CHAMBERS AND HESS DEVELOPMENT

TRAFFIC IMPACT STUDY (TIS)

TOWN OF PARKER, CO

SEPTEMBER 14, 2020

JOB NUMBER: 18633

RICK ENGINEERING COMPANY

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rickengineering.com

CHAMBERS AND HESS DEVELOPMENT
TRAFFIC IMPACT STUDY (TIS)
TOWN OF PARKER, CO

ORIGINAL JANUARY 23, 2020
REVISED SEPTEMBER 14, 2020

PREPARED FOR:
VENTANA CAPITAL
9801 EAST EASTER AVENUE
CENTENNIAL, CO 80112

PREPARED BY:

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APPENDICES

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)

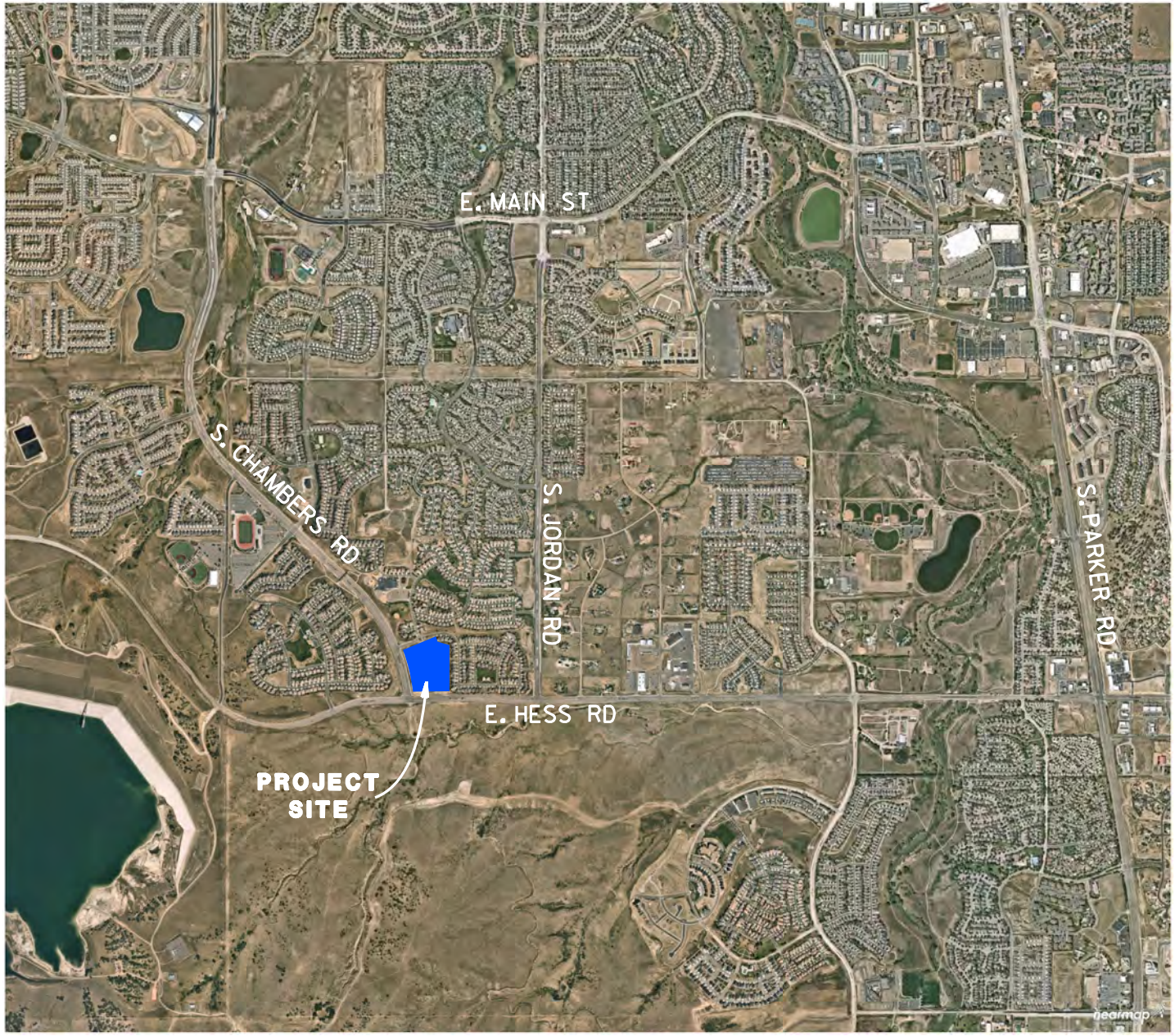

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EXHIBIT 1

VICINITY MAP

CHAMBERS AND HESS DEVELOPMENT

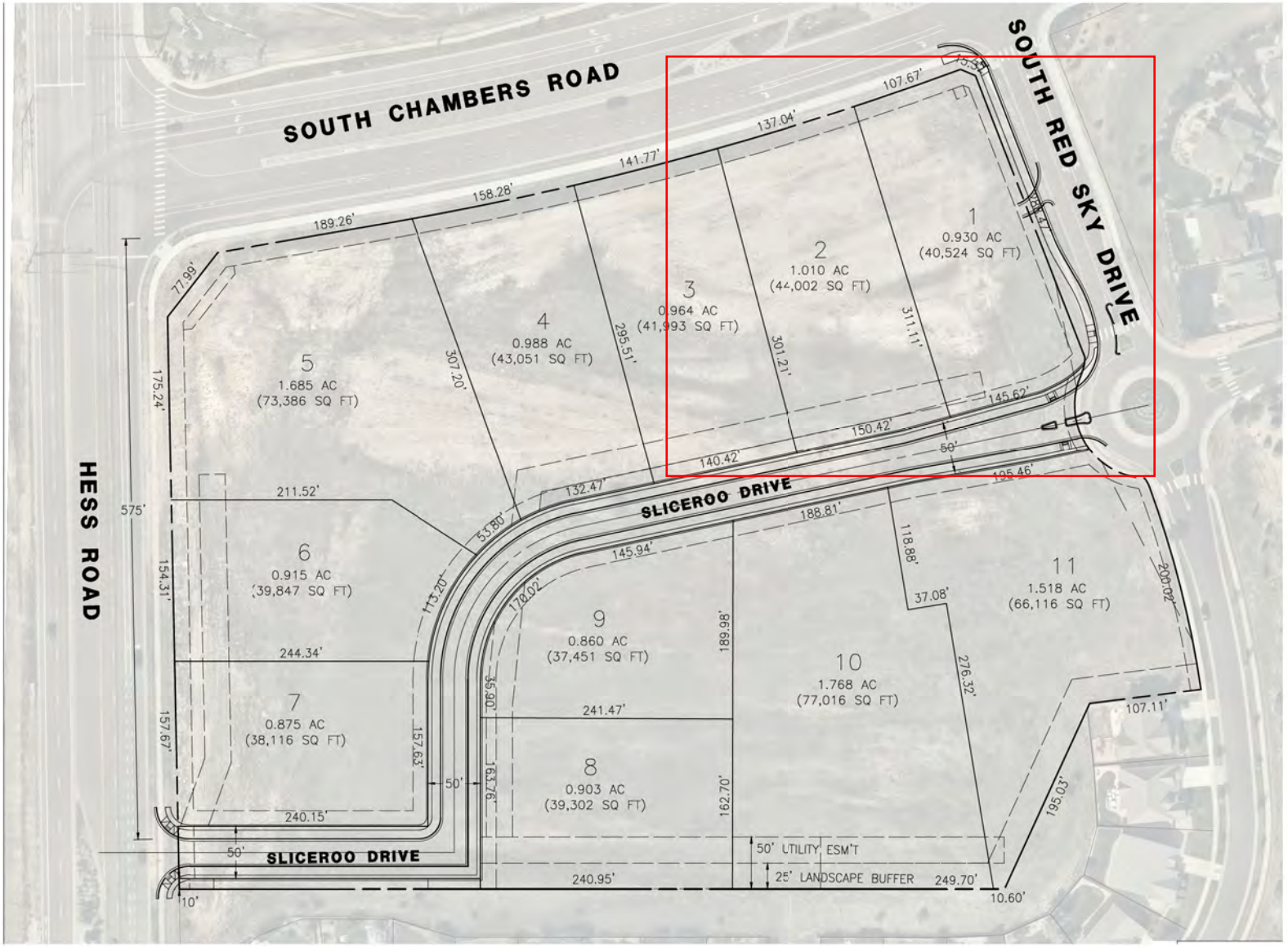

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EXHIBIT 2

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

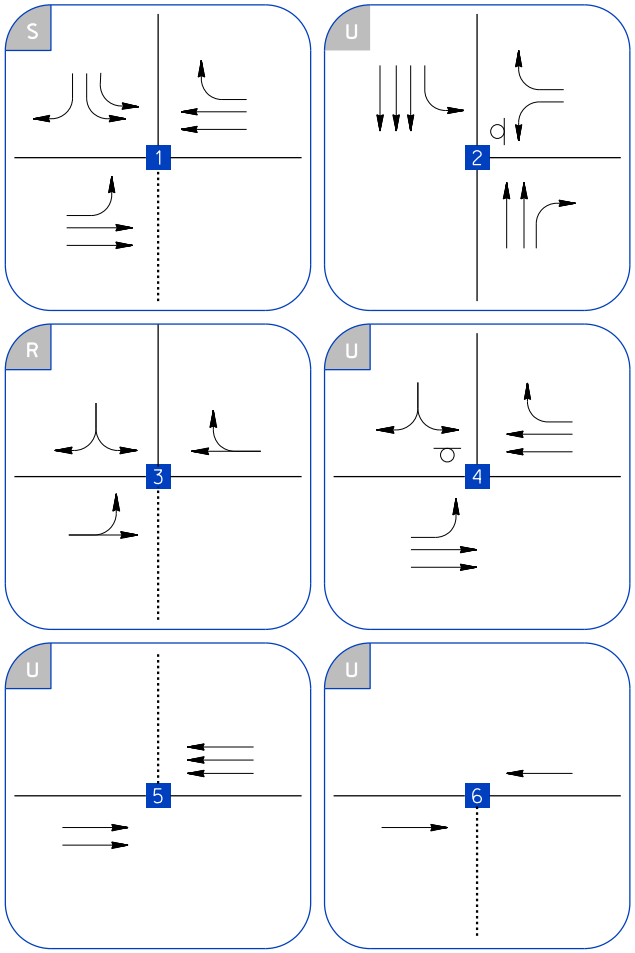
S. Chambers Road/E. Hess Road is currently built as a three-legged signalized intersection, consisting of the following lane configurations; two left turn lanes, and an exclusive right turn lane for the southbound approach; exclusive left turn lane and two through lanes for the eastbound approach; and 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.



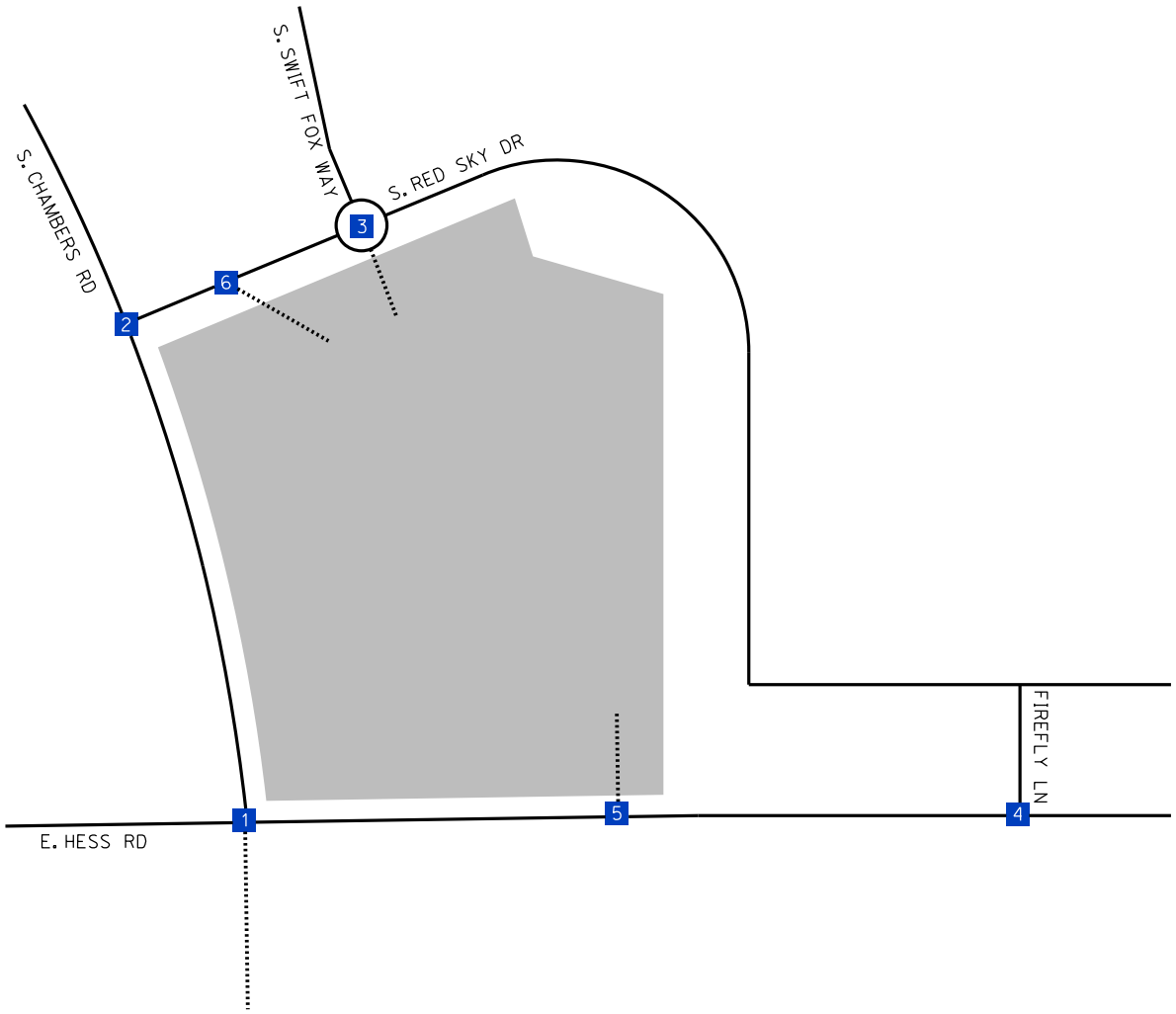


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EXHIBIT 3

EXISTING CONDITIONS

CHAMBERS AND HESS DEVELOPMENT

LEGEND

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

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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

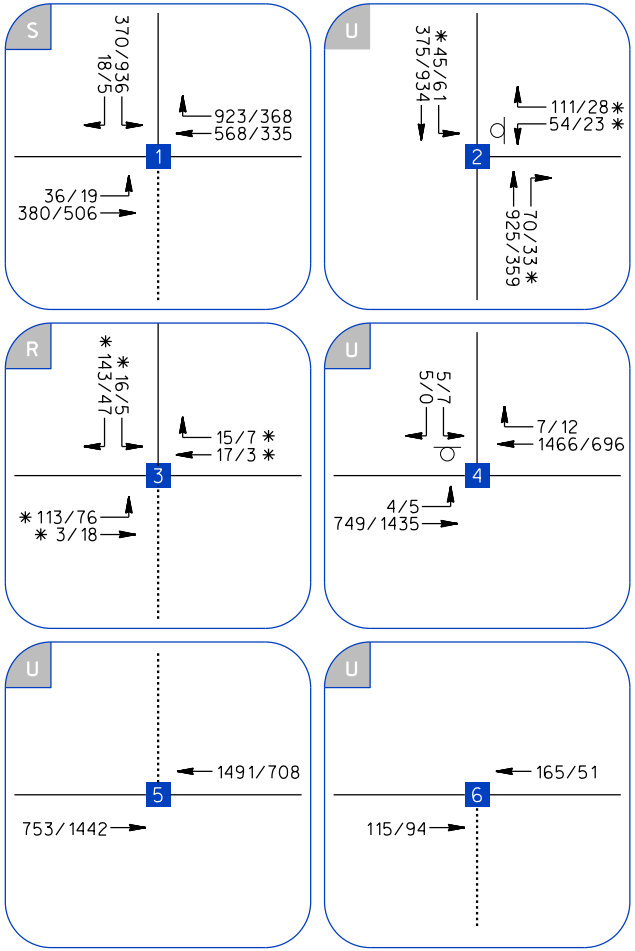
The Level of Service (LOS) for signalized intersections was calculated using the methodologies described in Chapter 19 of the 6th Edition Highway Capacity Manual (HCM 6). The LOS for signalized intersections is defined in terms of control delay, which is made up of several factors that relate to right-of-way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

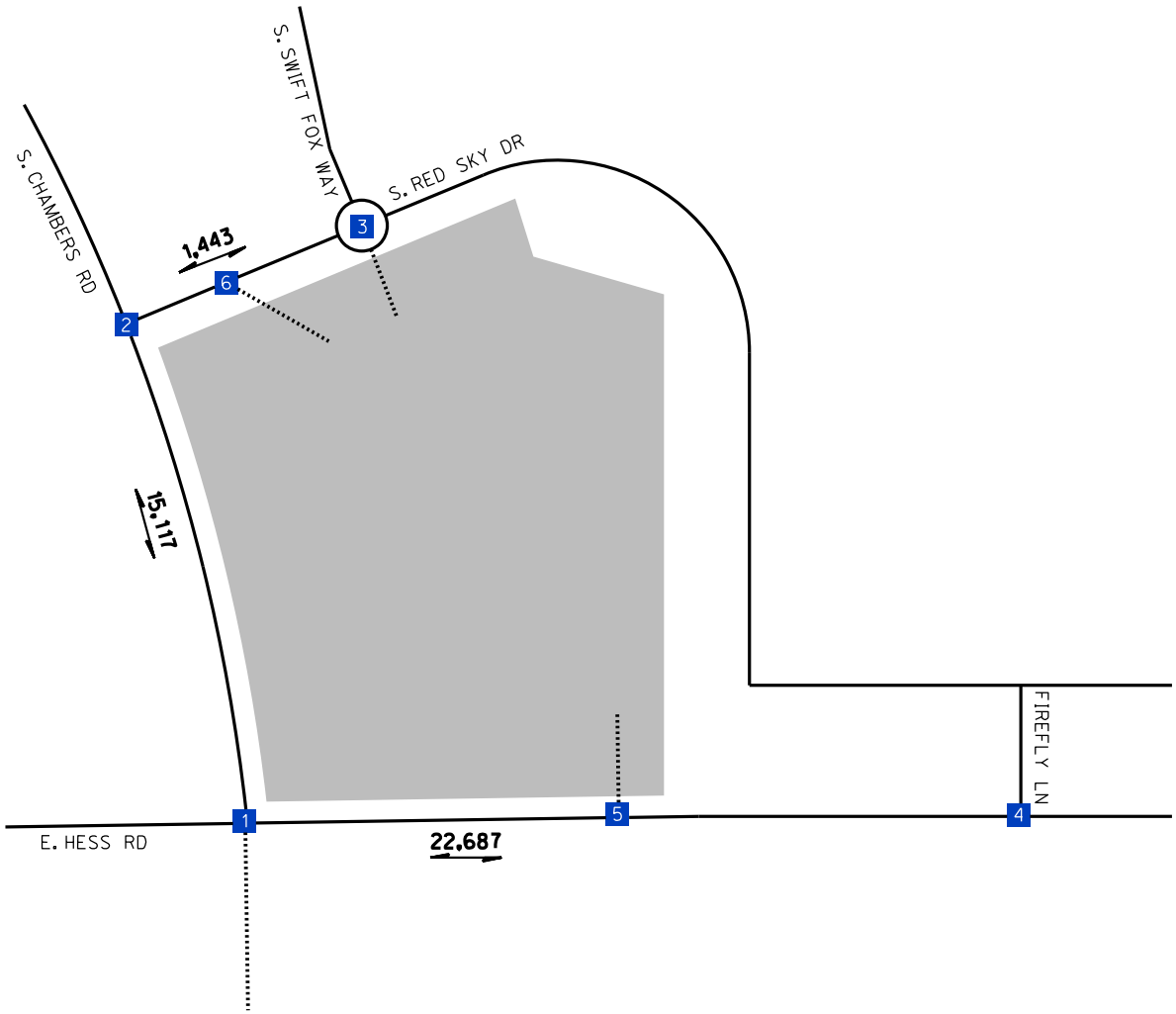
The LOS for two-way and all-way stop controlled intersections was calculated using the methodologies described in Chapters 20 and 21 of the 6th Edition HCM. The LOS for an unsignalized (two-way stop controlled) intersection is determined by the computed control delay for critical movement with corresponding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

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EXHIBIT 4

EXISTING (2019) 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

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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:

- 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	18.9	B	13.0	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. Chmabers 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, just west of 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 9,371 daily weekday trips, of which 804 trips (435 inbound and 369 outbound) are anticipated to be generated during the AM peak hour, and 875 trips (429 inbound and 446 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, provided by Fehr and Peers and minor edits made upon further coordination with Town Staff.

