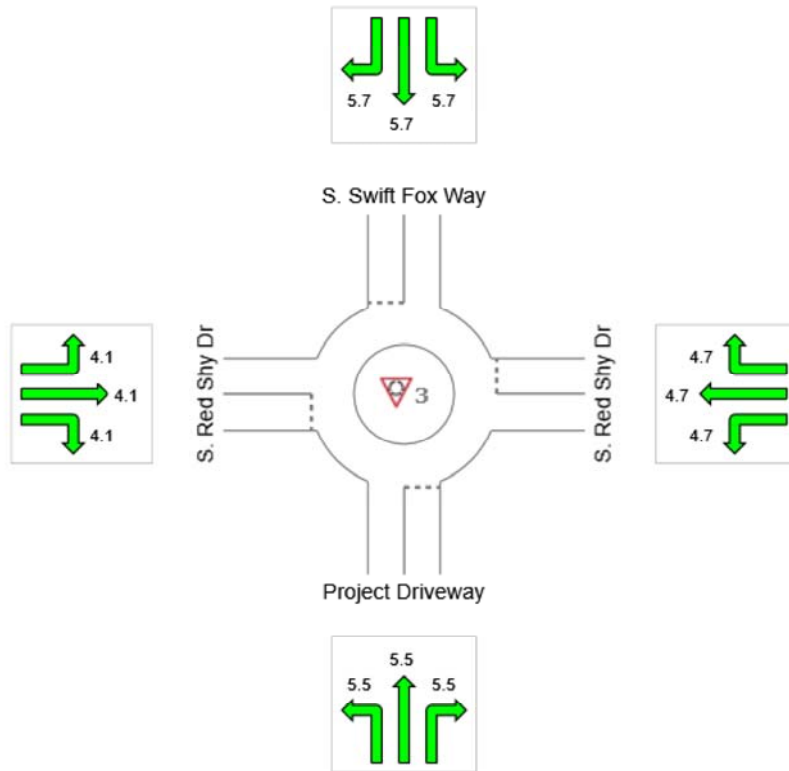
Average control delay per vehicle, or average pedestrian delay (seconds)

 Site: 3 [2021+Project_AM]

New Site
 Site Category: (None)
 Roundabout

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Delay (Control)	5.5	4.7	5.7	4.1	5.1
LOS	A	A	A	A	A



Colour code based on Level of Service



Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
 LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Roundabout Level of Service Method: Same as Sign Control

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Intersection						
Int Delay, s/veh	0.7					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	8	1021	1834	7	5	9
Future Vol, veh/h	8	1021	1834	7	5	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	215	-	-	215	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	88	88	88	88	88	88
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	1160	2084	8	6	10

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	2092	0	0 2682 1042
Stage 1	-	-	- 2084 -
Stage 2	-	-	- 598 -
Critical Hdwy	4.14	-	- 6.84 6.94
Critical Hdwy Stg 1	-	-	- 5.84 -
Critical Hdwy Stg 2	-	-	- 5.84 -
Follow-up Hdwy	2.22	-	- 3.52 3.32
Pot Cap-1 Maneuver	260	-	- 18 226
Stage 1	-	-	- 82 -
Stage 2	-	-	- 512 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	260	-	- 17 226
Mov Cap-2 Maneuver	-	-	- 17 -
Stage 1	-	-	- 79 -
Stage 2	-	-	- 512 -

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	135.7
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	260	-	-	-	42
HCM Lane V/C Ratio	0.035	-	-	-	0.379
HCM Control Delay (s)	19.3	-	-	-	135.7
HCM Lane LOS	C	-	-	-	F
HCM 95th %tile Q(veh)	0.1	-	-	-	1.3

Intersection						
Int Delay, s/veh	1.2					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑↑			↑
Traffic Vol, veh/h	0	1030	1613	232	0	92
Future Vol, veh/h	0	1030	1613	232	0	92
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	1120	1753	252	0	100

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	-	0	- 0 - 1003
Stage 1	-	-	- - -
Stage 2	-	-	- - -
Critical Hdwy	-	-	- - 7.14
Critical Hdwy Stg 1	-	-	- - -
Critical Hdwy Stg 2	-	-	- - -
Follow-up Hdwy	-	-	- - 3.92
Pot Cap-1 Maneuver	0	-	- 0 206
Stage 1	0	-	- 0 -
Stage 2	0	-	- 0 -
Platoon blocked, %	-	-	- - -
Mov Cap-1 Maneuver	-	-	- - 206
Mov Cap-2 Maneuver	-	-	- - -
Stage 1	-	-	- - -
Stage 2	-	-	- - -

Approach	EB	WB	SB
HCM Control Delay, s	0	0	37.9
HCM LOS			E

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	206
HCM Lane V/C Ratio	-	-	-	0.485
HCM Control Delay (s)	-	-	-	37.9
HCM Lane LOS	-	-	-	E
HCM 95th %tile Q(veh)	-	-	-	2.4

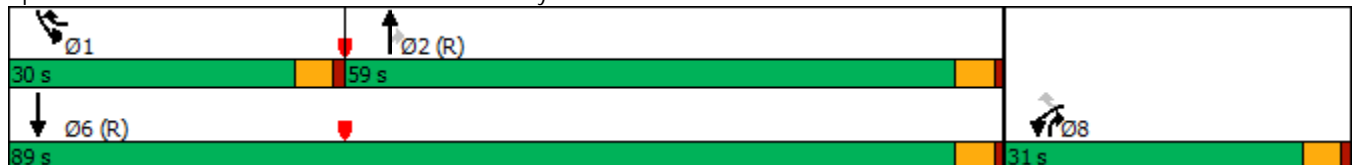
Timings
2: S. Chambers Rd. & S. Red Sky Dr.

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	199	224	1000	117	190	406
Future Volume (vph)	199	224	1000	117	190	406
Turn Type	Prot	pm+ov	NA	pm+ov	Prot	NA
Protected Phases	8	1	2	8	1	6
Permitted Phases		8		2		
Detector Phase	8	1	2	8	1	6
Switch Phase						
Minimum Initial (s)	11.0	5.0	14.0	11.0	5.0	14.0
Minimum Split (s)	22.5	9.5	22.5	22.5	9.5	22.5
Total Split (s)	31.0	30.0	59.0	31.0	30.0	89.0
Total Split (%)	25.8%	25.0%	49.2%	25.8%	25.0%	74.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag		Lead	Lag		Lead	
Lead-Lag Optimize?		Yes	Yes		Yes	
Recall Mode	None	None	C-Min	None	None	C-Min
Act Effct Green (s)	20.7	45.2	65.8	91.0	20.0	90.3
Actuated g/C Ratio	0.17	0.38	0.55	0.76	0.17	0.75
v/c Ratio	0.77	0.43	0.61	0.11	0.76	0.12
Control Delay	63.5	24.8	24.9	1.7	63.9	4.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	63.5	24.8	24.9	1.7	63.9	4.5
LOS	E	C	C	A	E	A
Approach Delay	43.0		22.5			23.5
Approach LOS	D		C			C

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 30 (25%), Referenced to phase 2:NBT and 6:SBT, Start of Green
 Natural Cycle: 70
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.77
 Intersection Signal Delay: 26.8
 Intersection LOS: C
 Intersection Capacity Utilization 60.4%
 ICU Level of Service B
 Analysis Period (min) 15

Splits and Phases: 2: S. Chambers Rd. & S. Red Sky Dr.



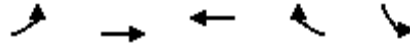
HCM 6th Signalized Intersection Summary Short-Term Background 2021 + ProjMitigation AM
 2: S. Chambers Rd. & S. Red Sky Dr. 06/24/2020



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	199	224	1000	117	190	406
Future Volume (veh/h)	199	224	1000	117	190	406
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	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	234	264	1176	138	224	478
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	293	487	2061	1180	255	3885
Arrive On Green	0.16	0.16	0.58	0.58	0.14	0.76
Sat Flow, veh/h	1781	1585	3647	1585	1781	5274
Grp Volume(v), veh/h	234	264	1176	138	224	478
Grp Sat Flow(s),veh/h/ln	1781	1585	1777	1585	1781	1702
Q Serve(g_s), s	15.2	16.6	24.9	2.9	14.8	3.0
Cycle Q Clear(g_c), s	15.2	16.6	24.9	2.9	14.8	3.0
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	293	487	2061	1180	255	3885
V/C Ratio(X)	0.80	0.54	0.57	0.12	0.88	0.12
Avail Cap(c_a), veh/h	393	577	2061	1180	379	3885
HCM Platoon Ratio	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
Uniform Delay (d), s/veh	48.2	34.5	15.8	4.3	50.4	3.8
Incr Delay (d2), s/veh	8.2	0.9	1.2	0.2	14.5	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.4	6.5	10.1	1.7	7.6	0.9
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	56.5	35.5	17.0	4.5	64.8	3.9
LnGrp LOS	E	D	B	A	E	A
Approach Vol, veh/h	498		1314			702
Approach Delay, s/veh	45.3		15.7			23.3
Approach LOS	D		B			C
Timer - Assigned Phs	1	2			6	8
Phs Duration (G+Y+Rc), s	21.7	74.1			95.8	24.2
Change Period (Y+Rc), s	4.5	4.5			4.5	4.5
Max Green Setting (Gmax), s	25.5	54.5			84.5	26.5
Max Q Clear Time (g_c+I1), s	16.8	26.9			5.0	18.6
Green Ext Time (p_c), s	0.4	10.9			3.8	1.1

Intersection Summary						
HCM 6th Ctrl Delay			23.7			
HCM 6th LOS			C			

Timings
4: E. Hess Rd & Firefly Ln

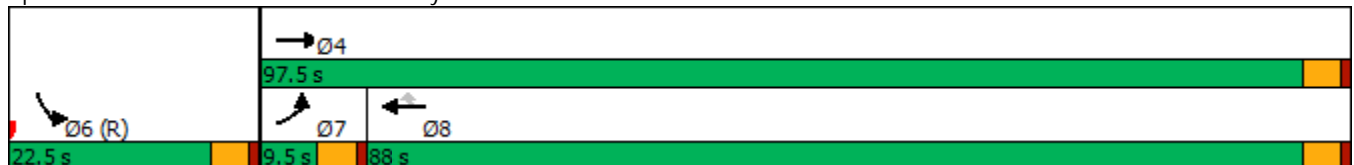


Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations	↖	↗↗	↗↗	↖	↖↖
Traffic Volume (vph)	8	1021	1834	7	5
Future Volume (vph)	8	1021	1834	7	5
Turn Type	Prot	NA	NA	Perm	Prot
Protected Phases	7	4	8		6
Permitted Phases				8	
Detector Phase	7	4	8	8	6
Switch Phase					
Minimum Initial (s)	5.0	14.0	14.0	14.0	11.0
Minimum Split (s)	9.5	22.5	22.5	22.5	22.5
Total Split (s)	9.5	97.5	88.0	88.0	22.5
Total Split (%)	7.9%	81.3%	73.3%	73.3%	18.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead		Lag	Lag	
Lead-Lag Optimize?	Yes		Yes	Yes	
Recall Mode	None	None	None	None	C-Min
Act Effct Green (s)	6.2	86.5	84.1	84.1	24.5
Actuated g/C Ratio	0.05	0.72	0.70	0.70	0.20
v/c Ratio	0.10	0.45	0.84	0.01	0.05
Control Delay	57.4	12.0	17.3	5.4	42.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	57.4	12.0	17.3	5.4	42.3
LOS	E	B	B	A	D
Approach Delay		12.4	17.3		42.3
Approach LOS		B	B		D

Intersection Summary

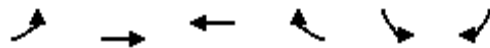
Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.84
 Intersection Signal Delay: 15.6
 Intersection LOS: B
 Intersection Capacity Utilization 67.4%
 ICU Level of Service C
 Analysis Period (min) 15

Splits and Phases: 4: E. Hess Rd & Firefly Ln



HCM 6th Signalized Intersection Summary Short-Term Background 2021 + ProjMitigation AM
 4: E. Hess Rd & Firefly Ln

06/24/2020



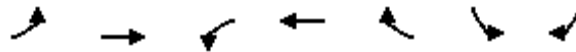
Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations							
Traffic Volume (veh/h)	8	1021	1834	7	5	9	
Future Volume (veh/h)	8	1021	1834	7	5	9	
Initial Q (Qb), veh	0	0	0	0	0	0	
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach		No	No		No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1900	1900	
Adj Flow Rate, veh/h	9	1160	2084	8	6	10	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	
Percent Heavy Veh, %	2	2	2	2	0	0	
Cap, veh/h	19	2478	2307	1029	134	223	
Arrive On Green	0.01	0.70	0.65	0.65	0.23	0.23	
Sat Flow, veh/h	1781	3647	3647	1585	588	979	
Grp Volume(v), veh/h	9	1160	2084	8	17	0	
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1585	1665	0	
Q Serve(g_s), s	0.6	17.6	59.7	0.2	1.0	0.0	
Cycle Q Clear(g_c), s	0.6	17.6	59.7	0.2	1.0	0.0	
Prop In Lane	1.00			1.00	0.35	0.59	
Lane Grp Cap(c), veh/h	19	2478	2307	1029	379	0	
V/C Ratio(X)	0.47	0.47	0.90	0.01	0.04	0.00	
Avail Cap(c_a), veh/h	74	2754	2473	1103	379	0	
HCM Platoon Ratio	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	0.00	
Uniform Delay (d), s/veh	59.0	8.2	17.9	7.4	36.2	0.0	
Incr Delay (d2), s/veh	16.6	0.1	4.9	0.0	0.2	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	0.4	5.7	22.1	0.1	0.4	0.0	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	75.6	8.3	22.8	7.4	36.4	0.0	
LnGrp LOS	E	A	C	A	D	A	
Approach Vol, veh/h		1169	2092		17		
Approach Delay, s/veh		8.8	22.7		36.4		
Approach LOS		A	C		D		
Timer - Assigned Phs				4	6	7	8
Phs Duration (G+Y+Rc), s				88.2	31.8	5.8	82.4
Change Period (Y+Rc), s				4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s				93.0	18.0	5.0	83.5
Max Q Clear Time (g_c+I1), s				19.6	3.0	2.6	61.7
Green Ext Time (p_c), s				10.3	0.0	0.0	16.2

Intersection Summary	
HCM 6th Ctrl Delay	17.8
HCM 6th LOS	B

Timings

1: E. Hess Rd & S. Chambers Rd.

06/23/2020

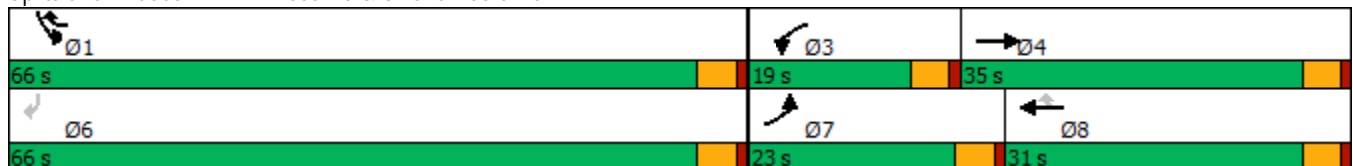


Lane Group	EBL	EBT	WBL	WBT	WBR	SBL	SBR
Lane Configurations	↙	↑↑	↙	↑↑	↙	↙↘	↙
Traffic Volume (vph)	42	547	91	383	419	1184	5
Future Volume (vph)	42	547	91	383	419	1184	5
Turn Type	Prot	NA	Prot	NA	pm+ov	Prot	Perm
Protected Phases	7	4	3	8	1	1	
Permitted Phases					8		6
Detector Phase	7	4	3	8	1	1	6
Switch Phase							
Minimum Initial (s)	11.0	15.0	11.0	15.0	11.0	11.0	4.0
Minimum Split (s)	22.5	20.5	15.5	20.5	15.5	15.5	20.0
Total Split (s)	23.0	35.0	19.0	31.0	66.0	66.0	66.0
Total Split (%)	19.2%	29.2%	15.8%	25.8%	55.0%	55.0%	55.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag			
Lead-Lag Optimize?	Yes	Yes	Yes	Yes			
Recall Mode	None	None	None	None	None	None	None
Act Effect Green (s)	12.0	21.7	12.7	25.9	74.7	41.3	41.3
Actuated g/C Ratio	0.14	0.25	0.15	0.30	0.88	0.49	0.49
v/c Ratio	0.18	0.64	0.36	0.37	0.31	0.75	0.01
Control Delay	43.5	34.7	44.7	27.8	0.8	22.2	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.5	34.7	44.7	27.8	0.8	22.2	0.0
LOS	D	C	D	C	A	C	A
Approach Delay		35.3		16.8			
Approach LOS		D		B			

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 85.1
 Natural Cycle: 80
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.75
 Intersection Signal Delay: 23.3
 Intersection LOS: C
 Intersection Capacity Utilization 68.9%
 ICU Level of Service C
 Analysis Period (min) 15

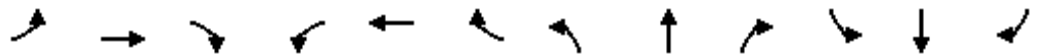
Splits and Phases: 1: E. Hess Rd & S. Chambers Rd.



HCM 6th Signalized Intersection Summary
1: E. Hess Rd & S. Chambers Rd.

Short-Term Background 2021 + Proj PM

06/23/2020



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗	↖				↖	↗	↖
Traffic Volume (veh/h)	42	547	0	91	383	419	0	0	0	1184	0	5
Future Volume (veh/h)	42	547	0	91	383	419	0	0	0	1184	0	5
Initial Q (Qb), veh	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
Parking Bus, Adj	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	
Adj Sat Flow, veh/h/ln	1870	1870	0	1870	1870	1870				1870	0	1870
Adj Flow Rate, veh/h	44	576	0	96	403	441				1246	0	5
Peak Hour Factor	0.95	0.95	0.92	0.95	0.95	0.95				0.95	0.92	0.95
Percent Heavy Veh, %	2	2	0	2	2	2				2	0	2
Cap, veh/h	163	812	0	243	971	1121				1499	0	688
Arrive On Green	0.09	0.23	0.00	0.14	0.27	0.27				0.43	0.00	0.43
Sat Flow, veh/h	1781	3647	0	1781	3554	1585				3456	0	1585
Grp Volume(v), veh/h	44	576	0	96	403	441				1246	0	5
Grp Sat Flow(s),veh/h/ln	1781	1777	0	1781	1777	1585				1728	0	1585
Q Serve(g_s), s	1.5	10.0	0.0	3.3	6.2	7.6				21.4	0.0	0.1
Cycle Q Clear(g_c), s	1.5	10.0	0.0	3.3	6.2	7.6				21.4	0.0	0.1
Prop In Lane	1.00		0.00	1.00		1.00				1.00		1.00
Lane Grp Cap(c), veh/h	163	812	0	243	971	1121				1499	0	688
V/C Ratio(X)	0.27	0.71	0.00	0.39	0.42	0.39				0.83	0.00	0.01
Avail Cap(c_a), veh/h	491	1615	0	385	1403	1314				3167	0	1453
HCM Platoon Ratio	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	0.00	1.00	1.00	1.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	28.4	23.8	0.0	26.4	20.0	4.0				16.8	0.0	10.8
Incr Delay (d2), s/veh	0.9	1.2	0.0	1.0	0.3	0.2				1.3	0.0	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
%ile BackOfQ(50%),veh/ln	0.6	3.8	0.0	1.3	2.3	1.2				7.1	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	29.3	25.0	0.0	27.5	20.3	4.2				18.1	0.0	10.8
LnGrp LOS	C	C	A	C	C	A				B	A	B
Approach Vol, veh/h		620			940						1251	
Approach Delay, s/veh		25.3			13.5						18.0	
Approach LOS		C			B						B	
Timer - Assigned Phs			3	4		6	7	8				
Phs Duration (G+Y+Rc), s			13.7	19.8		33.6	10.7	22.8				
Change Period (Y+Rc), s			4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s			14.5	30.5		61.5	18.5	26.5				
Max Q Clear Time (g_c+I1), s			5.3	12.0		23.4	3.5	9.6				
Green Ext Time (p_c), s			0.1	3.3		5.7	0.1	3.7				
Intersection Summary												
HCM 6th Ctrl Delay			18.1									
HCM 6th LOS			B									

Intersection						
Int Delay, s/veh	30.1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘	↗	↑↑	↗	↘	↑↑↑
Traffic Vol, veh/h	197	160	388	78	239	1010
Future Vol, veh/h	197	160	388	78	239	1010
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	-	0	400	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	203	165	400	80	246	1041

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	1308	200	0	0	480
Stage 1	400	-	-	-	-
Stage 2	908	-	-	-	-
Critical Hdwy	6.29	6.94	-	-	4.14
Critical Hdwy Stg 1	5.84	-	-	-	-
Critical Hdwy Stg 2	6.04	-	-	-	-
Follow-up Hdwy	3.67	3.32	-	-	2.22
Pot Cap-1 Maneuver	~ 181	808	-	-	1079
Stage 1	624	-	-	-	-
Stage 2	328	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	~ 140	808	-	-	1079
Mov Cap-2 Maneuver	~ 140	-	-	-	-
Stage 1	624	-	-	-	-
Stage 2	253	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	168.4	0	1.8
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	140	808	1079
HCM Lane V/C Ratio	-	-	1.451	0.204	0.228
HCM Control Delay (s)	-	-	296.6	10.6	9.3
HCM Lane LOS	-	-	F	B	A
HCM 95th %tile Q(veh)	-	-	13.5	0.8	0.9

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

DELAY (CONTROL)

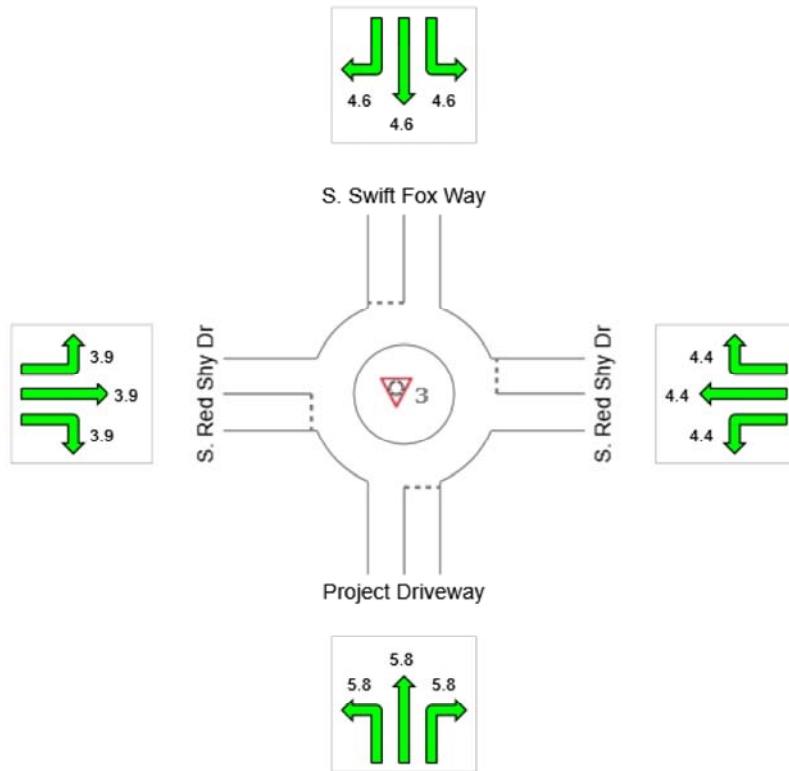
Average control delay per vehicle, or average pedestrian delay (seconds)

 Site: 3 [2021+Project_PM]

New Site
 Site Category: (None)
 Roundabout

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Delay (Control)	5.8	4.4	4.6	3.9	5.1
LOS	A	A	A	A	A



Colour code based on Level of Service



Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
 LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Roundabout Level of Service Method: Same as Sign Control

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Intersection						
Int Delay, s/veh	0.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	9	1809	1004	12	7	4
Future Vol, veh/h	9	1809	1004	12	7	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	215	-	-	215	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	1904	1057	13	7	4

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	1070	0	0 2027 529
Stage 1	-	-	- 1057 -
Stage 2	-	-	- 970 -
Critical Hdwy	4.14	-	- 6.84 6.94
Critical Hdwy Stg 1	-	-	- 5.84 -
Critical Hdwy Stg 2	-	-	- 5.84 -
Follow-up Hdwy	2.22	-	- 3.52 3.32
Pot Cap-1 Maneuver	647	-	- 50 494
Stage 1	-	-	- 295 -
Stage 2	-	-	- 328 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	647	-	- 49 494
Mov Cap-2 Maneuver	-	-	- 49 -
Stage 1	-	-	- 291 -
Stage 2	-	-	- 328 -

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	63.4
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	647	-	-	-	73
HCM Lane V/C Ratio	0.015	-	-	-	0.159
HCM Control Delay (s)	10.6	-	-	-	63.4
HCM Lane LOS	B	-	-	-	F
HCM 95th %tile Q(veh)	0	-	-	-	0.5

Intersection						
Int Delay, s/veh	0.7					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑↑			↑
Traffic Vol, veh/h	0	1818	760	234	0	112
Future Vol, veh/h	0	1818	760	234	0	112
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	1976	826	254	0	122

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	-	0	- 0 - 540
Stage 1	-	-	- - -
Stage 2	-	-	- - -
Critical Hdwy	-	-	- - 7.14
Critical Hdwy Stg 1	-	-	- - -
Critical Hdwy Stg 2	-	-	- - -
Follow-up Hdwy	-	-	- - 3.92
Pot Cap-1 Maneuver	0	-	- 0 416
Stage 1	0	-	- 0 -
Stage 2	0	-	- 0 -
Platoon blocked, %	-	-	- - -
Mov Cap-1 Maneuver	-	-	- - 416
Mov Cap-2 Maneuver	-	-	- - -
Stage 1	-	-	- - -
Stage 2	-	-	- - -

Approach	EB	WB	SB
HCM Control Delay, s	0	0	17.2
HCM LOS			C

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	416
HCM Lane V/C Ratio	-	-	-	0.293
HCM Control Delay (s)	-	-	-	17.2
HCM Lane LOS	-	-	-	C
HCM 95th %tile Q(veh)	-	-	-	1.2

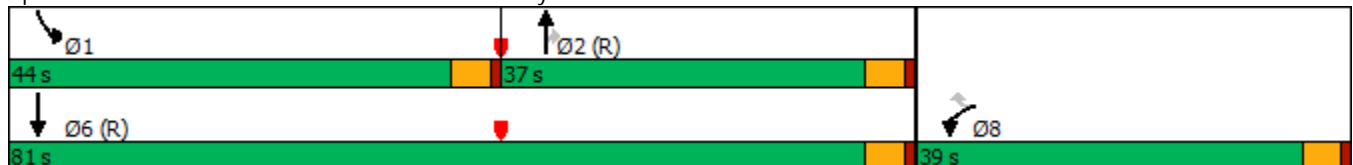
Timings
2: S. Chambers Rd. & S. Red Sky Dr.