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, adjacent land uses, as well as further coordination with the Town's staff. 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. Consistent with the Anthology Traffic Study, once the fourth leg of Chambers Road at Hess Road intersection is built, traffic patterns are assumed to shift in the long-term. Some of the westbound right-turn traffic volumes from Hess Road, traveling north on Chambers Road, are assumed to shift and originate from the new southern Chambers Road leg. Due to the large increase in traffic volumes anticipated along

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TABLE 3
PROJECT TRIP GENERATION SUMMARY
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LAND USE	QUANTITY		ITE Trip Gen. 10th Edition Code	ADT	AM PEAK HOUR VOLUMES			PM PEAK HOUR 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	168	35	6	41	3	16	19
Pharmacy/Drugstore With a Drive-Through Window	12	TSF	881	1310	24	22	46	61	62	123
Drive-in Bank	3	TSF	912	324	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[1]	6	TSF	942	See Footnote 1	9	5	14	12	14	26
Gasoline/Service Station with Convenience Market	16	VFP	945	3134	106	101	207	114	110	224
Automated Car Wash [2]	1	CWT	948	See Footnote 2				39	39	78
Sub Total				9,524	460	390	850	455	473	926
Internal Capture				74	21	17	38	23	22	44
External Walk, Bike				79	4	4	8	3	4	7
TOTAL NET NEW PROJECT TRIPS				**9,371**	**435**	**369**	**804**	**429**	**446**	**875**

Source : *Fehr and Peers MXD + Methodology and Validation Technical Memorandum, Dated May 06, 2020* - with revisions based on Town's Comments on July 16, 2020, and further coordination with the Town on August 7, 2020

TSF = Thousand Square Feet

VFP = Vehicle Fueling Position

CWT = Car Wash Tunnels

[1]ITE Trip Generation Manual does not publish Weekday Daily Trips for Auto Care Centers. Instead, weekend (Saturday/Sunday) trips are provided in ITE to depict realistic use and hours of operation.

[2]ITE Trip Generation Manual does not publish Weekday Daily Trips or AM peak hour for Automated Car Wash. Instead, weekend (Saturday/Sunday) trips are provided in ITE to depict realistic use and hours of operation.

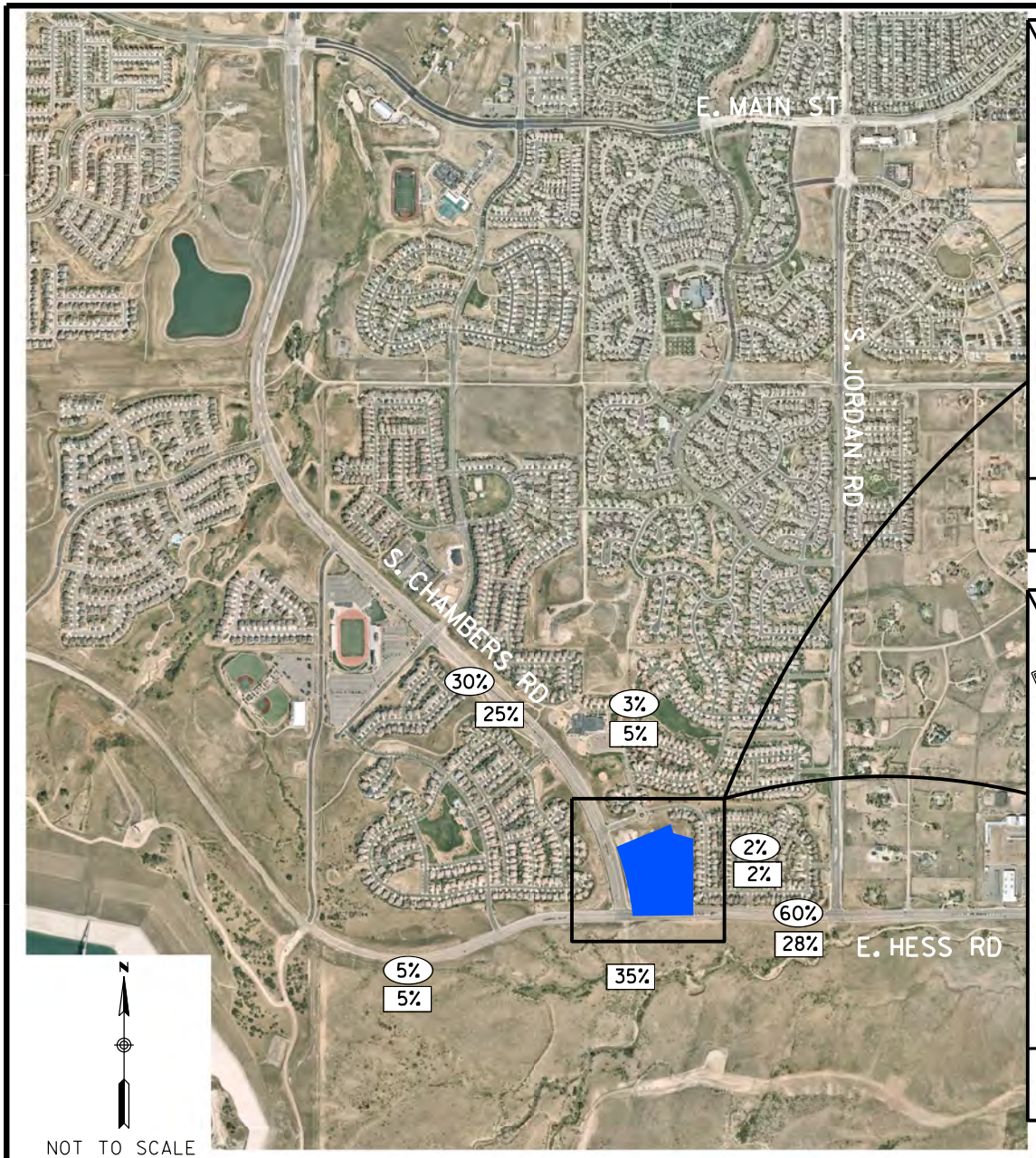
Chambers Road in the long-term, a few additional project traffic (2% more than short term) is also assumed along S. Swift Fox Way, anticipating cut-through traffic through internal streets.

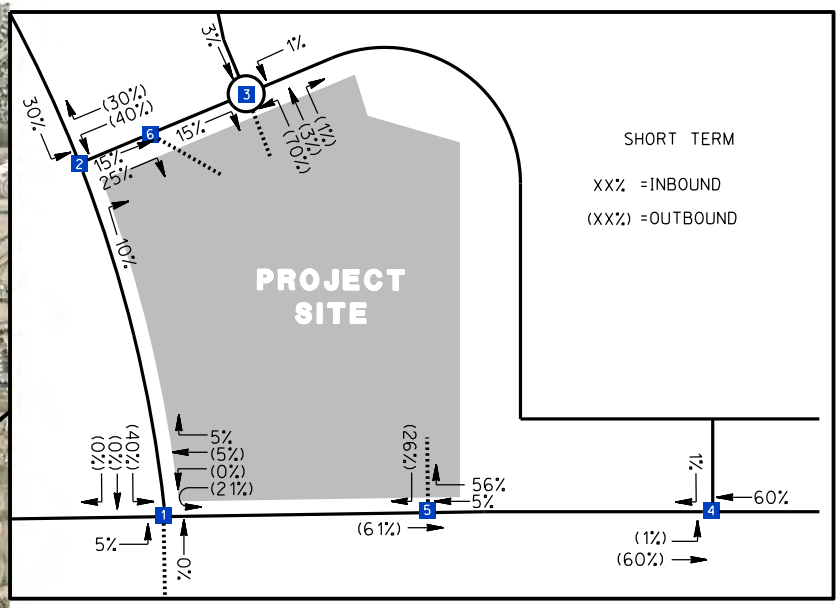
Assumptions for pass-by project traffic were also made as follows: In the short-term, the majority of the project traffic (61%) is assumed to originate from the east on Hess Road. Due to the high number of volumes, it is expected that some of those trips (5%) would pass-by the project driveway at Hess Road to the driveways along S. Red Sky Drive. In comparison, due to traffic patterns shifting in the long-term as noted above, the project traffic assumed from east of Hess Road, is approximately half of the short-term trips (29%), therefore, no project pass-by is assumed at the project driveway on Hess Road, and that all 29% of the in-bound project traffic is anticipated to utilize the driveway on Hess Road.

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.





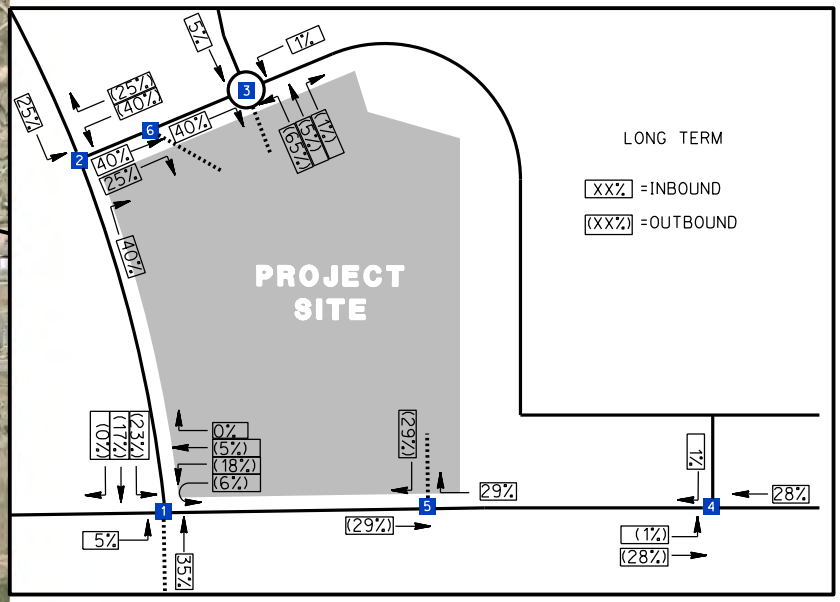


EXHIBIT 5

PROJECT TRIP DISTRIBUTION

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LEGEND

(XX%) =PERCENT DISTRIBUTION - SHORT TERM

XX% =PERCENT DISTRIBUTION - LONG TERM

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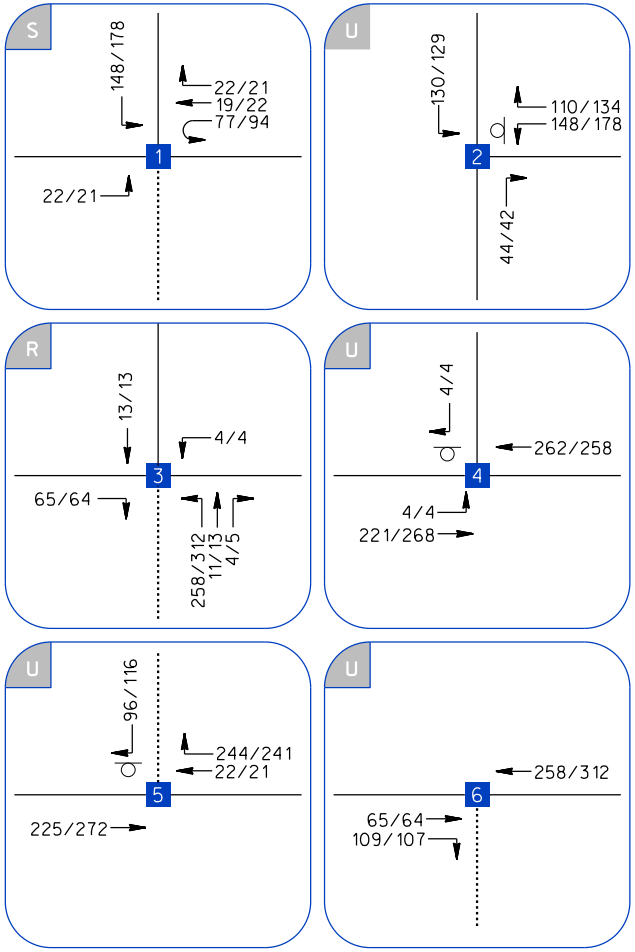

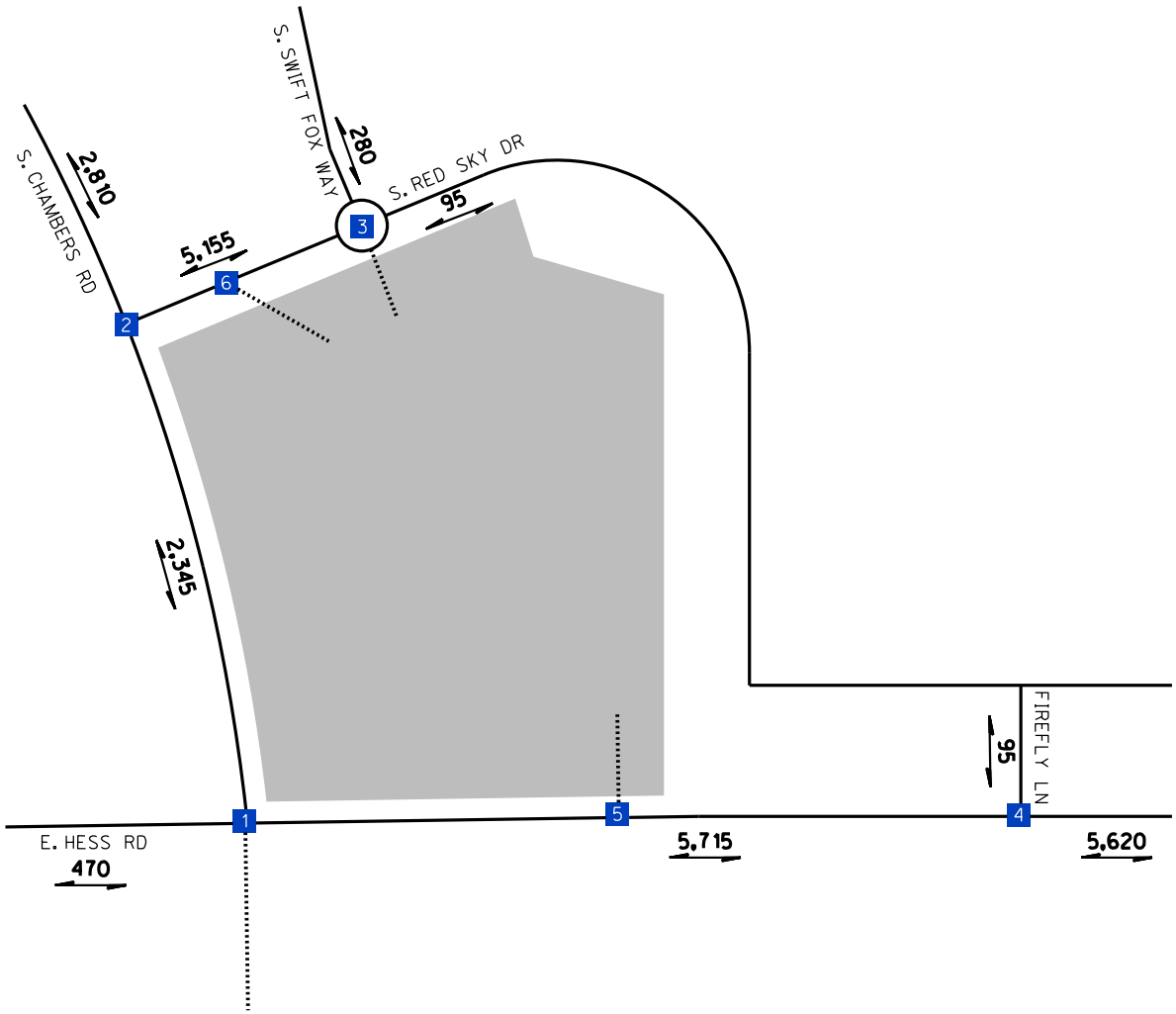

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EXHIBIT 6

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

=PROJECT SITE

= FUTURE ROAD/DRIVEWAY

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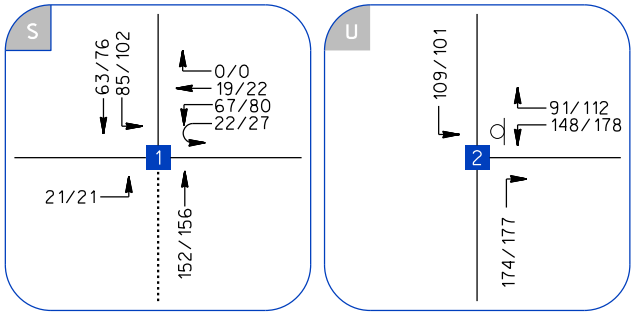

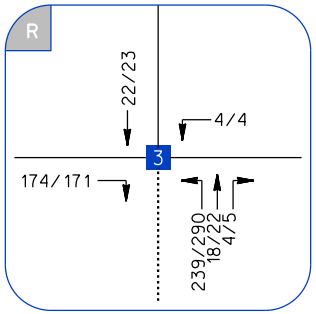

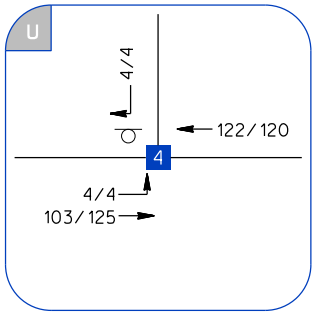

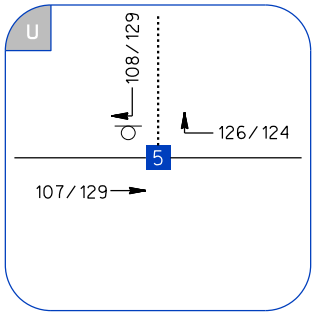

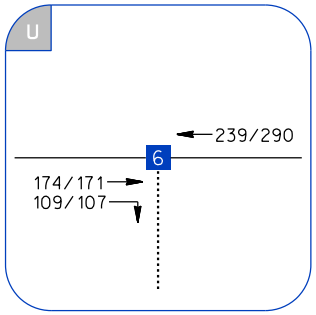

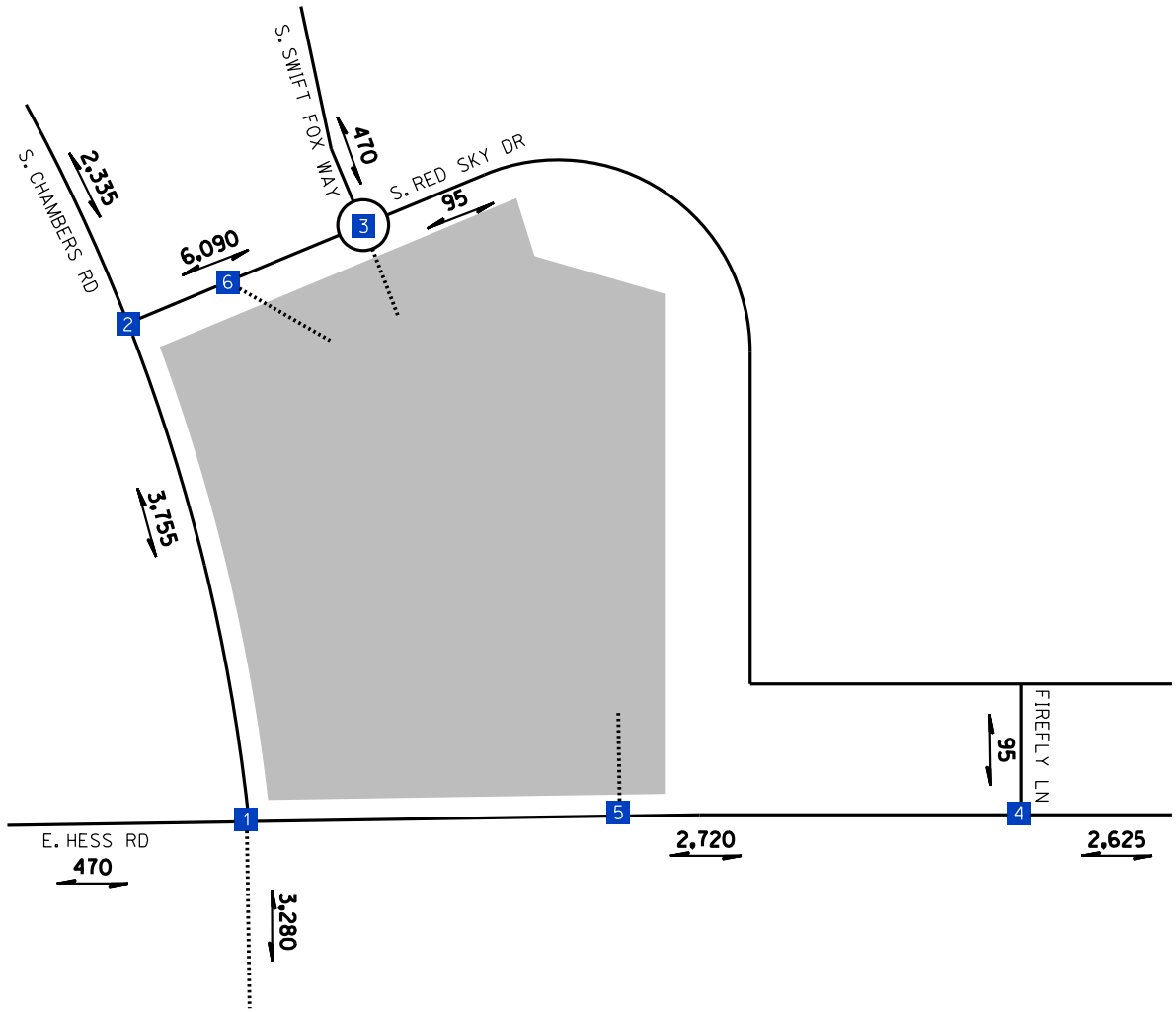

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EXHIBIT 7

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
=PROJECT SITE
= FUTURE ROAD/DRIVEWAY

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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:

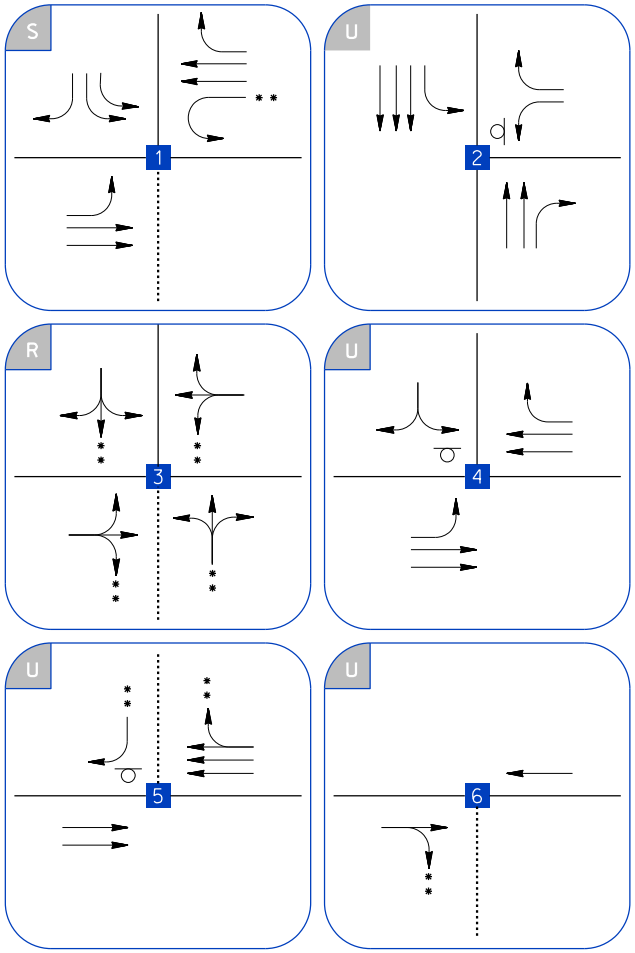
S. Chambers Road/E. Hess Road is currently built as a three-legged signalized intersection. For the Plus Project scenarios, it is assumed that the signal and striping could be modified to allow westbound U-turn movements and consisting of the following lane configurations; two left turn lanes, and an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



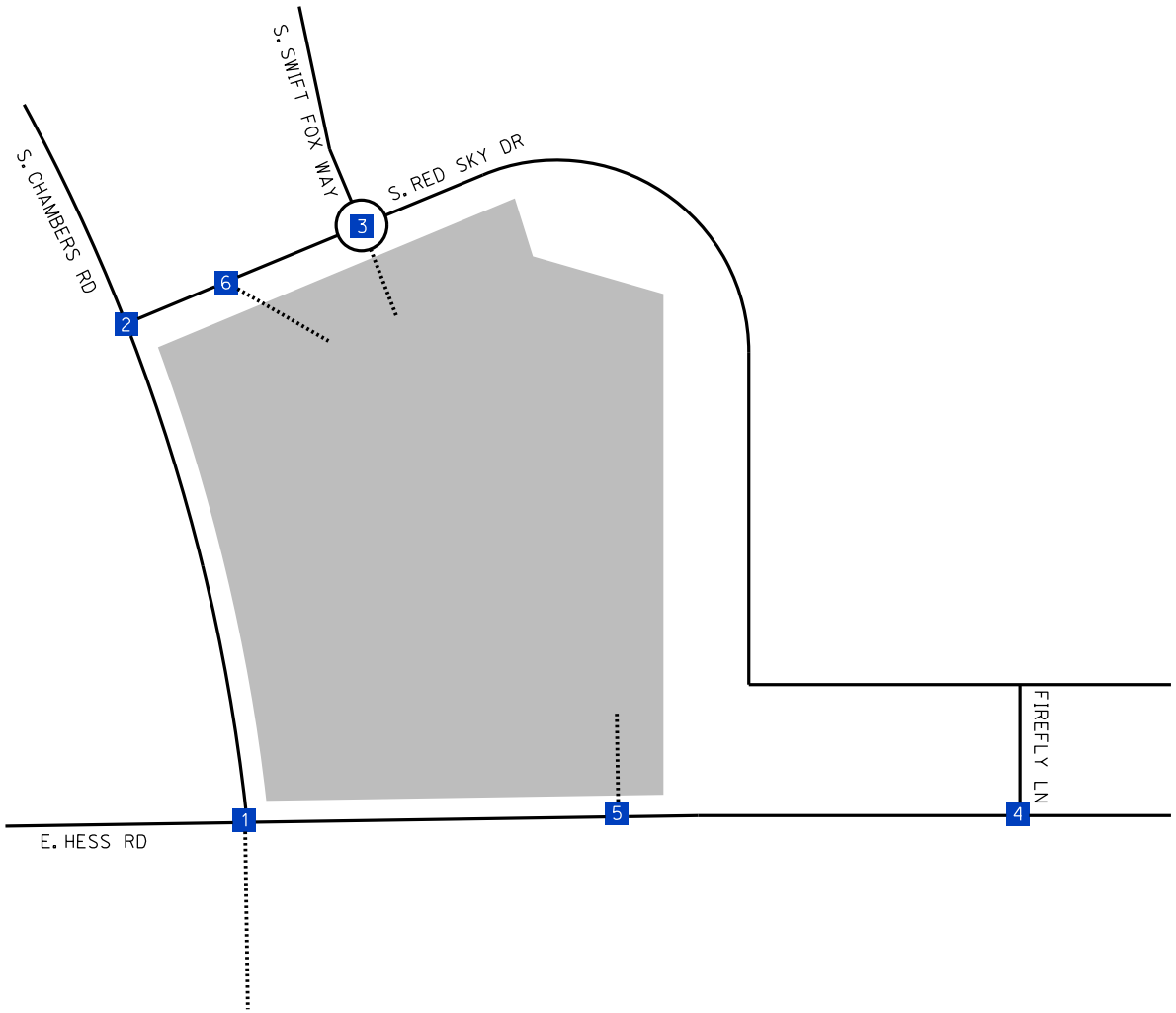


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EXHIBIT 8

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

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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:

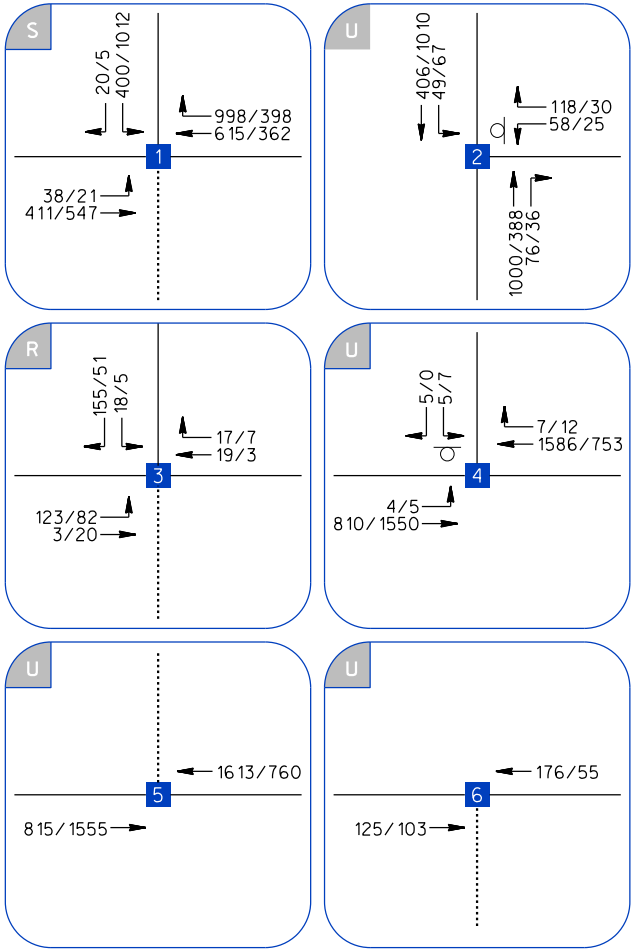
S. Chambers Road, between S. Red Sky Drive and E. Hess Road is a north-south roadway that is ultimately classified as a six-lane Principal Arterial. For this study scenario, this roadway is assumed to be built to its ultimate configuration with three travel lanes and acceleration/deceleration lanes in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

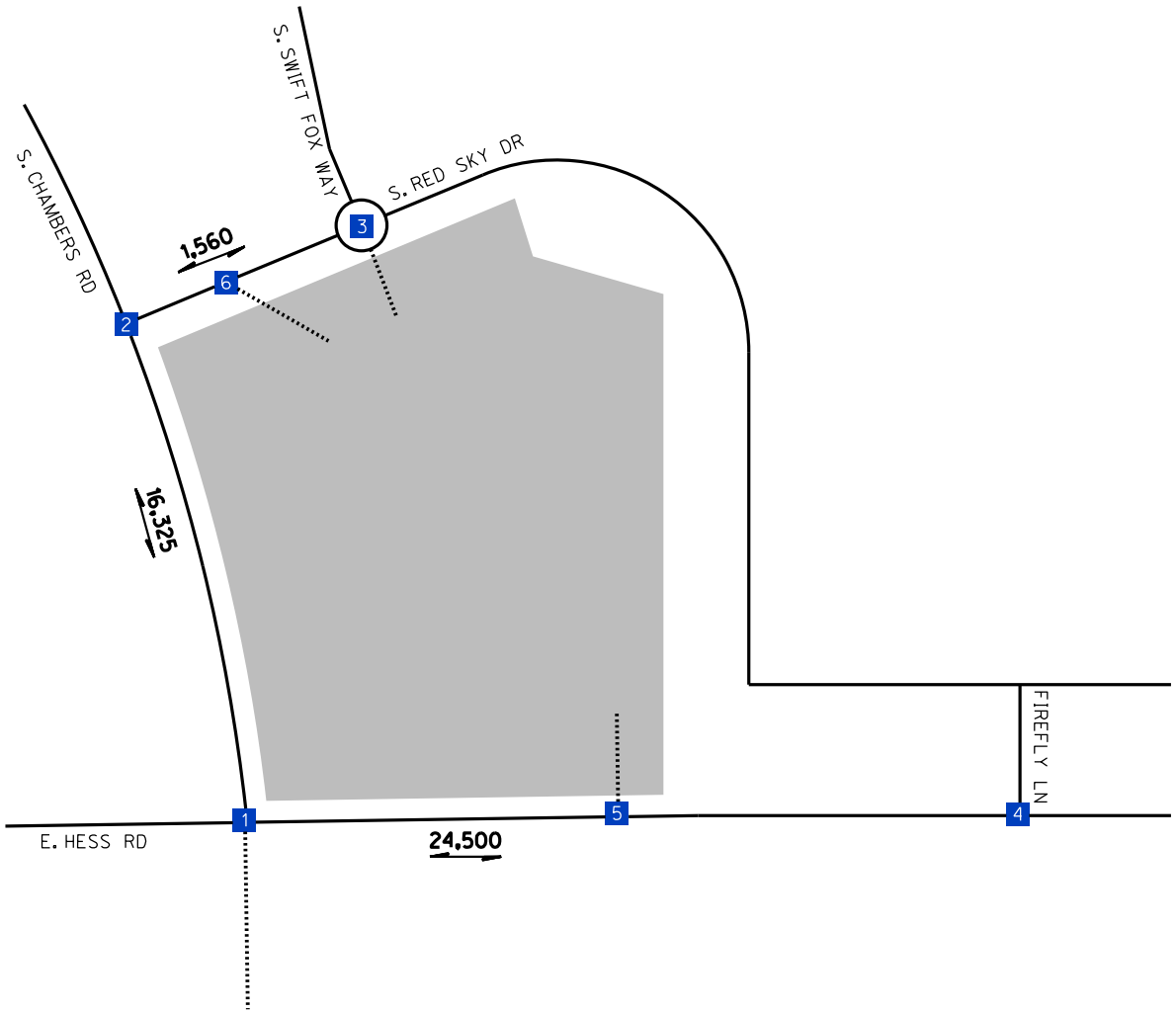
E. Hess Road between S. Chambers Road and Firefly Lane is an east-west roadway that is currently built to its ultimate four-lane divided roadway configuration providing two travel lanes and acceleration/deceleration lanes in each direction. No additional lane changes were assumed from the short-term 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, and as a project design feature, dual left turns for the westbound direction is proposed. 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 dual left turns and a single right turn lane for the westbound approach.





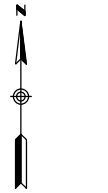


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EXHIBIT 9

SHORT-TERM (2021) BACKGROUND TRAFFIC VOLUMES

CHAMBERS AND HESS DEVELOPMENT

LEGEND

AM/PM=PEAK HOUR VOLUMES

X,XXX =TWO-WAY ADT

1 =INTERSECTION NUMBER

=PROJECT SITE

= FUTURE ROAD/DRIVEWAY

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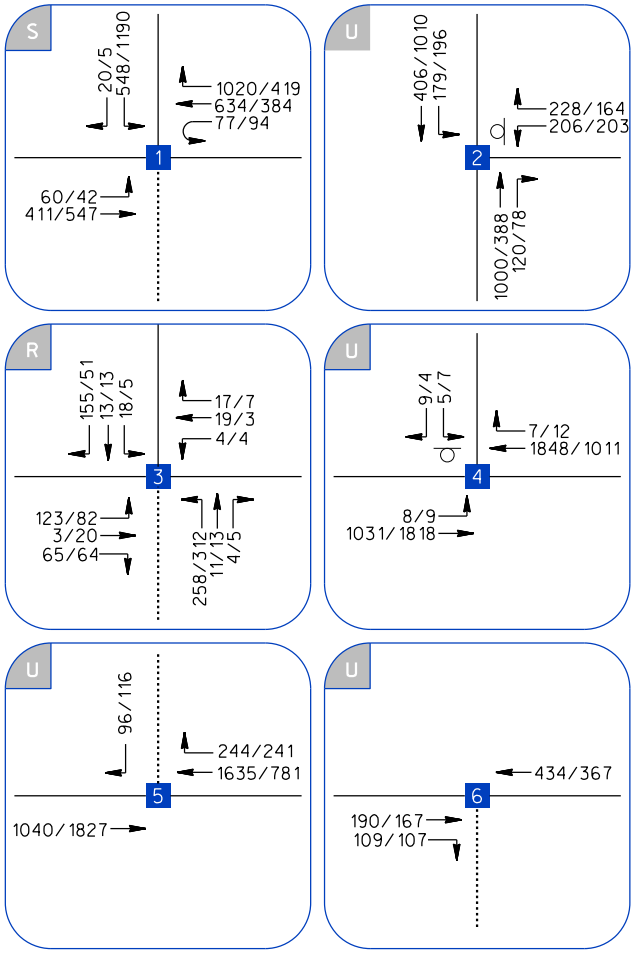

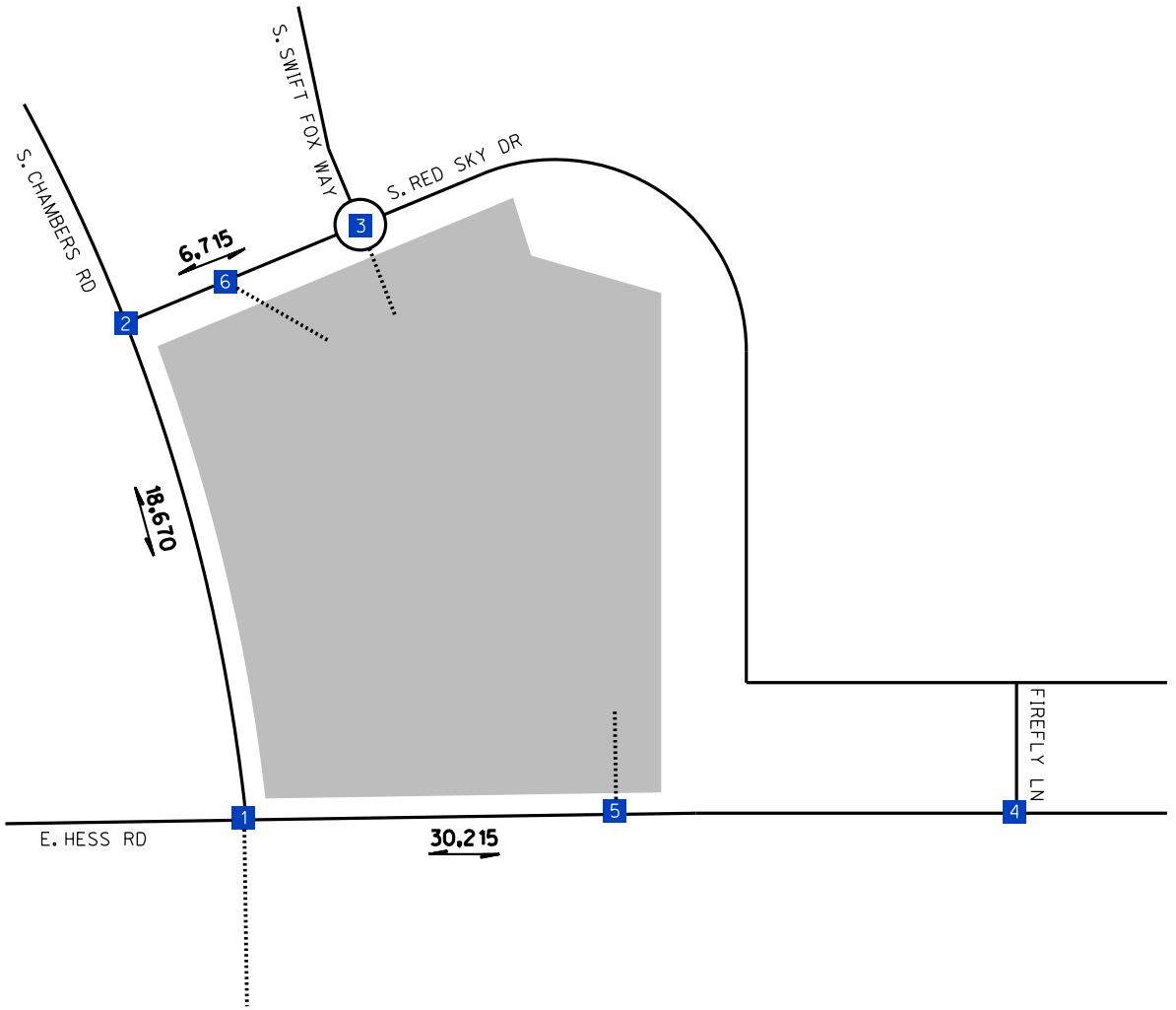

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EXHIBIT 10

SHORT-TERM (2021) TOTAL (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

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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 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.

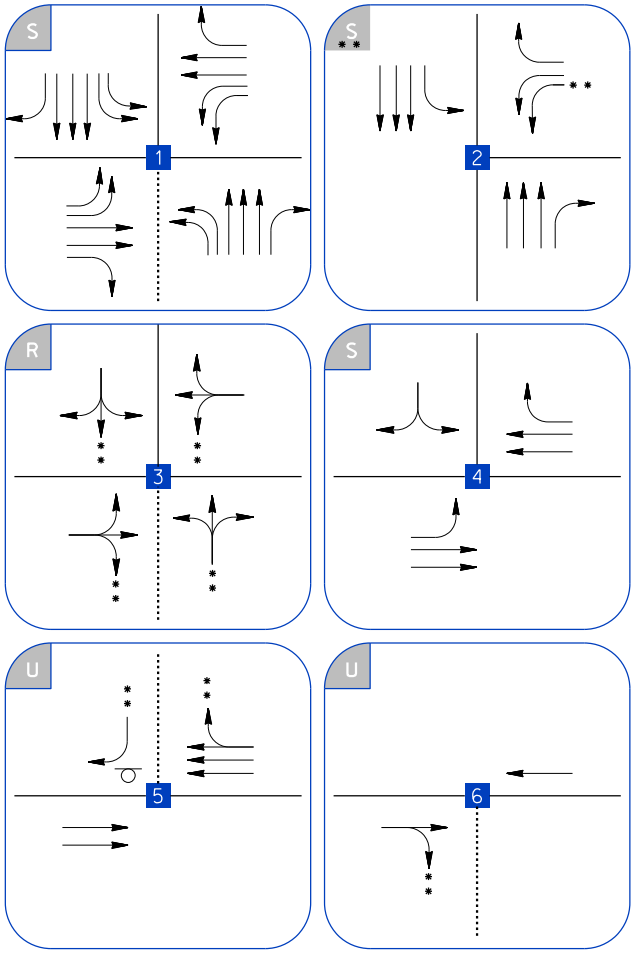
LONG-TERM (2041) BACKGROUND AND TOTAL TRAFFIC VOLUMES

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.