	↙	↖	↑	↗	↘	↓
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↙	↖	↑↑	↗	↘	↑↑↑
Traffic Volume (vph)	197	160	388	78	239	1010
Future Volume (vph)	197	160	388	78	239	1010
Turn Type	Prot	Perm	NA	Perm	Prot	NA
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Detector Phase	8	8	2	2	1	6
Switch Phase						
Minimum Initial (s)	11.0	11.0	14.0	14.0	5.0	14.0
Minimum Split (s)	22.5	22.5	22.5	22.5	9.5	22.5
Total Split (s)	39.0	39.0	37.0	37.0	44.0	81.0
Total Split (%)	32.5%	32.5%	30.8%	30.8%	36.7%	67.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag			Lag	Lag	Lead	
Lead-Lag Optimize?			Yes	Yes	Yes	
Recall Mode	None	None	C-Min	C-Min	None	C-Min
Act Effect Green (s)	19.1	19.1	65.2	65.2	22.2	91.9
Actuated g/C Ratio	0.16	0.16	0.54	0.54	0.18	0.77
v/c Ratio	0.72	0.42	0.21	0.09	0.75	0.27
Control Delay	61.9	9.5	21.5	10.9	60.3	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	61.9	9.5	21.5	10.9	60.3	4.7
LOS	E	A	C	B	E	A
Approach Delay	38.4		19.7			15.3
Approach LOS	D		B			B

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 30 (25%), Referenced to phase 2:NBT and 6:SBT, Start of Green
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.75
 Intersection Signal Delay: 20.3
 Intersection LOS: C
 Intersection Capacity Utilization 47.1%
 ICU Level of Service A
 Analysis Period (min) 15

Splits and Phases: 2: S. Chambers Rd. & S. Red Sky Dr.



HCM 6th Signalized Intersection Summary Short-Term Background 2021 + ProjMitigation PM
 2: S. Chambers Rd. & S. Red Sky Dr. 06/23/2020



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	197	160	388	78	239	1010
Future Volume (veh/h)	197	160	388	78	239	1010
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	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	203	165	400	80	246	1041
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	244	217	2109	941	280	4025
Arrive On Green	0.14	0.14	0.59	0.59	0.16	0.79
Sat Flow, veh/h	1781	1585	3647	1585	1781	5274
Grp Volume(v), veh/h	203	165	400	80	246	1041
Grp Sat Flow(s),veh/h/ln	1781	1585	1777	1585	1781	1702
Q Serve(g_s), s	13.3	12.0	6.2	2.6	16.2	6.5
Cycle Q Clear(g_c), s	13.3	12.0	6.2	2.6	16.2	6.5
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	244	217	2109	941	280	4025
V/C Ratio(X)	0.83	0.76	0.19	0.09	0.88	0.26
Avail Cap(c_a), veh/h	512	456	2109	941	586	4025
HCM Platoon Ratio	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
Uniform Delay (d), s/veh	50.5	49.9	11.2	10.4	49.4	3.4
Incr Delay (d2), s/veh	7.3	5.4	0.2	0.2	8.6	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.4	5.1	2.5	0.9	7.9	1.9
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	57.7	55.3	11.4	10.6	58.1	3.5
LnGrp LOS	E	E	B	B	E	A
Approach Vol, veh/h	368		480			1287
Approach Delay, s/veh	56.7		11.3			14.0
Approach LOS	E		B			B
Timer - Assigned Phs	1	2			6	8
Phs Duration (G+Y+Rc), s	23.4	75.7			99.1	20.9
Change Period (Y+Rc), s	4.5	4.5			4.5	4.5
Max Green Setting (Gmax), s	39.5	32.5			76.5	34.5
Max Q Clear Time (g_c+I1), s	18.2	8.2			8.5	15.3
Green Ext Time (p_c), s	0.7	3.0			9.9	1.1
Intersection Summary						
HCM 6th Ctrl Delay			20.7			
HCM 6th LOS			C			

Timings
4: E. Hess Rd & Firefly Ln



Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations	↖	↗↗	↗↗	↖	↘↘
Traffic Volume (vph)	9	1809	1004	12	7
Future Volume (vph)	9	1809	1004	12	7
Turn Type	Prot	NA	NA	Perm	Prot
Protected Phases	7	4	8		6
Permitted Phases				8	
Detector Phase	7	4	8	8	6
Switch Phase					
Minimum Initial (s)	5.0	14.0	14.0	14.0	11.0
Minimum Split (s)	9.5	22.5	22.5	22.5	22.5
Total Split (s)	10.0	96.0	86.0	86.0	24.0
Total Split (%)	8.3%	80.0%	71.7%	71.7%	20.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead		Lag	Lag	
Lead-Lag Optimize?	Yes		Yes	Yes	
Recall Mode	None	None	None	None	C-Min
Act Effct Green (s)	6.2	94.3	91.9	91.9	16.7
Actuated g/C Ratio	0.05	0.79	0.77	0.77	0.14
v/c Ratio	0.10	0.68	0.39	0.01	0.05
Control Delay	58.7	11.7	5.2	3.2	50.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	58.7	11.7	5.2	3.2	50.0
LOS	E	B	A	A	D
Approach Delay		11.9	5.2		50.0
Approach LOS		B	A		D

Intersection Summary

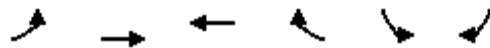
Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green
 Natural Cycle: 65
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.68
 Intersection Signal Delay: 9.7
 Intersection Capacity Utilization 66.7%
 Analysis Period (min) 15
 Intersection LOS: A
 ICU Level of Service C

Splits and Phases: 4: E. Hess Rd & Firefly Ln



HCM 6th Signalized Intersection Summary Short-Term Background 2021 + ProjMitigation PM
 4: E. Hess Rd & Firefly Ln

06/23/2020



Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations							
Traffic Volume (veh/h)	9	1809	1004	12	7	4	
Future Volume (veh/h)	9	1809	1004	12	7	4	
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	1870	1870	1870	1870	1900	1900	
Adj Flow Rate, veh/h	9	1904	1057	13	7	4	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	
Percent Heavy Veh, %	2	2	2	2	0	0	
Cap, veh/h	19	2216	2045	912	302	172	
Arrive On Green	0.01	0.62	0.58	0.58	0.30	0.30	
Sat Flow, veh/h	1781	3647	3647	1585	1002	572	
Grp Volume(v), veh/h	9	1904	1057	13	12	0	
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1585	1717	0	
Q Serve(g_s), s	0.6	52.1	21.6	0.4	0.6	0.0	
Cycle Q Clear(g_c), s	0.6	52.1	21.6	0.4	0.6	0.0	
Prop In Lane	1.00			1.00	0.58	0.33	
Lane Grp Cap(c), veh/h	19	2216	2045	912	517	0	
V/C Ratio(X)	0.47	0.86	0.52	0.01	0.02	0.00	
Avail Cap(c_a), veh/h	82	2710	2414	1077	517	0	
HCM Platoon Ratio	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	0.00	
Uniform Delay (d), s/veh	59.0	18.3	15.4	10.9	29.5	0.0	
Incr Delay (d2), s/veh	16.6	2.5	0.2	0.0	0.1	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	0.4	19.2	8.0	0.1	0.3	0.0	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	75.6	20.8	15.6	10.9	29.6	0.0	
LnGrp LOS	E	C	B	B	C	A	
Approach Vol, veh/h		1913	1070		12		
Approach Delay, s/veh		21.1	15.5		29.6		
Approach LOS		C	B		C		
Timer - Assigned Phs				4	6	7	8
Phs Duration (G+Y+Rc), s				79.3	40.7	5.8	73.5
Change Period (Y+Rc), s				4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s				91.5	19.5	5.5	81.5
Max Q Clear Time (g_c+I1), s				54.1	2.6	2.6	23.6
Green Ext Time (p_c), s				20.7	0.0	0.0	8.9

Intersection Summary

HCM 6th Ctrl Delay	19.1
HCM 6th LOS	B

Notes

User approved volume balancing among the lanes for turning movement.

Timings

1: E. Hess Rd & S. Chambers Rd.

06/24/2020

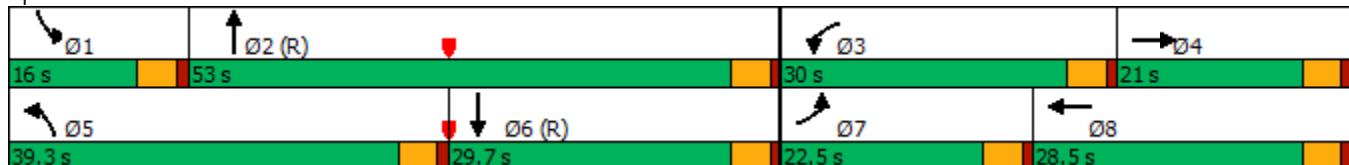


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖	↖↗	↑↑	↖	↖↗	↑↑↑	↖	↖↗	↑↑↑	↖
Traffic Volume (vph)	190	385	490	610	490	610	800	1685	910	240	765	90
Future Volume (vph)	190	385	490	610	490	610	800	1685	910	240	765	90
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			Free			Free			Free			Free
Detector Phase	7	4		3	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	11.0	14.0		11.0	14.0		11.0	14.0		11.0	14.0	
Minimum Split (s)	22.5	20.5		15.5	20.5		15.5	22.5		15.5	20.0	
Total Split (s)	22.5	21.0		30.0	28.5		39.3	53.0		16.0	29.7	
Total Split (%)	18.8%	17.5%		25.0%	23.8%		32.8%	44.2%		13.3%	24.8%	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Recall Mode	None	None		None	None		None	C-Min		None	C-Max	
Act Effct Green (s)	12.9	16.3	120.0	25.1	28.4	120.0	33.5	49.3	120.0	11.4	27.2	120.0
Actuated g/C Ratio	0.11	0.14	1.00	0.21	0.24	1.00	0.28	0.41	1.00	0.10	0.23	1.00
v/c Ratio	0.56	0.87	0.34	0.92	0.64	0.42	0.91	0.88	0.62	0.80	0.72	0.06
Control Delay	56.7	70.4	0.6	45.6	31.4	0.5	56.0	38.7	1.9	72.1	47.7	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.7	70.4	0.6	45.6	31.4	0.5	56.0	38.7	1.9	72.1	47.7	0.1
LOS	E	E	A	D	C	A	E	D	A	E	D	A
Approach Delay		35.8			25.4			32.9			49.1	
Approach LOS		D			C			C			D	

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 39.3 (33%), Referenced to phase 2:NBT and 6:SBT, Start of Green
 Natural Cycle: 105
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.92
 Intersection Signal Delay: 34.0
 Intersection LOS: C
 Intersection Capacity Utilization 85.8%
 ICU Level of Service E
 Analysis Period (min) 15

Splits and Phases: 1: E. Hess Rd & S. Chambers Rd.



HCM 6th Signalized Intersection Summary
 1: E. Hess Rd & S. Chambers Rd.

Long-Term Background 2041 AM

06/24/2020



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖	↖↗	↑↑	↖	↖↗	↑↑↑	↖	↖↗	↑↑↑	↖
Traffic Volume (veh/h)	190	385	490	610	490	610	800	1685	910	240	765	90
Future Volume (veh/h)	190	385	490	610	490	610	800	1685	910	240	765	90
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	207	418	0	663	533	0	870	1832	0	261	832	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	316	475		716	886		940	2132		317	1212	
Arrive On Green	0.09	0.13	0.00	0.21	0.25	0.00	0.27	0.42	0.00	0.09	0.24	0.00
Sat Flow, veh/h	3456	3554	1585	3456	3554	1585	3456	5106	1585	3456	5106	1585
Grp Volume(v), veh/h	207	418	0	663	533	0	870	1832	0	261	832	0
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1728	1777	1585	1728	1702	1585	1728	1702	1585
Q Serve(g_s), s	6.9	13.9	0.0	22.6	15.9	0.0	29.4	39.1	0.0	8.9	17.8	0.0
Cycle Q Clear(g_c), s	6.9	13.9	0.0	22.6	15.9	0.0	29.4	39.1	0.0	8.9	17.8	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	316	475		716	886		940	2132		317	1212	
V/C Ratio(X)	0.65	0.88		0.93	0.60		0.93	0.86		0.82	0.69	
Avail Cap(c_a), veh/h	518	489		734	886		1002	2132		331	1212	
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	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	52.7	51.0	0.0	46.7	39.8	0.0	42.5	31.7	0.0	53.6	41.7	0.0
Incr Delay (d2), s/veh	2.3	16.5	0.0	17.4	1.1	0.0	13.5	4.8	0.0	15.0	3.2	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	3.0	7.1	0.0	11.1	6.9	0.0	13.8	16.0	0.0	4.4	7.6	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	55.0	67.6	0.0	64.1	40.9	0.0	56.0	36.5	0.0	68.5	44.9	0.0
LnGrp LOS	D	E		E	D		E	D		E	D	
Approach Vol, veh/h		625	A		1196	A		2702	A		1093	A
Approach Delay, s/veh		63.4			53.8			42.8			50.5	
Approach LOS		E			D			D			D	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	15.5	54.6	29.4	20.5	37.1	33.0	15.5	34.4				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	11.5	48.5	25.5	16.5	34.8	25.2	18.0	24.0				
Max Q Clear Time (g_c+I1), s	10.9	41.1	24.6	15.9	31.4	19.8	8.9	17.9				
Green Ext Time (p_c), s	0.1	5.8	0.3	0.2	1.2	2.4	0.4	1.6				

Intersection Summary

HCM 6th Ctrl Delay	48.9
HCM 6th LOS	D

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection						
Int Delay, s/veh	33.5					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↵	↵	↑↑↑	↵	↵	↑↑↑
Traffic Vol, veh/h	35	140	2445	40	30	1060
Future Vol, veh/h	35	140	2445	40	30	1060
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	135	-	0	400	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	38	152	2658	43	33	1152

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	3185	1329	0	0	2701
Stage 1	2658	-	-	-	-
Stage 2	527	-	-	-	-
Critical Hdwy	5.74	7.14	-	-	5.34
Critical Hdwy Stg 1	6.64	-	-	-	-
Critical Hdwy Stg 2	6.04	-	-	-	-
Follow-up Hdwy	3.82	3.92	-	-	3.12
Pot Cap-1 Maneuver	~ 21	~ 125	-	-	54
Stage 1	~ 21	-	-	-	-
Stage 2	508	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	~ 8	~ 125	-	-	54
Mov Cap-2 Maneuver	~ 8	-	-	-	-
Stage 1	~ 21	-	-	-	-
Stage 2	198	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	\$ 693	0	4
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	8	125	54	-
HCM Lane V/C Ratio	-	-	4.755	1.217	0.604	-
HCM Control Delay (s)	-	-	\$ 2594.9	217.5	144	-
HCM Lane LOS	-	-	F	F	F	-
HCM 95th %tile Q(veh)	-	-	6.1	9.4	2.4	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

DELAY (CONTROL)

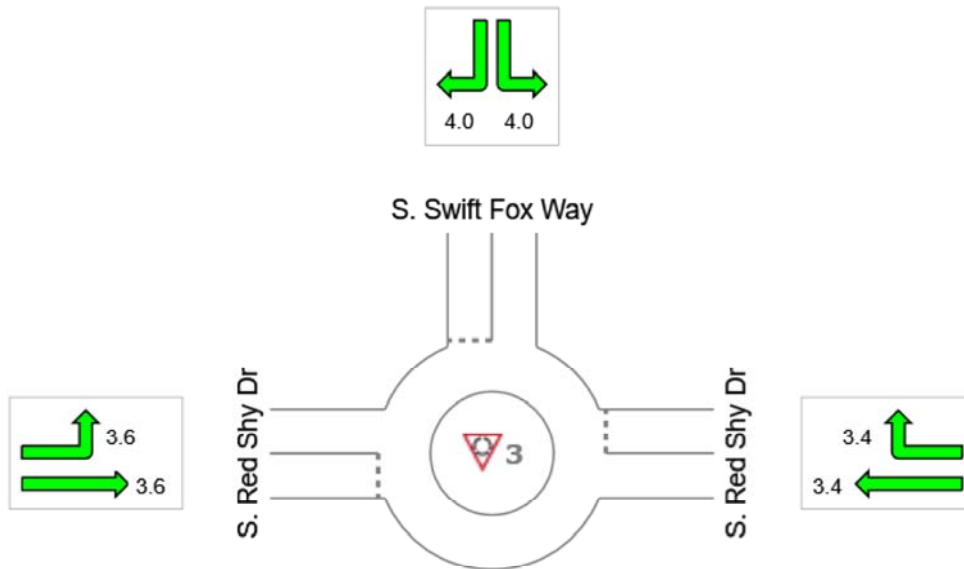
Average control delay per vehicle, or average pedestrian delay (seconds)

 Site: 3 [2041Background_AM]

New Site
 Site Category: (None)
 Roundabout

All Movement Classes

	Approaches			Intersection
	East	North	West	
Delay (Control)	3.4	4.0	3.6	3.8
LOS	A	A	A	A



Colour code based on Level of Service



Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
 LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Roundabout Level of Service Method: Same as Sign Control

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Timings
4: E. Hess Rd & Firefly Ln

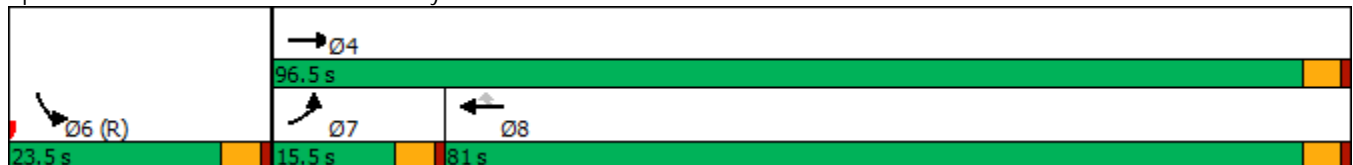


Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations	↶	↕↕	↕↕	↷	↶↶
Traffic Volume (vph)	10	1525	1700	16	10
Future Volume (vph)	10	1525	1700	16	10
Turn Type	Prot	NA	NA	Perm	Prot
Protected Phases	7	4	8		6
Permitted Phases				8	
Detector Phase	7	4	8	8	6
Switch Phase					
Minimum Initial (s)	11.0	14.0	14.0	14.0	11.0
Minimum Split (s)	15.5	22.5	22.5	22.5	22.5
Total Split (s)	15.5	96.5	81.0	81.0	23.5
Total Split (%)	12.9%	80.4%	67.5%	67.5%	19.6%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead		Lag	Lag	
Lead-Lag Optimize?	Yes		Yes	Yes	
Recall Mode	None	None	None	None	C-Min
Act Effct Green (s)	11.0	79.8	76.7	76.7	31.2
Actuated g/C Ratio	0.09	0.66	0.64	0.64	0.26
v/c Ratio	0.07	0.70	0.82	0.02	0.05
Control Delay	39.0	21.1	19.7	6.8	40.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	39.0	21.1	19.7	6.8	40.2
LOS	D	C	B	A	D
Approach Delay		21.3	19.5		40.3
Approach LOS		C	B		D

Intersection Summary

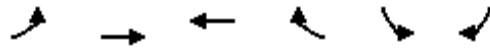
Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.82
 Intersection Signal Delay: 20.5
 Intersection LOS: C
 Intersection Capacity Utilization 63.7%
 ICU Level of Service B
 Analysis Period (min) 15

Splits and Phases: 4: E. Hess Rd & Firefly Ln



HCM 6th Signalized Intersection Summary
 4: E. Hess Rd & Firefly Ln

Long-Term Background 2041 AM
 06/24/2020



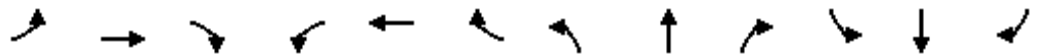
Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations							
Traffic Volume (veh/h)	10	1525	1700	16	10	10	
Future Volume (veh/h)	10	1525	1700	16	10	10	
Initial Q (Qb), veh	0	0	0	0	0	0	
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach		No	No		No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1900	1900	
Adj Flow Rate, veh/h	11	1658	1848	17	11	11	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Percent Heavy Veh, %	2	2	2	2	0	0	
Cap, veh/h	50	2303	2069	923	223	223	
Arrive On Green	0.03	0.65	0.58	0.58	0.28	0.28	
Sat Flow, veh/h	1781	3647	3647	1585	806	806	
Grp Volume(v), veh/h	11	1658	1848	17	23	0	
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1585	1685	0	
Q Serve(g_s), s	0.7	36.9	54.3	0.5	1.2	0.0	
Cycle Q Clear(g_c), s	0.7	36.9	54.3	0.5	1.2	0.0	
Prop In Lane	1.00			1.00	0.48	0.48	
Lane Grp Cap(c), veh/h	50	2303	2069	923	467	0	
V/C Ratio(X)	0.22	0.72	0.89	0.02	0.05	0.00	
Avail Cap(c_a), veh/h	163	2724	2265	1010	467	0	
HCM Platoon Ratio	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	0.00	
Uniform Delay (d), s/veh	57.0	13.9	21.8	10.6	31.8	0.0	
Incr Delay (d2), s/veh	2.2	0.8	4.7	0.0	0.2	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	0.3	13.0	21.3	0.2	0.5	0.0	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	59.2	14.7	26.5	10.6	32.0	0.0	
LnGrp LOS	E	B	C	B	C	A	
Approach Vol, veh/h		1669	1865		23		
Approach Delay, s/veh		15.0	26.4		32.0		
Approach LOS		B	C		C		
Timer - Assigned Phs				4	6	7	8
Phs Duration (G+Y+Rc), s				82.3	37.7	7.9	74.4
Change Period (Y+Rc), s				4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s				92.0	19.0	11.0	76.5
Max Q Clear Time (g_c+I1), s				38.9	3.2	2.7	56.3
Green Ext Time (p_c), s				18.9	0.0	0.0	13.6

Intersection Summary	
HCM 6th Ctrl Delay	21.1
HCM 6th LOS	C

Timings

1: E. Hess Rd & S. Chambers Rd.

06/24/2020

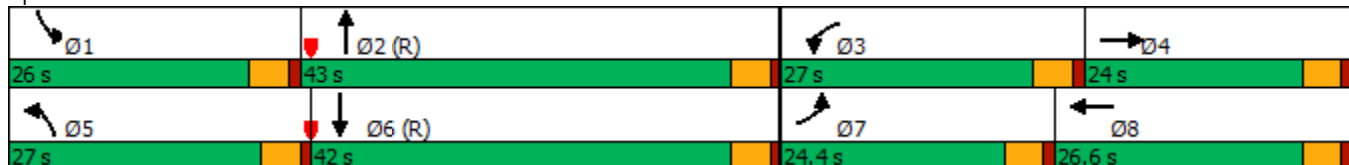


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖	↑↑	↗	↖↖	↑↑	↗	↖↖	↑↑↑	↗	↖↖	↑↑↑	↗
Traffic Volume (vph)	280	575	980	780	490	345	800	1685	910	770	2015	120
Future Volume (vph)	280	575	980	780	490	345	800	1685	910	770	2015	120
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			Free			Free			Free			Free
Detector Phase	7	4		3	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	11.0	14.0		11.0	14.0		11.0	14.0		11.0	14.0	
Minimum Split (s)	22.5	20.5		15.5	20.5		15.5	22.5		15.5	20.0	
Total Split (s)	24.4	24.0		27.0	26.6		27.0	43.0		26.0	42.0	
Total Split (%)	20.3%	20.0%		22.5%	22.2%		22.5%	35.8%		21.7%	35.0%	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Recall Mode	None	None		None	None		None	C-Min		None	C-Max	
Act Effect Green (s)	15.9	19.5	120.0	22.5	26.1	120.0	22.5	38.5	120.0	21.5	37.5	120.0
Actuated g/C Ratio	0.13	0.16	1.00	0.19	0.22	1.00	0.19	0.32	1.00	0.18	0.31	1.00
v/c Ratio	0.67	1.09	0.67	1.32	0.69	0.24	1.35	1.12	0.62	1.36	1.38	0.08
Control Delay	56.9	110.3	2.3	186.0	40.3	0.3	207.1	102.3	1.9	211.1	207.9	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.9	110.3	2.3	186.0	40.3	0.3	207.1	102.3	1.9	211.1	207.9	0.1
LOS	E	F	A	F	D	A	F	F	A	F	F	A
Approach Delay		44.5			102.1			100.1			200.2	
Approach LOS		D			F			F			F	

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 39.3 (33%), Referenced to phase 2:NBT and 6:SBT, Start of Green
 Natural Cycle: 145
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.38
 Intersection Signal Delay: 119.8
 Intersection LOS: F
 Intersection Capacity Utilization 114.9%
 ICU Level of Service H
 Analysis Period (min) 15

Splits and Phases: 1: E. Hess Rd & S. Chambers Rd.



HCM 6th Signalized Intersection Summary
 1: E. Hess Rd & S. Chambers Rd.