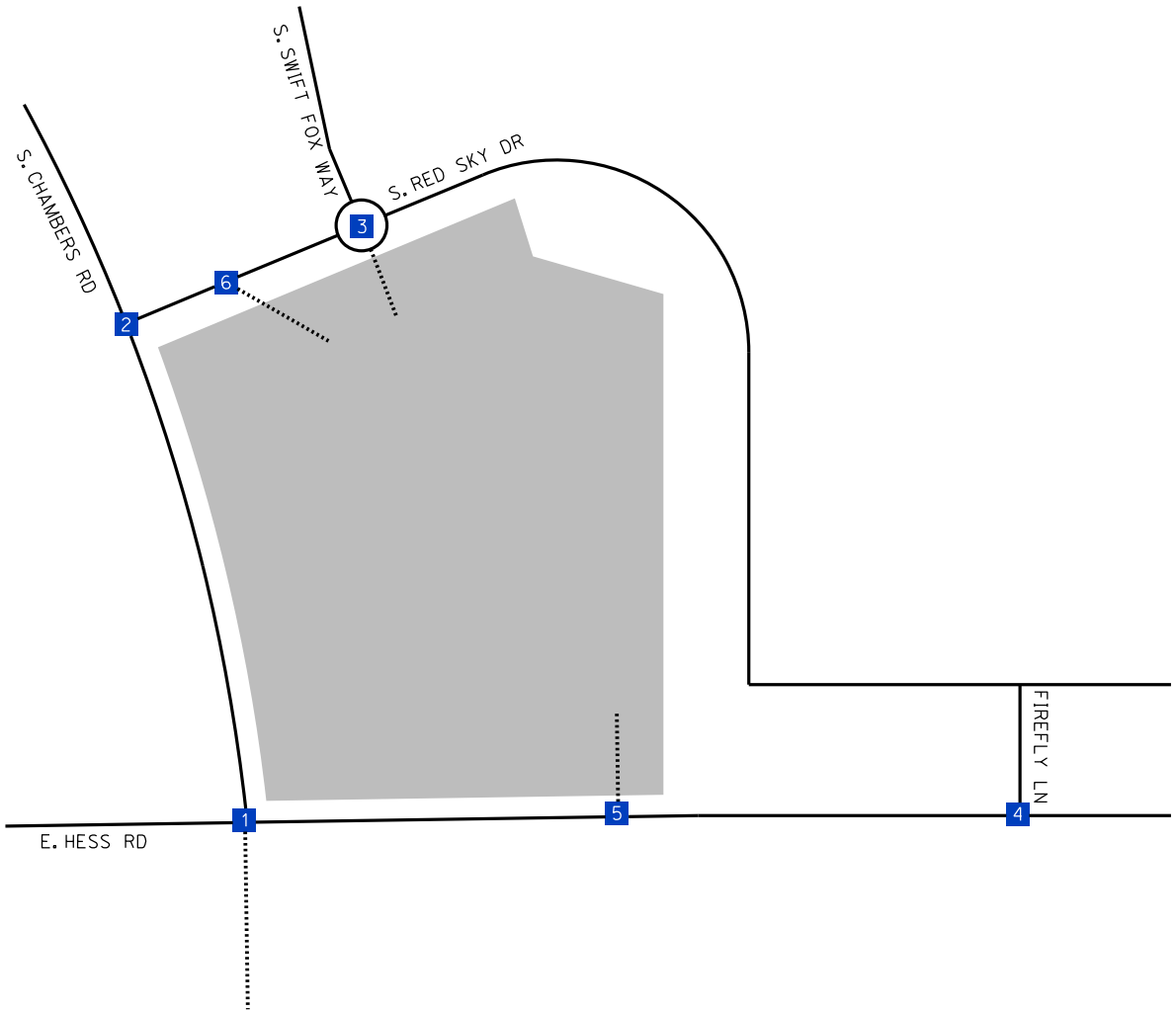


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EXHIBIT 11

LONG-TERM (2041) TRANSPORTATION CONDITIONS

CHAMBERS AND HESS DEVELOPMENT

LEGEND

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

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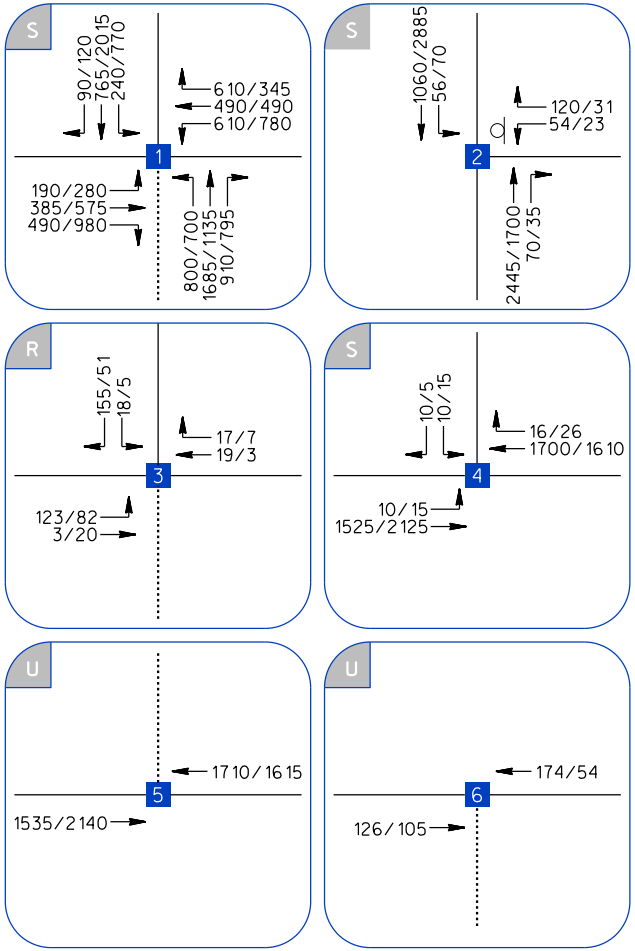

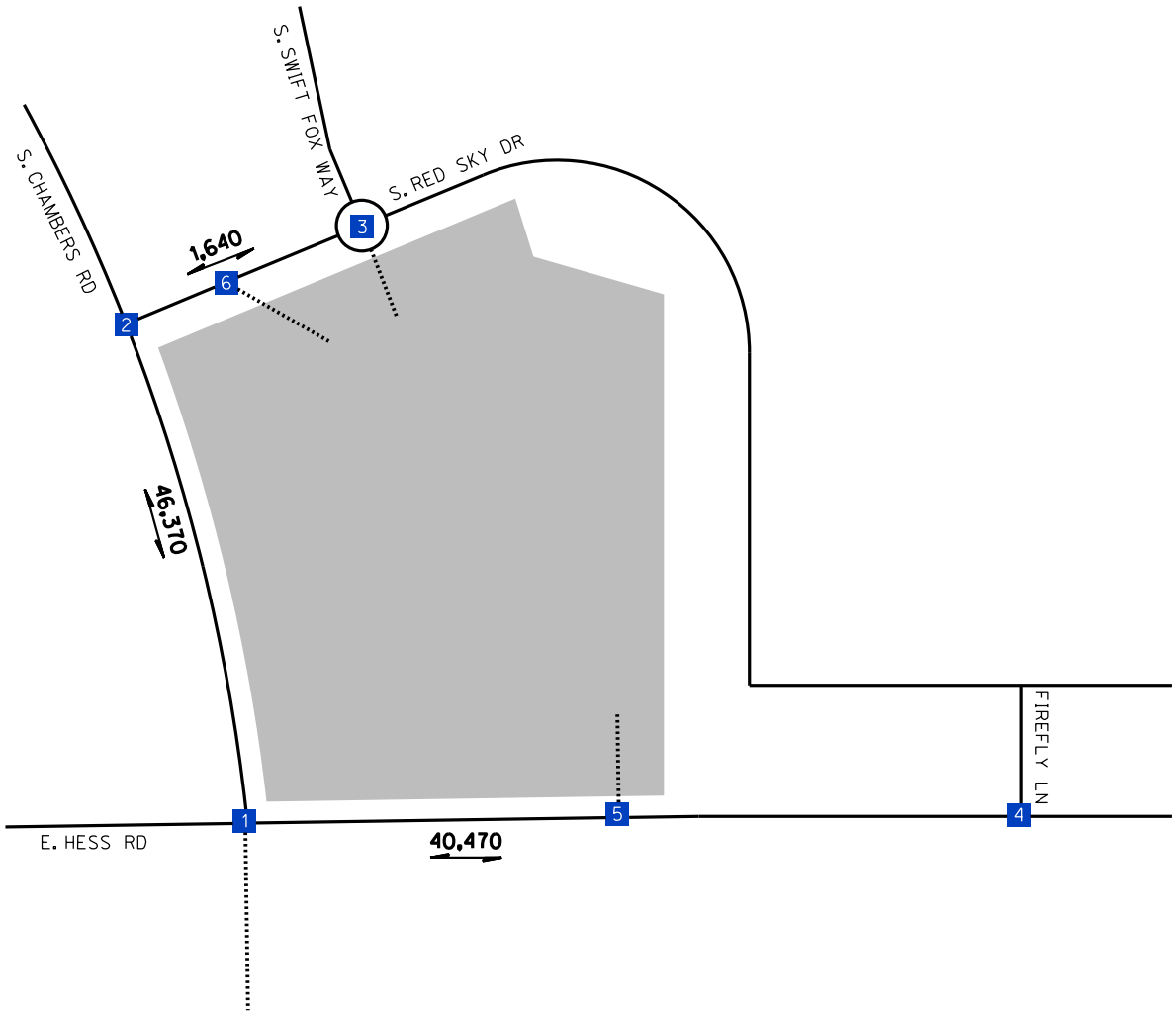

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EXHIBIT 12

LONG-TERM (2041) BACKGROUND TRAFFIC VOLUMES

CHAMBERS AND HESS DEVELOPMENT

LEGEND

AM/PM=PEAK HOUR VOLUMES

X,XXX =TWO-WAY ADT

1 =INTERSECTION NUMBER

=PROJECT SITE

= FUTURE ROAD/DRIVEWAY

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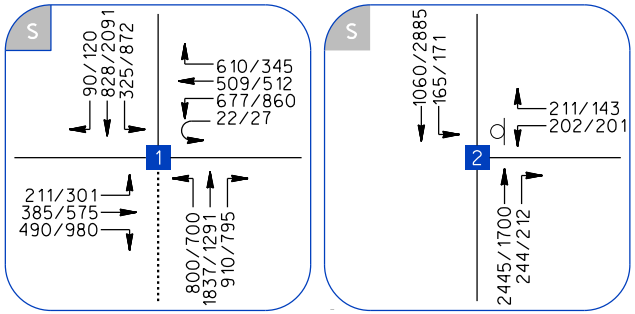

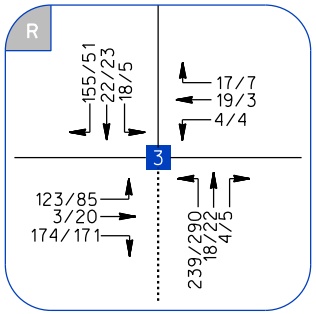

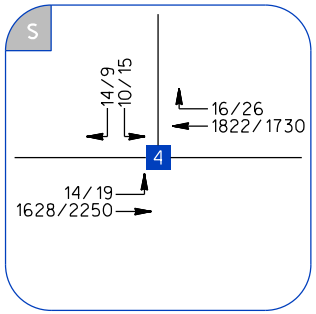

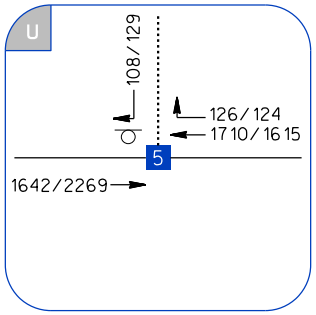

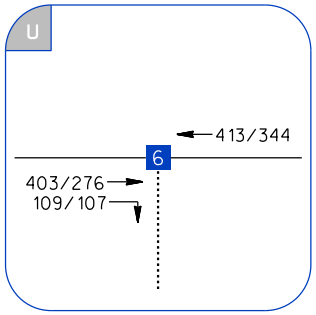

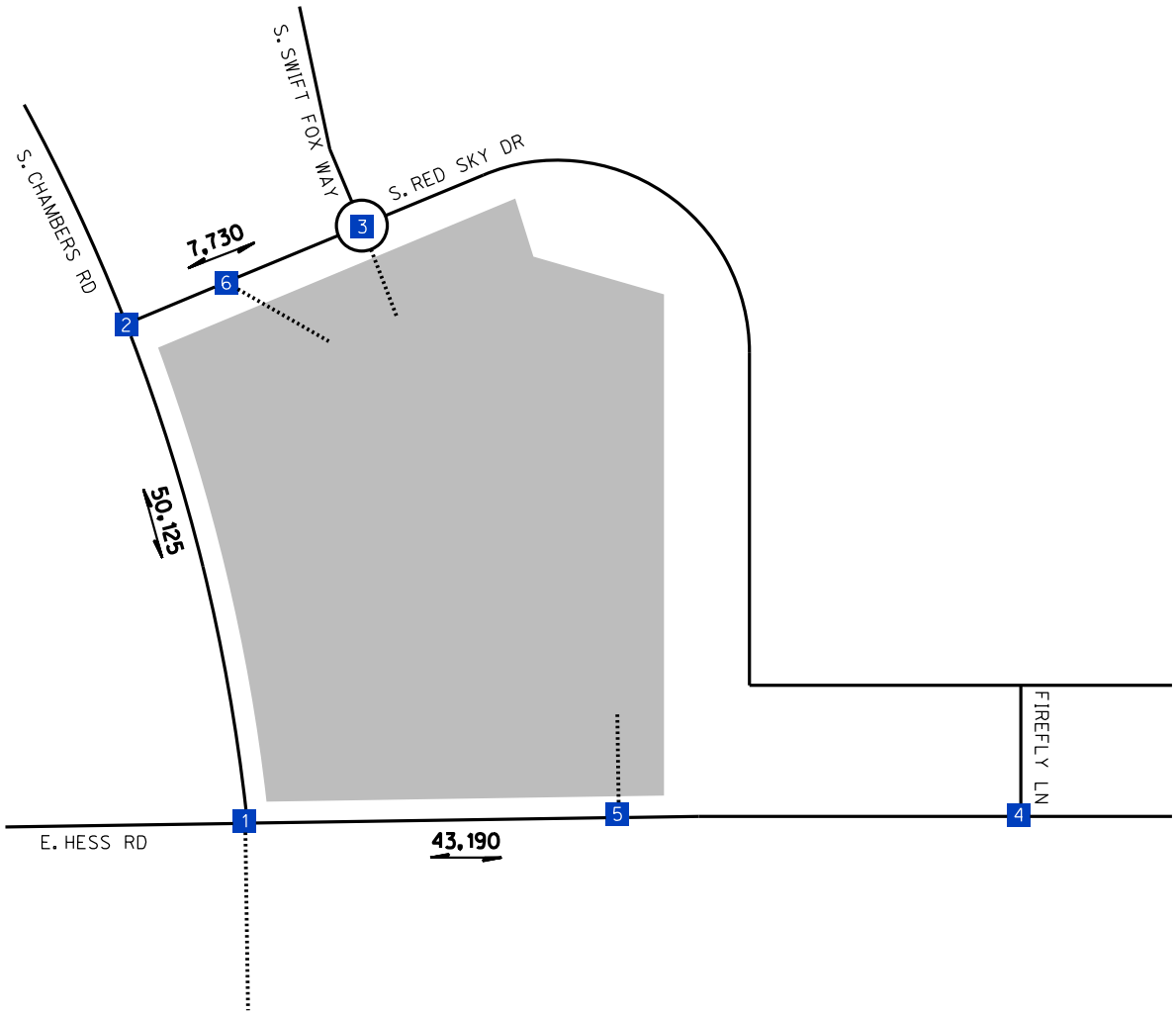

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EXHIBIT 13

LONG-TERM (2041) TOTAL (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

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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 (total), 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 LOS F 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 LOS F 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) background plus project scenarios (total), 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 WBL, WB-R and SB-L 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)

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	27.5	C	13.6	B	34.1	C	18.0	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	23.9	C	10.6	B
			SB-L	12.4	B	8.4	A	16.5	C	9.1	A
	With Recommended Improvements - Signal	**(S)**	Overall	-	-	-	-	24.7	C	18.9	B
3	**S. Red Sky Dr/S. Swift Fox Way**	**(R)**	Overall	3.8	A	3.3	A	5.2	A	5.2	A
4	**E. Hess Rd/Firefly Ln**	**(OWSC)**	EB-L	15.9	C	9.5	A	19.5	C	10.7	B
			SB-LR	**>50**	**F**	47.0	E	**>50**	**F**	**>50**	**F**
	With Recommended Improvements - Signal (By Others)	**(S)**	Overall	-	-	-	-	7.4	A	5.9	A
5	**E. Hess Rd/Project Dwy**	**(OWSC)**	SB-R	**-**	**-**	**-**	**-**	40.8	E	17.8	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	18,670	0.467	A
E. Hess Road between S. Chambers Road and Firefly Lane	Arterial (4L)	40,000	Arterial (4L)	40,000	24,500	0.61	B	30,215	0.755	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	6,715	0.560	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**	66.5	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**	-	-	-	-
	With Recommended Improvements - Signal and additional WB left turn lane	**(S)**	Overall	-	-	-	-	10.4	B	10.7	B
3	**S. Red Sky Dr/S. Swift Fox Way**	**(R)**	Overall	3.8	A	3.3	A	5.4	A	5.3	A
4	**E. Hess Rd/Firefly Ln**	**(S)**	Overall	7.7	A	7.2	A	7.7	A	8.4	A
5	**E. Hess Rd/Project Dwy**	**(OWSC)**	SB-R	-	-	-	-	42.6	E	43.9	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	50,125	0.911	D
E. Hess Road between S. Chambers Road and Firefly Lane	Arterial (4L)	40,000	**40,470**	**1.01**	**E**	**43,190**	**1.080**	**E**
	Arterial (5L)[2]	47,500	40,470	0.85	C	43,190	0.909	D
S. Red Sky Drive east of S. Chambers Road	Residential Collector (2L)	12,000	1,640	0.14	A	7,730	0.644	B

Footnote:

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

[2] Functions as a Five Lane Roadway (including acceleration/decelration lane). Capacity interpolated between 40,000 and 55,00

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, 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 or proposed storage, and thus no impacts due to the project 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 for the short-term and 150 cycle lengths for the long-term as well as coordinated for both the A.M. and P.M. peak periods and with a goal of at least a 40 second bandwidth. For the short-term, a minimum of 40 second bandwidth was achieved for the AM and 36 seconds for the PM. Due to the high traffic volumes

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

INTERSECTION				STORAGE [1]	TOTAL[3] (2041) AM Peak QUEUE [2]	TOTAL[3] (2041) PM Peak QUEUE [2]	RECOMMENDED MIN. STORAGE[4]
1	**S. Chambers Rd/E. Hess Rd**	**(S)**	EB-L	400x2	218	237	-
			EB-R	400	278	**425**	*
			WB-L	450x2	471	459	-
			WB-R	1100	529	92	-
			NB-L	535x2	605	560	**
			NB-R	435	**544**	240	*
			SB-L	535x2	367	781	**
			SB-R	535	55	100	***
2	**S. Chambers Rd/S. Red Sky Dr**	**(S)**	WB-L	150x2	183	148	**
			WB-R	150	236	163	****
			NB-R	700+	71	190	-
			SB-L	450	294	252	-
3	**S. Red Sky Dr/S. Swift Fox Way**	**(R)**	S	135 [5]	57	187	-
			E	270	51	166	-
			N	50	48	**72**	100
			W	300+	31	38	-
4	**E. Hess Rd/Firefly Ln**	**(S)**	EB-L	215	93	46	-
			SB-LR	110	51	46	-
			WB-R	220	15	168	-
5	**E. Hess Rd/Project Dwy**		SB-R	200	113	**263**	265
6	**S. Red Sky Dr/Project Dwy**		EB-TR	100	38	**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 and Synchro 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 two lanes

*** = Report shows 758' queue for PM, due to the queue's in the through movements. However, the queue observed in the simulation is ~ 100'.

**** = Can be accommodated within transition

for all movements 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 the 40 second minimum bandwidth is unachievable. Based on the results, the long-term scenarios showed bandwidth between 22 – 56 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 where the entrances have approach grades meeting the Town's 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 to be 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. These movements typically cause few traffic incidents, and therefore, are 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 and an additional westbound left turn lane 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 scenario, 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). To further mitigate queuing for the long-term scenario with project conditions, install an additional westbound left turn lane at this intersection.
- 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.

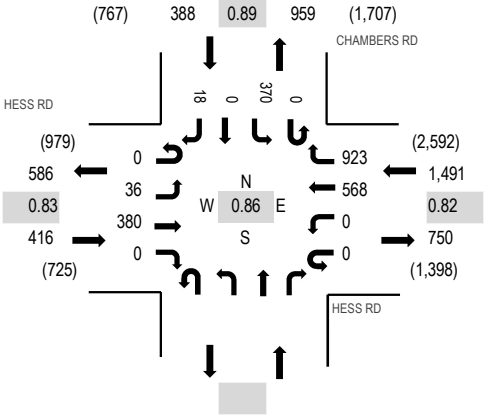
APPENDIX A

TRAFFIC COUNTS

All Traffic Data
Services Inc.
(303) 216-2439
www.alltrafficdata.net

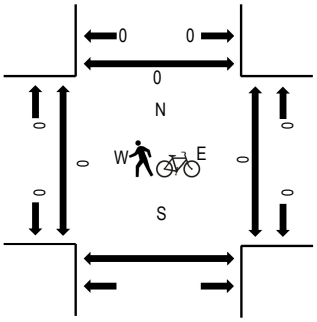
Location: 1 CHAMBERS RD & HESS RD AM
Date: Wednesday, August 21, 2019
Peak Hour: 07:00 AM - 08:00 AM
Peak 15-Minutes: 07:15 AM - 07:30 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



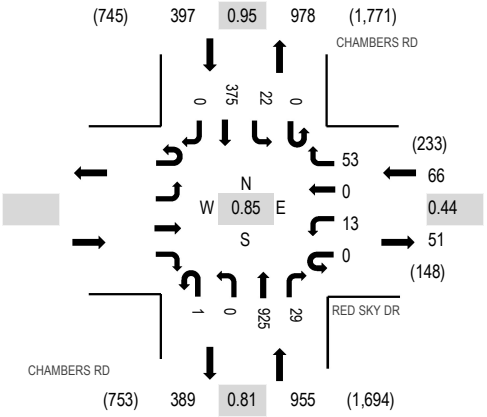
Traffic Counts

Interval Start Time	HESS RD Eastbound				HESS RD Westbound				Northbound				CHAMBERS RD Southbound					Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
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

All Traffic Data Services Inc.
(303) 216-2439
www.alltrafficdata.net

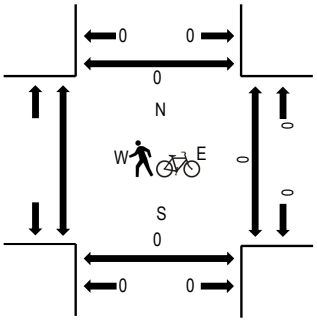
Location: 2 CHAMBERS RD & RED SKY DR AM
Date: Wednesday, August 21, 2019
Peak Hour: 07:00 AM - 08:00 AM
Peak 15-Minutes: 07:15 AM - 07:30 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



Traffic Counts

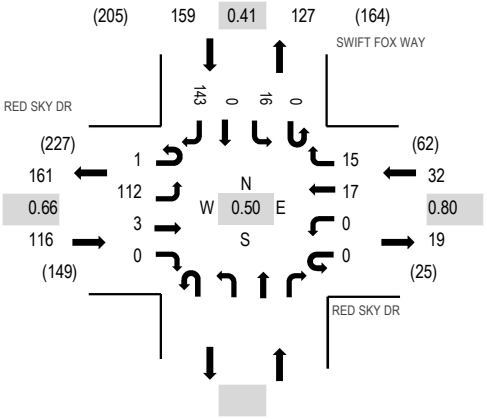
Interval Start Time	Eastbound				RED SKY DR Westbound				CHAMBERS RD Northbound				CHAMBERS RD Southbound					Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
7:00 AM					0	5	0	22	0	0	217	5	0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

All Traffic Data Services Inc.

(303) 216-2439
www.alltrafficdata.net

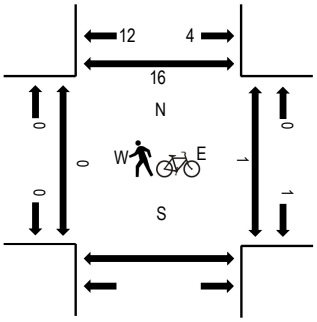
Location: 3 SWIFT FOX WAY & RED SKY DR AM
Date: Wednesday, August 21, 2019
Peak Hour: 07:45 AM - 08:45 AM
Peak 15-Minutes: 08:15 AM - 08:30 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



Traffic Counts

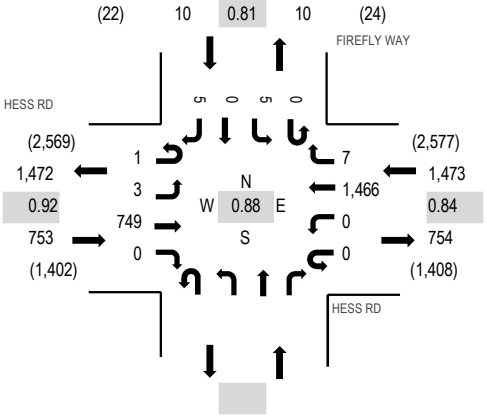
Interval Start Time	RED SKY DR Eastbound				RED SKY DR Westbound				Northbound				SWIFT FOX WAY Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
7:00 AM	0	9	2	0	0	0	9	3					0	0	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

All Traffic Data Services Inc.

(303) 216-2439
www.alltrafficdata.net

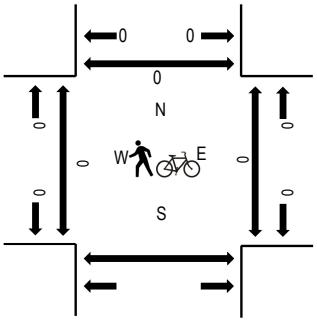
Location: 4 FIREFLY WAY & HESS RD AM
Date: Wednesday, August 21, 2019
Peak Hour: 07:00 AM - 08:00 AM
Peak 15-Minutes: 07:15 AM - 07:30 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



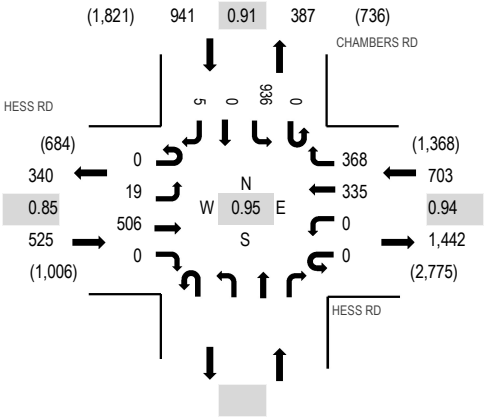
Traffic Counts

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

All Traffic Data Services Inc.
(303) 216-2439
www.alltrafficdata.net

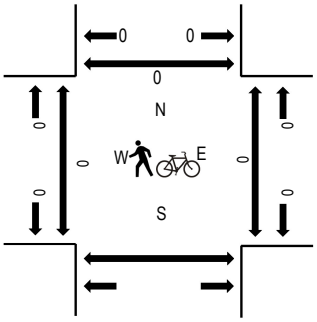
Location: 1 CHAMBERS RD & HESS RD PM
Date: Wednesday, August 21, 2019
Peak Hour: 05:00 PM - 06:00 PM
Peak 15-Minutes: 05:15 PM - 05:30 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



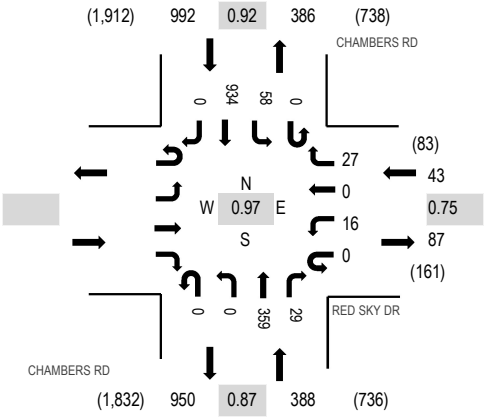
Traffic Counts

Interval Start Time	HESS RD Eastbound				HESS RD Westbound				Northbound				CHAMBERS RD Southbound					Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00 PM	0	4	100	0	0	0	94	67					0	200	0	3	468	2,026	0	0		0
4:15 PM	0	5	124	0	0	0	72	111					0	202	0	2	516	2,094	0	0		0
4:30 PM	0	3	108	0	0	0	94	79					0	209	0	4	497	2,147	0	0		0
4:45 PM	0	5	132	0	0	0	73	75					0	258	0	2	545	2,158	0	0		0
5:00 PM	0	6	114	0	0	0	79	107					0	227	0	3	536	2,169	0	0		0
5:15 PM	0	7	147	0	0	0	93	84					0	238	0	0	569		0	0		0
5:30 PM	0	3	112	0	0	0	86	91					0	216	0	0	508		0	0		0
5:45 PM	0	3	133	0	0	0	77	86					0	255	0	2	556		0	0		0
Count Total	0	36	970	0	0	0	668	700					0	1,805	0	16	4,195		0	0		0
Peak Hour	0	19	506	0	0	0	335	368					0	936	0	5	2,169		0	0		0

All Traffic Data Services Inc.
(303) 216-2439
www.alltrafficdata.net

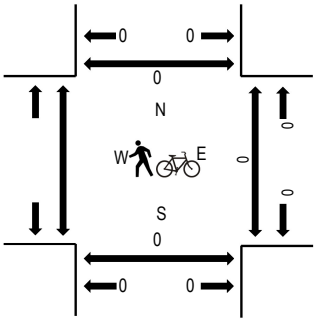
Location: 2 CHAMBERS RD & RED SKY DR PM
Date: Wednesday, August 21, 2019
Peak Hour: 05:00 PM - 06:00 PM
Peak 15-Minutes: 05:00 PM - 05:15 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



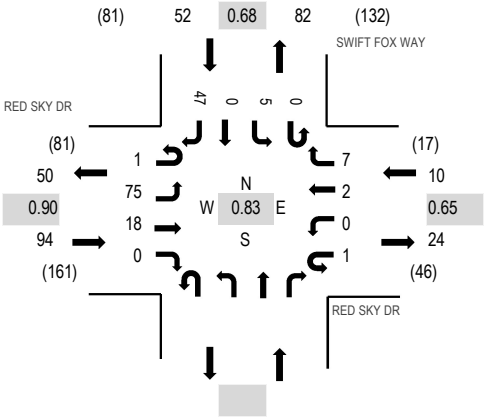
Traffic Counts

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

All Traffic Data Services Inc.
(303) 216-2439
www.alltrafficdata.net

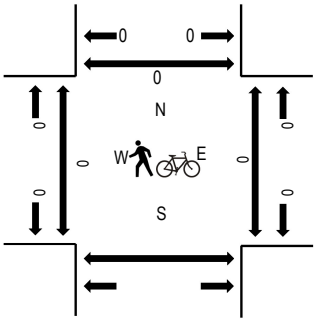
Location: 3 SWIFT FOX WAY & RED SKY DR PM
Date: Wednesday, August 21, 2019
Peak Hour: 04:30 PM - 05:30 PM
Peak 15-Minutes: 05:00 PM - 05:15 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



Traffic Counts

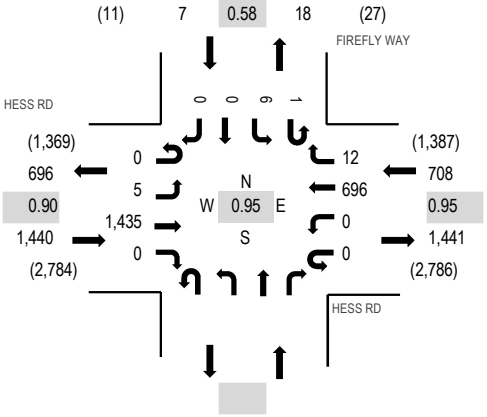
Interval Start Time	RED SKY DR Eastbound				RED SKY DR Westbound				Northbound				SWIFT FOX WAY Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
4:00 PM	0	8	5	0	0	0	1	0					1	0	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

All Traffic Data Services Inc.

(303) 216-2439
www.alltrafficdata.net

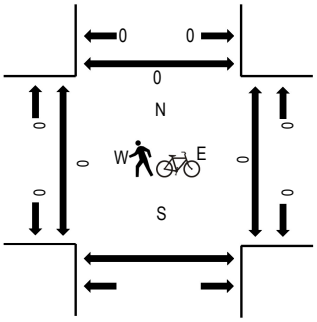
Location: 4 FIREFLY WAY & HESS RD PM
Date: Wednesday, August 21, 2019
Peak Hour: 05:00 PM - 06:00 PM
Peak 15-Minutes: 05:15 PM - 05:30 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



Traffic Counts

Interval Start Time	HESS RD Eastbound				HESS RD Westbound				Northbound				FIREFLY WAY Southbound					Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		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: 5
Station ID: 5
CHAMBERS RD S.O. RED SKY DR

Start Time	21-Aug-19 Wed	NB	SB							Total
12:00 AM		4	34							38
01:00		6	12							18
02:00		13	9							22
03:00		17	7							24
04:00		92	11							103
05:00		422	79							501
06:00		773	258							1031
07:00		**969**	**405**							**1374**
08:00		746	383							1129
09:00		471	290							761
10:00		369	272							641
11:00		345	310							655
12:00 PM		364	324							688
01:00		354	358							712
02:00		379	539							918
03:00		**466**	786							1252
04:00		354	878							1232
05:00		383	**925**							**1308**
06:00		320	670							990
07:00		240	452							692
08:00		129	342							471
09:00		76	245							321
10:00		37	120							157
11:00		12	67							79
Total		7341	7776							15117
Percent		48.6%	51.4%							
AM Peak	-	07:00	07:00	-	-	-	-	-	-	07:00
Vol.	-	969	405	-	-	-	-	-	-	1374
PM Peak	-	15:00	17:00	-	-	-	-	-	-	17:00
Vol.	-	466	925	-	-	-	-	-	-	1308
Grand Total		7341	7776							15117
Percent		48.6%	51.4%							
ADT		ADT 14,606		AADT 14,606						

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						

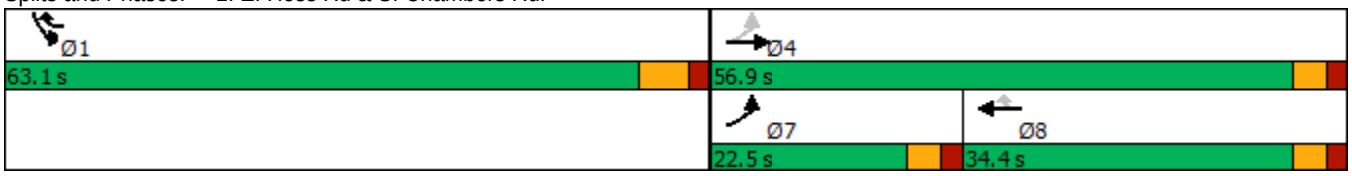
APPENDIX B

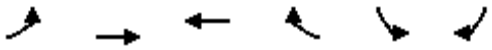
INTERSECTION CAPACITY ANALYSIS RESULTS

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	pm+pt	NA	NA	pm+ov	Prot	Free
Protected Phases	7	4	8	1	1	
Permitted Phases	4			8		Free
Detector Phase	7	4	8	1	1	
Switch Phase						
Minimum Initial (s)	11.0	15.0	15.0	15.0	15.0	
Minimum Split (s)	22.5	21.5	21.5	21.5	21.5	
Total Split (s)	22.5	56.9	34.4	63.1	63.1	
Total Split (%)	18.8%	47.4%	28.7%	52.6%	52.6%	
Yellow Time (s)	3.0	3.0	3.0	4.5	4.5	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	5.0	5.0	6.5	6.5	
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Recall Mode	None	None	None	None	None	
Act Effct Green (s)	22.8	22.8	17.9	45.6	17.6	52.6
Actuated g/C Ratio	0.43	0.43	0.34	0.87	0.33	1.00
v/c Ratio	0.08	0.27	0.51	0.67	0.35	0.01
Control Delay	8.3	9.4	17.5	3.5	16.2	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.3	9.4	17.5	3.5	16.2	0.0
LOS	A	A	B	A	B	A
Approach Delay		9.3	8.8		15.4	
Approach LOS		A	A		B	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 52.6	
Natural Cycle: 70	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.67	
Intersection Signal Delay: 10.0	Intersection LOS: B
Intersection Capacity Utilization 75.9%	ICU Level of Service D
Analysis Period (min) 15	

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





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	0
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	361	2139	1570	1057	779	
Arrive On Green	0.08	0.60	0.44	0.44	0.23	0.00
Sat Flow, veh/h	1781	3647	3647	1585	3456	1585
Grp Volume(v), veh/h	39	413	617	1003	402	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1585	1728	1585
Q Serve(g_s), s	0.7	3.5	7.8	29.4	6.8	0.0
Cycle Q Clear(g_c), s	0.7	3.5	7.8	29.4	6.8	0.0
Prop In Lane	1.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	361	2139	1570	1057	779	
V/C Ratio(X)	0.11	0.19	0.39	0.95	0.52	
Avail Cap(c_a), veh/h	678	2772	1570	1057	2939	
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	7.5	6.0	12.5	10.0	22.6	0.0
Incr Delay (d2), s/veh	0.1	0.0	0.2	16.7	0.5	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	0.9	2.6	4.9	2.5	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	7.6	6.0	12.7	26.8	23.1	0.0
LnGrp LOS	A	A	B	C	C	
Approach Vol, veh/h		452	1620		402	A
Approach Delay, s/veh		6.2	21.4		23.1	
Approach LOS		A	C		C	

Timer - Assigned Phs			4		6	7	8
Phs Duration (G+Y+Rc), s			45.1		21.5	10.7	34.4
Change Period (Y+Rc), s			5.0		6.5	5.0	5.0
Max Green Setting (Gmax), s			51.9		56.6	17.5	29.4
Max Q Clear Time (g_c+I1), s			5.5		8.8	2.7	31.4
Green Ext Time (p_c), s			2.7		1.4	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	18.9
HCM 6th LOS	B

Notes

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

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	0
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	NBR	WBLn1	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)

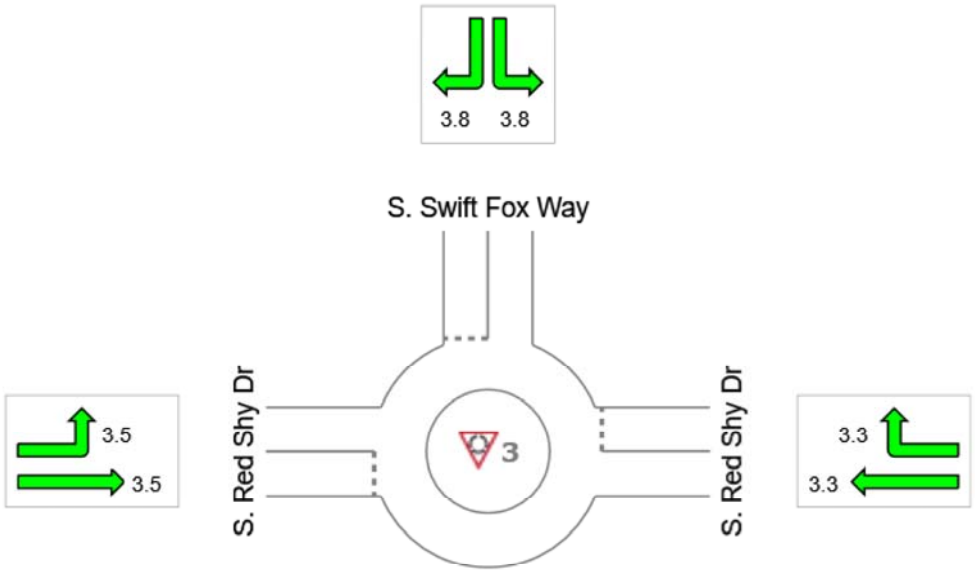
Average control delay per vehicle, or average pedestrian delay (seconds)

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

LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

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	-

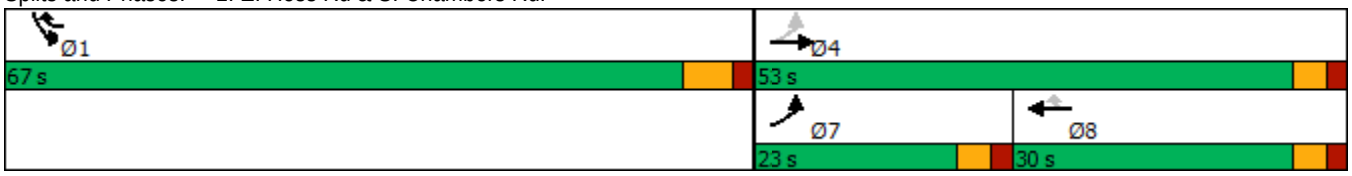
Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	60.5
HCM LOS			F

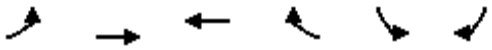
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	379	-	-	-	76
HCM Lane V/C Ratio	0.012	-	-	-	0.15
HCM Control Delay (s)	14.6	-	-	-	60.5
HCM Lane LOS	B	-	-	-	F
HCM 95th %tile Q(veh)	0	-	-	-	0.5