Long-Term Background 2041 PM

06/24/2020



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖	↖↗	↑↑	↖	↖↗	↑↑↑	↖	↖↗	↑↑↑	↖
Traffic Volume (veh/h)	280	575	980	780	490	345	800	1685	910	770	2015	120
Future Volume (veh/h)	280	575	980	780	490	345	800	1685	910	770	2015	120
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	304	625	0	848	533	0	870	1832	0	837	2190	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	373	577		648	861		648	1638		619	1596	
Arrive On Green	0.11	0.16	0.00	0.19	0.24	0.00	0.19	0.32	0.00	0.18	0.31	0.00
Sat Flow, veh/h	3456	3554	1585	3456	3554	1585	3456	5106	1585	3456	5106	1585
Grp Volume(v), veh/h	304	625	0	848	533	0	870	1832	0	837	2190	0
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1728	1777	1585	1728	1702	1585	1728	1702	1585
Q Serve(g_s), s	10.3	19.5	0.0	22.5	16.0	0.0	22.5	38.5	0.0	21.5	37.5	0.0
Cycle Q Clear(g_c), s	10.3	19.5	0.0	22.5	16.0	0.0	22.5	38.5	0.0	21.5	37.5	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	373	577		648	861		648	1638		619	1596	
V/C Ratio(X)	0.82	1.08		1.31	0.62		1.34	1.12		1.35	1.37	
Avail Cap(c_a), veh/h	573	577		648	861		648	1638		619	1596	
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	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	52.4	50.3	0.0	48.8	40.5	0.0	48.8	40.8	0.0	49.3	41.3	0.0
Incr Delay (d2), s/veh	5.3	61.7	0.0	149.9	1.4	0.0	164.4	62.1	0.0	168.8	171.7	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	4.6	13.3	0.0	22.9	7.0	0.0	24.2	24.7	0.0	23.5	40.3	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	57.7	111.9	0.0	198.6	41.9	0.0	213.2	102.9	0.0	218.1	212.9	0.0
LnGrp LOS	E	F		F	D		F	F		F	F	
Approach Vol, veh/h		929	A		1381	A		2702	A		3027	A
Approach Delay, s/veh		94.2			138.1			138.4			214.3	
Approach LOS		F			F			F			F	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	26.0	43.0	27.0	24.0	27.0	42.0	17.4	33.6				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	21.5	38.5	22.5	19.5	22.5	37.5	19.9	22.1				
Max Q Clear Time (g_c+I1), s	23.5	40.5	24.5	21.5	24.5	39.5	12.3	18.0				
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.2				

Intersection Summary

HCM 6th Ctrl Delay	161.8
HCM 6th LOS	F

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Intersection						
Int Delay, s/veh	8.8					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘	↗	↑↑↑	↗	↘	↑↑↑
Traffic Vol, veh/h	23	31	1700	35	70	2885
Future Vol, veh/h	23	31	1700	35	70	2885
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	135	-	0	400	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	25	34	1848	38	76	3136

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	3254	924	0	0	1886
Stage 1	1848	-	-	-	-
Stage 2	1406	-	-	-	-
Critical Hdwy	5.74	7.14	-	-	5.34
Critical Hdwy Stg 1	6.64	-	-	-	-
Critical Hdwy Stg 2	6.04	-	-	-	-
Follow-up Hdwy	3.82	3.92	-	-	3.12
Pot Cap-1 Maneuver	~ 19	233	-	-	143
Stage 1	71	-	-	-	-
Stage 2	171	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	~ 9	233	-	-	143
Mov Cap-2 Maneuver	~ 9	-	-	-	-
Stage 1	71	-	-	-	-
Stage 2	80	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s\$	702.1	0	1.3
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	9	233	143	-
HCM Lane V/C Ratio	-	-	2.778	0.145	0.532	-
HCM Control Delay (s)	-	\$	1617.4	23	55.7	-
HCM Lane LOS	-	-	F	C	F	-
HCM 95th %tile Q(veh)	-	-	4.2	0.5	2.6	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

DELAY (CONTROL)

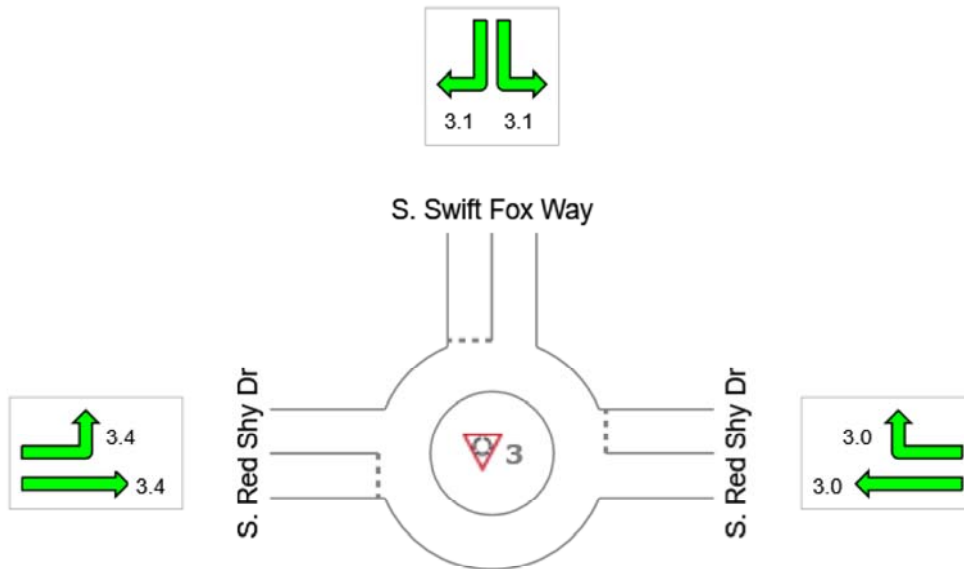
Average control delay per vehicle, or average pedestrian delay (seconds)

Site: 3 [2041Background_PM]

New Site
 Site Category: (None)
 Roundabout

All Movement Classes

	Approaches			Intersection
	East	North	West	
Delay (Control)	3.0	3.1	3.4	3.3
LOS	A	A	A	A



Colour code based on Level of Service



Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab). LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Roundabout Level of Service Method: Same as Sign Control

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Timings
4: E. Hess Rd & Firefly Ln

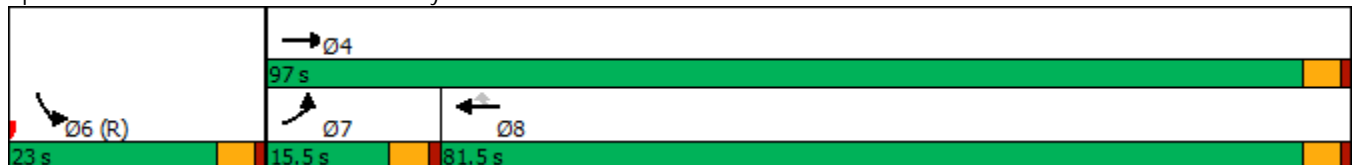


Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations	↶	↕↕	↕↕	↶	↶↶
Traffic Volume (vph)	15	2125	1610	26	10
Future Volume (vph)	15	2125	1610	26	10
Turn Type	Prot	NA	NA	Perm	Prot
Protected Phases	7	4	8		6
Permitted Phases				8	
Detector Phase	7	4	8	8	6
Switch Phase					
Minimum Initial (s)	11.0	14.0	14.0	14.0	11.0
Minimum Split (s)	15.5	22.5	22.5	22.5	22.5
Total Split (s)	15.5	97.0	81.5	81.5	23.0
Total Split (%)	12.9%	80.8%	67.9%	67.9%	19.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead		Lag	Lag	
Lead-Lag Optimize?	Yes		Yes	Yes	
Recall Mode	None	None	None	None	C-Min
Act Effect Green (s)	11.0	96.7	90.5	90.5	14.3
Actuated g/C Ratio	0.09	0.81	0.75	0.75	0.12
v/c Ratio	0.10	0.81	0.66	0.02	0.11
Control Delay	54.7	17.2	10.7	6.0	47.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	54.7	17.2	10.7	6.0	47.9
LOS	D	B	B	A	D
Approach Delay		17.4	10.6		47.9
Approach LOS		B	B		D

Intersection Summary

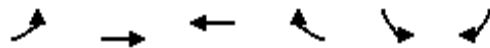
Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.81
 Intersection Signal Delay: 14.7
 Intersection Capacity Utilization 75.4%
 Analysis Period (min) 15
 Intersection LOS: B
 ICU Level of Service D

Splits and Phases: 4: E. Hess Rd & Firefly Ln



HCM 6th Signalized Intersection Summary
 4: E. Hess Rd & Firefly Ln

Long-Term Background 2041 PM
 06/24/2020

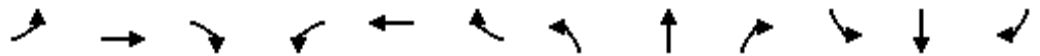


Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations							
Traffic Volume (veh/h)	15	2125	1610	26	10	10	
Future Volume (veh/h)	15	2125	1610	26	10	10	
Initial Q (Qb), veh	0	0	0	0	0	0	
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach		No	No		No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1900	1900	
Adj Flow Rate, veh/h	16	2310	1750	28	11	11	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Percent Heavy Veh, %	2	2	2	2	0	0	
Cap, veh/h	67	2555	2287	1020	166	166	
Arrive On Green	0.04	0.72	0.64	0.64	0.21	0.21	
Sat Flow, veh/h	1781	3647	3647	1585	806	806	
Grp Volume(v), veh/h	16	2310	1750	28	23	0	
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1585	1685	0	
Q Serve(g_s), s	1.0	62.6	41.5	0.8	1.3	0.0	
Cycle Q Clear(g_c), s	1.0	62.6	41.5	0.8	1.3	0.0	
Prop In Lane	1.00			1.00	0.48	0.48	
Lane Grp Cap(c), veh/h	67	2555	2287	1020	347	0	
V/C Ratio(X)	0.24	0.90	0.77	0.03	0.07	0.00	
Avail Cap(c_a), veh/h	163	2739	2287	1020	347	0	
HCM Platoon Ratio	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	0.00	
Uniform Delay (d), s/veh	56.0	13.5	15.0	7.8	38.4	0.0	
Incr Delay (d2), s/veh	1.8	4.5	1.6	0.0	0.4	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	0.5	20.8	14.8	0.2	0.6	0.0	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	57.8	18.1	16.6	7.8	38.7	0.0	
LnGrp LOS	E	B	B	A	D	A	
Approach Vol, veh/h		2326	1778		23		
Approach Delay, s/veh		18.3	16.5		38.7		
Approach LOS		B	B		D		
Timer - Assigned Phs				4	6	7	8
Phs Duration (G+Y+Rc), s				90.8	29.2	9.0	81.7
Change Period (Y+Rc), s				4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s				92.5	18.5	11.0	77.0
Max Q Clear Time (g_c+I1), s				64.6	3.3	3.0	43.5
Green Ext Time (p_c), s				21.7	0.0	0.0	17.4
Intersection Summary							
HCM 6th Ctrl Delay			17.6				
HCM 6th LOS			B				

Timings

1: E. Hess Rd & S. Chambers Rd.

06/24/2020

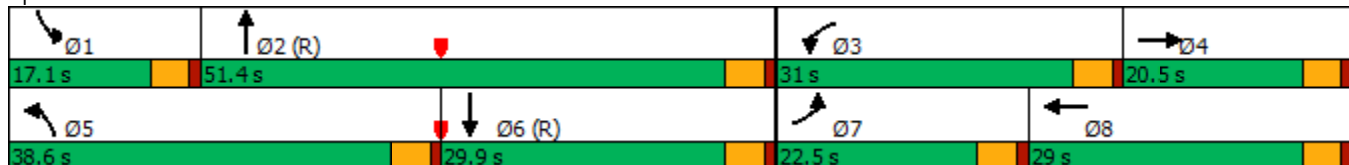


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖	↖↗	↑↑	↖	↖↗	↑↑↑	↖	↖↗	↑↑↑	↖
Traffic Volume (vph)	211	385	490	694	508	610	800	1829	910	321	825	90
Future Volume (vph)	211	385	490	694	508	610	800	1829	910	321	825	90
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			Free			Free			Free			Free
Detector Phase	7	4		3	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	11.0	14.0		11.0	14.0		11.0	14.0		11.0	14.0	
Minimum Split (s)	22.5	20.5		15.5	20.5		15.5	22.5		15.5	20.0	
Total Split (s)	22.5	20.5		31.0	29.0		38.6	51.4		17.1	29.9	
Total Split (%)	18.8%	17.1%		25.8%	24.2%		32.2%	42.8%		14.3%	24.9%	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Recall Mode	None	None		None	None		None	C-Min		None	C-Max	
Act Effect Green (s)	13.6	15.9	120.0	26.5	28.9	120.0	33.1	46.9	120.0	12.7	26.5	120.0
Actuated g/C Ratio	0.11	0.13	1.00	0.22	0.24	1.00	0.28	0.39	1.00	0.11	0.22	1.00
v/c Ratio	0.59	0.89	0.34	0.99	0.65	0.42	0.92	1.00	0.62	0.96	0.80	0.06
Control Delay	56.8	73.3	0.6	61.0	30.8	0.5	57.5	57.0	1.9	99.5	48.2	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0	0.0	0.0
Total Delay	56.8	73.3	0.6	61.0	30.8	0.5	57.5	61.8	1.9	99.5	48.2	0.1
LOS	E	E	A	E	C	A	E	E	A	F	D	A
Approach Delay		37.2			32.2			45.4			58.0	
Approach LOS		D			C			D			E	

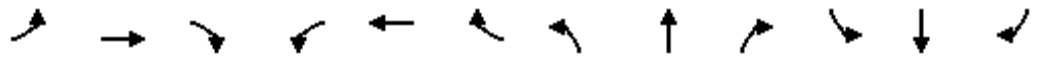
Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 37.6 (31%), Referenced to phase 2:NBT and 6:SBT, Start of Green
 Natural Cycle: 125
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.00
 Intersection Signal Delay: 43.2
 Intersection LOS: D
 Intersection Capacity Utilization 91.0%
 ICU Level of Service E
 Analysis Period (min) 15

Splits and Phases: 1: E. Hess Rd & S. Chambers Rd.



HCM 6th Signalized Intersection Summary
1: E. Hess Rd & S. Chambers Rd.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖↗	↕	↖	↖↗	↕	↖	↖↗	↕	↖
Traffic Volume (veh/h)	211	385	490	694	508	610	800	1829	910	321	825	90
Future Volume (veh/h)	211	385	490	694	508	610	800	1829	910	321	825	90
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	229	418	0	754	552	0	870	1988	0	349	897	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	317	471		763	930		935	1999		363	1155	
Arrive On Green	0.09	0.13	0.00	0.22	0.26	0.00	0.27	0.39	0.00	0.21	0.45	0.00
Sat Flow, veh/h	3456	3554	1585	3456	3554	1585	3456	5106	1585	3456	5106	1585
Grp Volume(v), veh/h	229	418	0	754	552	0	870	1988	0	349	897	0
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1728	1777	1585	1728	1702	1585	1728	1702	1585
Q Serve(g_s), s	7.7	13.9	0.0	26.1	16.3	0.0	29.5	46.5	0.0	12.0	17.8	0.0
Cycle Q Clear(g_c), s	7.7	13.9	0.0	26.1	16.3	0.0	29.5	46.5	0.0	12.0	17.8	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	317	471		763	930		935	1999		363	1155	
V/C Ratio(X)	0.72	0.89		0.99	0.59		0.93	0.99		0.96	0.78	
Avail Cap(c_a), veh/h	518	474		763	930		982	1999		363	1155	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	0.94	0.94	0.00
Uniform Delay (d), s/veh	53.0	51.2	0.0	46.6	38.7	0.0	42.7	36.4	0.0	47.2	30.3	0.0
Incr Delay (d2), s/veh	3.1	18.1	0.0	29.5	1.0	0.0	14.5	18.8	0.0	35.8	4.9	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	3.4	7.2	0.0	13.9	7.0	0.0	13.9	21.7	0.0	6.2	5.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	56.2	69.2	0.0	76.1	39.7	0.0	57.2	55.2	0.0	83.0	35.2	0.0
LnGrp LOS	E	E		E	D		E	E		F	D	
Approach Vol, veh/h		647	A		1306	A		2858	A		1246	A
Approach Delay, s/veh		64.6			60.7			55.8			48.6	
Approach LOS		E			E			E			D	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	17.1	51.5	31.0	20.4	37.0	31.6	15.5	35.9				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	12.6	46.9	26.5	16.0	34.1	25.4	18.0	24.5				
Max Q Clear Time (g_c+I1), s	14.0	48.5	28.1	15.9	31.5	19.8	9.7	18.3				
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	1.0	2.6	0.4	1.7				

Intersection Summary

HCM 6th Ctrl Delay	56.3
HCM 6th LOS	E

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Timings
2: S. Chambers Rd. & S. Red Sky Dr.

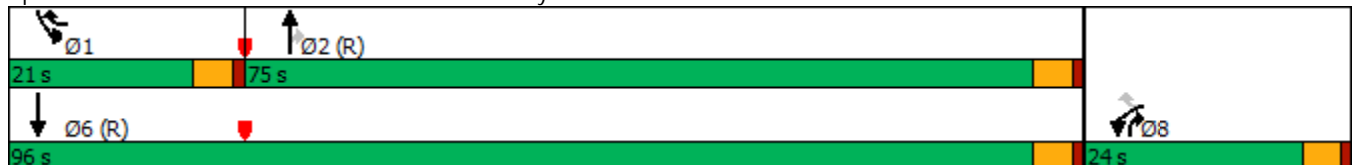


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘	↗	↑↑↑	↗	↘	↑↑↑
Traffic Volume (vph)	195	208	2445	235	159	1060
Future Volume (vph)	195	208	2445	235	159	1060
Turn Type	Prot	pm+ov	NA	pm+ov	Prot	NA
Protected Phases	8	1	2	8	1	6
Permitted Phases		8		2		
Detector Phase	8	1	2	8	1	6
Switch Phase						
Minimum Initial (s)	11.0	5.0	14.0	11.0	5.0	14.0
Minimum Split (s)	22.5	15.5	22.5	22.5	15.5	22.5
Total Split (s)	24.0	21.0	75.0	24.0	21.0	96.0
Total Split (%)	20.0%	17.5%	62.5%	20.0%	17.5%	80.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag		Lead	Lag		Lead	
Lead-Lag Optimize?		Yes	Yes		Yes	
Recall Mode	None	None	C-Min	None	None	C-Min
Act Effct Green (s)	17.8	37.4	73.6	95.9	15.1	93.2
Actuated g/C Ratio	0.15	0.31	0.61	0.80	0.13	0.78
v/c Ratio	0.81	0.46	0.85	0.20	0.78	0.29
Control Delay	72.7	35.5	7.2	0.2	74.0	4.2
Queue Delay	0.0	0.0	0.4	0.0	0.0	0.0
Total Delay	72.7	35.5	7.6	0.2	74.0	4.2
LOS	E	D	A	A	E	A
Approach Delay	53.5		7.0			13.3
Approach LOS	D		A			B

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 22 (18%), Referenced to phase 2:NBT and 6:SBT, Start of Green
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.85
 Intersection Signal Delay: 13.1
 Intersection Capacity Utilization 78.1%
 Analysis Period (min) 15
 Intersection LOS: B
 ICU Level of Service D

Splits and Phases: 2: S. Chambers Rd. & S. Red Sky Dr.



HCM 6th Signalized Intersection Summary
2: S. Chambers Rd. & S. Red Sky Dr.



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↵	↵	↑↑↑	↵	↵	↑↑↑
Traffic Volume (veh/h)	195	208	2445	235	159	1060
Future Volume (veh/h)	195	208	2445	235	159	1060
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	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	212	226	2658	255	173	1152
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	256	407	3221	1228	201	3989
Arrive On Green	0.14	0.14	1.00	1.00	0.11	0.78
Sat Flow, veh/h	1781	1585	5274	1585	1781	5274
Grp Volume(v), veh/h	212	226	2658	255	173	1152
Grp Sat Flow(s),veh/h/ln	1781	1585	1702	1585	1781	1702
Q Serve(g_s), s	13.9	14.8	0.0	0.0	11.5	7.7
Cycle Q Clear(g_c), s	13.9	14.8	0.0	0.0	11.5	7.7
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	256	407	3221	1228	201	3989
V/C Ratio(X)	0.83	0.56	0.83	0.21	0.86	0.29
Avail Cap(c_a), veh/h	289	436	3221	1228	245	3989
HCM Platoon Ratio	1.00	1.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.44	0.44	1.00	1.00
Uniform Delay (d), s/veh	49.9	38.7	0.0	0.0	52.3	3.7
Incr Delay (d2), s/veh	16.2	1.3	1.1	0.2	22.1	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.3	5.9	0.3	0.1	6.3	2.3
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	66.1	40.0	1.1	0.2	74.4	3.9
LnGrp LOS	E	D	A	A	E	A
Approach Vol, veh/h	438		2913			1325
Approach Delay, s/veh	52.6		1.1			13.1
Approach LOS	D		A			B
Timer - Assigned Phs	1	2			6	8
Phs Duration (G+Y+Rc), s	18.0	80.2			98.2	21.8
Change Period (Y+Rc), s	4.5	4.5			4.5	4.5
Max Green Setting (Gmax), s	16.5	70.5			91.5	19.5
Max Q Clear Time (g_c+I1), s	13.5	2.0			9.7	16.8
Green Ext Time (p_c), s	0.1	52.7			11.6	0.4

Intersection Summary

HCM 6th Ctrl Delay			9.3			
HCM 6th LOS			A			

DELAY (CONTROL)

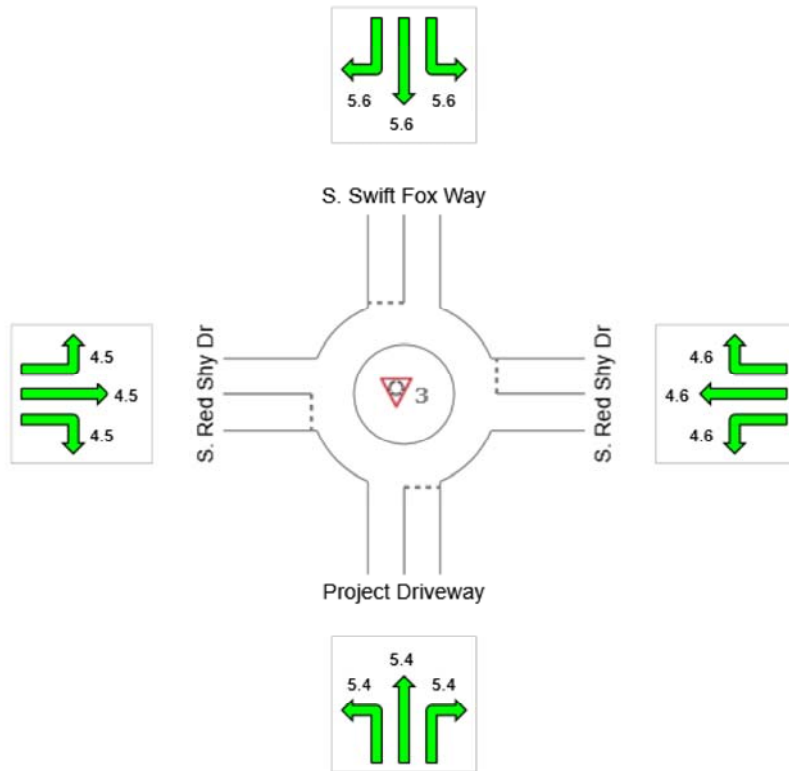
Average control delay per vehicle, or average pedestrian delay (seconds)

 Site: 3 [2041+Project_AM]

New Site
 Site Category: (None)
 Roundabout

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Delay (Control)	5.4	4.6	5.6	4.5	5.1
LOS	A	A	A	A	A



Colour code based on Level of Service



Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
 LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Roundabout Level of Service Method: Same as Sign Control

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Timings
4: E. Hess Rd & Firefly Ln

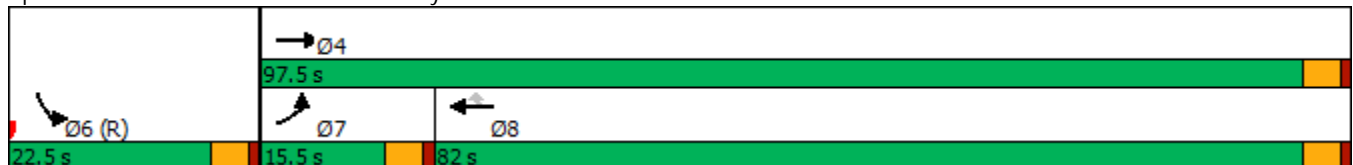


Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations	↖	↕	↕	↗	↘
Traffic Volume (vph)	14	1623	1816	16	10
Future Volume (vph)	14	1623	1816	16	10
Turn Type	Prot	NA	NA	Perm	Prot
Protected Phases	7	4	8		6
Permitted Phases				8	
Detector Phase	7	4	8	8	6
Switch Phase					
Minimum Initial (s)	11.0	14.0	14.0	14.0	11.0
Minimum Split (s)	15.5	22.5	22.5	22.5	22.5
Total Split (s)	15.5	97.5	82.0	82.0	22.5
Total Split (%)	12.9%	81.3%	68.3%	68.3%	18.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead		Lag	Lag	
Lead-Lag Optimize?	Yes		Yes	Yes	
Recall Mode	None	None	None	None	C-Min
Act Effct Green (s)	11.0	85.5	79.3	79.3	25.5
Actuated g/C Ratio	0.09	0.71	0.66	0.66	0.21
v/c Ratio	0.09	0.70	0.84	0.02	0.07
Control Delay	38.7	19.7	19.6	6.2	45.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	38.7	19.7	19.6	6.2	45.5
LOS	D	B	B	A	D
Approach Delay		19.9	19.5		45.5
Approach LOS		B	B		D

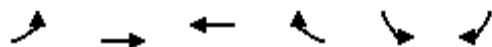
Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.84
 Intersection Signal Delay: 19.9
 Intersection LOS: B
 Intersection Capacity Utilization 66.9%
 ICU Level of Service C
 Analysis Period (min) 15