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	pm+pt	NA	NA	pm+ov	Prot	Free
Protected Phases	7	4	8	1	1	
Permitted Phases	4			8		Free
Detector Phase	7	4	8	1	1	
Switch Phase						
Minimum Initial (s)	11.0	15.0	15.0	15.0	15.0	
Minimum Split (s)	22.5	21.5	21.5	21.5	21.5	
Total Split (s)	23.0	53.0	30.0	67.0	67.0	
Total Split (%)	19.2%	44.2%	25.0%	55.8%	55.8%	
Yellow Time (s)	3.0	3.0	3.0	4.5	4.5	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	5.0	5.0	6.5	6.5	
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Recall Mode	None	None	None	None	None	
Act Effct Green (s)	18.8	18.8	16.6	52.4	24.4	55.4
Actuated g/C Ratio	0.34	0.34	0.30	0.95	0.44	1.00
v/c Ratio	0.04	0.44	0.33	0.25	0.65	0.00
Control Delay	14.9	16.6	19.5	0.7	14.7	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.9	16.6	19.5	0.7	14.7	0.0
LOS	B	B	B	A	B	A
Approach Delay		16.5	9.7		14.6	
Approach LOS		B	A		B	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 55.4	
Natural Cycle: 75	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.65	
Intersection Signal Delay: 13.5	Intersection LOS: B
Intersection Capacity Utilization 52.1%	ICU Level of Service A
Analysis Period (min) 15	

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





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	0
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	369	1500	984	1018	1263	
Arrive On Green	0.05	0.42	0.28	0.28	0.37	0.00
Sat Flow, veh/h	1781	3647	3647	1585	3456	1585
Grp Volume(v), veh/h	20	533	353	387	985	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1585	1728	1585
Q Serve(g_s), s	0.4	5.5	4.3	6.3	13.7	0.0
Cycle Q Clear(g_c), s	0.4	5.5	4.3	6.3	13.7	0.0
Prop In Lane	1.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	369	1500	984	1018	1263	
V/C Ratio(X)	0.05	0.36	0.36	0.38	0.78	
Avail Cap(c_a), veh/h	867	3150	1641	1311	3861	
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	11.4	10.6	15.7	4.6	15.2	0.0
Incr Delay (d2), s/veh	0.1	0.1	0.2	0.2	1.1	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	0.1	1.6	1.5	0.1	4.3	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	11.4	10.8	15.9	4.8	16.3	0.0
LnGrp LOS	B	B	B	A	B	
Approach Vol, veh/h		553	740		985	A
Approach Delay, s/veh		10.8	10.1		16.3	
Approach LOS		B	B		B	

Timer - Assigned Phs	4	6	7	8
Phs Duration (G+Y+Rc), s	27.9	26.3	7.9	20.0
Change Period (Y+Rc), s	5.0	6.5	5.0	5.0
Max Green Setting (Gmax), s	48.0	60.5	18.0	25.0
Max Q Clear Time (g_c+I1), s	7.5	15.7	2.4	8.3
Green Ext Time (p_c), s	3.5	4.1	0.0	3.2

Intersection Summary	
HCM 6th Ctrl Delay	13.0
HCM 6th LOS	B

Notes

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

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	NBR	WBLn1	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)

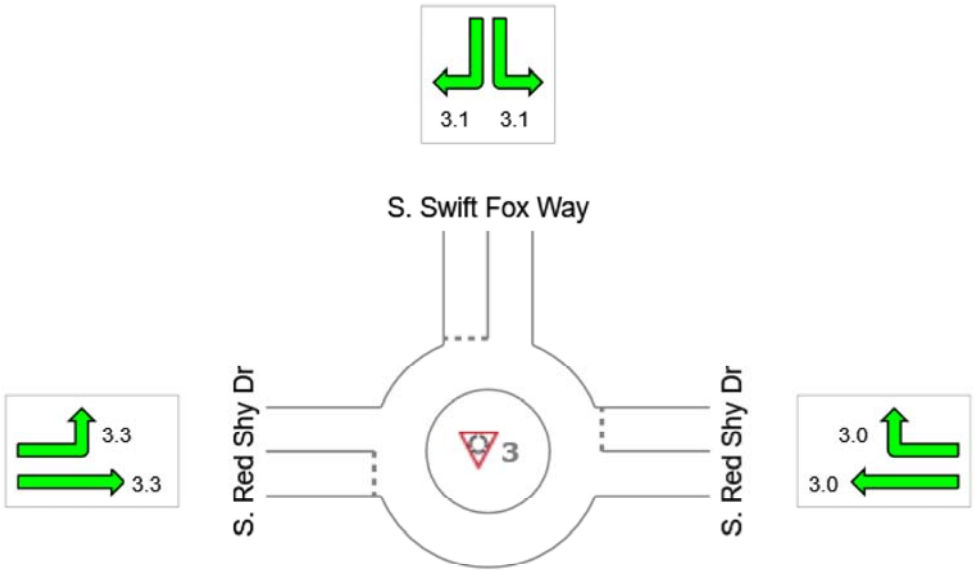
Average control delay per vehicle, or average pedestrian delay (seconds)

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

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

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	-

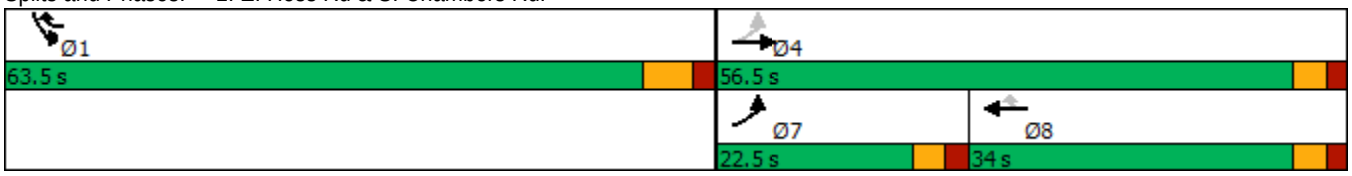
Approach	EB	WB	SB
HCM Control Delay, s	0	0	39.1
HCM LOS			E

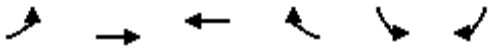
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	858	-	-	-	112
HCM Lane V/C Ratio	0.006	-	-	-	0.056
HCM Control Delay (s)	9.2	-	-	-	39.1
HCM Lane LOS	A	-	-	-	E
HCM 95th %tile Q(veh)	0	-	-	-	0.2

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	pm+pt	NA	NA	pm+ov	Prot	Free
Protected Phases	7	4	8	1	1	
Permitted Phases	4			8		Free
Detector Phase	7	4	8	1	1	
Switch Phase						
Minimum Initial (s)	11.0	15.0	15.0	15.0	15.0	
Minimum Split (s)	22.5	21.5	21.5	21.5	21.5	
Total Split (s)	22.5	56.5	34.0	63.5	63.5	
Total Split (%)	18.8%	47.1%	28.3%	52.9%	52.9%	
Yellow Time (s)	3.0	3.0	3.0	4.5	4.5	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	5.0	5.0	6.5	6.5	
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Recall Mode	None	None	None	None	None	
Act Effct Green (s)	28.1	28.1	19.9	50.8	21.5	62.3
Actuated g/C Ratio	0.45	0.45	0.32	0.82	0.35	1.00
v/c Ratio	0.09	0.28	0.59	0.75	0.37	0.01
Control Delay	11.2	11.5	23.0	5.1	17.7	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.2	11.5	23.0	5.1	17.7	0.0
LOS	B	B	C	A	B	A
Approach Delay		11.5	11.9		16.9	
Approach LOS		B	B		B	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 62.3	
Natural Cycle: 70	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.75	
Intersection Signal Delay: 12.7	Intersection LOS: B
Intersection Capacity Utilization 80.5%	ICU Level of Service D
Analysis Period (min) 15	

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





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	0
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	349	2134	1554	1051	781	
Arrive On Green	0.09	0.60	0.44	0.44	0.23	0.00
Sat Flow, veh/h	1781	3647	3647	1585	3456	1585
Grp Volume(v), veh/h	41	447	668	1085	435	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1585	1728	1585
Q Serve(g_s), s	0.7	3.8	8.6	29.0	7.4	0.0
Cycle Q Clear(g_c), s	0.7	3.8	8.6	29.0	7.4	0.0
Prop In Lane	1.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	349	2134	1554	1051	781	
V/C Ratio(X)	0.12	0.21	0.43	1.03	0.56	
Avail Cap(c_a), veh/h	663	2759	1554	1051	2970	
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	7.7	6.1	12.9	11.2	22.7	0.0
Incr Delay (d2), s/veh	0.1	0.0	0.2	36.3	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	0.2	1.0	2.8	10.6	2.7	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	7.9	6.1	13.1	47.5	23.3	0.0
LnGrp LOS	A	A	B	F	C	
Approach Vol, veh/h		488	1753		435	A
Approach Delay, s/veh		6.2	34.4		23.3	
Approach LOS		A	C		C	

Timer - Assigned Phs	4	6	7	8
Phs Duration (G+Y+Rc), s	44.8	21.5	10.8	34.0
Change Period (Y+Rc), s	5.0	6.5	5.0	5.0
Max Green Setting (Gmax), s	51.5	57.0	17.5	29.0
Max Q Clear Time (g_c+I1), s	5.8	9.4	2.7	31.0
Green Ext Time (p_c), s	2.9	1.5	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	27.5
HCM 6th LOS	C

Notes

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

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	NBR	WBLn1	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)

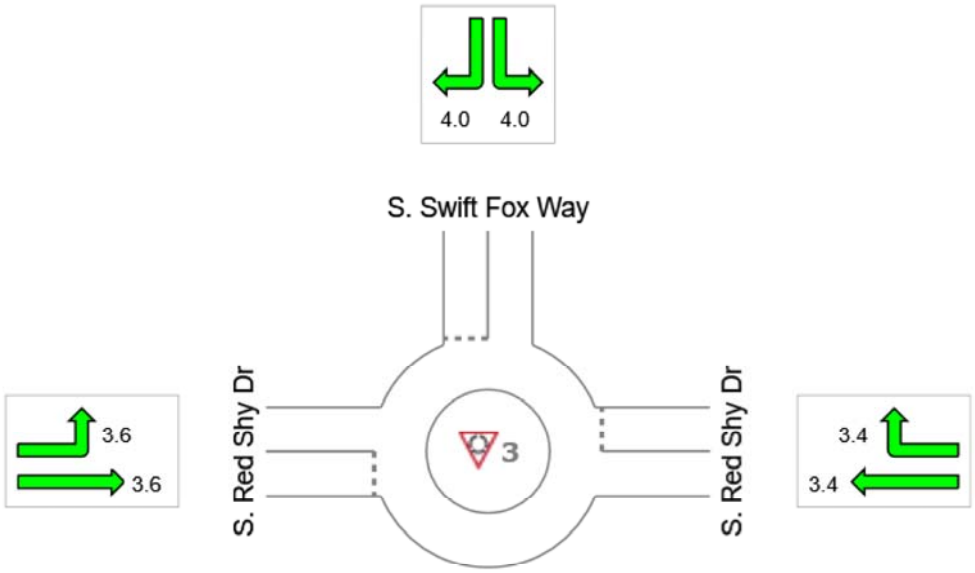
Average control delay per vehicle, or average pedestrian delay (seconds)

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

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

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	2272	901
Stage 1	-	-	-	-	1802	-
Stage 2	-	-	-	-	470	-
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	336	-	-	-	34	281
Stage 1	-	-	-	-	117	-
Stage 2	-	-	-	-	595	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	336	-	-	-	33	281
Mov Cap-2 Maneuver	-	-	-	-	33	-
Stage 1	-	-	-	-	115	-
Stage 2	-	-	-	-	595	-

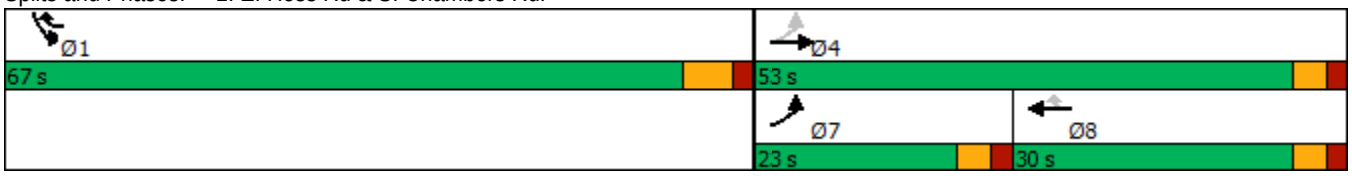
Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	80
HCM LOS			F

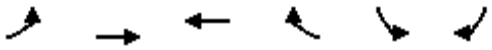
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	336	-	-	-	59
HCM Lane V/C Ratio	0.014	-	-	-	0.193
HCM Control Delay (s)	15.9	-	-	-	80
HCM Lane LOS	C	-	-	-	F
HCM 95th %tile Q(veh)	0	-	-	-	0.6

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	pm+pt	NA	NA	pm+ov	Prot	Free
Protected Phases	7	4	8	1	1	
Permitted Phases	4			8		Free
Detector Phase	7	4	8	1	1	
Switch Phase						
Minimum Initial (s)	11.0	15.0	15.0	15.0	15.0	
Minimum Split (s)	22.5	21.5	21.5	21.5	21.5	
Total Split (s)	23.0	53.0	30.0	67.0	67.0	
Total Split (%)	19.2%	44.2%	25.0%	55.8%	55.8%	
Yellow Time (s)	3.0	3.0	3.0	4.5	4.5	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	5.0	5.0	6.5	6.5	
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Recall Mode	None	None	None	None	None	
Act Effct Green (s)	21.9	21.9	17.2	55.2	27.5	61.9
Actuated g/C Ratio	0.35	0.35	0.28	0.89	0.44	1.00
v/c Ratio	0.05	0.46	0.39	0.29	0.70	0.00
Control Delay	15.4	17.4	23.6	0.9	17.2	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.4	17.4	23.6	0.9	17.2	0.0
LOS	B	B	C	A	B	A
Approach Delay		17.3	11.7		17.1	
Approach LOS		B	B		B	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 61.9	
Natural Cycle: 75	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.70	
Intersection Signal Delay: 15.4	Intersection LOS: B
Intersection Capacity Utilization 55.9%	ICU Level of Service B
Analysis Period (min) 15	

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





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	0
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	348	1455	940	1034	1341	
Arrive On Green	0.06	0.41	0.26	0.26	0.39	0.00
Sat Flow, veh/h	1781	3647	3647	1585	3456	1585
Grp Volume(v), veh/h	22	576	381	419	1065	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1585	1728	1585
Q Serve(g_s), s	0.5	6.5	5.0	7.1	15.5	0.0
Cycle Q Clear(g_c), s	0.5	6.5	5.0	7.1	15.5	0.0
Prop In Lane	1.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	348	1455	940	1034	1341	
V/C Ratio(X)	0.06	0.40	0.41	0.41	0.79	
Avail Cap(c_a), veh/h	812	3006	1566	1313	3685	
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	12.3	11.8	17.2	4.7	15.4	0.0
Incr Delay (d2), s/veh	0.1	0.2	0.3	0.3	1.1	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	0.2	2.0	1.7	0.1	4.9	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	12.4	12.0	17.5	4.9	16.5	0.0
LnGrp LOS	B	B	B	A	B	
Approach Vol, veh/h		598	800		1065	A
Approach Delay, s/veh		12.0	10.9		16.5	
Approach LOS		B	B		B	

Timer - Assigned Phs			4		6	7	8
Phs Duration (G+Y+Rc), s			28.2		28.5	8.2	20.0
Change Period (Y+Rc), s			5.0		6.5	5.0	5.0
Max Green Setting (Gmax), s			48.0		60.5	18.0	25.0
Max Q Clear Time (g_c+I1), s			8.5		17.5	2.5	9.1
Green Ext Time (p_c), s			3.9		4.5	0.0	3.4

Intersection Summary		
HCM 6th Ctrl Delay	13.6	
HCM 6th LOS	B	

Notes

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

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	0
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)

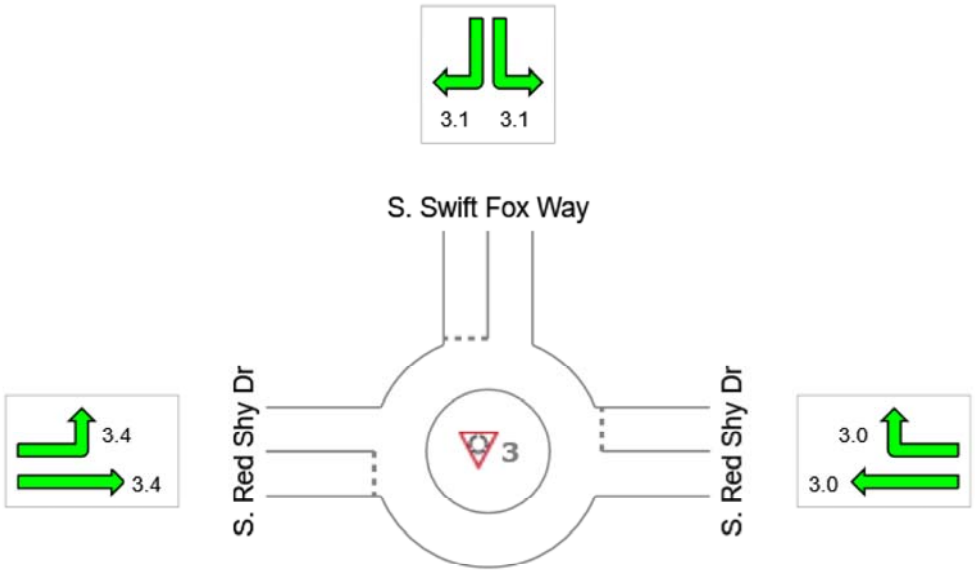
Average control delay per vehicle, or average pedestrian delay (seconds)

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

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

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	-

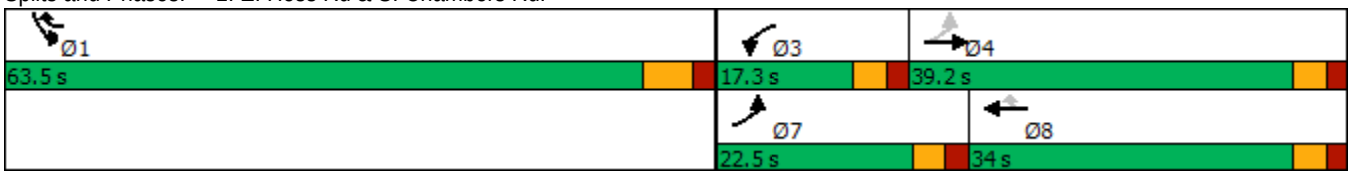
Approach	EB	WB	SB
HCM Control Delay, s	0	0	47
HCM LOS			E

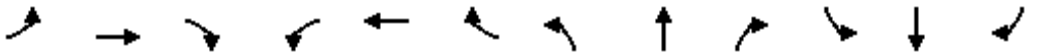
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	814	-	-	-	93
HCM Lane V/C Ratio	0.006	-	-	-	0.079
HCM Control Delay (s)	9.5	-	-	-	47
HCM Lane LOS	A	-	-	-	E
HCM 95th %tile Q(veh)	0	-	-	-	0.3

Lane Group	EBL	EBT	WBL	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (vph)	60	411	77	634	1020	548	20
Future Volume (vph)	60	411	77	634	1020	548	20
Turn Type	pm+pt	NA	Prot	NA	pm+ov	Prot	Free
Protected Phases	7	4	3	8	1	1	
Permitted Phases	4				8		Free
Detector Phase	7	4	3	8	1	1	
Switch Phase							
Minimum Initial (s)	11.0	15.0	5.0	15.0	15.0	15.0	
Minimum Split (s)	22.5	21.5	16.5	21.5	21.5	21.5	
Total Split (s)	22.5	39.2	17.3	34.0	63.5	63.5	
Total Split (%)	18.8%	32.7%	14.4%	28.3%	52.9%	52.9%	
Yellow Time (s)	3.0	3.0	3.0	3.0	4.5	4.5	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	5.0	5.0	5.0	6.5	6.5	
Lead/Lag	Lead	Lag	Lead	Lag			
Lead-Lag Optimize?	Yes	Yes	Yes	Yes			
Recall Mode	None	None	None	None	None	None	
Act Effct Green (s)	31.3	23.0	9.5	22.0	56.8	27.0	73.8
Actuated g/C Ratio	0.42	0.31	0.13	0.30	0.77	0.37	1.00
v/c Ratio	0.16	0.41	0.37	0.65	0.80	0.48	0.01
Control Delay	15.2	25.1	41.4	29.2	7.1	19.7	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.2	25.1	41.4	29.2	7.1	19.7	0.0
LOS	B	C	D	C	A	B	A
Approach Delay		23.8		16.7			
Approach LOS		C		B			