Splits and Phases: 4: E. Hess Rd & Firefly Ln



HCM 6th Signalized Intersection Summary
4: E. Hess Rd & Firefly Ln



Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations							
Traffic Volume (veh/h)	14	1623	1816	16	10	14	
Future Volume (veh/h)	14	1623	1816	16	10	14	
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	1870	1870	1870	1870	1900	1900	
Adj Flow Rate, veh/h	15	1764	1974	17	11	15	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Percent Heavy Veh, %	2	2	2	2	0	0	
Cap, veh/h	64	2429	2168	967	164	224	
Arrive On Green	0.04	0.68	0.61	0.61	0.24	0.24	
Sat Flow, veh/h	1781	3647	3647	1585	680	927	
Grp Volume(v), veh/h	15	1764	1974	17	27	0	
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1585	1669	0	
Q Serve(g_s), s	1.0	37.4	58.5	0.5	1.5	0.0	
Cycle Q Clear(g_c), s	1.0	37.4	58.5	0.5	1.5	0.0	
Prop In Lane	1.00			1.00	0.41	0.56	
Lane Grp Cap(c), veh/h	64	2429	2168	967	403	0	
V/C Ratio(X)	0.23	0.73	0.91	0.02	0.07	0.00	
Avail Cap(c_a), veh/h	163	2754	2295	1024	403	0	
HCM Platoon Ratio	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	0.00	
Uniform Delay (d), s/veh	56.2	11.9	20.5	9.2	35.1	0.0	
Incr Delay (d2), s/veh	1.8	0.9	5.8	0.0	0.3	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	0.5	12.5	22.7	0.2	0.7	0.0	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	58.1	12.8	26.3	9.2	35.4	0.0	
LnGrp LOS	E	B	C	A	D	A	
Approach Vol, veh/h		1779	1991		27		
Approach Delay, s/veh		13.2	26.2		35.4		
Approach LOS		B	C		D		
Timer - Assigned Phs				4	6	7	8
Phs Duration (G+Y+Rc), s				86.5	33.5	8.8	77.7
Change Period (Y+Rc), s				4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s				93.0	18.0	11.0	77.5
Max Q Clear Time (g_c+I1), s				39.4	3.5	3.0	60.5
Green Ext Time (p_c), s				21.3	0.0	0.0	12.7
Intersection Summary							
HCM 6th Ctrl Delay			20.1				
HCM 6th LOS			C				

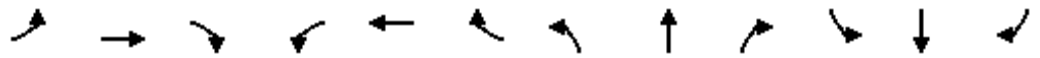
Intersection						
Int Delay, s/veh	1.1					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑↑			↑
Traffic Vol, veh/h	0	1637	1710	120	0	102
Future Vol, veh/h	0	1637	1710	120	0	102
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	1779	1859	130	0	111

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

Approach	EB	WB	SB
HCM Control Delay, s	0	0	40.2
HCM LOS			E

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	209
HCM Lane V/C Ratio	-	-	-	0.53
HCM Control Delay (s)	-	-	-	40.2
HCM Lane LOS	-	-	-	E
HCM 95th %tile Q(veh)	-	-	-	2.8

HCM 6th Signalized Intersection Summary
1: E. Hess Rd & S. Chambers Rd.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖	↖↗	↑↑	↖	↖↗	↑↑↑	↖	↖↗	↑↑↑	↖
Traffic Volume (veh/h)	301	575	980	884	511	345	700	1280	795	869	2088	120
Future Volume (veh/h)	301	575	980	884	511	345	700	1280	795	869	2088	120
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	327	625	0	961	555	0	761	1391	0	945	2270	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	395	577		706	896		590	1425		706	1596	
Arrive On Green	0.11	0.16	0.00	0.20	0.25	0.00	0.17	0.28	0.00	0.07	0.10	0.00
Sat Flow, veh/h	3456	3554	1585	3456	3554	1585	3456	5106	1585	3456	5106	1585
Grp Volume(v), veh/h	327	625	0	961	555	0	761	1391	0	945	2270	0
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1728	1777	1585	1728	1702	1585	1728	1702	1585
Q Serve(g_s), s	11.1	19.5	0.0	24.5	16.6	0.0	20.5	32.4	0.0	24.5	37.5	0.0
Cycle Q Clear(g_c), s	11.1	19.5	0.0	24.5	16.6	0.0	20.5	32.4	0.0	24.5	37.5	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	395	577		706	896		590	1425		706	1596	
V/C Ratio(X)	0.83	1.08		1.36	0.62		1.29	0.98		1.34	1.42	
Avail Cap(c_a), veh/h	573	577		706	896		590	1425		706	1596	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	0.50	0.50	0.00
Uniform Delay (d), s/veh	52.0	50.3	0.0	47.8	39.8	0.0	49.8	42.8	0.0	56.0	53.8	0.0
Incr Delay (d2), s/veh	6.6	61.7	0.0	172.0	1.3	0.0	142.5	18.7	0.0	157.6	192.1	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	5.0	13.3	0.0	27.0	7.2	0.0	20.3	15.5	0.0	26.7	45.4	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	58.5	111.9	0.0	219.8	41.1	0.0	192.2	61.6	0.0	213.6	245.9	0.0
LnGrp LOS	E	F		F	D		F	E		F	F	
Approach Vol, veh/h		952	A		1516	A		2152	A		3215	A
Approach Delay, s/veh		93.6			154.3			107.8			236.4	
Approach LOS		F			F			F			F	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	29.0	38.0	29.0	24.0	25.0	42.0	18.2	34.8				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	24.5	33.5	24.5	19.5	20.5	37.5	19.9	24.1				
Max Q Clear Time (g_c+I1), s	26.5	34.4	26.5	21.5	22.5	39.5	13.1	18.6				
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.6				

Intersection Summary

HCM 6th Ctrl Delay	167.8
HCM 6th LOS	F

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.


HCM 6th Signalized Intersection Summary
2: S. Chambers Rd. & S. Red Sky Dr.



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↵	↗	↑↑↑	↗	↵	↑↑↑
Traffic Volume (veh/h)	195	139	1700	201	174	2885
Future Volume (veh/h)	195	139	1700	201	174	2885
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	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	212	151	1848	218	189	3136
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	248	415	3194	1212	219	4013
Arrive On Green	0.14	0.14	0.63	0.63	0.12	0.79
Sat Flow, veh/h	1781	1585	5274	1585	1781	5274
Grp Volume(v), veh/h	212	151	1848	218	189	3136
Grp Sat Flow(s),veh/h/ln	1781	1585	1702	1585	1781	1702
Q Serve(g_s), s	14.0	9.3	25.5	4.5	12.5	40.9
Cycle Q Clear(g_c), s	14.0	9.3	25.5	4.5	12.5	40.9
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	248	415	3194	1212	219	4013
V/C Ratio(X)	0.86	0.36	0.58	0.18	0.86	0.78
Avail Cap(c_a), veh/h	353	509	3194	1212	321	4013
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.49	0.49	1.00	1.00
Uniform Delay (d), s/veh	50.5	36.1	13.2	3.9	51.6	7.1
Incr Delay (d2), s/veh	13.3	0.5	0.4	0.2	14.9	1.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.1	3.7	9.4	2.5	6.5	12.1
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	63.8	36.7	13.6	4.0	66.5	8.7
LnGrp LOS	E	D	B	A	E	A
Approach Vol, veh/h	363		2066			3325
Approach Delay, s/veh	52.5		12.6			12.0
Approach LOS	D		B			B
Timer - Assigned Phs	1	2			6	8
Phs Duration (G+Y+Rc), s	19.2	79.6			98.8	21.2
Change Period (Y+Rc), s	4.5	4.5			4.5	4.5
Max Green Setting (Gmax), s	21.6	61.1			87.2	23.8
Max Q Clear Time (g_c+I1), s	14.5	27.5			42.9	16.0
Green Ext Time (p_c), s	0.3	20.6			40.8	0.7
Intersection Summary						
HCM 6th Ctrl Delay			14.8			
HCM 6th LOS			B			

DELAY (CONTROL)

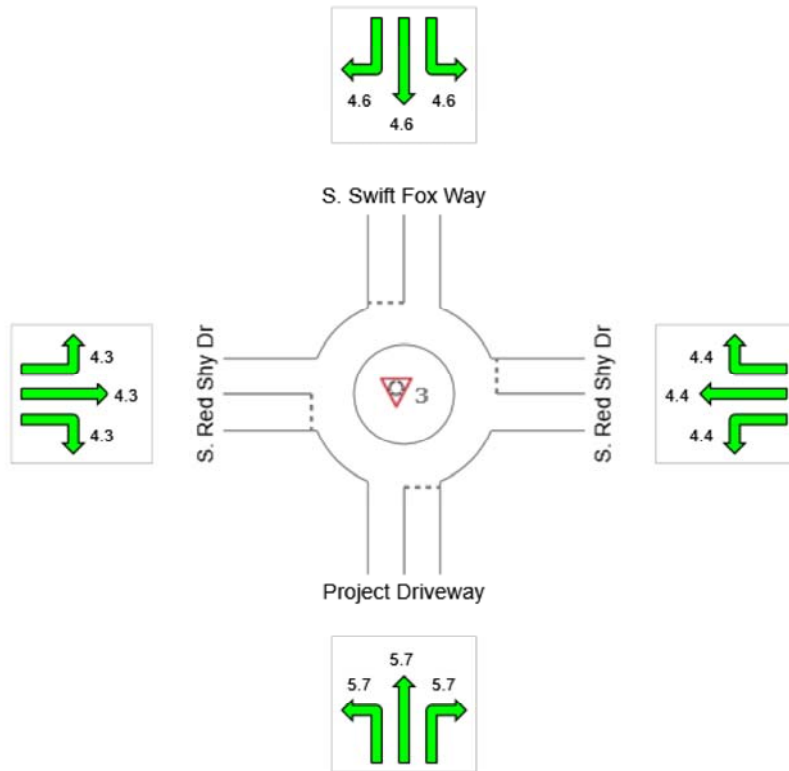
Average control delay per vehicle, or average pedestrian delay (seconds)

 Site: 3 [2041+Project_PM]

New Site
 Site Category: (None)
 Roundabout

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Delay (Control)	5.7	4.4	4.6	4.3	5.0
LOS	A	A	A	A	A



Colour code based on Level of Service



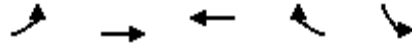
Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
 LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Roundabout Level of Service Method: Same as Sign Control

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Timings
4: E. Hess Rd & Firefly Ln

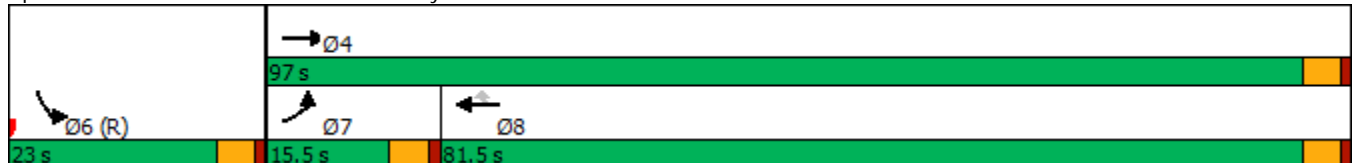


Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations	↖	↗↗	↗↗	↖	↘↘
Traffic Volume (vph)	19	2246	1727	26	15
Future Volume (vph)	19	2246	1727	26	15
Turn Type	Prot	NA	NA	Perm	Prot
Protected Phases	7	4	8		6
Permitted Phases				8	
Detector Phase	7	4	8	8	6
Switch Phase					
Minimum Initial (s)	11.0	14.0	14.0	14.0	11.0
Minimum Split (s)	15.5	22.5	22.5	22.5	22.5
Total Split (s)	15.5	97.0	81.5	81.5	23.0
Total Split (%)	12.9%	80.8%	67.9%	67.9%	19.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead		Lag	Lag	
Lead-Lag Optimize?	Yes		Yes	Yes	
Recall Mode	None	None	None	None	C-Min
Act Effect Green (s)	11.0	96.8	90.6	90.6	14.2
Actuated g/C Ratio	0.09	0.81	0.76	0.76	0.12
v/c Ratio	0.13	0.86	0.70	0.02	0.13
Control Delay	35.5	21.4	10.6	5.0	49.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	35.5	21.4	10.6	5.0	49.9
LOS	D	C	B	A	D
Approach Delay		21.5	10.5		49.9
Approach LOS		C	B		D

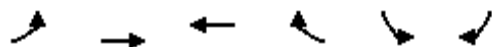
Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.86
 Intersection Signal Delay: 16.9
 Intersection LOS: B
 Intersection Capacity Utilization 78.8%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 4: E. Hess Rd & Firefly Ln



HCM 6th Signalized Intersection Summary
4: E. Hess Rd & Firefly Ln



Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations							
Traffic Volume (veh/h)	19	2246	1727	26	15	10	
Future Volume (veh/h)	19	2246	1727	26	15	10	
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	1870	1870	1870	1870	1900	1900	
Adj Flow Rate, veh/h	21	2441	1877	28	16	11	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Percent Heavy Veh, %	2	2	2	2	0	0	
Cap, veh/h	82	2636	2339	1043	178	122	
Arrive On Green	0.05	0.74	0.66	0.66	0.18	0.18	
Sat Flow, veh/h	1781	3647	3647	1585	972	668	
Grp Volume(v), veh/h	21	2441	1877	28	28	0	
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1585	1701	0	
Q Serve(g_s), s	1.4	68.0	45.9	0.7	1.6	0.0	
Cycle Q Clear(g_c), s	1.4	68.0	45.9	0.7	1.6	0.0	
Prop In Lane	1.00			1.00	0.57	0.39	
Lane Grp Cap(c), veh/h	82	2636	2339	1043	312	0	
V/C Ratio(X)	0.26	0.93	0.80	0.03	0.09	0.00	
Avail Cap(c_a), veh/h	163	2739	2339	1043	312	0	
HCM Platoon Ratio	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	0.00	
Uniform Delay (d), s/veh	55.2	12.8	14.9	7.1	40.7	0.0	
Incr Delay (d2), s/veh	1.6	6.0	2.1	0.0	0.6	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	0.6	21.9	16.3	0.2	0.7	0.0	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	56.9	18.8	17.0	7.2	41.3	0.0	
LnGrp LOS	E	B	B	A	D	A	
Approach Vol, veh/h		2462	1905		28		
Approach Delay, s/veh		19.1	16.8		41.3		
Approach LOS		B	B		D		
Timer - Assigned Phs				4	6	7	8
Phs Duration (G+Y+Rc), s				93.5	26.5	10.0	83.5
Change Period (Y+Rc), s				4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s				92.5	18.5	11.0	77.0
Max Q Clear Time (g_c+I1), s				70.0	3.6	3.4	47.9
Green Ext Time (p_c), s				19.0	0.0	0.0	17.7
Intersection Summary							
HCM 6th Ctrl Delay			18.3				
HCM 6th LOS			B				

Intersection						
Int Delay, s/veh	1.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑↑			↑
Traffic Vol, veh/h	0	2265	1615	121	0	125
Future Vol, veh/h	0	2265	1615	121	0	125
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	2462	1755	132	0	136

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	-	0	-	0	944
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	-	-	-	7.14
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	3.92
Pot Cap-1 Maneuver	0	-	-	-	0 226
Stage 1	0	-	-	-	0 -
Stage 2	0	-	-	-	0 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	-	226
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	42.4
HCM LOS			E

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	226
HCM Lane V/C Ratio	-	-	-	0.601
HCM Control Delay (s)	-	-	-	42.4
HCM Lane LOS	-	-	-	E
HCM 95th %tile Q(veh)	-	-	-	3.5

APPENDIX C

DOUGLAS COUNTY ROADWAY SEGMENT THRESHOLDS

Table 3: Vehicular Level of Service

VEHICULAR LEVEL OF SERVICE (LOS)	DEFINITION
LOS A	Free-flow vehicular traffic; vehicles moving freely.
LOS B	Stable flow with the ability of vehicles to choose speed and/or lane.
LOS C	Stable flow; however monitoring of speed and lane changes of vehicles is required.
LOS D	Stable flow with restricted speed and ability to change lanes.
LOS E	Unstable flow at or near capacity; experiencing increased delays and reduced traveler reliability.
LOS F	Unstable flow; stop and go conditions.

Developing and maintaining a safe transportation system to address present and future demands the County established LOS thresholds of LOS D for arterial and collector roadways in urban and semi-urban areas and LOS C for arterial and collector roadways in rural areas. This LOS criteria provides safety and mobility on the County roadways and ensures operations do not become unstable

Average daily traffic volume capacities of roads, by classification, were estimated based on typical traffic flow characteristics and capacities per hour per lane that have been documented in various regional and local agency studies throughout the United States. **Table 4** presents the daily capacities, by roadway classification, based on the number of lanes and area type.

Table 4: Recommended Traffic Volume Thresholds

ROADWAY CLASSIFICATION	URBAN		
	NUMBER OF LANES		
	2	4	6
Roadway Classification	LOS D	LOS D	LOS D
Collector	12,000	20,000	
Arterial			
Minor Arterial		30,000	
Major Arterial		40,000	55,000
Expressway		50,000	70,000

Not currently identified in Douglas County Roadway Standards.

1. Collector (4-lane)
2. Expressway

APPENDIX D

MXD + METHODOLOGY MEMO



MXD+ Methodology and Validation

TECHNICAL MEMORANDUM

To: Dave Aden, PE, Town of Parker Traffic Engineer

Date: May 6, 2020

From: Ann Bowers, PE, PTOE, PTP - Fehr & Peers

Subject: MXD+ Methodology and Validation Memorandum

The purpose of this memorandum is to discuss the MXD+ methodology and present the validation statistics for all 27 validation sites as well as additional detail for five validation sites that are larger in nature and have a broad mix of land uses.

MXD+ Methodology

Current accepted methodologies, such as the Institute of Transportation Engineers (ITE) *Trip Generation* methodology, are primarily based on data collected at suburban, single-use, freestanding sites. These defining characteristics limit their applicability to mixed-use or multi-use development projects. The land use mix, design features, and setting of a mixed-use project in the Boise area would include characteristics that influence travel behavior differently from typical single-use suburban developments. Thus, traditional data and methodologies, such as ITE, would not accurately estimate the project vehicle trip generation. Although the *ITE Trip Generation Handbook* includes an approach for adjusting trip generation for internal trip making at mixed-use developments, the data for this methodology is based on six sites in Florida. This sample set is not diverse enough to cover mixed-use developments across the United States.

In response to the limitations in the ITE methodology, and to provide a straightforward and empirically validated method of estimating vehicle trip generation at mixed-use developments, the US Environmental Protection Agency (EPA) sponsored a national study of the trip generation characteristics of multi-use sites. Travel survey data was gathered from 239 mixed-use developments (MXDs) in six major metropolitan regions and correlated with the characteristics of the sites and their surroundings. The findings indicate that the amount of external traffic generated is affected by a wide variety of factors, each pertaining to one or more of the following characteristics:

- **The relative numbers of residents and jobs on the site** – the better the site jobs/ housing balance, the greater the proportion of commute trips that remain internal.
- **The amount of retail and service use on the site relative to the number of residences** – the greater the degree to which retail and service opportunities match the needs generated by site residents, the greater the internalization of household-generated shopping, personal services and entertainment travel.

- **The overall size of the development** – the larger the scale of the development in terms of acreage and total amounts of residential and commercial use, the greater the likelihood that travel destinations can be satisfied within the site.
- **The density of development** – the greater the concentration of dwellings and commercial space per acre, the greater the likelihood that the interacting land uses will be near enough together to encourage walking or short-distance internal driving.
- **The internal connectivity for walking or driving among different activities** – measured in terms of the ratio of intersections to total land area within the site directly influences trip internalization and the number of trips made by walking instead of driving.
- **The availability of transit** – the greater the number of jobs within a reasonable travel time via transit, the greater the share of travel likely to occur by transit, and the lower the traffic generation.
- **The number of convenient trip destinations within the immediate area** – the number of retail and other jobs in neighborhoods immediately surrounding the multi-use site reduces the amount of walking to/from the site and reduce traffic generation.

These characteristics were related statistically to the trip behavior observed at the study development sites. This effort quantified relationships between characteristics of the MXDs and the likelihood that trips generated by those MXDs will stay internal and/or use modes of transportation other than the private vehicle. These statistical relationships produced equations, known as the EPA MXD model, that enables predicting external vehicle trip reduction as a function of the MXD characteristics.

The following characteristics are collected as part of an MXD analysis. This data can usually be collected through publicly available sources frequently used in transportation analyses including GIS databases, census data, household travel surveys, and regional travel demand models.

Site Specific Information

- Land Area (of project site in acres)
- Intersection Density
- Land Use Plan

Surrounding Area Variables

- Local Employment
- Regional Employment
- Percent of households within ¼ mile of transit stop

Socioeconomic Data

- Average vehicle ownership
- Average household size

The MXD model consists of four steps to achieve an estimate of daily vehicle trips on external roadways generated by MXDs. The four steps and outputs are:

1. Compute daily trip estimates using the equations from the ITE *Trip Generation Manual* (these are referred to as "Raw ITE Trips"). These estimates do not assume any internalization, and only minimal trips made by walking and/or transit modes.
2. Compute the probability of a trip staying internal to the MXD ('Pinternal')
3. Compute the probability an external trip will be made by walking ('Pwalk')
4. Compute the probability an external trip will be made by transit ('Ptransit')

Mathematically, if we call the above probabilities generated in steps 2-4 above Pinternal, Pwalk, and Ptransit, respectively, the desired result of number of external vehicle trips is given by:

$$\text{External Vehicle Trips} = \text{Raw ITE Trips} * (1 - \text{Pinternal}) * (1 - \text{Pwalk} - \text{Ptransit}).$$

MXD+ Validation

Since the conclusion of the EPA sponsored study, Fehr & Peers has been actively enhancing the MXD model to improve sensitivity to various site characteristics, improve peak hour performance, and to validate the results of the model against actual observed counts at MXDs across the country. The Fehr & Peers-led effort to improve the EPA MXD model has culminated in the MXD+ methodology.

Validation Process

To illustrate the improvement the MXD+ methodology provides for estimating trip generation at MXDs, a set of 27 MXD sites across the country that were not included in the initial model development were analyzed using the available trip generation methodologies. These sites represent locations where it is expected that traditional data and methodologies, such as ITE, would not accurately estimate the vehicle trip generation.

The validation sites were selected based on several criteria. Sites must have met the traditional ITE definition of "mixed use," and contain significant amounts of at least two the following general land uses: residential, retail, and nonretail jobs. The potential for through trips must have been minimal, to avoid counting vehicles that do not begin or end their trips within the site and thus should not be accounted for in trip generation. For sites where significant through trips were observed, license plate surveys were performed and the through traffic was subtracted from all calculations.

For most validation sites, traffic counts were collected for every entrance and exit to each site from published reports. For the remaining sites, traffic counts were collected over 48 hours using tube counts. For validation purposes, the data were averaged to a typical single day. The observed count data used for validation is included in **Appendix A**. The validation methodology included estimating "raw trip generation" with ITE *Trip Generation* equations; then reducing the estimates by the MXD+ equations and separately with the standard ITE internalization procedures. All three of the trip generation methodologies were compared to the actual observed external vehicle counts at the sites.

Table 1 presents the performance of the MXD+ model against ITE and ITE internalization procedures for all validation sites.

Table 2 presents the performance of the MXD+ model against ITE and ITE internalization procedures for sites in the validation test set that are larger in size and a diverse mix of land use. **Table 3** summarizes the input values and data sources for the MXD+ methodology for the five specific validation sites. The five sites' trip generation estimates, observed counts, and observed reduction in trip generation relative to ITE, are shown in **Table 4** for the PM peak hour. A complete set of trip generation estimates and observed counts for all time periods and for all the validation sites is included in **Appendix A**. The observed counts show that the use of ITE procedures alone would significantly overestimate traffic generation.

The five sites are briefly described below. The sites represent a diverse set of MXDs, each with different land use profiles. Some sites might be more housing focused or non-residential focused, but all sites represent mixed use developments not accurately reflected by ITE Trip Generation rates. The specific land use mix for each site has a large impact on the type of reduction identified through MXD+ equations.

Boca Del Mar is a 250-acre development located in the Palm Beach, FL and includes complementary residential and non-residential land uses. This MXD provides very limited transit service and is not located near major activity centers.

Moraga is a 2,500-acre neighborhood located in the California Bay Area in Moraga, CA and includes substantial single family residential and office land uses. This MXD provides limited transit service and is not within walk or bicycle distance of nearby activity centers. There is little non-auto interaction with outside land uses.

South Davis is an 800-acre neighborhood located outside Sacramento, CA in Davis, CA and includes substantial residential land uses with complementary non-residential land uses. This MXD provides limited transit service but is within walk and bicycle distance of nearby activity centers.

Redwood Shores is a 2,000-acre neighborhood located in the California Bay Area in Redwood City, CA and includes substantial residential and non-residential land uses. This MXD provides transit service connecting to the major employment centers of San Francisco and San Jose.

Southern Village is a 250-acre development located in Chapel Hill, NC and includes residential land uses with limited neighborhood supporting non-residential land uses. This MXD provides limited transit service and is within bicycle distance of a nearby activity center.