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 73.8	
Natural Cycle: 70	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.80	
Intersection Signal Delay: 18.4	Intersection LOS: B
Intersection Capacity Utilization 81.9%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 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)	60	411	0	77	634	1020	0	0	0	548	0	20
Future Volume (veh/h)	60	411	0	77	634	1020	0	0	0	548	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	65	447	0	84	689	1109				596	0	0
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	384	1667	0	109	1476	1014				775	0	
Arrive On Green	0.12	0.47	0.00	0.06	0.42	0.42				0.22	0.00	0.00
Sat Flow, veh/h	1781	3647	0	1781	3554	1585				3456	0	1585
Grp Volume(v), veh/h	65	447	0	84	689	1109				596	0	0
Grp Sat Flow(s),veh/h/ln	1781	1777	0	1781	1777	1585				1728	0	1585
Q Serve(g_s), s	1.2	5.1	0.0	3.1	9.5	22.6				10.9	0.0	0.0
Cycle Q Clear(g_c), s	1.2	5.1	0.0	3.1	9.5	22.6				10.9	0.0	0.0
Prop In Lane	1.00		0.00	1.00		1.00				1.00		1.00
Lane Grp Cap(c), veh/h	384	1667	0	109	1476	1014				775	0	
V/C Ratio(X)	0.17	0.27	0.00	0.77	0.47	1.09				0.77	0.00	
Avail Cap(c_a), veh/h	643	1808	0	326	1533	1039				2930	0	
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	0.00
Uniform Delay (d), s/veh	8.4	10.8	0.0	31.1	14.3	3.3				24.4	0.0	0.0
Incr Delay (d2), s/veh	0.2	0.1	0.0	10.8	0.2	57.5				1.6	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	0.4	1.6	0.0	1.6	3.2	19.4				4.1	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	8.6	10.9	0.0	41.8	14.5	60.9				26.1	0.0	0.0
LnGrp LOS	A	B	A	D	B	F				C	A	
Approach Vol, veh/h		512			1882						596	A
Approach Delay, s/veh		10.6			43.0						26.1	
Approach LOS		B			D						C	

Timer - Assigned Phs		3	4		6	7	8					
Phs Duration (G+Y+Rc), s		9.1	36.5		21.6	12.7	32.9					
Change Period (Y+Rc), s		5.0	5.0		6.5	5.0	5.0					
Max Green Setting (Gmax), s		12.3	34.2		57.0	17.5	29.0					
Max Q Clear Time (g_c+I1), s		5.1	7.1		12.9	3.2	24.6					
Green Ext Time (p_c), s		0.1	2.7		2.2	0.1	3.3					

Intersection Summary	
HCM 6th Ctrl Delay	34.1
HCM 6th LOS	C

Notes

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

Intersection	
Int Delay, s/veh	162.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	206	228	1000	120	179	406
Future Vol, veh/h	206	228	1000	120	179	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	450	-
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	242	268	1176	141	211	478

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1789	588	0	0	1317	0
Stage 1	1176	-	-	-	-	-
Stage 2	613	-	-	-	-	-
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	~ 94	452	-	-	521	-
Stage 1	250	-	-	-	-	-
Stage 2	472	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 56	452	-	-	521	-
Mov Cap-2 Maneuver	~ 56	-	-	-	-	-
Stage 1	250	-	-	-	-	-
Stage 2	281	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	$ 793.9	0	5.1
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	56	452	521	-
HCM Lane V/C Ratio	-	-	4.328	0.593	0.404	-
HCM Control Delay (s)	-	-	$ 1646.2	23.9	16.5	-
HCM Lane LOS	-	-	F	C	C	-
HCM 95th %tile Q(veh)	-	-	26.7	3.8	1.9	-

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

DELAY (CONTROL)

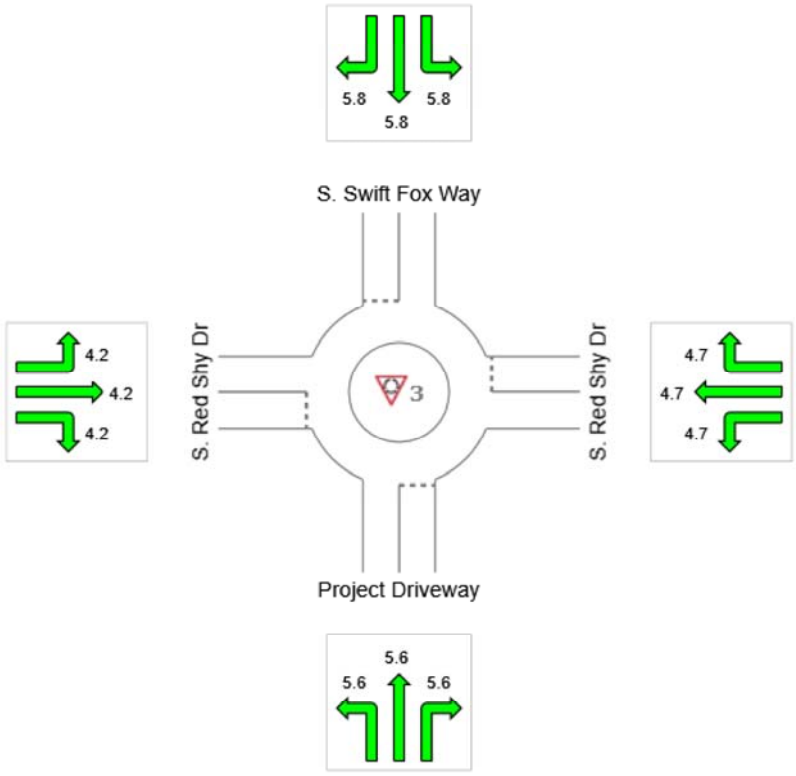
Average control delay per vehicle, or average pedestrian delay (seconds)

Site: 3 [2021+Project_AM]

New Site
Site Category: (None)
Roundabout

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Delay (Control)	5.6	4.7	5.8	4.2	5.2
LOS	A	A	A	A	A



Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

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	0.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	8	1031	1848	7	5	9
Future Vol, veh/h	8	1031	1848	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	1172	2100	8	6	10

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	2108	0	-	0	2704	1050
Stage 1	-	-	-	-	2100	-
Stage 2	-	-	-	-	604	-
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	257	-	-	-	17	224
Stage 1	-	-	-	-	80	-
Stage 2	-	-	-	-	508	-
Platoon blocked, %			-	-	-	
Mov Cap-1 Maneuver	257	-	-	-	16	224
Mov Cap-2 Maneuver	-	-	-	-	16	-
Stage 1	-	-	-	-	77	-
Stage 2	-	-	-	-	508	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	145.2
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	257	-	-	-	40
HCM Lane V/C Ratio	0.035	-	-	-	0.398
HCM Control Delay (s)	19.5	-	-	-	145.2
HCM Lane LOS	C	-	-	-	F
HCM 95th %tile Q(veh)	0.1	-	-	-	1.4

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑↑			↱
Traffic Vol, veh/h	0	1040	1635	244	0	96
Future Vol, veh/h	0	1040	1635	244	0	96
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	1130	1777	265	0	104

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	-	1021
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	201
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	-	-	-	-	-	201
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

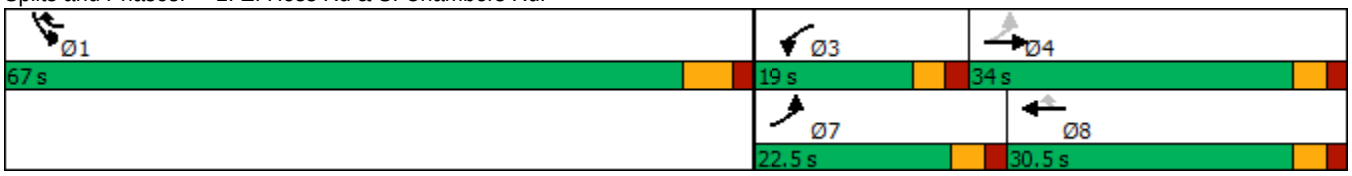
Approach	EB	WB	SB
HCM Control Delay, s	0	0	40.8
HCM LOS			E

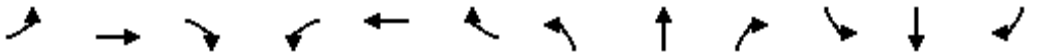
Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	201
HCM Lane V/C Ratio	-	-	-	0.519
HCM Control Delay (s)	-	-	-	40.8
HCM Lane LOS	-	-	-	E
HCM 95th %tile Q(veh)	-	-	-	2.7

Lane Group	EBL	EBT	WBL	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (vph)	42	547	94	384	419	1190	5
Future Volume (vph)	42	547	94	384	419	1190	5
Turn Type	pm+pt	NA	Prot	NA	pm+ov	Prot	Free
Protected Phases	7	4	3	8	1	1	
Permitted Phases	4				8		Free
Detector Phase	7	4	3	8	1	1	
Switch Phase							
Minimum Initial (s)	11.0	15.0	5.0	15.0	15.0	15.0	
Minimum Split (s)	22.5	21.5	16.5	21.5	21.5	21.5	
Total Split (s)	22.5	34.0	19.0	30.5	67.0	67.0	
Total Split (%)	18.8%	28.3%	15.8%	25.4%	55.8%	55.8%	
Yellow Time (s)	3.0	3.0	3.0	3.0	4.5	4.5	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	5.0	5.0	5.0	6.5	6.5	
Lead/Lag	Lead	Lag	Lead	Lag			
Lead-Lag Optimize?	Yes	Yes	Yes	Yes			
Recall Mode	None	None	None	None	None	None	
Act Effct Green (s)	30.0	21.8	10.7	25.8	77.8	42.9	89.4
Actuated g/C Ratio	0.34	0.24	0.12	0.29	0.87	0.48	1.00
v/c Ratio	0.10	0.67	0.47	0.40	0.31	0.76	0.00
Control Delay	20.3	37.6	50.9	30.2	0.8	23.7	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.3	37.6	50.9	30.2	0.8	23.7	0.0
LOS	C	D	D	C	A	C	A
Approach Delay		36.3		18.6			
Approach LOS		D		B			

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 89.4	
Natural Cycle: 80	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.76	
Intersection Signal Delay: 24.7	Intersection LOS: C
Intersection Capacity Utilization 67.3%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 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)	42	547	0	94	384	419	0	0	0	1190	0	5
Future Volume (veh/h)	42	547	0	94	384	419	0	0	0	1190	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	99	404	441				1253	0	0
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	353	867	0	129	799	1048				1507	0	
Arrive On Green	0.09	0.24	0.00	0.07	0.22	0.22				0.44	0.00	0.00
Sat Flow, veh/h	1781	3647	0	1781	3554	1585				3456	0	1585
Grp Volume(v), veh/h	44	576	0	99	404	441				1253	0	0
Grp Sat Flow(s),veh/h/ln	1781	1777	0	1781	1777	1585				1728	0	1585
Q Serve(g_s), s	1.2	9.8	0.0	3.6	6.6	4.3				21.4	0.0	0.0
Cycle Q Clear(g_c), s	1.2	9.8	0.0	3.6	6.6	4.3				21.4	0.0	0.0
Prop In Lane	1.00		0.00	1.00		1.00				1.00		1.00
Lane Grp Cap(c), veh/h	353	867	0	129	799	1048				1507	0	
V/C Ratio(X)	0.12	0.66	0.00	0.77	0.51	0.42				0.83	0.00	
Avail Cap(c_a), veh/h	657	1544	0	374	1358	1297				3132	0	
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	0.00
Uniform Delay (d), s/veh	16.3	22.8	0.0	30.4	22.6	1.3				16.6	0.0	0.0
Incr Delay (d2), s/veh	0.2	0.9	0.0	9.1	0.5	0.3				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	0.4	3.7	0.0	1.8	2.5	1.3				7.0	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	16.5	23.6	0.0	39.5	23.1	1.6				17.9	0.0	0.0
LnGrp LOS	B	C	A	D	C	A				B	A	
Approach Vol, veh/h		620			944						1253	A
Approach Delay, s/veh		23.1			14.8						17.9	
Approach LOS		C			B						B	

Timer - Assigned Phs			3	4		6	7	8				
Phs Duration (G+Y+Rc), s			9.8	21.3		35.6	11.1	20.0				
Change Period (Y+Rc), s			5.0	5.0		6.5	5.0	5.0				
Max Green Setting (Gmax), s			14.0	29.0		60.5	17.5	25.5				
Max Q Clear Time (g_c+I1), s			5.6	11.8		23.4	3.2	8.6				
Green Ext Time (p_c), s			0.1	3.2		5.7	0.1	3.7				

Intersection Summary												
HCM 6th Ctrl Delay			18.0									
HCM 6th LOS			B									

Notes

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

Intersection	
Int Delay, s/veh	23.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	203	164	388	78	196	1010
Future Vol, veh/h	203	164	388	78	196	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	450	-
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	209	169	400	80	202	1041

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1220	200	0	0	480	0
Stage 1	400	-	-	-	-	-
Stage 2	820	-	-	-	-	-
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	~ 203	808	-	-	1079	-
Stage 1	624	-	-	-	-	-
Stage 2	366	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 165	808	-	-	1079	-
Mov Cap-2 Maneuver	~ 165	-	-	-	-	-
Stage 1	624	-	-	-	-	-
Stage 2	298	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	123.2	0	1.5
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	165	808	1079	-
HCM Lane V/C Ratio	-	-	1.268	0.209	0.187	-
HCM Control Delay (s)	-	-	214.1	10.6	9.1	-
HCM Lane LOS	-	-	F	B	A	-
HCM 95th %tile Q(veh)	-	-	12	0.8	0.7	-

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

DELAY (CONTROL)

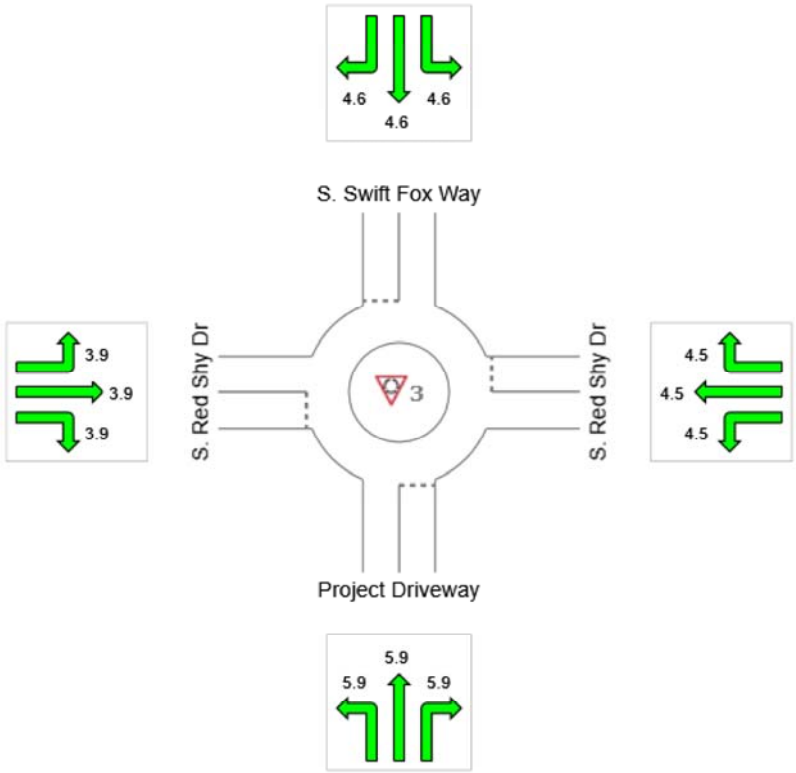
Average control delay per vehicle, or average pedestrian delay (seconds)

Site: 3 [2021+Project_PM]

New Site
Site Category: (None)
Roundabout

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Delay (Control)	5.9	4.5	4.6	3.9	5.2
LOS	A	A	A	A	A



Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

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	1818	1011	12	7	4
Future Vol, veh/h	9	1818	1011	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	1914	1064	13	7	4

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1077	0	-	0	2039	532
Stage 1	-	-	-	-	1064	-
Stage 2	-	-	-	-	975	-
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	643	-	-	-	49	492
Stage 1	-	-	-	-	293	-
Stage 2	-	-	-	-	326	-
Platoon blocked, %			-	-	-	
Mov Cap-1 Maneuver	643	-	-	-	48	492
Mov Cap-2 Maneuver	-	-	-	-	48	-
Stage 1	-	-	-	-	289	-
Stage 2	-	-	-	-	326	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	65.3
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	643	-	-	-	71
HCM Lane V/C Ratio	0.015	-	-	-	0.163
HCM Control Delay (s)	10.7	-	-	-	65.3
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	1827	781	241	0	116
Future Vol, veh/h	0	1827	781	241	0	116
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	1986	849	262	0	126

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	-	556
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	406
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	-	-	-	-	-	406
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	17.8
HCM LOS			C

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	406
HCM Lane V/C Ratio	-	-	-	0.311
HCM Control Delay (s)	-	-	-	17.8
HCM Lane LOS	-	-	-	C
HCM 95th %tile Q(veh)	-	-	-	1.3

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	206	228	1000	120	179	406
Future Volume (vph)	206	228	1000	120	179	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)	23.5	10.5	24.5	23.5	10.5	24.5
Total Split (s)	32.0	29.0	59.0	32.0	29.0	88.0
Total Split (%)	26.7%	24.2%	49.2%	26.7%	24.2%	73.3%
Yellow Time (s)	3.0	3.0	4.5	3.0	3.0	4.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	6.5	5.0	5.0	6.5
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)	21.2	45.2	63.3	91.0	19.0	87.3
Actuated g/C Ratio	0.18	0.38	0.53	0.76	0.16	0.73
v/c Ratio	0.78	0.44	0.63	0.11	0.75	0.13
Control Delay	63.5	25.5	27.4	1.7	64.8	5.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	63.5	25.5	27.4	1.7	64.8	5.4
LOS	E	C	C	A	E	A
Approach Delay	43.6		24.6			23.6
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: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.78	
Intersection Signal Delay: 28.2	Intersection LOS: C
Intersection Capacity Utilization 62.7%	ICU Level of Service B
Analysis Period (min) 15	

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

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	206	228	1000	120	179	406
Future Volume (veh/h)	206	228	1000	120	179	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	242	268	1176	141	211	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	299	481	1986	1152	242	3760
Arrive On Green	0.17	0.17	0.56	0.56	0.14	0.74
Sat Flow, veh/h	1781	1585	3647	1585	1781	5274
Grp Volume(v), veh/h	242	268	1176	141	211	478
Grp Sat Flow(s),veh/h/ln	1781	1585	1777	1585	1781	1702
Q Serve(g_s), s	15.7	17.0	26.2	3.2	13.9	3.3
Cycle Q Clear(g_c), s	15.7	17.0	26.2	3.2	13.9	3.3
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	299	481	1986	1152	242	3760
V/C Ratio(X)	0.81	0.56	0.59	0.12	0.87	0.13
Avail Cap(c_a), veh/h	401	572	1986	1152	356	3760
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	48.1	35.0	17.4	4.9	50.8	4.6
Incr Delay (d2), s/veh	8.8	1.0	1.3	0.2	14.7	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	7.7	6.7	10.7	1.9	7.2	1.1
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	56.9	36.0	18.8	5.1	65.5	4.7
LnGrp LOS	E	D	B	A	E	A
Approach Vol, veh/h	510		1317			689
Approach Delay, s/veh	45.9		17.3			23.3
Approach LOS	D		B			C

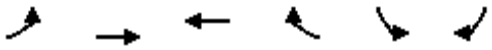
Timer - Assigned Phs	1	2			6	8
Phs Duration (G+Y+Rc), s	21.3	73.6			94.9	25.1
Change Period (Y+Rc), s	5.0	6.5			6.5	5.0
Max Green Setting (Gmax), s	24.0	52.5			81.5	27.0
Max Q Clear Time (g_c+I1), s	15.9	28.2			5.3	19.0
Green Ext Time (p_c), s	0.4	10.3			3.8	1.1

Intersection Summary			
HCM 6th Ctrl Delay		24.7	
HCM 6th LOS		C	

Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Traffic Volume (vph)	8	1031	1848	7	5
Future Volume (vph)	8	1031	1848	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)	10.5	23.5	23.5	23.5	23.5
Total Split (s)	10.5	96.5	86.0	86.0	23.5
Total Split (%)	8.8%	80.4%	71.7%	71.7%	19.6%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5
Lead/Lag	Lead		Lag	Lag	
Lead-Lag Optimize?	Yes		Yes	Yes	
Recall Mode	None	C-Max	C-Max	C-Max	Min
Act Effct Green (s)	6.2	98.0	95.4	95.4	11.0
Actuated g/C Ratio	0.05	0.82	0.80	0.80	0.09
v/c Ratio	0.10	0.41	0.75	0.01	0.10
Control Delay	66.2	2.4	9.2	3.7	51.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	66.2	2.4	9.2	3.7	51.9
LOS	E	A	A	A	D
Approach Delay		2.9	9.2		51.9
Approach LOS		A	A		D

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 34 (28%), Referenced to phase 4:EBT and 8:WBT, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.75	
Intersection Signal Delay: 7.2	Intersection LOS: A
Intersection Capacity Utilization 69.4%	ICU Level of Service C
Analysis Period (min) 15	