Table 1 MXD+ Model Validation Statistics – All Sites			
Validation Statistic	ITE raw	ITE with internalization	MXD+ Model
Daily			
Average Model Error ¹	28%	16%	2%
% RMSE ²	40%	27%	17%
R-Squared ³	0.77	0.89	0.96
AM Peak Hour			
Average Model Error	54%	49%	12%
% RMSE	54%	53%	21%
R-Squared	0.81	0.81	0.97
PM Peak Hour			
Average Model Error	49%	35%	4%
% RMSE	64%	49%	15%
R-Squared	0.40	0.65	0.97
<p>1. Average model error measures the difference between the estimated trip generation and the observed counted trip generation</p> <p>2. RMSE stands for percent root mean squared error is a demand assessment of performance of transportation models in that it does not apply average that would allow over-estimates and under-estimates to cancel one another out and it penalizes proportionally more for large errors. A % RMSE of less than 40% is generally considered acceptable in transportation modeling</p> <p>3. R-squared is a statistical measure that indicates, in this case, the degree to which each method explains the variation in trip generation among the survey sites. A R-Squared value closer to 1.0 indicates that the method fully explains the variation in trip generation amongst the survey sites and would be suitable to be used for that set of site types.</p> <p>Source: Fehr & Peers, 2013.</p>			

Table 2 MXD+ Model Validation Statistics – Five Specified Sites			
Validation Statistic	ITE raw	ITE with internalization	MXD+ Model
Daily			
Average Model Error ¹	25%	15%	2%
% RMSE ²	30%	21%	12%
R-Squared ³	0.57	0.79	0.93
AM Peak Hour			
Average Model Error	36%	36%	9%
% RMSE	29%	29%	11%
R-Squared	0.68	0.68	0.96
PM Peak Hour			
Average Model Error	41%	30%	4%
% RMSE	46%	35%	11%
R-Squared	0.17	0.50	0.95
<p>1. Average model error measures the difference between the estimated trip generation and the observed counted trip generation</p> <p>2. RMSE stands for percent root mean squared error is a demand assessment of performance of transportation models in that it does not apply average that would allow over-estimates and under-estimates to cancel one another out and it penalizes proportionally more for large errors. A % RMSE of less than 40% is generally considered acceptable in transportation modeling</p> <p>3. R-squared is a statistical measure that indicates, in this case, the degree to which each method explains the variation in trip generation among the survey sites. A R-Squared value closer to 1.0 indicates that the method fully explains the variation in trip generation amongst the survey sites and would be suitable to be used for that set of site types.</p> <p>Source: Fehr & Peers, 2013.</p>			

Table 3 MXD+ Model Five Specified Validation Sites - MXD+ Model Inputs						
Input Variable	Boca Del Mar	Moraga	South Davis	Redwood Shores	Southern Village	Source
MXD Specific Inputs						
Project Area (acres)	253	2,444	791	2,000	250	Project Site Plan
Intersection per Square Mile	28	75	169	11	64	Project Site Plan
Employment within 1 mile of site	7,491	782	3,558	13,000	1,000	Regional Travel Demand Model / Business Parcel GIS Databases
Employment within a 30-minute trip by transit	12,236	11,000	8,931	100,666	17,000	Regional Travel Demand Model
Percent of households within ¼ mile of transit stop	6%	20%	75%	75%	80%	Project Site Plan
Average Vehicle Ownership	1.35	1.99	1.93	1.83	1.65	Census 2000/2010, American Community Survey 2010-2011
Average Household Size	1.78	2.59	2.48	2.25	2.28	Census 2000/2010, American Community Survey 2010-2011
Land Use Inputs						
Single Family Dwelling Units	513	5,195	2,384	2,204	510	Project Land Use Plan
Multi Family Dwelling Units	631	753	2,070	2,256	585	Project Land Use Plan
Retail (Square Feet)	200,000	267,000	455,000	396,000	15,000	Project Land Use Plan
Office (Square Feet)	301,000	1,105,000	455,000	5,877,000	95,000	Project Land Use Plan
Industrial (Square Feet)	0	0	60,000	172,000	0	Project Land Use Plan
Source: Fehr & Peers, 2013.						

Table 4 External Vehicle Trip Estimates – PM Peak Hour Five Specified Validation Sites						
Validation Site	Acres	ITE Raw	ITE with internalization	MXD+	Observed Count ¹	Observed Reduction Relative to ITE ²
Boca Del Mar	253	3,294	2,891	2,290	2,144	35%
Moraga	2,444	6,972	6,515	4,945	4,055	42%
South Davis	791	8,650	7,585	5,026	n/a	n/a
Redwood Shores	2,000	8,731	8,002	6,753	6,488	26%
Southern Village	250	1,406	1,371	1,110	1,336	5%

1. PM peak hour counts were not available for the South Davis site
2. Comparison of observed counts to ITE estimates for the PM peak hour.

Source: Fehr & Peers, 2013.

Based on all statistical measurements, the MXD model performs better than the ITE recommended procedures for these mixed-use development sites, including those that are larger in size and have a diverse mix of land uses. The ITE recommended procedures also significantly overestimate traffic generation, which exaggerates estimates of impacts and results in excessive development costs, skewed public perceptions, and decision maker resistance.

The MXD+ model has been approved for use by the EPA¹. It has also been peer-reviewed in the American Society of Civil Engineers (ASCE) Journal of Urban Planning and Development², peer-reviewed in a 2012 Transportation Research Board (TRB) paper evaluating various smart growth trip generation methodologies³, recommended by the San Diego Association of Governments (SANDAG) for use on mixed-use smart growth developments⁴, and promoted in an American Planning Association (APA)

¹ Trip Generation Tool for Mixed-Use Developments (2012). www.epa.gov/dced/mxd_tripgeneration.html

² "Traffic Generated by Mixed-Use Developments—Six-Region Study Using Consistent Built Environmental Measures." Journal of Urban Planning and Development, 137(3), 248–261.

³ Shafizadeh, Kevan et al. "Evaluation of the Operation and Accuracy of Available Smart Growth Trip Generation Methodologies for Use in California". Presented at 91st Annual Meeting of the Transportation Research Board, Washington, D.C., 2012.

⁴ SANDAG Smart Growth Trip Generation and Parking Study. <http://www.sandag.org/index.asp?projectid=378&fuseaction=projects.detail>

Planning Advisory Service (PAS)⁵ which recommended it for evaluating traffic generation of mixed-use and other forms of smart growth, including in-fill and transit oriented development. It has also been used successfully in multiple certified EIRs in California and is accepted by the City and County of Denver and has been applied on multiple development sites.

Appendix A contains detailed MXD+ model input values, generic land use inputs, and estimated and observed trip generation data for all the 27 validation sites.

Please let us know if you have any questions. Thank you.

⁵ Walters, Jerry et al. "Getting Trip Generation Right – Eliminating the Bias Against Mixed Use Development". American Planning Association. May 2013.

APPENDIX

Validation Data

Site Name and Location	External Vehicle Estimates											
	Daily				AM Peak Hour				PM Peak Hour			
	ITE Raw	ITE with internalization	MXD+	Observed Count	ITE Raw	ITE with internalization	MXD+	Observed Count	ITE Raw	ITE with internalization	MXD+	Observed Count
Atlantic Station	39,312	33,479	31,419	28,787	2,304	2,304	1,731	1,198	3,813	3,283	2,449	2,256
Boca Del Mar	32,527	28,790	27,713	28,560	2,304	2,304	1,789	1,455	3,294	2,891	2,290	2,144
Celebration	49,625	47,431	36,008	40,912	4,464	4,464	3,127	n/a	5,017	4,799	3,375	3,458
Country Isles	30,088	27,878	27,368	28,023	1,833	1,833	1,625	1,669	3,169	2,929	2,640	2,175
Crocker Center	12,620	12,620	11,538	9,791	1,007	1,007	898	717	1,200	1,185	931	812
Galleria	27,687	24,015	23,789	22,971	1,312	1,312	1,050	960	2,564	2,151	1,864	1,867
Gateway Oaks	19,733	19,154	16,379	23,280	2,172	2,172	1,719	n/a	2,299	2,244	1,795	n/a
Jamboree Center	43,706	39,673	36,075	36,569	3,810	3,810	3,018	3,125	4,774	4,431	3,529	3,513
Legacy Town Center	35,035	29,930	24,945	20,082	2,386	2,386	1,511	1,051	3,268	2,801	1,784	1,660
Mizner Park	14,454	13,200	11,561	12,086	786	786	562	365	1,423	1,307	936	875
Mockingbird Station	15,731	14,333	11,145	8,640	761	761	450	400	1,504	1,366	853	720
Moraga	78,593	73,503	62,747	49,689	6,075	6,075	4,770	4,313	6,972	6,515	4,945	4,055
Park Place	21,035	19,809	17,422	19,064	2,296	2,296	1,815	1,295	2,776	2,680	2,101	1,676
South Davis	92,684	81,373	67,201	74,648	7,032	7,032	4,929	n/a	8,650	7,585	5,026	n/a
The Villages	8,720	8,373	7,681	7,128	692	692	582	664	769	742	633	605
Rio Vista	6,689	5,719	4,959	5,307	509	435	329	280	596	509	394	452
La Mesa Village Plaza	5,681	4,857	3,913	4,280	421	360	215	283	476	407	275	384
Uptown Center	20,214	18,193	14,705	16,886	908	817	549	638	2,023	1,821	1,327	1,560
Morena Linda Vista	6,376	5,451	4,549	4,712	471	402	275	315	549	469	341	361
Hazard Center	15,051	12,869	11,825	11,644	1,036	886	754	614	1,397	1,195	898	978
Otay Ranch	10,465	9,455	9,272	7,935	591	534	494	667	1,051	950	838	673
Bay Street	23,968	22,241	17,835	14,145	827	827	512	288	2,220	2,042	1,361	1,201
Larkspur Landing	18,602	15,884	16,777	15,404	1,253	1,253	1,073	956	1,925	1,657	1,520	1,278
Redwood Shores	92,966	85,715	80,137	75,138	7,264	7,264	6,081	6,606	8,731	8,002	6,753	6,488
Redstone	14,953	13,261	12,708	12,605	481	481	388	483	1,513	1,354	1,139	1,119
Quarry Bend	22,632	21,001	20,009	20,142	750	750	650	606	1,999	1,832	1,679	1,682
Southern Village	13,561	13,225	11,543	12,609	1,296	1,296	1,035	n/a	1,406	1,371	1,110	1,336

Sites similar to Harris Ranch

Site Name and Location	MXD+ Model Inputs											
	MXD Specific Inputs						Land Use Inputs					
	Acres	Intersection Density (int/sq mi.)	Employment within 1 mile	Employment within 30 min transit	% of HHs within 1/4 mile of transit stop	Average Vehicle Ownership	Average HH Size	Single Family (DU)	Multi Family (DU)	Retail (KSF)	Office (KSF)	Industrial (KSF)
Atlantic Station	138	139	29,200	118,132	100%	1.70	2.07	0	1,031	480	509	0
Boca Del Mar	253	28	7,491	12,236	6%	1.35	1.78	513	631	200	301	0
Celebration	3,500	44	4,326	0	0%	1.50	2.75	2,232	1,868	58	1,023	0
Country Isles	61	220	0	0	0%	1.89	2.90	0	368	189	60	0
Crocker Center	29	88	11,632	16,981	0%	1.58	1.79	0	0	78	196	0
Galleria	165	50	4,236	24,795	100%	1.42	1.73	179	258	1,019	87	0
Gateway Oaks	227	85	7,817	5,096	83%	1.40	1.88	0	1,351	12	1,084	0
Jamboree Center	128	110	17,236	190,841	100%	1.33	1.68	0	513	136	1,850	55
Legacy Town Center	75	299	27,225	32,121	88%	1.45	1.63	0	1,361	265	311	0
Mizner Park	30	299	13,880	18,488	100%	1.41	1.85	0	136	121	89	0
Mockingbird Station	9	356	15,054	185,000	100%	1.43	1.78	0	191	167	92	0
Moraga	2,444	75	782	11,000	20%	1.99	2.59	5,195	753	267	1,105	0
Park Place	109	70	51,852	155,220	100%	1.29	1.58	0	162	90	1,643	0
South Davis	791	169	3,558	8,931	75%	1.93	2.48	2,384	2,070	455	455	60
The Villages	32	140	12,959	96,980	88%	2.00	3.00	0	1,132	4	0	0
Rio Vista	16	156	12,074	356,448	100%	1.27	1.68	0	922	17	0	0
La Mesa Village Plaza	6	670	6,280	212,647	100%	1.16	1.82	0	89	27	14	0
Uptown Center	14	181	15,722	271,368	100%	1.35	1.74	0	295	131	3	0
Morena Linda Vista	7	583	7,003	409,060	100%	1.56	1.92	0	176	25	0	0
Hazard Center	16	203	8,050	385,031	100%	1.27	1.68	0	0	109	256	0
Otay Ranch	16	119	753	54,740	100%	1.76	2.49	0	244	38	64	0
Bay Street	22	204	19,000	405,688	100%	1.17	1.49	0	381	382	0	0
Larkspur Landing	65	59	1,500	11,191	25%	1.62	1.82	248	342	144	311	0
Redwood Shores	2,000	11	13,000	100,666	75%	1.83	2.25	2,204	2,256	396	5,877	172
Redstone	52	271	1,917	16,784	100%	2.19	2.97	0	304	199	50	0
Quarry Bend	100	128	5,624	10,770	0%	1.96	2.71	0	375	424	0	0
Southern Village	250	64	1,000	17,000	80%	1.65	2.28	510	585	15	95	0

Sites similar to Harris Ranch

Input Variable	Input Value	Source
MXD specific inputs		
Project Area (Acres)	16.61	GIS
Intersections per Square Mile	53	EPA Smart Location Database (2013) - 2010 Scenario
Employment within 1 mile of Project Site	837	EPA Smart Location Database (2013) - 2010 Scenario
Share of regional employment within a 30 minute trip by transit	0.00193961	EPA Smart Location Database (2013) - 2010 Scenario
Surrounding Household Size	3.11	Census 2010 - All Housing Types
Surrounding Vehicle Ownership	2.51	Census 2000 - All Housing Types
Site Household Size	2.87	ACS 2012 (5-year) - All Housing Types
Site Vehicle Ownership	2.10	ACS 2012 (5-year) - All Housing Types
Average Vehicle Occupancy (HBW Trips)	1.0	NCHRP 758
Average Vehicle Occupancy (HBO Trips)	1.0	NCHRP 758
Average Vehicle Occupancy (NHB Trips)	1.0	NCHRP 758

ITE Vehicle Trip Generation by Land Use

ITE Land Use	Units	ITE Code	Quantity	Daily Total	AM In	AM Out	AM Total	PM In	PM Out	PM Total
(948) - Automated Car Wash (Adj Streets, 7-9A, 4-6P)	Car Wash Tunnels	948	1	0	0	0	0	39	39	78
(941) - Quick Lubrication Vehicle Shop (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	941	3	209	13	4	17	11	15	26
(912) - Drive-in Bank (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	912	2.5	250	14	10	24	26	26	51
(942) - Automobile Care Center (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	942	6	0	9	5	14	9	10	19
	Avg. 1,000 Square Feet									
(565) - Day Care Center (Adj Streets, 7-9A, 4-6P)	Gross Floor Area	565	13	619	76	67	143	68	77	145
(710) - General Office Building (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	710	15	146	15	2	17	3	14	17
(945) - Gasoline/Service Station with Convenience Market (Adj Streets, 7-9A, 4-6P)	Vehicle Fueling Position	945	16	3,286	102	98	200	114	110	224
(934) - Fast-Food Restaurant with Drive-Through Window (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	934	2.5	1,177	51	49	100	43	39	82
(934) - Fast-Food Restaurant with Drive-Through Window (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	934	2	942	41	39	80	34	31	65
(880) - Pharmacy/Drugstore Without Drive-Through Window (Adj Street, 7-9A, 4-6P)	1000 Sq. Ft.	880	12	1,081	23	12	35	50	52	102
(937) - Coffee/Donut Shop with Drive-Through Window (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	937	2	1,641	91	87	178	44	44	87
			SubTotal	9,351	435	373	808	441	457	896
			Internal Capture	-72	-18	-16	-34	-22	-22	-44
			External Walk, Bike	-77	-4	-4	-8	-3	-4	-7
			Total Reductions	-149	-22	-20	-42	-25	-26	-51
			Net New Project Trips	9,202	413	353	766	416	431	845

APPENDIX E

ANTHOLOGY BUILDOUT VOLUMES

ANTHOLOGY NORTH TRAFFIC IMPACT ANALYSIS

April 2015

Prepared by



DAVID EVANS
AND ASSOCIATES INC.

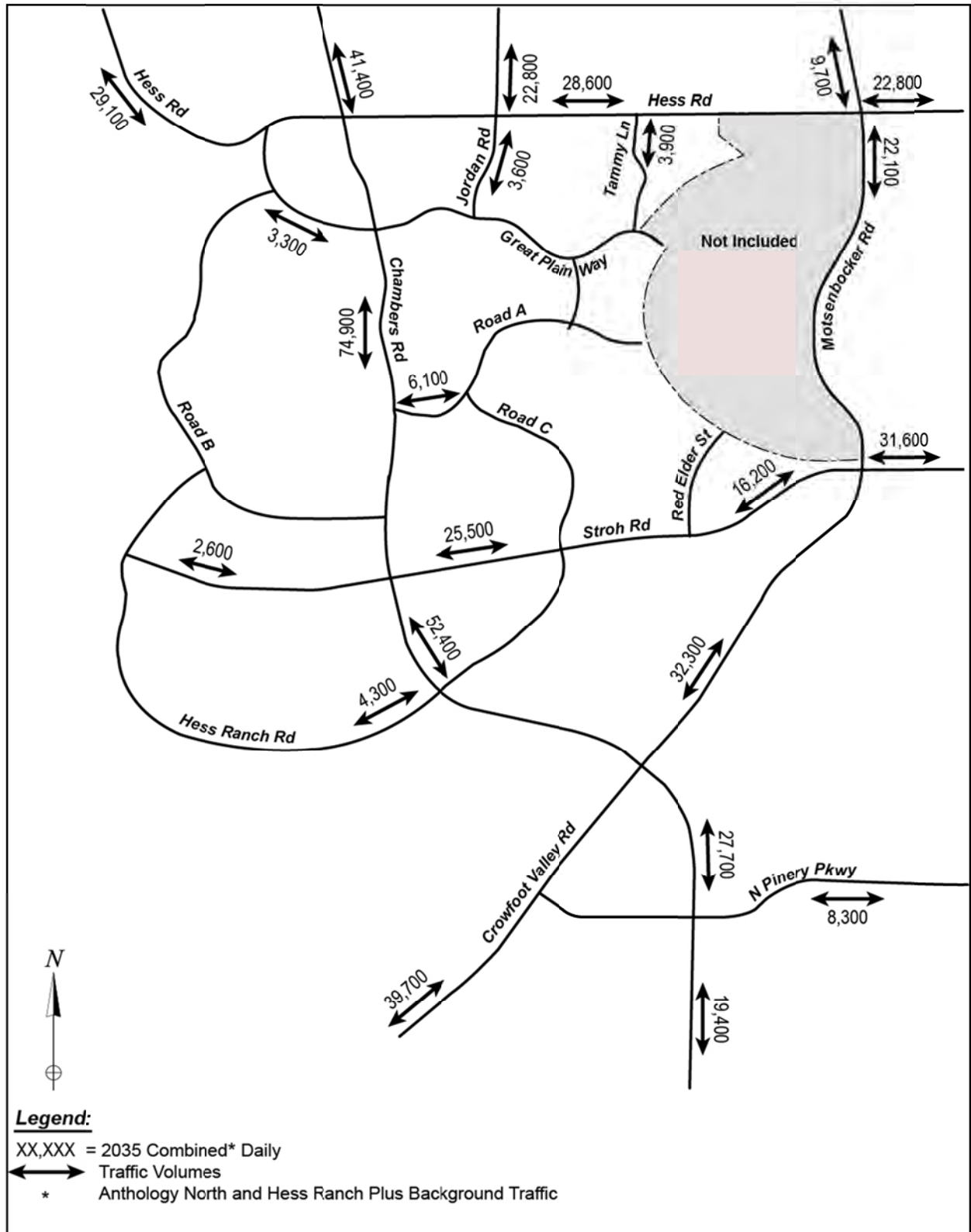


Figure 7. 2035 Total Site Plus Background Traffic Volumes

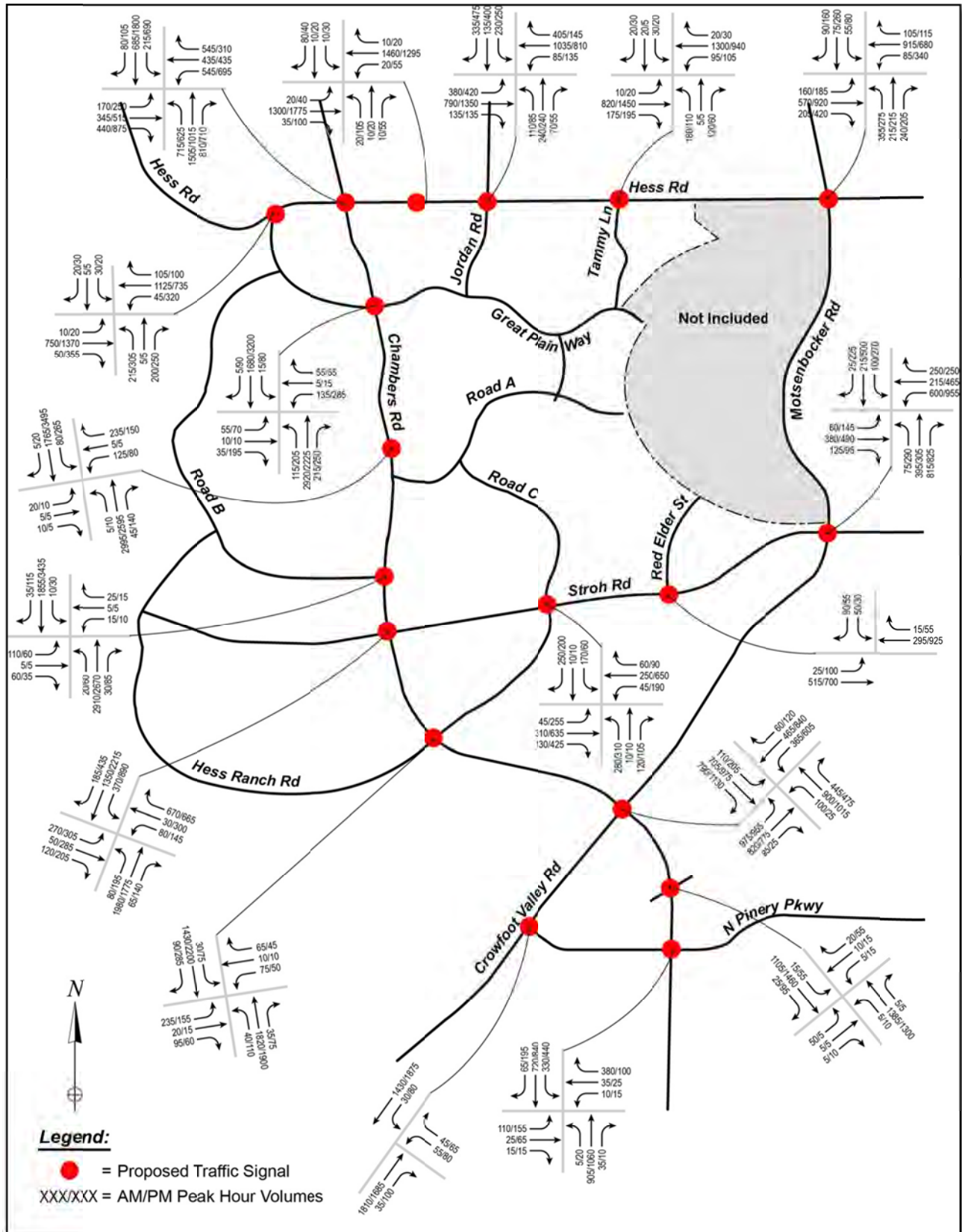


Figure 9. 2035 Peak Hour Intersection Traffic Volumes

If volumes are not projected to decrease after the specific commercial uses are known, possible mitigation measures would be to encourage additional site traffic to utilize the collector network rather than the arterial network, to construct additional right-in, right-out or $\frac{3}{4}$ movement accesses to reduce the volume turning onto and out of the intersecting streets, or to modify the commercial land uses to decrease the proposed number of trips in the area.

One potential solution to alleviate some of the anticipated congestion at the intersection of Hess Road and Chambers Road would be to construct a three lane cross section of Great Plain Way with two lanes in the northbound direction between Chambers Road and Hess Road. Constructing an additional lane would allow some of the traffic traveling from the Anthology and Hess Ranch areas to travel towards I-25 via Great Plain Way rather than having to use the Hess Road and Chambers Road intersection.

Table 5. 2035 Intersection Capacity Analysis

Intersection	AM Peak Hour		PM Peak Hour		Leg with LOS E or F?	
	LOS	Delay ⁽¹⁾	LOS	Delay ⁽¹⁾	AM	PM
Chambers Rd / Hess Rd	D	49.6	F	84.3	EB, WB	NB, SB, EB, WB
Chambers Rd / Great Plain Wy	B	17.8	D	52.5	WB	EB, WB, SB
Chambers Rd / Road A	D	39.8	E	55.3	WB	WB, SB
Chambers Rd / Road B	A	4.6	C	29.2		
Chambers Rd / Stroh Road	C	23.0	D	39.2	EB, WB	EB, WB
Chambers Rd / Hess Ranch Rd	C	20.6	B	18.5		
Chambers Rd / Crowfoot Valley Rd	D	49.9	E	78.7	EB, WB	NB, SB, EB, WB
Bayou Gulch Rd / PA 22, 27, 26, 23	A	4.7	A	7.4		
Bayou Gulch Rd / N Pinery Pkwy	C	28.5	C	22.0		
Hess Rd / Great Plain Way	B	13.4	C	30.2		NB
Hess Rd / PA 16 & 17	A	9.0	A	9.4		
Hess Rd / Jordan Rd	B	17.9	C	24.1		
Hess Rd / Tammy Lane	C	23.2	A	8.4		
Hess Rd / Motsenbocker Rd	C	30.4	C	32.8		
Stroh Rd / Road C (Hess Ranch Rd)	C	31.1	C	20.5		
Stroh Rd / Red Elder	B	14.8	A	2.9		
Stroh Rd / Motsenbocker Rd	C	30.4	C	34.2		
Crowfoot Valley Rd / N Pinery Pkwy	A	8.8	B	18.0		

(1) Average Control Delay in Seconds per Vehicle

Several intersections will require free right turn lanes with an added acceleration lane due to high projected right turning volumes. Acceleration lanes are required at these locations for the following movements:

6.0 SUMMARY AND RECOMMENDATIONS

Based upon the analysis presented in this report, the following conclusions can be made regarding the traffic impacts and roadway network requirements of the proposed Anthology North development.

- When completed, the Anthology North development will encompass just over 1,200 acres of mixed residential and commercial planning areas as well as schools, parks and open space. Hess Ranch, the southern portion of the study area, will contain approximately 1,500 acres.
- The planned areas of the Anthology North and Hess Ranch developments are estimated to generate approximately 98,500 net off-site vehicle trips on an average weekday. The Institute of Transportation Engineers code for “Shopping Center” was used for the commercial planning areas because specific site uses have not yet been determined, which may overstate the traffic volumes generated. In addition, retail square footage was calculated as the maximum developable area of 20 percent of the land use net acreage, but based on market conditions it is likely actual development and the resulting trip generation will be lower. Using these assumptions, approximately 45 percent of the daily trips are projected to be commercial trips, even though the mixed use and commercial areas make up less than 8 percent of the total net area of land. Once specific land uses are determined an updated detailed traffic study may be submitted and the intersection and roadway laneage recommendations may be modified.
- The distribution of site-generated traffic is anticipated to be highest to the west and north given the site’s location in the southeast Denver Metropolitan area. Chambers Road north of the development will carry a substantial portion of the site traffic as it leads to E-470, RidgeGate Parkway, Lincoln Avenue, and the Arapahoe Road corridor. Hess Road will also carry a significant portion of the site traffic to I-25. Crowfoot Valley Road will carry a considerable amount of development traffic to Castle Rock and the southwest.
- The roadway system proposed for the Anthology North and Hess Ranch developments is consistent with the roadways as defined in the *Town of Parker Roadway System Evaluation* and the *Town of Parker Transportation Master Plan* (March 2014).
- Most proposed signalized intersections are expected to operate at an acceptable LOS during the 2035 morning and evening peak hours with the recommended laneage improvements described in Section 5.2 and 5.3. It is recommended the intersections with movements that do not meet the Town’s criteria of a LOS E or F will be revisited when the commercial land uses have been finalized.
- Based on the *State Highway Access Code* standards and the peak hour traffic volume estimates, it is estimated that most of the signalized intersections within the development will require an exclusive left turn and right turn deceleration lane or dual left turn lanes, and several intersections will require a channelized right turn lane with an acceleration lane.

- Progression for through traffic along Chambers Road, Stroh Road, and Hess Road will be challenging due to the constraints of the signal timing at the intersections of arterial roadways with high through and turning traffic volumes. An intermediate stop built into the progression is anticipated along Chambers Road at the Stroh Road intersection.
- Many of the planned 2035 roadway laneages are warranted by the development of land outside of the Anthology North and Hess Ranch developments as well as existing travel demand, particularly along Stroh Road, Chambers Road, Hess Road and Motsenbocker Road/Crowfoot Valley Road.
- Further analysis of specific site access, traffic controls and internal local streets will be necessary in conjunction with subsequent submittals for approval of individual development parcels. The need for additional development access, off-site access, specific signalization warrants, and improvements to the existing roadway network to support additional traffic will be evaluated at that time.

APPENDIX F

95TH PERCENTILE QUEUE RESULTS

Queuing and Blocking Report
 Long-Term Background 2041 + Project AM

06/24/2020

Intersection: 1: E. Hess Rd & S. Chambers Rd.

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	L	T	T	R	L	L	T	T	R	L	L
Maximum Queue (ft)	169	248	296	283	353	232	245	474	454	471	472	558
Average Queue (ft)	78	130	214	175	129	226	236	374	256	248	319	411
95th Queue (ft)	173	211	292	255	253	244	262	594	436	436	445	572
Link Distance (ft)			758	758				459	459	459		
Upstream Blk Time (%)								9	0	1		0
Queuing Penalty (veh)								51	1	5		0
Storage Bay Dist (ft)	400	400			400	220	220				535	535
Storage Blk Time (%)						10	42	0				1
Queuing Penalty (veh)						25	106	1				4

Intersection: 1: E. Hess Rd & S. Chambers Rd.

Movement	NB	NB	NB	NB	SB	SB	SB	SB	SB	SB
Directions Served	T	T	T	R	L	L	T	T	T	R
Maximum Queue (ft)	574	574	597	460	292	288	327	311	264	56
Average Queue (ft)	410	440	475	409	168	164	223	217	160	11
95th Queue (ft)	570	606	673	531	264	258	294	285	220	48
Link Distance (ft)	559	559	559			719	719	719	719	
Upstream Blk Time (%)	1	2	8							
Queuing Penalty (veh)	0	0	0							
Storage Bay Dist (ft)				435	450					550
Storage Blk Time (%)	1		1	13						
Queuing Penalty (veh)	9		12	81						

Intersection: 2: S. Chambers Rd. & S. Red Sky Dr.

Movement	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	R	T	T	T	R	L	T	T	T
Maximum Queue (ft)	93	87	528	639	642	459	310	137	191	116
Average Queue (ft)	82	50	161	212	239	38	134	61	93	51
95th Queue (ft)	107	99	363	439	475	174	230	119	148	106
Link Distance (ft)	85	85	719	719	719	719		754	754	754
Upstream Blk Time (%)	46	12								
Queuing Penalty (veh)	93	25								
Storage Bay Dist (ft)							450			
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 3: S. Red Sky Dr. & S. Swift Fox Way

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	102	51	87	220
Average Queue (ft)	23	8	29	82
95th Queue (ft)	84	35	71	197
Link Distance (ft)	90	312	72	336
Upstream Blk Time (%)	2		2	
Queuing Penalty (veh)	5		0	
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 4: E. Hess Rd & Firefly Ln

Movement	EB	EB	EB	WB	WB	WB	SB
Directions Served	L	T	T	T	T	R	LR
Maximum Queue (ft)	51	314	322	365	536	31	94
Average Queue (ft)	10	126	151	197	179	3	20
95th Queue (ft)	34	245	268	335	365	15	57
Link Distance (ft)		626	626	616	616		243
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	215					215	
Storage Blk Time (%)		2			4		
Queuing Penalty (veh)		0			1		

Intersection: 5: E. Hess Rd & ProjDwy

Movement	WB	WB	WB	SB
Directions Served	T	T	TR	R
Maximum Queue (ft)	413	334	78	98
Average Queue (ft)	112	36	5	57
95th Queue (ft)	307	179	30	107
Link Distance (ft)	626	626	626	83
Upstream Blk Time (%)				16
Queuing Penalty (veh)				0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 6: S. Red Sky Dr.

Movement	EB	WB
Directions Served	TR	T
Maximum Queue (ft)	98	153
Average Queue (ft)	9	108
95th Queue (ft)	50	183
Link Distance (ft)	85	90
Upstream Blk Time (%)	1	33
Queuing Penalty (veh)	4	131
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 555

Queuing and Blocking Report
 Long-Term Background 2041 + Project PM

06/24/2020

Intersection: 1: E. Hess Rd & S. Chambers Rd.

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	L	T	T	R	L	L	T	T	R	L	L
Maximum Queue (ft)	196	249	734	813	425	232	245	474	203	470	548	559
Average Queue (ft)	68	128	415	778	425	231	244	465	103	120	536	557
95th Queue (ft)	185	220	825	795	425	234	245	473	168	379	560	562
Link Distance (ft)			759	759				459	459	459		
Upstream Blk Time (%)				80				48		4	0	36
Queuing Penalty (veh)				0				277		26	0	0
Storage Bay Dist (ft)	400	400			400	220	220				535	535
Storage Blk Time (%)				2	75	24	64				2	67
Queuing Penalty (veh)				16	215	61	163				10	288

Intersection: 1: E. Hess Rd & S. Chambers Rd.

Movement	NB	NB	NB	NB	SB	SB	SB	SB	SB	SB	B12	B12
Directions Served	T	T	T	R	L	L	T	T	T	R	T	T
Maximum Queue (ft)	622	558	574	460	307	426	415	415	402	307	438	435
Average Queue (ft)	578	316	278	226	292	361	381	380	378	225	298	321
95th Queue (ft)	595	511	486	457	347	459	395	392	391	449	562	522
Link Distance (ft)	559	559	559			307	307	307	307		353	353
Upstream Blk Time (%)	39	0	1		4	43	62	64	58	1	22	26
Queuing Penalty (veh)	0	0	0		0	329	476	489	450	0	173	201
Storage Bay Dist (ft)				435	535						435	
Storage Blk Time (%)	17		6	0	4	43			58	1		
Queuing Penalty (veh)	116		49	1	17	186			70	7		

Intersection: 1: E. Hess Rd & S. Chambers Rd.

Movement	B12	B12
Directions Served	T	T
Maximum Queue (ft)	434	409
Average Queue (ft)	310	305
95th Queue (ft)	500	510
Link Distance (ft)	353	353
Upstream Blk Time (%)	20	24
Queuing Penalty (veh)	157	184
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Queuing and Blocking Report
 Long-Term Background 2041 + Project PM

06/24/2020

Intersection: 2: S. Chambers Rd. & S. Red Sky Dr.

Movement	WB	WB	NB	NB	NB	NB	B12	B12	B12	B12	SB	SB
Directions Served	L	R	T	T	T	R	T	T	T	T	L	T
Maximum Queue (ft)	90	77	186	224	306	426	287	289	307	366	425	795
Average Queue (ft)	83	5	34	75	81	300	19	46	92	146	399	759
95th Queue (ft)	91	30	124	170	190	542	136	190	293	420	492	833
Link Distance (ft)	77	77	353	353	353	353	307	307	307	307		756
Upstream Blk Time (%)	84	1				47		0	0	24		50
Queuing Penalty (veh)	140	2				226		0	1	115		0
Storage Bay Dist (ft)												400
Storage Blk Time (%)												38
Queuing Penalty (veh)												369
												40

Intersection: 2: S. Chambers Rd. & S. Red Sky Dr.

Movement	SB	SB
Directions Served	T	T
Maximum Queue (ft)	808	787
Average Queue (ft)	762	637
95th Queue (ft)	857	1000
Link Distance (ft)	756	756
Upstream Blk Time (%)	50	11
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 3: S. Red Sky Dr. & S. Swift Fox Way

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	116	94	106	388
Average Queue (ft)	93	29	85	344
95th Queue (ft)	118	81	93	363
Link Distance (ft)	96	312	72	336
Upstream Blk Time (%)	67		100	100
Queuing Penalty (veh)	139		0	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 4: E. Hess Rd & Firefly Ln

Movement	EB	EB	EB	WB	WB	WB	SB
Directions Served	L	T	T	T	T	R	LR
Maximum Queue (ft)	73	193	201	668	654	225	52
Average Queue (ft)	25	109	137	636	632	12	28
95th Queue (ft)	58	166	180	654	644	81	53
Link Distance (ft)		626	626	616	616		243
Upstream Blk Time (%)				83	31		
Queuing Penalty (veh)				0	0		
Storage Bay Dist (ft)	215					215	
Storage Blk Time (%)					2	0	
Queuing Penalty (veh)					1	0	

Intersection: 5: E. Hess Rd & ProjDwy

Movement	WB	WB	SB
Directions Served	T	TR	R
Maximum Queue (ft)	647	118	286
Average Queue (ft)	637	8	277
95th Queue (ft)	646	55	284
Link Distance (ft)	626	626	271
Upstream Blk Time (%)	23		100
Queuing Penalty (veh)	133		0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 6: S. Red Sky Dr.

Movement	EB	WB
Directions Served	TR	T
Maximum Queue (ft)	94	152
Average Queue (ft)	67	134
95th Queue (ft)	114	148
Link Distance (ft)	77	96
Upstream Blk Time (%)	65	83
Queuing Penalty (veh)	242	278
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 5646

APPENDIX G

SIGNAL WARRANT WORKSHEETS

**SIGNAL WARRANT SUMMARY TABLE
CHAMBERS AND HESS DEVELOPMENT**

#	INTERSECTION	EXISTING (2019)		2021 BACKGROUND		2021 TOTAL		2041 BACKGROUND		2041 TOTAL	
		Warrant Number		Warrant Number		Warrant Number		Warrant Number		Warrant Number	
		Met		Met		Met		Met		Met	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
2	S. Chambers Rd./S. Red Sky Dr.	1,2,3	No	*	No	*	1,2,3	*	*	*	*
4	E. Hess Rd./ Firefly Ln	No	No	No	No	No	No	No	No	No	No

Footnotes:

1= Eight-hour warrant, 2= Four-hour warrant, 3= Peak-hour warrant

* = Met in previous year study scenario

Signal Warrants Report For Intersection 2: S. Chambers Road and S. Red Sky Dr

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	Yes
#2	Four Hour Vehicular Volume	Yes
#3	Peak Hour	Yes

Intersection Warrants Parameters

Major Approaches	S, N
Minor Approaches	E
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	S	N	E
1	995	420	165
2	955	403	158
3	935	395	155
4	796	336	132
5	756	319	125
6	677	286	112
7	627	265	104
8	597	252	99
9	478	202	79
10	448	189	74
11	448	189	74
12	428	181	71
13	388	164	64
14	358	151	59
15	358	151	59
16	348	147	58
17	199	84	33
18	109	46	18
19	100	42	17
20	40	17	7
21	30	13	5
22	30	13	5
23	20	8	3
24	20	8	3

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	7	1415	2	165	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	7	1358	2	158	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	7	1330	2	155	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	7	1132	2	132	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	7	1075	2	125	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No
6	7	963	2	112	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No
7	7	892	2	104	No	No	No	No	No	Yes	Yes	Yes	Yes	No
8	7	849	2	99	No	No	No	No	No	Yes	Yes	Yes	Yes	No
9	7	680	2	79	No	No	No	No	No	No	Yes	Yes	No	No
10	7	637	2	74	No	No	No	No	No	No	Yes	Yes	No	No
11	7	637	2	74	No	No	No	No	No	No	Yes	Yes	No	No
12	7	609	2	71	No	No	No	No	No	No	No	Yes	No	No
13	7	552	2	64	No	No	No	No	No	No	No	Yes	No	No
14	7	509	2	59	No	No	No	No	No	No	No	Yes	No	No
15	7	509	2	59	No	No	No	No	No	No	No	Yes	No	No
16	7	495	2	58	No	No	No	No	No	No	No	No	No	No
17	7	283	2	33	No	No	No	No	No	No	No	No	No	No
18	7	155	2	18	No	No	No	No	No	No	No	No	No	No
19	7	142	2	17	No	No	No	No	No	No	No	No	No	No
20	7	57	2	7	No	No	No	No	No	No	No	No	No	No
21	7	43	2	5	No	No	No	No	No	No	No	No	No	No
22	7	43	2	5	No	No	No	No	No	No	No	No	No	No
23	7	28	2	3	No	No	No	No	No	No	No	No	No	No
24	7	28	2	3	No	No	No	No	No	No	No	No	No	No
Hours Met					0	1	3	6	6	8	11	15	8	4

Warrant 3 Condition A

Orientation	E
Total Stopped Delay Per Vehicle on Minor Approach (s)	21
Number of Lanes on Minor Street Approach	2
VehicleHours of Stopped Delay on Minor Approach ([h]h:mm)	0:57
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	165
High Minor Volume Condition Met	Yes
Total Entering Volume on All Approaches During Same Hour	1580
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	No
Warrant Met for Intersection	No

Signal Warrants Report For Intersection 4: E. Hess Road and Firefly Lane

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	E, W
Minor Approaches	N
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	E	W	N
1	1473	753	10
2	1414	723	10
3	1385	708	9
4	1178	602	8
5	1119	572	8
6	1002	512	7
7	928	474	6
8	884	452	6
9	707	361	5
10	663	339	5
11	663	339	5
12	633	324	4
13	574	294	4
14	530	271	4
15	530	271	4
16	516	264	4
17	295	151	2
18	162	83	1
19	147	75	1
20	59	30	0
21	44	23	0
22	44	23	0
23	29	15	0
24	29	15	0

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	5	2226	1	10	No	No	No	No	No	No	No	No	No	No
2	5	2137	1	10	No	No	No	No	No	No	No	No	No	No
3	5	2093	1	9	No	No	No	No	No	No	No	No	No	No
4	5	1780	1	8	No	No	No	No	No	No	No	No	No	No
5	5	1691	1	8	No	No	No	No	No	No	No	No	No	No
6	5	1514	1	7	No	No	No	No	No	No	No	No	No	No
7	5	1402	1	6	No	No	No	No	No	No	No	No	No	No
8	5	1336	1	6	No	No	No	No	No	No	No	No	No	No
9	5	1068	1	5	No	No	No	No	No	No	No	No	No	No
10	5	1002	1	5	No	No	No	No	No	No	No	No	No	No
11	5	1002	1	5	No	No	No	No	No	No	No	No	No	No
12	5	957	1	4	No	No	No	No	No	No	No	No	No	No
13	5	868	1	4	No	No	No	No	No	No	No	No	No	No
14	5	801	1	4	No	No	No	No	No	No	No	No	No	No
15	5	801	1	4	No	No	No	No	No	No	No	No	No	No
16	5	780	1	4	No	No	No	No	No	No	No	No	No	No
17	5	446	1	2	No	No	No	No	No	No	No	No	No	No
18	5	245	1	1	No	No	No	No	No	No	No	No	No	No
19	5	222	1	1	No	No	No	No	No	No	No	No	No	No
20	5	89	1	0	No	No	No	No	No	No	No	No	No	No
21	5	67	1	0	No	No	No	No	No	No	No	No	No	No
22	5	67	1	0	No	No	No	No	No	No	No	No	No	No
23	5	44	1	0	No	No	No	No	No	No	No	No	No	No
24	5	44	1	0	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	0	0	0	0	0	0	0

Warrant 3 Condition A

Orientation	N
Total Stopped Delay Per Vehicle on Minor Approach (s)	40.9
Number of Lanes on Minor Street Approach	1
VehicleHours of Stopped Delay on Minor Approach ([h]:mm)	0:06
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	10
High Minor Volume Condition Met	No
Total Entering Volume on All Approaches During Same Hour	2236
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	No
Warrant Met for Intersection	No

Study Intersections



Signal Warrants Report For Intersection 2: S. Chambers Road and S. Red Sky Dr

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	S, N
Minor Approaches	E
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	S	N	E
1	392	995	51
2	376	955	49
3	368	935	48
4	314	796	41
5	298	756	39
6	267	677	35
7	247	627	32
8	235	597	31
9	188	478	24
10	176	448	23
11	176	448	23
12	169	428	22
13	153	388	20
14	141	358	18
15	141	358	18
16	137	348	18
17	78	199	10
18	43	109	6
19	39	100	5
20	16	40	2
21	12	30	2
22	12	30	2
23	8	20	1
24	8	20	1

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	7	1387	2	51	No	No	No	No	No	No	No	No	No	No
2	7	1331	2	49	No	No	No	No	No	No	No	No	No	No
3	7	1303	2	48	No	No	No	No	No	No	No	No	No	No
4	7	1110	2	41	No	No	No	No	No	No	No	No	No	No
5	7	1054	2	39	No	No	No	No	No	No	No	No	No	No
6	7	944	2	35	No	No	No	No	No	No	No	No	No	No
7	7	874	2	32	No	No	No	No	No	No	No	No	No	No
8	7	832	2	31	No	No	No	No	No	No	No	No	No	No
9	7	666	2	24	No	No	No	No	No	No	No	No	No	No
10	7	624	2	23	No	No	No	No	No	No	No	No	No	No
11	7	624	2	23	No	No	No	No	No	No	No	No	No	No
12	7	597	2	22	No	No	No	No	No	No	No	No	No	No
13	7	541	2	20	No	No	No	No	No	No	No	No	No	No
14	7	499	2	18	No	No	No	No	No	No	No	No	No	No
15	7	499	2	18	No	No	No	No	No	No	No	No	No	No
16	7	485	2	18	No	No	No	No	No	No	No	No	No	No
17	7	277	2	10	No	No	No	No	No	No	No	No	No	No
18	7	152	2	6	No	No	No	No	No	No	No	No	No	No
19	7	139	2	5	No	No	No	No	No	No	No	No	No	No
20	7	56	2	2	No	No	No	No	No	No	No	No	No	No
21	7	42	2	2	No	No	No	No	No	No	No	No	No	No
22	7	42	2	2	No	No	No	No	No	No	No	No	No	No
23	7	28	2	1	No	No	No	No	No	No	No	No	No	No
24	7	28	2	1	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	0	0	0	0	0	0	0

Warrant 3 Condition A

Orientation	E
Total Stopped Delay Per Vehicle on Minor Approach (s)	14.8
Number of Lanes on Minor Street Approach	2
VehicleHours of Stopped Delay on Minor Approach ([h]h:mm)	0:12
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	51
High Minor Volume Condition Met	No
Total Entering Volume on All Approaches During Same Hour	1438
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	No
Warrant Met for Intersection	No

Signal Warrants Report For Intersection 4: E. Hess Road and Firefly Lane

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	E, W
Minor Approaches	N
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	E	W	N
1	708	1440	8
2	680	1382	8
3	666	1354	8
4	566	1152	6
5	538	1094	6
6	481	979	5
7	446	907	5
8	425	864	5
9	340	691	4
10	319	648	4
11	319	648	4
12	304	619	3
13	276	562	3
14	255	518	3
15	255	518	3
16	248	504	3
17	142	288	2
18	78	158	1
19	71	144	1
20	28	58	0
21	21	43	0
22	21	43	0
23	14	29	0
24	14	29	0

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	6	2148	1	8	No	No	No	No	No	No	No	No	No	No
2	6	2062	1	8	No	No	No	No	No	No	No	No	No	No
3	6	2020	1	8	No	No	No	No	No	No	No	No	No	No
4	6	1718	1	6	No	No	No	No	No	No	No	No	No	No
5	6	1632	1	6	No	No	No	No	No	No	No	No	No	No
6	6	1460	1	5	No	No	No	No	No	No	No	No	No	No
7	6	1353	1	5	No	No	No	No	No	No	No	No	No	No
8	6	1289	1	5	No	No	No	No	No	No	No	No	No	No
9	6	1031	1	4	No	No	No	No	No	No	No	No	No	No
10	6	967	1	4	No	No	No	No	No	No	No	No	No	No
11	6	967	1	4	No	No	No	No	No	No	No	No	No	No
12	6	923	1	3	No	No	No	No	No	No	No	No	No	No
13	6	838	1	3	No	No	No	No	No	No	No	No	No	No
14	6	773	1	3	No	No	No	No	No	No	No	No	No	No
15	6	773	1	3	No	No	No	No	No	No	No	No	No	No
16	6	752	1	3	No	No	No	No	No	No	No	No	No	No
17	6	430	1	2	No	No	No	No	No	No	No	No	No	No
18	6	236	1	1	No	No	No	No	No	No	No	No	No	No
19	6	215	1	1	No	No	No	No	No	No	No	No	No	No
20	6	86	1	0	No	No	No	No	No	No	No	No	No	No
21	6	64	1	0	No	No	No	No	No	No	No	No	No	No
22	6	64	1	0	No	No	No	No	No	No	No	No	No	No
23	6	43	1	0	No	No	No	No	No	No	No	No	No	No
24	6	43	1	0	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	0	0	0	0	0	0	0

Warrant 3 Condition A

Orientation	N
Total Stopped Delay Per Vehicle on Minor Approach (s)	32.2
Number of Lanes on Minor Street Approach	1
VehicleHours of Stopped Delay on Minor Approach ([h]:mm)	0:04
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	8
High Minor Volume Condition Met	No
Total Entering Volume on All Approaches During Same Hour	2156
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	No
Warrant Met for Intersection	No

Study Intersections



Signal Warrants Report For Intersection 2: S. Chambers Road and S. Red Sky Dr

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	S, N
Minor Approaches	E
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	S	N	E
1	1030	430	72
2	989	413	69
3	968	404	68
4	824	344	58
5	783	327	55
6	700	292	49
7	649	271	45
8	618	258	43
9	494	206	35
10	464	194	32
11	464	194	32
12	443	185	31
13	402	168	28
14	371	155	26
15	371	155	26
16	361	151	25
17	206	86	14
18	113	47	8
19	103	43	7
20	41	17	3
21	31	13	2
22	31	13	2
23	21	9	1
24	21	9	1

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	7	1460	2	72	No	No	No	No	No	No	Yes	Yes	No	No
2	7	1402	2	69	No	No	No	No	No	No	No	Yes	No	No
3	7	1372	2	68	No	No	No	No	No	No	No	Yes	No	No
4	7	1168	2	58	No	No	No	No	No	No	No	Yes	No	No
5	7	1110	2	55	No	No	No	No	No	No	No	No	No	No
6	7	992	2	49	No	No	No	No	No	No	No	No	No	No
7	7	920	2	45	No	No	No	No	No	No	No	No	No	No
8	7	876	2	43	No	No	No	No	No	No	No	No	No	No
9	7	700	2	35	No	No	No	No	No	No	No	No	No	No
10	7	658	2	32	No	No	No	No	No	No	No	No	No	No
11	7	658	2	32	No	No	No	No	No	No	No	No	No	No
12	7	628	2	31	No	No	No	No	No	No	No	No	No	No
13	7	570	2	28	No	No	No	No	No	No	No	No	No	No
14	7	526	2	26	No	No	No	No	No	No	No	No	No	No
15	7	526	2	26	No	No	No	No	No	No	No	No	No	No
16	7	512	2	25	No	No	No	No	No	No	No	No	No	No
17	7	292	2	14	No	No	No	No	No	No	No	No	No	No
18	7	160	2	8	No	No	No	No	No	No	No	No	No	No
19	7	146	2	7	No	No	No	No	No	No	No	No	No	No
20	7	58	2	3	No	No	No	No	No	No	No	No	No	No
21	7	44	2	2	No	No	No	No	No	No	No	No	No	No
22	7	44	2	2	No	No	No	No	No	No	No	No	No	No
23	7	30	2	1	No	No	No	No	No	No	No	No	No	No
24	7	30	2	1	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	0	0	0	1	4	0	0

Warrant 3 Condition A

Orientation	E
Total Stopped Delay Per Vehicle on Minor Approach (s)	16.4
Number of Lanes on Minor Street Approach	2
VehicleHours of Stopped Delay on Minor Approach ([h]:mm)	0:19
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	72
High Minor Volume Condition Met	No
Total Entering Volume on All Approaches During Same Hour	1532
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	No
Warrant Met for Intersection	No

Signal Warrants Report For Intersection 4: E. Hess Road and Firefly Lane

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	E, W
Minor Approaches	N
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	E	W	N
1	1593	814	10
2	1529	781	10
3	1497	765	9
4	1274	651	8
5	1211	619	8
6	1083	554	7
7	1004	513	6
8	956	488	6
9	765	391	5
10	717	366	5
11	717	366	5
12	685	350	4
13	621	317	4
14	573	293	4
15	573	293	4
16	558	285	4
17	319	163	2
18	175	90	1
19	159	81	1
20	64	33	0
21	48	24	0
22	48	24	0
23	32	16	0
24	32	16	0

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	6	2407	1	10	No	No	No	No	No	No	No	No	No	No
2	6	2310	1	10	No	No	No	No	No	No	No	No	No	No
3	6	2262	1	9	No	No	No	No	No	No	No	No	No	No
4	6	1925	1	8	No	No	No	No	No	No	No	No	No	No
5	6	1830	1	8	No	No	No	No	No	No	No	No	No	No
6	6	1637	1	7	No	No	No	No	No	No	No	No	No	No
7	6	1517	1	6	No	No	No	No	No	No	No	No	No	No
8	6	1444	1	6	No	No	No	No	No	No	No	No	No	No
9	6	1156	1	5	No	No	No	No	No	No	No	No	No	No
10	6	1083	1	5	No	No	No	No	No	No	No	No	No	No
11	6	1083	1	5	No	No	No	No	No	No	No	No	No	No
12	6	1035	1	4	No	No	No	No	No	No	No	No	No	No
13	6	938	1	4	No	No	No	No	No	No	No	No	No	No
14	6	866	1	4	No	No	No	No	No	No	No	No	No	No
15	6	866	1	4	No	No	No	No	No	No	No	No	No	No
16	6	843	1	4	No	No	No	No	No	No	No	No	No	No
17	6	482	1	2	No	No	No	No	No	No	No	No	No	No
18	6	265	1	1	No	No	No	No	No	No	No	No	No	No
19	6	240	1	1	No	No	No	No	No	No	No	No	No	No
20	6	97	1	0	No	No	No	No	No	No	No	No	No	No
21	6	72	1	0	No	No	No	No	No	No	No	No	No	No
22	6	72	1	0	No	No	No	No	No	No	No	No	No	No
23	6	48	1	0	No	No	No	No	No	No	No	No	No	No
24	6	48	1	0	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	0	0	0	0	0	0	0

Warrant 3 Condition A

Orientation	N
Total Stopped Delay Per Vehicle on Minor Approach (s)	50.3
Number of Lanes on Minor Street Approach	1
VehicleHours of Stopped Delay on Minor Approach ([h]:mm)	0:08
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	10
High Minor Volume Condition Met	No
Total Entering Volume on All Approaches During Same Hour	2417
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	No
Warrant Met for Intersection	No

Study Intersections



Signal Warrants Report For Intersection 2: S. Chambers Road and S. Red Sky Dr

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	Yes
#2	Four Hour Vehicular Volume	Yes
#3	Peak Hour	Yes

Intersection Warrants Parameters

Major Approaches	S, N
Minor Approaches	E
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	S	N	E
1	1076	455	176
2	1033	437	169
3	1011	428	165
4	861	364	141
5	818	346	134
6	732	309	120
7	678	287	111
8	646	273	106
9	516	218	84
10	484	205	79
11	484	205	79
12	463	196	76
13	420	177	69
14	387	164	63
15	387	164	63
16	377	159	62
17	215	91	35
18	118	50	19
19	108	46	18
20	43	18	7
21	32	14	5
22	32	14	5
23	22	9	4
24	22	9	4

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	7	1531	2	176	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	7	1470	2	169	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	7	1439	2	165	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	7	1225	2	141	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	7	1164	2	134	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6	7	1041	2	120	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No
7	7	965	2	111	No	No	No	No	Yes	Yes	Yes	Yes	Yes	No
8	7	919	2	106	No	No	No	No	Yes	Yes	Yes	Yes	Yes	No
9	7	734	2	84	No	No	No	No	No	Yes	Yes	Yes	No	No
10	7	689	2	79	No	No	No	No	No	No	Yes	Yes	No	No
11	7	689	2	79	No	No	No	No	No	No	Yes	Yes	No	No
12	7	659	2	76	No	No	No	No	No	No	Yes	Yes	No	No
13	7	597	2	69	No	No	No	No	No	No	No	Yes	No	No
14	7	551	2	63	No	No	No	No	No	No	No	Yes	No	No
15	7	551	2	63	No	No	No	No	No	No	No	Yes	No	No
16	7	536	2	62	No	No	No	No	No	No	No	Yes	No	No
17	7	306	2	35	No	No	No	No	No	No	No	No	No	No
18	7	168	2	19	No	No	No	No	No	No	No	No	No	No
19	7	154	2	18	No	No	No	No	No	No	No	No	No	No
20	7	61	2	7	No	No	No	No	No	No	No	No	No	No
21	7	46	2	5	No	No	No	No	No	No	No	No	No	No
22	7	46	2	5	No	No	No	No	No	No	No	No	No	No
23	7	31	2	4	No	No	No	No	No	No	No	No	No	No
24	7	31	2	4	No	No	No	No	No	No	No	No	No	No
Hours Met					0	3	4	6	8	9	12	16	8	5

Warrant 3 Condition A

Orientation	E
Total Stopped Delay Per Vehicle on Minor Approach (s)	25
Number of Lanes on Minor Street Approach	2
VehicleHours of Stopped Delay on Minor Approach ([h]h:mm)	1:13
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	176
High Minor Volume Condition Met	Yes
Total Entering Volume on All Approaches During Same Hour	1707
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	No
Warrant Met for Intersection	No

Signal Warrants Report For Intersection 4: E. Hess Road and Firefly Lane

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	E, W
Minor Approaches	N
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	E	W	N
1	1593	814	10
2	1529	781	10
3	1497	765	9
4	1274	651	8
5	1211	619	8
6	1083	554	7
7	1004	513	6
8	956	488	6
9	765	391	5
10	717	366	5
11	717	366	5
12	685	350	4
13	621	317	4
14	573	293	4
15	573	293	4
16	558	285	4
17	319	163	2
18	175	90	1
19	159	81	1
20	64	33	0
21	48	24	0
22	48	24	0
23	32	16	0
24	32	16	0

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	6	2407	1	10	No	No	No	No	No	No	No	No	No	No
2	6	2310	1	10	No	No	No	No	No	No	No	No	No	No
3	6	2262	1	9	No	No	No	No	No	No	No	No	No	No
4	6	1925	1	8	No	No	No	No	No	No	No	No	No	No
5	6	1830	1	8	No	No	No	No	No	No	No	No	No	No
6	6	1637	1	7	No	No	No	No	No	No	No	No	No	No
7	6	1517	1	6	No	No	No	No	No	No	No	No	No	No
8	6	1444	1	6	No	No	No	No	No	No	No	No	No	No
9	6	1156	1	5	No	No	No	No	No	No	No	No	No	No
10	6	1083	1	5	No	No	No	No	No	No	No	No	No	No
11	6	1083	1	5	No	No	No	No	No	No	No	No	No	No
12	6	1035	1	4	No	No	No	No	No	No	No	No	No	No
13	6	938	1	4	No	No	No	No	No	No	No	No	No	No
14	6	866	1	4	No	No	No	No	No	No	No	No	No	No
15	6	866	1	4	No	No	No	No	No	No	No	No	No	No
16	6	843	1	4	No	No	No	No	No	No	No	No	No	No
17	6	482	1	2	No	No	No	No	No	No	No	No	No	No
18	6	265	1	1	No	No	No	No	No	No	No	No	No	No
19	6	240	1	1	No	No	No	No	No	No	No	No	No	No
20	6	97	1	0	No	No	No	No	No	No	No	No	No	No
21	6	72	1	0	No	No	No	No	No	No	No	No	No	No
22	6	72	1	0	No	No	No	No	No	No	No	No	No	No
23	6	48	1	0	No	No	No	No	No	No	No	No	No	No
24	6	48	1	0	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	0	0	0	0	0	0	0

Warrant 3 Condition A

Orientation	N
Total Stopped Delay Per Vehicle on Minor Approach (s)	50.3
Number of Lanes on Minor Street Approach	1
VehicleHours of Stopped Delay on Minor Approach ([h]h:mm)	0:08
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	10
High Minor Volume Condition Met	No
Total Entering Volume on All Approaches During Same Hour	2417
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	No
Warrant Met for Intersection	No

Study Intersections



Signal Warrants Report For Intersection 2: S. Chambers Road and S. Red Sky Dr

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	S, N
Minor Approaches	E
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	S	N	E
1	417	1072	47
2	400	1029	45
3	392	1008	44
4	334	858	38
5	317	815	36
6	284	729	32
7	263	675	30
8	250	643	28
9	200	515	23
10	188	482	21
11	188	482	21
12	179	461	20
13	163	418	18
14	150	386	17
15	150	386	17
16	146	375	16
17	83	214	9
18	46	118	5
19	42	107	5
20	17	43	2
21	13	32	1
22	13	32	1
23	8	21	1
24	8	21	1

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	7	1489	2	47	No	No	No	No	No	No	No	No	No	No
2	7	1429	2	45	No	No	No	No	No	No	No	No	No	No
3	7	1400	2	44	No	No	No	No	No	No	No	No	No	No
4	7	1192	2	38	No	No	No	No	No	No	No	No	No	No
5	7	1132	2	36	No	No	No	No	No	No	No	No	No	No
6	7	1013	2	32	No	No	No	No	No	No	No	No	No	No
7	7	938	2	30	No	No	No	No	No	No	No	No	No	No
8	7	893	2	28	No	No	No	No	No	No	No	No	No	No
9	7	715	2	23	No	No	No	No	No	No	No	No	No	No
10	7	670	2	21	No	No	No	No	No	No	No	No	No	No
11	7	670	2	21	No	No	No	No	No	No	No	No	No	No
12	7	640	2	20	No	No	No	No	No	No	No	No	No	No
13	7	581	2	18	No	No	No	No	No	No	No	No	No	No
14	7	536	2	17	No	No	No	No	No	No	No	No	No	No
15	7	536	2	17	No	No	No	No	No	No	No	No	No	No
16	7	521	2	16	No	No	No	No	No	No	No	No	No	No
17	7	297	2	9	No	No	No	No	No	No	No	No	No	No
18	7	164	2	5	No	No	No	No	No	No	No	No	No	No
19	7	149	2	5	No	No	No	No	No	No	No	No	No	No
20	7	60	2	2	No	No	No	No	No	No	No	No	No	No
21	7	45	2	1	No	No	No	No	No	No	No	No	No	No
22	7	45	2	1	No	No	No	No	No	No	No	No	No	No
23	7	29	2	1	No	No	No	No	No	No	No	No	No	No
24	7	29	2	1	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	0	0	0	0	0	0	0

Warrant 3 Condition A

Orientation	E
Total Stopped Delay Per Vehicle on Minor Approach (s)	14.6
Number of Lanes on Minor Street Approach	2
VehicleHours of Stopped Delay on Minor Approach ([h]h:mm)	0:11
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	47
High Minor Volume Condition Met	No
Total Entering Volume on All Approaches During Same Hour	1536
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	No
Warrant Met for Intersection	No

Signal Warrants Report For Intersection 4: E. Hess Road and Firefly Lane

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	E, W
Minor Approaches	N
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	E	W	N
1	765	1555	8
2	734	1493	8
3	719	1462	8
4	612	1244	6
5	581	1182	6
6	520	1057	5
7	482	980	5
8	459	933	5
9	367	746	4
10	344	700	4
11	344	700	4
12	329	669	3
13	298	606	3
14	275	560	3
15	275	560	3
16	268	544	3
17	153	311	2
18	84	171	1
19	77	156	1
20	31	62	0
21	23	47	0
22	23	47	0
23	15	31	0
24	15	31	0

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	6	2320	1	8	No	No	No	No	No	No	No	No	No	No
2	6	2227	1	8	No	No	No	No	No	No	No	No	No	No
3	6	2181	1	8	No	No	No	No	No	No	No	No	No	No
4	6	1856	1	6	No	No	No	No	No	No	No	No	No	No
5	6	1763	1	6	No	No	No	No	No	No	No	No	No	No
6	6	1577	1	5	No	No	No	No	No	No	No	No	No	No
7	6	1462	1	5	No	No	No	No	No	No	No	No	No	No
8	6	1392	1	5	No	No	No	No	No	No	No	No	No	No
9	6	1113	1	4	No	No	No	No	No	No	No	No	No	No
10	6	1044	1	4	No	No	No	No	No	No	No	No	No	No
11	6	1044	1	4	No	No	No	No	No	No	No	No	No	No
12	6	998	1	3	No	No	No	No	No	No	No	No	No	No
13	6	904	1	3	No	No	No	No	No	No	No	No	No	No
14	6	835	1	3	No	No	No	No	No	No	No	No	No	No
15	6	835	1	3	No	No	No	No	No	No	No	No	No	No
16	6	812	1	3	No	No	No	No	No	No	No	No	No	No
17	6	464	1	2	No	No	No	No	No	No	No	No	No	No
18	6	255	1	1	No	No	No	No	No	No	No	No	No	No
19	6	233	1	1	No	No	No	No	No	No	No	No	No	No
20	6	93	1	0	No	No	No	No	No	No	No	No	No	No
21	6	70	1	0	No	No	No	No	No	No	No	No	No	No
22	6	70	1	0	No	No	No	No	No	No	No	No	No	No
23	6	46	1	0	No	No	No	No	No	No	No	No	No	No
24	6	46	1	0	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	0	0	0	0	0	0	0

Warrant 3 Condition A

Orientation	N
Total Stopped Delay Per Vehicle on Minor Approach (s)	37.7
Number of Lanes on Minor Street Approach	1
VehicleHours of Stopped Delay on Minor Approach ([h]:mm)	0:05
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	8
High Minor Volume Condition Met	No
Total Entering Volume on All Approaches During Same Hour	2328
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	No
Warrant Met for Intersection	No

Study Intersections



Signal Warrants Report For Intersection 2: S. Chambers Road and S. Red Sky Dr

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	S, N
Minor Approaches	E
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	S	N	E
1	424	1077	55
2	407	1034	53
3	399	1012	52
4	339	862	44
5	322	819	42
6	288	732	37
7	267	679	35
8	254	646	33
9	204	517	26
10	191	485	25
11	191	485	25
12	182	463	24
13	165	420	21
14	153	388	20
15	153	388	20
16	148	377	19
17	85	215	11
18	47	118	6
19	42	108	6
20	17	43	2
21	13	32	2
22	13	32	2
23	8	22	1
24	8	22	1

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	7	1501	2	55	No	No	No	No	No	No	No	No	No	No
2	7	1441	2	53	No	No	No	No	No	No	No	No	No	No
3	7	1411	2	52	No	No	No	No	No	No	No	No	No	No
4	7	1201	2	44	No	No	No	No	No	No	No	No	No	No
5	7	1141	2	42	No	No	No	No	No	No	No	No	No	No
6	7	1020	2	37	No	No	No	No	No	No	No	No	No	No
7	7	946	2	35	No	No	No	No	No	No	No	No	No	No
8	7	900	2	33	No	No	No	No	No	No	No	No	No	No
9	7	721	2	26	No	No	No	No	No	No	No	No	No	No
10	7	676	2	25	No	No	No	No	No	No	No	No	No	No
11	7	676	2	25	No	No	No	No	No	No	No	No	No	No
12	7	645	2	24	No	No	No	No	No	No	No	No	No	No
13	7	585	2	21	No	No	No	No	No	No	No	No	No	No
14	7	541	2	20	No	No	No	No	No	No	No	No	No	No
15	7	541	2	20	No	No	No	No	No	No	No	No	No	No
16	7	525	2	19	No	No	No	No	No	No	No	No	No	No
17	7	300	2	11	No	No	No	No	No	No	No	No	No	No
18	7	165	2	6	No	No	No	No	No	No	No	No	No	No
19	7	150	2	6	No	No	No	No	No	No	No	No	No	No
20	7	60	2	2	No	No	No	No	No	No	No	No	No	No
21	7	45	2	2	No	No	No	No	No	No	No	No	No	No
22	7	45	2	2	No	No	No	No	No	No	No	No	No	No
23	7	30	2	1	No	No	No	No	No	No	No	No	No	No
24	7	30	2	1	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	0	0	0	0	0	0	0

Warrant 3 Condition A

Orientation	E
Total Stopped Delay Per Vehicle on Minor Approach (s)	16
Number of Lanes on Minor Street Approach	2
VehicleHours of Stopped Delay on Minor Approach ([h]h:mm)	0:14
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	55
High Minor Volume Condition Met	No
Total Entering Volume on All Approaches During Same Hour	1556
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	No
Warrant Met for Intersection	No

Signal Warrants Report For Intersection 4: E. Hess Road and Firefly Lane

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	E, W
Minor Approaches	N
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	E	W	N
1	765	1555	8
2	734	1493	8
3	719	1462	8
4	612	1244	6
5	581	1182	6
6	520	1057	5
7	482	980	5
8	459	933	5
9	367	746	4
10	344	700	4
11	344	700	4
12	329	669	3
13	298	606	3
14	275	560	3
15	275	560	3
16	268	544	3
17	153	311	2
18	84	171	1
19	77	156	1
20	31	62	0
21	23	47	0
22	23	47	0
23	15	31	0
24	15	31	0

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	6	2320	1	8	No	No	No	No	No	No	No	No	No	No
2	6	2227	1	8	No	No	No	No	No	No	No	No	No	No
3	6	2181	1	8	No	No	No	No	No	No	No	No	No	No
4	6	1856	1	6	No	No	No	No	No	No	No	No	No	No
5	6	1763	1	6	No	No	No	No	No	No	No	No	No	No
6	6	1577	1	5	No	No	No	No	No	No	No	No	No	No
7	6	1462	1	5	No	No	No	No	No	No	No	No	No	No
8	6	1392	1	5	No	No	No	No	No	No	No	No	No	No
9	6	1113	1	4	No	No	No	No	No	No	No	No	No	No
10	6	1044	1	4	No	No	No	No	No	No	No	No	No	No
11	6	1044	1	4	No	No	No	No	No	No	No	No	No	No
12	6	998	1	3	No	No	No	No	No	No	No	No	No	No
13	6	904	1	3	No	No	No	No	No	No	No	No	No	No
14	6	835	1	3	No	No	No	No	No	No	No	No	No	No
15	6	835	1	3	No	No	No	No	No	No	No	No	No	No
16	6	812	1	3	No	No	No	No	No	No	No	No	No	No
17	6	464	1	2	No	No	No	No	No	No	No	No	No	No
18	6	255	1	1	No	No	No	No	No	No	No	No	No	No
19	6	233	1	1	No	No	No	No	No	No	No	No	No	No
20	6	93	1	0	No	No	No	No	No	No	No	No	No	No
21	6	70	1	0	No	No	No	No	No	No	No	No	No	No
22	6	70	1	0	No	No	No	No	No	No	No	No	No	No
23	6	46	1	0	No	No	No	No	No	No	No	No	No	No
24	6	46	1	0	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	0	0	0	0	0	0	0

Warrant 3 Condition A

Orientation	N
Total Stopped Delay Per Vehicle on Minor Approach (s)	37.7
Number of Lanes on Minor Street Approach	1
VehicleHours of Stopped Delay on Minor Approach ([h]h:mm)	0:05
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	8
High Minor Volume Condition Met	No
Total Entering Volume on All Approaches During Same Hour	2328
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	No
Warrant Met for Intersection	No

Signal Warrants Report For Intersection 2: S. Chambers Road and S. Red Sky Dr

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	Yes
#2	Four Hour Vehicular Volume	Yes
#3	Peak Hour	Yes

Intersection Warrants Parameters

Major Approaches	S, N
Minor Approaches	E
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	S	N	E
1	1114	535	373
2	1069	514	358
3	1047	503	351
4	891	428	298
5	847	407	283
6	758	364	254
7	702	337	235
8	668	321	224
9	535	257	179
10	501	241	168
11	501	241	168
12	479	230	160
13	434	209	145
14	401	193	134
15	401	193	134
16	390	187	131
17	223	107	75
18	123	59	41
19	111	54	37
20	45	21	15
21	33	16	11
22	33	16	11
23	22	11	7
24	22	11	7

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	7	1649	2	373	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	7	1583	2	358	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	7	1550	2	351	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	7	1319	2	298	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	7	1254	2	283	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6	7	1122	2	254	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7	7	1039	2	235	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8	7	989	2	224	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9	7	792	2	179	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No
10	7	742	2	168	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No
11	7	742	2	168	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No
12	7	709	2	160	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No
13	7	643	2	145	No	No	Yes	Yes	No	No	Yes	Yes	No	No
14	7	594	2	134	No	No	No	Yes	No	No	No	Yes	No	No
15	7	594	2	134	No	No	No	Yes	No	No	No	Yes	No	No
16	7	577	2	131	No	No	No	Yes	No	No	No	Yes	No	No
17	7	330	2	75	No	No	No	No	No	No	No	No	No	No
18	7	182	2	41	No	No	No	No	No	No	No	No	No	No
19	7	165	2	37	No	No	No	No	No	No	No	No	No	No
20	7	66	2	15	No	No	No	No	No	No	No	No	No	No
21	7	49	2	11	No	No	No	No	No	No	No	No	No	No
22	7	49	2	11	No	No	No	No	No	No	No	No	No	No
23	7	33	2	7	No	No	No	No	No	No	No	No	No	No
24	7	33	2	7	No	No	No	No	No	No	No	No	No	No
Hours Met					8	12	13	16	8	11	13	16	12	8

Warrant 3 Condition A

Orientation	E
Total Stopped Delay Per Vehicle on Minor Approach (s)	430.7
Number of Lanes on Minor Street Approach	2
VehicleHours of Stopped Delay on Minor Approach ([h]:mm)	44:37
Delay Condition Met	Yes
Volume on Minor Street Approach During Same Hour	373
High Minor Volume Condition Met	Yes
Total Entering Volume on All Approaches During Same Hour	2022
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	Yes
Warrant Met for Intersection	Yes

Signal Warrants Report For Intersection 4: E. Hess Road and Firefly Lane

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	E, W
Minor Approaches	N
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	E	W	N
1	1917	1091	10
2	1840	1047	10
3	1802	1026	9
4	1534	873	8
5	1457	829	8
6	1304	742	7
7	1208	687	6
8	1150	655	6
9	920	524	5
10	863	491	5
11	863	491	5
12	824	469	4
13	748	425	4
14	690	393	4
15	690	393	4
16	671	382	4
17	383	218	2
18	211	120	1
19	192	109	1
20	77	44	0
21	58	33	0
22	58	33	0
23	38	22	0
24	38	22	0

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	6	3008	1	10	No	No	No	No	No	No	No	No	No	No
2	6	2887	1	10	No	No	No	No	No	No	No	No	No	No
3	6	2828	1	9	No	No	No	No	No	No	No	No	No	No
4	6	2407	1	8	No	No	No	No	No	No	No	No	No	No
5	6	2286	1	8	No	No	No	No	No	No	No	No	No	No
6	6	2046	1	7	No	No	No	No	No	No	No	No	No	No
7	6	1895	1	6	No	No	No	No	No	No	No	No	No	No
8	6	1805	1	6	No	No	No	No	No	No	No	No	No	No
9	6	1444	1	5	No	No	No	No	No	No	No	No	No	No
10	6	1354	1	5	No	No	No	No	No	No	No	No	No	No
11	6	1354	1	5	No	No	No	No	No	No	No	No	No	No
12	6	1293	1	4	No	No	No	No	No	No	No	No	No	No
13	6	1173	1	4	No	No	No	No	No	No	No	No	No	No
14	6	1083	1	4	No	No	No	No	No	No	No	No	No	No
15	6	1083	1	4	No	No	No	No	No	No	No	No	No	No
16	6	1053	1	4	No	No	No	No	No	No	No	No	No	No
17	6	601	1	2	No	No	No	No	No	No	No	No	No	No
18	6	331	1	1	No	No	No	No	No	No	No	No	No	No
19	6	301	1	1	No	No	No	No	No	No	No	No	No	No
20	6	121	1	0	No	No	No	No	No	No	No	No	No	No
21	6	91	1	0	No	No	No	No	No	No	No	No	No	No
22	6	91	1	0	No	No	No	No	No	No	No	No	No	No
23	6	60	1	0	No	No	No	No	No	No	No	No	No	No
24	6	60	1	0	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	0	0	0	0	0	0	0

Warrant 3 Condition A

Orientation	N
Total Stopped Delay Per Vehicle on Minor Approach (s)	105.6
Number of Lanes on Minor Street Approach	1
VehicleHours of Stopped Delay on Minor Approach ([h]h:mm)	0:17
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	10
High Minor Volume Condition Met	No
Total Entering Volume on All Approaches During Same Hour	3018
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	No
Warrant Met for Intersection	No

Study Intersections



Signal Warrants Report For Intersection 2: S. Chambers Road and S. Red Sky Dr

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	Yes
#2	Four Hour Vehicular Volume	Yes
#3	Peak Hour	Yes

Intersection Warrants Parameters

Major Approaches	S, N
Minor Approaches	E
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	S	N	E
1	635	1233	587
2	610	1184	564
3	597	1159	552
4	508	986	470
5	483	937	446
6	432	838	399
7	400	777	370
8	381	740	352
9	305	592	282
10	286	555	264
11	286	555	264
12	273	530	252
13	248	481	229
14	229	444	211
15	229	444	211
16	222	432	205
17	127	247	117
18	70	136	65
19	64	123	59
20	25	49	23
21	19	37	18
22	19	37	18
23	13	25	12
24	13	25	12

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	7	1868	2	587	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	7	1794	2	564	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	7	1756	2	552	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	7	1494	2	470	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	7	1420	2	446	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6	7	1270	2	399	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7	7	1177	2	370	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8	7	1121	2	352	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9	7	897	2	282	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
10	7	841	2	264	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
11	7	841	2	264	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
12	7	803	2	252	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
13	7	729	2	229	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No
14	7	673	2	211	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No
15	7	673	2	211	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No
16	7	654	2	205	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No
17	7	374	2	117	No	No	No	Yes	No	No	No	No	No	No
18	7	206	2	65	No	No	No	No	No	No	No	No	No	No
19	7	187	2	59	No	No	No	No	No	No	No	No	No	No
20	7	74	2	23	No	No	No	No	No	No	No	No	No	No
21	7	56	2	18	No	No	No	No	No	No	No	No	No	No
22	7	56	2	18	No	No	No	No	No	No	No	No	No	No
23	7	38	2	12	No	No	No	No	No	No	No	No	No	No
24	7	38	2	12	No	No	No	No	No	No	No	No	No	No
Hours Met					16	16	16	17	8	13	16	16	16	12

Warrant 3 Condition A

Orientation	E
Total Stopped Delay Per Vehicle on Minor Approach (s)	828
Number of Lanes on Minor Street Approach	2
VehicleHours of Stopped Delay on Minor Approach ([h]:mm)	135:00
Delay Condition Met	Yes
Volume on Minor Street Approach During Same Hour	587
High Minor Volume Condition Met	Yes
Total Entering Volume on All Approaches During Same Hour	2455
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	Yes
Warrant Met for Intersection	Yes

Signal Warrants Report For Intersection 4: E. Hess Road and Firefly Lane

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	E, W
Minor Approaches	N
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	E	W	N
1	1275	2054	8
2	1224	1972	8
3	1199	1931	8
4	1020	1643	6
5	969	1561	6
6	867	1397	5
7	803	1294	5
8	765	1232	5
9	612	986	4
10	574	924	4
11	574	924	4
12	548	883	3
13	497	801	3
14	459	739	3
15	459	739	3
16	446	719	3
17	255	411	2
18	140	226	1
19	128	205	1
20	51	82	0
21	38	62	0
22	38	62	0
23	26	41	0
24	26	41	0

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	6	3329	1	8	No	No	No	No	No	No	No	No	No	No
2	6	3196	1	8	No	No	No	No	No	No	No	No	No	No
3	6	3130	1	8	No	No	No	No	No	No	No	No	No	No
4	6	2663	1	6	No	No	No	No	No	No	No	No	No	No
5	6	2530	1	6	No	No	No	No	No	No	No	No	No	No
6	6	2264	1	5	No	No	No	No	No	No	No	No	No	No
7	6	2097	1	5	No	No	No	No	No	No	No	No	No	No
8	6	1997	1	5	No	No	No	No	No	No	No	No	No	No
9	6	1598	1	4	No	No	No	No	No	No	No	No	No	No
10	6	1498	1	4	No	No	No	No	No	No	No	No	No	No
11	6	1498	1	4	No	No	No	No	No	No	No	No	No	No
12	6	1431	1	3	No	No	No	No	No	No	No	No	No	No
13	6	1298	1	3	No	No	No	No	No	No	No	No	No	No
14	6	1198	1	3	No	No	No	No	No	No	No	No	No	No
15	6	1198	1	3	No	No	No	No	No	No	No	No	No	No
16	6	1165	1	3	No	No	No	No	No	No	No	No	No	No
17	6	666	1	2	No	No	No	No	No	No	No	No	No	No
18	6	366	1	1	No	No	No	No	No	No	No	No	No	No
19	6	333	1	1	No	No	No	No	No	No	No	No	No	No
20	6	133	1	0	No	No	No	No	No	No	No	No	No	No
21	6	100	1	0	No	No	No	No	No	No	No	No	No	No
22	6	100	1	0	No	No	No	No	No	No	No	No	No	No
23	6	67	1	0	No	No	No	No	No	No	No	No	No	No
24	6	67	1	0	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	0	0	0	0	0	0	0

Warrant 3 Condition A

Orientation	N
Total Stopped Delay Per Vehicle on Minor Approach (s)	129.1
Number of Lanes on Minor Street Approach	1
VehicleHours of Stopped Delay on Minor Approach ([h]h:mm)	0:17
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	8
High Minor Volume Condition Met	No
Total Entering Volume on All Approaches During Same Hour	3337
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	No
Warrant Met for Intersection	No

Signal Warrants Report For Intersection 2: S. Chambers Road and S. Red Sky Dr

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	Yes
#2	Four Hour Vehicular Volume	Yes
#3	Peak Hour	Yes

Intersection Warrants Parameters

Major Approaches	S, N
Minor Approaches	E
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	S	N	E
1	2485	1090	175
2	2386	1046	168
3	2336	1025	165
4	1988	872	140
5	1889	828	133
6	1690	741	119
7	1566	687	110
8	1491	654	105
9	1193	523	84
10	1118	491	79
11	1118	491	79
12	1069	469	75
13	969	425	68
14	895	392	63
15	895	392	63
16	870	382	61
17	497	218	35
18	273	120	19
19	249	109	18
20	99	44	7
21	75	33	5
22	75	33	5
23	50	22	4
24	50	22	4

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	7	3575	2	175	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	7	3432	2	168	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	7	3361	2	165	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	7	2860	2	140	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	7	2717	2	133	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6	7	2431	2	119	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7	7	2253	2	110	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
8	7	2145	2	105	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
9	7	1716	2	84	No	No	No	No	No	Yes	Yes	Yes	Yes	No
10	7	1609	2	79	No	No	No	No	No	No	Yes	Yes	No	No
11	7	1609	2	79	No	No	No	No	No	No	Yes	Yes	No	No
12	7	1538	2	75	No	No	No	No	No	No	Yes	Yes	No	No
13	7	1394	2	68	No	No	No	No	No	No	No	Yes	No	No
14	7	1287	2	63	No	No	No	No	No	No	No	Yes	No	No
15	7	1287	2	63	No	No	No	No	No	No	No	Yes	No	No
16	7	1252	2	61	No	No	No	No	No	No	No	Yes	No	No
17	7	715	2	35	No	No	No	No	No	No	No	No	No	No
18	7	393	2	19	No	No	No	No	No	No	No	No	No	No
19	7	358	2	18	No	No	No	No	No	No	No	No	No	No
20	7	143	2	7	No	No	No	No	No	No	No	No	No	No
21	7	108	2	5	No	No	No	No	No	No	No	No	No	No
22	7	108	2	5	No	No	No	No	No	No	No	No	No	No
23	7	72	2	4	No	No	No	No	No	No	No	No	No	No
24	7	72	2	4	No	No	No	No	No	No	No	No	No	No
Hours Met					0	3	4	6	8	9	12	16	9	8

Warrant 3 Condition A

Orientation	E
Total Stopped Delay Per Vehicle on Minor Approach (s)	526
Number of Lanes on Minor Street Approach	2
VehicleHours of Stopped Delay on Minor Approach ([h]:mm)	25:34
Delay Condition Met	Yes
Volume on Minor Street Approach During Same Hour	175
High Minor Volume Condition Met	Yes
Total Entering Volume on All Approaches During Same Hour	3750
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	Yes
Warrant Met for Intersection	Yes

Signal Warrants Report For Intersection 4: E. Hess Road and Firefly Lane

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	E, W
Minor Approaches	N
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	E	W	N
1	1716	1535	20
2	1647	1474	19
3	1613	1443	19
4	1373	1228	16
5	1304	1167	15
6	1167	1044	14
7	1081	967	13
8	1030	921	12
9	824	737	10
10	772	691	9
11	772	691	9
12	738	660	9
13	669	599	8
14	618	553	7
15	618	553	7
16	601	537	7
17	343	307	4
18	189	169	2
19	172	154	2
20	69	61	1
21	51	46	1
22	51	46	1
23	34	31	0
24	34	31	0

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	6	3251	1	20	No	No	No	No	No	No	No	No	No	No
2	6	3121	1	19	No	No	No	No	No	No	No	No	No	No
3	6	3056	1	19	No	No	No	No	No	No	No	No	No	No
4	6	2601	1	16	No	No	No	No	No	No	No	No	No	No
5	6	2471	1	15	No	No	No	No	No	No	No	No	No	No
6	6	2211	1	14	No	No	No	No	No	No	No	No	No	No
7	6	2048	1	13	No	No	No	No	No	No	No	No	No	No
8	6	1951	1	12	No	No	No	No	No	No	No	No	No	No
9	6	1561	1	10	No	No	No	No	No	No	No	No	No	No
10	6	1463	1	9	No	No	No	No	No	No	No	No	No	No
11	6	1463	1	9	No	No	No	No	No	No	No	No	No	No
12	6	1398	1	9	No	No	No	No	No	No	No	No	No	No
13	6	1268	1	8	No	No	No	No	No	No	No	No	No	No
14	6	1171	1	7	No	No	No	No	No	No	No	No	No	No
15	6	1171	1	7	No	No	No	No	No	No	No	No	No	No
16	6	1138	1	7	No	No	No	No	No	No	No	No	No	No
17	6	650	1	4	No	No	No	No	No	No	No	No	No	No
18	6	358	1	2	No	No	No	No	No	No	No	No	No	No
19	6	326	1	2	No	No	No	No	No	No	No	No	No	No
20	6	130	1	1	No	No	No	No	No	No	No	No	No	No
21	6	97	1	1	No	No	No	No	No	No	No	No	No	No
22	6	97	1	1	No	No	No	No	No	No	No	No	No	No
23	6	65	1	0	No	No	No	No	No	No	No	No	No	No
24	6	65	1	0	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	0	0	0	0	0	0	0

Warrant 3 Condition A

Orientation	N
Total Stopped Delay Per Vehicle on Minor Approach (s)	142.7
Number of Lanes on Minor Street Approach	1
VehicleHours of Stopped Delay on Minor Approach ([h]:mm)	0:47
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	20
High Minor Volume Condition Met	No
Total Entering Volume on All Approaches During Same Hour	3271
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	No
Warrant Met for Intersection	No

Study Intersections



Signal Warrants Report For Intersection 2: S. Chambers Road and S. Red Sky Dr

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	S, N
Minor Approaches	E
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	S	N	E
1	1730	2915	55
2	1661	2798	53
3	1626	2740	52
4	1384	2332	44
5	1315	2215	42
6	1176	1982	37
7	1090	1836	35
8	1038	1749	33
9	830	1399	26
10	779	1312	25
11	779	1312	25
12	744	1253	24
13	675	1137	21
14	623	1049	20
15	623	1049	20
16	606	1020	19
17	346	583	11
18	190	321	6
19	173	292	6
20	69	117	2
21	52	87	2
22	52	87	2
23	35	58	1
24	35	58	1

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	7	4645	2	55	No	No	No	No	No	No	No	No	No	No
2	7	4459	2	53	No	No	No	No	No	No	No	No	No	No
3	7	4366	2	52	No	No	No	No	No	No	No	No	No	No
4	7	3716	2	44	No	No	No	No	No	No	No	No	No	No
5	7	3530	2	42	No	No	No	No	No	No	No	No	No	No
6	7	3158	2	37	No	No	No	No	No	No	No	No	No	No
7	7	2926	2	35	No	No	No	No	No	No	No	No	No	No
8	7	2787	2	33	No	No	No	No	No	No	No	No	No	No
9	7	2229	2	26	No	No	No	No	No	No	No	No	No	No
10	7	2091	2	25	No	No	No	No	No	No	No	No	No	No
11	7	2091	2	25	No	No	No	No	No	No	No	No	No	No
12	7	1997	2	24	No	No	No	No	No	No	No	No	No	No
13	7	1812	2	21	No	No	No	No	No	No	No	No	No	No
14	7	1672	2	20	No	No	No	No	No	No	No	No	No	No
15	7	1672	2	20	No	No	No	No	No	No	No	No	No	No
16	7	1626	2	19	No	No	No	No	No	No	No	No	No	No
17	7	929	2	11	No	No	No	No	No	No	No	No	No	No
18	7	511	2	6	No	No	No	No	No	No	No	No	No	No
19	7	465	2	6	No	No	No	No	No	No	No	No	No	No
20	7	186	2	2	No	No	No	No	No	No	No	No	No	No
21	7	139	2	2	No	No	No	No	No	No	No	No	No	No
22	7	139	2	2	No	No	No	No	No	No	No	No	No	No
23	7	93	2	1	No	No	No	No	No	No	No	No	No	No
24	7	93	2	1	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	0	0	0	0	0	0	0

Warrant 3 Condition A

Orientation	E
Total Stopped Delay Per Vehicle on Minor Approach (s)	685.8
Number of Lanes on Minor Street Approach	2
VehicleHours of Stopped Delay on Minor Approach ([h]:mm)	10:28
Delay Condition Met	Yes
Volume on Minor Street Approach During Same Hour	55
High Minor Volume Condition Met	No
Total Entering Volume on All Approaches During Same Hour	4700
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	No
Warrant Met for Intersection	No

Signal Warrants Report For Intersection 4: E. Hess Road and Firefly Lane

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	E, W
Minor Approaches	N
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	E	W	N
1	1636	2140	20
2	1571	2054	19
3	1538	2012	19
4	1309	1712	16
5	1243	1626	15
6	1112	1455	14
7	1031	1348	13
8	982	1284	12
9	785	1027	10
10	736	963	9
11	736	963	9
12	703	920	9
13	638	835	8
14	589	770	7
15	589	770	7
16	573	749	7
17	327	428	4
18	180	235	2
19	164	214	2
20	65	86	1
21	49	64	1
22	49	64	1
23	33	43	0
24	33	43	0

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	6	3776	1	20	No	No	No	No	No	No	No	No	No	No
2	6	3625	1	19	No	No	No	No	No	No	No	No	No	No
3	6	3550	1	19	No	No	No	No	No	No	No	No	No	No
4	6	3021	1	16	No	No	No	No	No	No	No	No	No	No
5	6	2869	1	15	No	No	No	No	No	No	No	No	No	No
6	6	2567	1	14	No	No	No	No	No	No	No	No	No	No
7	6	2379	1	13	No	No	No	No	No	No	No	No	No	No
8	6	2266	1	12	No	No	No	No	No	No	No	No	No	No
9	6	1812	1	10	No	No	No	No	No	No	No	No	No	No
10	6	1699	1	9	No	No	No	No	No	No	No	No	No	No
11	6	1699	1	9	No	No	No	No	No	No	No	No	No	No
12	6	1623	1	9	No	No	No	No	No	No	No	No	No	No
13	6	1473	1	8	No	No	No	No	No	No	No	No	No	No
14	6	1359	1	7	No	No	No	No	No	No	No	No	No	No
15	6	1359	1	7	No	No	No	No	No	No	No	No	No	No
16	6	1322	1	7	No	No	No	No	No	No	No	No	No	No
17	6	755	1	4	No	No	No	No	No	No	No	No	No	No
18	6	415	1	2	No	No	No	No	No	No	No	No	No	No
19	6	378	1	2	No	No	No	No	No	No	No	No	No	No
20	6	151	1	1	No	No	No	No	No	No	No	No	No	No
21	6	113	1	1	No	No	No	No	No	No	No	No	No	No
22	6	113	1	1	No	No	No	No	No	No	No	No	No	No
23	6	76	1	0	No	No	No	No	No	No	No	No	No	No
24	6	76	1	0	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	0	0	0	0	0	0	0

Warrant 3 Condition A

Orientation	N
Total Stopped Delay Per Vehicle on Minor Approach (s)	418.9
Number of Lanes on Minor Street Approach	1
VehicleHours of Stopped Delay on Minor Approach ([h]:mm)	2:19
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	20
High Minor Volume Condition Met	No
Total Entering Volume on All Approaches During Same Hour	3796
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	No
Warrant Met for Intersection	No

Study Intersections



Signal Warrants Report For Intersection 2: S. Chambers Road and S. Red Sky Dr

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	Yes
#2	Four Hour Vehicular Volume	Yes
#3	Peak Hour	Yes

Intersection Warrants Parameters

Major Approaches	S, N
Minor Approaches	E
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	S	N	E
1	2549	1122	239
2	2447	1077	229
3	2396	1055	225
4	2039	898	191
5	1937	853	182
6	1733	763	163
7	1606	707	151
8	1529	673	143
9	1224	539	115
10	1147	505	108
11	1147	505	108
12	1096	482	103
13	994	438	93
14	918	404	86
15	918	404	86
16	892	393	84
17	510	224	48
18	280	123	26
19	255	112	24
20	102	45	10
21	76	34	7
22	76	34	7
23	51	22	5
24	51	22	5

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	7	3671	2	239	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	7	3524	2	229	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	7	3451	2	225	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	7	2937	2	191	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	7	2790	2	182	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6	7	2496	2	163	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7	7	2313	2	151	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8	7	2202	2	143	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9	7	1763	2	115	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10	7	1652	2	108	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
11	7	1652	2	108	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
12	7	1578	2	103	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
13	7	1432	2	93	No	No	No	No	No	Yes	Yes	Yes	Yes	No
14	7	1322	2	86	No	No	No	No	No	Yes	Yes	Yes	Yes	No
15	7	1322	2	86	No	No	No	No	No	Yes	Yes	Yes	Yes	No
16	7	1285	2	84	No	No	No	No	No	Yes	Yes	Yes	Yes	No
17	7	734	2	48	No	No	No	No	No	No	No	No	No	No
18	7	403	2	26	No	No	No	No	No	No	No	No	No	No
19	7	367	2	24	No	No	No	No	No	No	No	No	No	No
20	7	147	2	10	No	No	No	No	No	No	No	No	No	No
21	7	110	2	7	No	No	No	No	No	No	No	No	No	No
22	7	110	2	7	No	No	No	No	No	No	No	No	No	No
23	7	73	2	5	No	No	No	No	No	No	No	No	No	No
24	7	73	2	5	No	No	No	No	No	No	No	No	No	No
Hours Met					3	6	8	9	12	16	16	16	16	12

Warrant 3 Condition A

Orientation	E
Total Stopped Delay Per Vehicle on Minor Approach (s)	2370.2
Number of Lanes on Minor Street Approach	2
VehicleHours of Stopped Delay on Minor Approach ([h]:mm)	157:21
Delay Condition Met	Yes
Volume on Minor Street Approach During Same Hour	239
High Minor Volume Condition Met	Yes
Total Entering Volume on All Approaches During Same Hour	3910
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	Yes
Warrant Met for Intersection	Yes

Signal Warrants Report For Intersection 4: E. Hess Road and Firefly Lane

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	E, W
Minor Approaches	N
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	E	W	N
1	1821	1595	20
2	1748	1531	19
3	1712	1499	19
4	1457	1276	16
5	1384	1212	15
6	1238	1085	14
7	1147	1005	13
8	1093	957	12
9	874	766	10
10	819	718	9
11	819	718	9
12	783	686	9
13	710	622	8
14	656	574	7
15	656	574	7
16	637	558	7
17	364	319	4
18	200	175	2
19	182	160	2
20	73	64	1
21	55	48	1
22	55	48	1
23	36	32	0
24	36	32	0

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	6	3416	1	20	No	No	No	No	No	No	No	No	No	No
2	6	3279	1	19	No	No	No	No	No	No	No	No	No	No
3	6	3211	1	19	No	No	No	No	No	No	No	No	No	No
4	6	2733	1	16	No	No	No	No	No	No	No	No	No	No
5	6	2596	1	15	No	No	No	No	No	No	No	No	No	No
6	6	2323	1	14	No	No	No	No	No	No	No	No	No	No
7	6	2152	1	13	No	No	No	No	No	No	No	No	No	No
8	6	2050	1	12	No	No	No	No	No	No	No	No	No	No
9	6	1640	1	10	No	No	No	No	No	No	No	No	No	No
10	6	1537	1	9	No	No	No	No	No	No	No	No	No	No
11	6	1537	1	9	No	No	No	No	No	No	No	No	No	No
12	6	1469	1	9	No	No	No	No	No	No	No	No	No	No
13	6	1332	1	8	No	No	No	No	No	No	No	No	No	No
14	6	1230	1	7	No	No	No	No	No	No	No	No	No	No
15	6	1230	1	7	No	No	No	No	No	No	No	No	No	No
16	6	1195	1	7	No	No	No	No	No	No	No	No	No	No
17	6	683	1	4	No	No	No	No	No	No	No	No	No	No
18	6	375	1	2	No	No	No	No	No	No	No	No	No	No
19	6	342	1	2	No	No	No	No	No	No	No	No	No	No
20	6	137	1	1	No	No	No	No	No	No	No	No	No	No
21	6	103	1	1	No	No	No	No	No	No	No	No	No	No
22	6	103	1	1	No	No	No	No	No	No	No	No	No	No
23	6	68	1	0	No	No	No	No	No	No	No	No	No	No
24	6	68	1	0	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	0	0	0	0	0	0	0

Warrant 3 Condition A

Orientation	N
Total Stopped Delay Per Vehicle on Minor Approach (s)	194.8
Number of Lanes on Minor Street Approach	1
VehicleHours of Stopped Delay on Minor Approach ([h]:mm)	1:04
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	20
High Minor Volume Condition Met	No
Total Entering Volume on All Approaches During Same Hour	3436
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	No
Warrant Met for Intersection	No

Study Intersections



Signal Warrants Report For Intersection 2: S. Chambers Road and S. Red Sky Dr

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	Yes
#2	Four Hour Vehicular Volume	Yes
#3	Peak Hour	Yes

Intersection Warrants Parameters

Major Approaches	S, N
Minor Approaches	E
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	S	N	E
1	1933	3056	412
2	1856	2934	396
3	1817	2873	387
4	1546	2445	330
5	1469	2323	313
6	1314	2078	280
7	1218	1925	260
8	1160	1834	247
9	928	1467	198
10	870	1375	185
11	870	1375	185
12	831	1314	177
13	754	1192	161
14	696	1100	148
15	696	1100	148
16	677	1070	144
17	387	611	82
18	213	336	45
19	193	306	41
20	77	122	16
21	58	92	12
22	58	92	12
23	39	61	8
24	39	61	8

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	7	4989	2	412	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	7	4790	2	396	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	7	4690	2	387	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	7	3991	2	330	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	7	3792	2	313	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6	7	3392	2	280	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7	7	3143	2	260	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8	7	2994	2	247	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9	7	2395	2	198	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10	7	2245	2	185	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
11	7	2245	2	185	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12	7	2145	2	177	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
13	7	1946	2	161	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
14	7	1796	2	148	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
15	7	1796	2	148	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
16	7	1747	2	144	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
17	7	998	2	82	No	No	No	No	No	Yes	Yes	Yes	Yes	No
18	7	549	2	45	No	No	No	No	No	No	No	No	No	No
19	7	499	2	41	No	No	No	No	No	No	No	No	No	No
20	7	199	2	16	No	No	No	No	No	No	No	No	No	No
21	7	150	2	12	No	No	No	No	No	No	No	No	No	No
22	7	150	2	12	No	No	No	No	No	No	No	No	No	No
23	7	100	2	8	No	No	No	No	No	No	No	No	No	No
24	7	100	2	8	No	No	No	No	No	No	No	No	No	No
Hours Met					8	13	16	16	16	17	17	17	17	16

Warrant 3 Condition A

Orientation	E
Total Stopped Delay Per Vehicle on Minor Approach (s)	6490.2
Number of Lanes on Minor Street Approach	2
VehicleHours of Stopped Delay on Minor Approach ([h]:mm)	742:45
Delay Condition Met	Yes
Volume on Minor Street Approach During Same Hour	412
High Minor Volume Condition Met	Yes
Total Entering Volume on All Approaches During Same Hour	5401
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	Yes
Warrant Met for Intersection	Yes

Signal Warrants Report For Intersection 4: E. Hess Road and Firefly Lane

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	E, W
Minor Approaches	N
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	E	W	N
1	1966	2470	20
2	1887	2371	19
3	1848	2322	19
4	1573	1976	16
5	1494	1877	15
6	1337	1680	14
7	1239	1556	13
8	1180	1482	12
9	944	1186	10
10	885	1112	9
11	885	1112	9
12	845	1062	9
13	767	963	8
14	708	889	7
15	708	889	7
16	688	865	7
17	393	494	4
18	216	272	2
19	197	247	2
20	79	99	1
21	59	74	1
22	59	74	1
23	39	49	0
24	39	49	0

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3 Condition B
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		
1	6	4436	1	20	No	No	No	No	No	No	No	No	No	No
2	6	4258	1	19	No	No	No	No	No	No	No	No	No	No
3	6	4170	1	19	No	No	No	No	No	No	No	No	No	No
4	6	3549	1	16	No	No	No	No	No	No	No	No	No	No
5	6	3371	1	15	No	No	No	No	No	No	No	No	No	No
6	6	3017	1	14	No	No	No	No	No	No	No	No	No	No
7	6	2795	1	13	No	No	No	No	No	No	No	No	No	No
8	6	2662	1	12	No	No	No	No	No	No	No	No	No	No
9	6	2130	1	10	No	No	No	No	No	No	No	No	No	No
10	6	1997	1	9	No	No	No	No	No	No	No	No	No	No
11	6	1997	1	9	No	No	No	No	No	No	No	No	No	No
12	6	1907	1	9	No	No	No	No	No	No	No	No	No	No
13	6	1730	1	8	No	No	No	No	No	No	No	No	No	No
14	6	1597	1	7	No	No	No	No	No	No	No	No	No	No
15	6	1597	1	7	No	No	No	No	No	No	No	No	No	No
16	6	1553	1	7	No	No	No	No	No	No	No	No	No	No
17	6	887	1	4	No	No	No	No	No	No	No	No	No	No
18	6	488	1	2	No	No	No	No	No	No	No	No	No	No
19	6	444	1	2	No	No	No	No	No	No	No	No	No	No
20	6	178	1	1	No	No	No	No	No	No	No	No	No	No
21	6	133	1	1	No	No	No	No	No	No	No	No	No	No
22	6	133	1	1	No	No	No	No	No	No	No	No	No	No
23	6	88	1	0	No	No	No	No	No	No	No	No	No	No
24	6	88	1	0	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	0	0	0	0	0	0	0

Warrant 3 Condition A

Orientation	N
Total Stopped Delay Per Vehicle on Minor Approach (s)	1259.6
Number of Lanes on Minor Street Approach	1
VehicleHours of Stopped Delay on Minor Approach ([h]:mm)	6:59
Delay Condition Met	Yes
Volume on Minor Street Approach During Same Hour	20
High Minor Volume Condition Met	No
Total Entering Volume on All Approaches During Same Hour	4456
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	No
Warrant Met for Intersection	No

Study Intersections



APPENDIX H

TRAFFIC SIGNAL PROGRESSION