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



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	8	1031	1848	7	5	9
Future Volume (veh/h)	8	1031	1848	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	1172	2100	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	2902	2701	1205	54	90
Arrive On Green	0.02	1.00	0.76	0.76	0.09	0.09
Sat Flow, veh/h	1781	3647	3647	1585	588	979
Grp Volume(v), veh/h	9	1172	2100	8	17	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1585	1665	0
Q Serve(g_s), s	0.6	0.0	41.6	0.1	1.1	0.0
Cycle Q Clear(g_c), s	0.6	0.0	41.6	0.1	1.1	0.0
Prop In Lane	1.00			1.00	0.35	0.59
Lane Grp Cap(c), veh/h	19	2902	2701	1205	153	0
V/C Ratio(X)	0.47	0.40	0.78	0.01	0.11	0.00
Avail Cap(c_a), veh/h	74	2902	2701	1205	250	0
HCM Platoon Ratio	2.00	2.00	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	58.4	0.0	8.4	3.5	50.0	0.0
Incr Delay (d2), s/veh	16.6	0.4	2.3	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	0.4	0.2	12.3	0.0	0.5	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	75.0	0.4	10.7	3.5	50.3	0.0
LnGrp LOS	E	A	B	A	D	A
Approach Vol, veh/h		1181	2108		17	
Approach Delay, s/veh		1.0	10.7		50.3	
Approach LOS		A	B		D	

Timer - Assigned Phs			4		6	7	8
Phs Duration (G+Y+Rc), s			103.5		16.5	6.8	96.7
Change Period (Y+Rc), s			5.5		5.5	5.5	5.5
Max Green Setting (Gmax), s			91.0		18.0	5.0	80.5
Max Q Clear Time (g_c+I1), s			2.0		3.1	2.6	43.6
Green Ext Time (p_c), s			10.6		0.0	0.0	23.8

Intersection Summary	
HCM 6th Ctrl Delay	7.4
HCM 6th LOS	A

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	203	164	388	78	196	1010
Future Volume (vph)	203	164	388	78	196	1010
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	15.0	11.0	5.0	15.0
Minimum Split (s)	23.5	10.5	24.5	23.5	10.5	24.5
Total Split (s)	40.0	40.0	40.0	40.0	40.0	80.0
Total Split (%)	33.3%	33.3%	33.3%	33.3%	33.3%	66.7%
Yellow Time (s)	3.0	3.0	4.5	3.0	3.0	4.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	6.5	5.0	5.0	6.5
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)	19.5	43.6	64.9	90.9	19.1	89.0
Actuated g/C Ratio	0.16	0.36	0.54	0.76	0.16	0.74
v/c Ratio	0.73	0.25	0.21	0.07	0.72	0.28
Control Delay	61.8	3.9	21.2	3.6	61.8	5.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	61.8	3.9	21.2	3.6	61.8	5.7
LOS	E	A	C	A	E	A
Approach Delay	35.9		18.3			14.8
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: 0.73	
Intersection Signal Delay: 19.4	Intersection LOS: B
Intersection Capacity Utilization 48.4%	ICU Level of Service A
Analysis Period (min) 15	

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

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	203	164	388	78	196	1010
Future Volume (veh/h)	203	164	388	78	196	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	209	169	400	80	202	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	250	431	2098	1158	235	3900
Arrive On Green	0.14	0.14	0.59	0.59	0.13	0.76
Sat Flow, veh/h	1781	1585	3647	1585	1781	5274
Grp Volume(v), veh/h	209	169	400	80	202	1041
Grp Sat Flow(s),veh/h/ln	1781	1585	1777	1585	1781	1702
Q Serve(g_s), s	13.7	10.4	6.2	1.7	13.3	7.3
Cycle Q Clear(g_c), s	13.7	10.4	6.2	1.7	13.3	7.3
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	250	431	2098	1158	235	3900
V/C Ratio(X)	0.84	0.39	0.19	0.07	0.86	0.27
Avail Cap(c_a), veh/h	520	671	2098	1158	520	3900
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	50.2	35.6	11.3	4.6	51.0	4.2
Incr Delay (d2), s/veh	7.2	0.6	0.2	0.1	8.9	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	6.6	4.1	2.5	0.9	6.5	2.2
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	57.5	36.2	11.6	4.7	59.9	4.4
LnGrp LOS	E	D	B	A	E	A
Approach Vol, veh/h	378		480			1243
Approach Delay, s/veh	47.9		10.4			13.4
Approach LOS	D		B			B

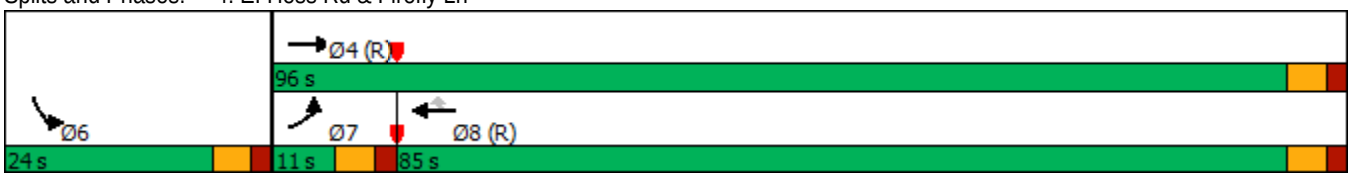
Timer - Assigned Phs	1	2			6	8
Phs Duration (G+Y+Rc), s	20.8	77.3			98.2	21.8
Change Period (Y+Rc), s	5.0	6.5			6.5	5.0
Max Green Setting (Gmax), s	35.0	33.5			73.5	35.0
Max Q Clear Time (g_c+I1), s	15.3	8.2			9.3	15.7
Green Ext Time (p_c), s	0.5	3.0			9.9	1.1

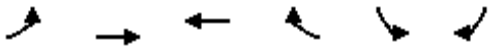
Intersection Summary		
HCM 6th Ctrl Delay		18.9
HCM 6th LOS		B

Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Traffic Volume (vph)	9	1818	1011	12	7
Future Volume (vph)	9	1818	1011	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)	10.5	23.5	23.5	23.5	23.5
Total Split (s)	11.0	96.0	85.0	85.0	24.0
Total Split (%)	9.2%	80.0%	70.8%	70.8%	20.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5
Lead/Lag	Lead		Lag	Lag	
Lead-Lag Optimize?	Yes		Yes	Yes	
Recall Mode	None	C-Max	C-Max	C-Max	Min
Act Effct Green (s)	6.2	98.0	95.4	95.4	11.0
Actuated g/C Ratio	0.05	0.82	0.80	0.80	0.09
v/c Ratio	0.10	0.66	0.38	0.01	0.07
Control Delay	67.6	5.4	4.5	3.6	51.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	67.6	5.4	4.5	3.6	51.1
LOS	E	A	A	A	D
Approach Delay		5.7	4.5		51.1
Approach LOS		A	A		D

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 36 (30%), Referenced to phase 4:EBT and 8:WBT, Start of Green	
Natural Cycle: 70	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.66	
Intersection Signal Delay: 5.4	Intersection LOS: A
Intersection Capacity Utilization 68.6%	ICU Level of Service C
Analysis Period (min) 15	

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





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	9	1818	1011	12	7	4
Future Volume (veh/h)	9	1818	1011	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	1914	1064	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	2902	2701	1205	92	52
Arrive On Green	0.01	0.82	0.76	0.76	0.09	0.09
Sat Flow, veh/h	1781	3647	3647	1585	1002	572
Grp Volume(v), veh/h	9	1914	1064	13	12	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1585	1717	0
Q Serve(g_s), s	0.6	25.7	12.3	0.2	0.8	0.0
Cycle Q Clear(g_c), s	0.6	25.7	12.3	0.2	0.8	0.0
Prop In Lane	1.00			1.00	0.58	0.33
Lane Grp Cap(c), veh/h	19	2902	2701	1205	157	0
V/C Ratio(X)	0.47	0.66	0.39	0.01	0.08	0.00
Avail Cap(c_a), veh/h	82	2902	2701	1205	265	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	4.4	4.9	3.5	49.9	0.0
Incr Delay (d2), s/veh	16.6	1.2	0.4	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	3.5	0.1	0.3	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	75.6	5.6	5.4	3.5	50.1	0.0
LnGrp LOS	E	A	A	A	D	A
Approach Vol, veh/h		1923	1077		12	
Approach Delay, s/veh		5.9	5.3		50.1	
Approach LOS		A	A		D	

Timer - Assigned Phs	4	6	7	8
Phs Duration (G+Y+Rc), s	103.5	16.5	6.8	96.7
Change Period (Y+Rc), s	5.5	5.5	5.5	5.5
Max Green Setting (Gmax), s	90.5	18.5	5.5	79.5
Max Q Clear Time (g_c+I1), s	27.7	2.8	2.6	14.3
Green Ext Time (p_c), s	26.4	0.0	0.0	9.0

Intersection Summary	
HCM 6th Ctrl Delay	5.9
HCM 6th LOS	A

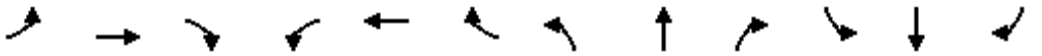
Notes

User approved volume balancing among the lanes for turning movement.

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	15.0		11.0	15.0		11.0	15.0		11.0	15.0	
Minimum Split (s)	22.5	21.0		16.0	21.0		17.5	24.5		17.5	21.5	
Total Split (s)	22.5	25.0		37.0	39.5		49.3	67.0		21.0	38.7	
Total Split (%)	15.0%	16.7%		24.7%	26.3%		32.9%	44.7%		14.0%	25.8%	
Yellow Time (s)	3.0	3.0		3.0	3.0		4.5	4.5		4.5	4.5	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0		6.5	6.5		6.5	6.5	
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)	14.3	19.7	150.0	31.3	36.7	150.0	41.1	61.9	150.0	14.1	34.9	150.0
Actuated g/C Ratio	0.10	0.13	1.00	0.21	0.24	1.00	0.27	0.41	1.00	0.09	0.23	1.00
v/c Ratio	0.63	0.90	0.34	0.93	0.62	0.42	0.92	0.87	0.62	0.81	0.70	0.06
Control Delay	74.1	86.9	0.6	78.8	47.4	0.6	68.7	46.4	1.9	85.8	57.3	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	74.1	86.9	0.6	78.8	47.4	0.6	68.7	46.4	1.9	85.8	57.3	0.1
LOS	E	F	A	E	D	A	E	D	A	F	E	A
Approach Delay		44.9			41.9			39.7			58.8	
Approach LOS		D			D			D			E	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 150	
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green	
Natural Cycle: 110	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.93	
Intersection Signal Delay: 43.9	Intersection LOS: D
Intersection Capacity Utilization 90.8%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 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)	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	258	463		710	928		928	2157		306	1238	
Arrive On Green	0.07	0.13	0.00	0.21	0.26	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	8.8	17.4	0.0	28.3	19.6	0.0	36.9	48.5	0.0	11.2	22.1	0.0
Cycle Q Clear(g_c), s	8.8	17.4	0.0	28.3	19.6	0.0	36.9	48.5	0.0	11.2	22.1	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	258	463		710	928		928	2157		306	1238	
V/C Ratio(X)	0.80	0.90		0.93	0.57		0.94	0.85		0.85	0.67	
Avail Cap(c_a), veh/h	403	474		737	928		986	2157		334	1238	
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	68.3	64.3	0.0	58.6	48.2	0.0	53.6	39.0	0.0	67.4	51.4	0.0
Incr Delay (d2), s/veh	6.3	20.1	0.0	18.6	0.9	0.0	15.3	4.4	0.0	17.6	2.9	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	4.1	9.0	0.0	14.0	8.6	0.0	17.6	20.4	0.0	5.6	9.6	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	74.7	84.4	0.0	77.2	49.0	0.0	69.0	43.4	0.0	85.0	54.3	0.0
LnGrp LOS	E	F		E	D		E	D		F	D	
Approach Vol, veh/h		625	A		1196	A		2702	A		1093	A
Approach Delay, s/veh		81.2			64.7			51.7			61.7	
Approach LOS		F			E			D			E	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	19.8	69.9	35.8	24.5	46.8	42.9	16.2	44.2
Change Period (Y+Rc), s	6.5	6.5	5.0	5.0	6.5	6.5	5.0	5.0
Max Green Setting (Gmax), s	14.5	60.5	32.0	20.0	42.8	32.2	17.5	34.5
Max Q Clear Time (g_c+I1), s	13.2	50.5	30.3	19.4	38.9	24.1	10.8	21.6
Green Ext Time (p_c), s	0.1	7.5	0.5	0.2	1.4	3.2	0.3	2.6

Intersection Summary	
HCM 6th Ctrl Delay	59.7
HCM 6th LOS	E

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	0
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)

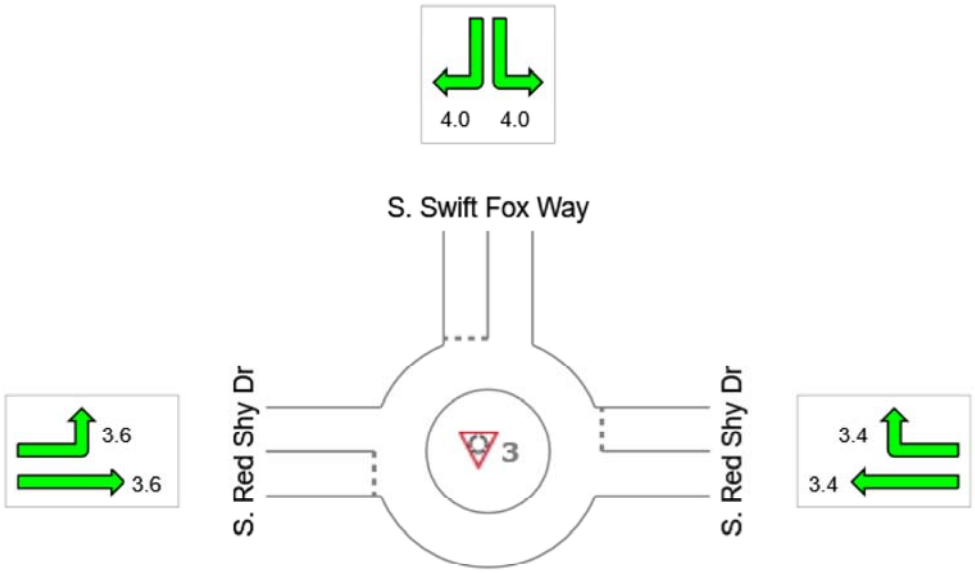
Average control delay per vehicle, or average pedestrian delay (seconds)

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

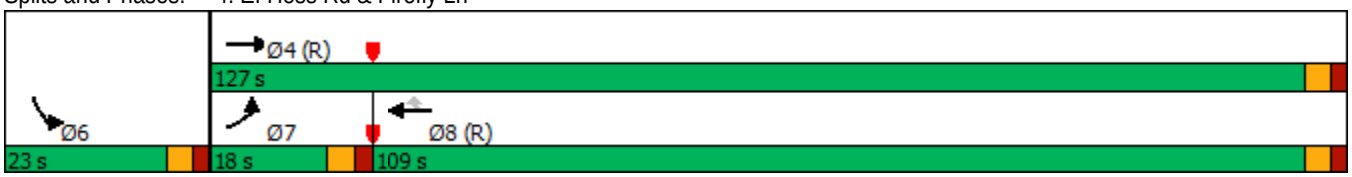
LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

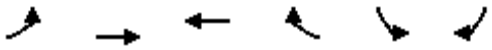
Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
NA (TWSC): Level of Service is not defined for major road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

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	15.0	15.0	15.0	15.0
Minimum Split (s)	17.5	24.5	24.5	24.5	23.0
Total Split (s)	18.0	127.0	109.0	109.0	23.0
Total Split (%)	12.0%	84.7%	72.7%	72.7%	15.3%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag	
Lead-Lag Optimize?	Yes		Yes	Yes	
Recall Mode	None	C-Max	C-Max	C-Max	Min
Act Effct Green (s)	11.0	125.0	118.6	118.6	15.0
Actuated g/C Ratio	0.07	0.83	0.79	0.79	0.10
v/c Ratio	0.09	0.56	0.66	0.01	0.13
Control Delay	65.2	3.7	9.4	4.9	63.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	65.2	3.7	9.4	4.9	63.6
LOS	E	A	A	A	E
Approach Delay		4.1	9.3		63.6
Approach LOS		A	A		E

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 150	
Offset: 42 (28%), Referenced to phase 4:EBT and 8:WBT, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.66	
Intersection Signal Delay: 7.2	Intersection LOS: A
Intersection Capacity Utilization 67.8%	ICU Level of Service C
Analysis Period (min) 15	

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





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	48	2961	2747	1225	81	81
Arrive On Green	0.03	0.83	0.77	0.77	0.10	0.10
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	0.9	21.9	36.9	0.4	1.9	0.0
Cycle Q Clear(g_c), s	0.9	21.9	36.9	0.4	1.9	0.0
Prop In Lane	1.00			1.00	0.48	0.48
Lane Grp Cap(c), veh/h	48	2961	2747	1225	169	0
V/C Ratio(X)	0.23	0.56	0.67	0.01	0.14	0.00
Avail Cap(c_a), veh/h	154	2961	2747	1225	202	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	71.5	3.9	8.0	3.9	61.6	0.0
Incr Delay (d2), s/veh	2.4	0.8	1.3	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	0.4	5.5	11.9	0.1	0.8	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	73.8	4.7	9.4	3.9	62.0	0.0
LnGrp LOS	E	A	A	A	E	A
Approach Vol, veh/h		1669	1865		23	
Approach Delay, s/veh		5.1	9.3		62.0	
Approach LOS		A	A		E	

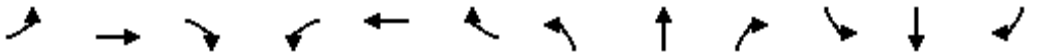
Timer - Assigned Phs			4		6	7	8
Phs Duration (G+Y+Rc), s			130.0		20.0	9.0	121.0
Change Period (Y+Rc), s			5.0		5.0	5.0	5.0
Max Green Setting (Gmax), s			122.0		18.0	13.0	104.0
Max Q Clear Time (g_c+I1), s			23.9		3.9	2.9	38.9
Green Ext Time (p_c), s			20.9		0.0	0.0	25.0

Intersection Summary	
HCM 6th Ctrl Delay	7.7
HCM 6th LOS	A

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	15.0		11.0	15.0		11.0	15.0		11.0	15.0	
Minimum Split (s)	22.5	21.0		16.0	21.0		17.5	24.5		17.5	21.5	
Total Split (s)	24.4	27.0		33.0	35.6		35.0	56.0		34.0	55.0	
Total Split (%)	16.3%	18.0%		22.0%	23.7%		23.3%	37.3%		22.7%	36.7%	
Yellow Time (s)	3.0	3.0		3.0	3.0		4.5	4.5		4.5	4.5	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0		6.5	6.5		6.5	6.5	
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)	17.5	22.0	150.0	28.0	32.5	150.0	28.5	49.5	150.0	27.5	48.5	150.0
Actuated g/C Ratio	0.12	0.15	1.00	0.19	0.22	1.00	0.19	0.33	1.00	0.18	0.32	1.00
v/c Ratio	0.76	1.20	0.67	1.32	0.70	0.24	1.33	1.09	0.62	1.33	1.33	0.08
Control Delay	76.7	161.5	2.3	200.4	52.4	0.3	206.1	98.1	1.9	205.3	193.5	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	76.7	161.5	2.3	200.4	52.4	0.3	206.1	98.1	1.9	205.3	193.5	0.1
LOS	E	F	A	F	D	A	F	F	A	F	F	A
Approach Delay		63.5			112.8			97.8			188.7	
Approach LOS		E			F			F			F	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 150	
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green	
Natural Cycle: 150	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.33	
Intersection Signal Delay: 120.9	Intersection LOS: F
Intersection Capacity Utilization 119.1%	ICU Level of Service H
Analysis Period (min) 15	

Splits and Phases: 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)	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	355	521		645	820		657	1685		634	1651	
Arrive On Green	0.10	0.15	0.00	0.19	0.23	0.00	0.19	0.33	0.00	0.18	0.32	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	13.0	22.0	0.0	28.0	20.4	0.0	28.5	49.5	0.0	27.5	48.5	0.0
Cycle Q Clear(g_c), s	13.0	22.0	0.0	28.0	20.4	0.0	28.5	49.5	0.0	27.5	48.5	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	355	521		645	820		657	1685		634	1651	
V/C Ratio(X)	0.86	1.20		1.31	0.65		1.33	1.09		1.32	1.33	
Avail Cap(c_a), veh/h	447	521		645	820		657	1685		634	1651	
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	66.2	64.0	0.0	61.0	52.2	0.0	60.8	50.2	0.0	61.2	50.8	0.0
Incr Delay (d2), s/veh	12.6	107.0	0.0	152.4	1.8	0.0	156.7	49.8	0.0	155.4	151.2	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	6.3	17.5	0.0	25.7	9.1	0.0	26.5	28.2	0.0	25.5	43.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	78.9	171.0	0.0	213.4	54.0	0.0	217.4	100.0	0.0	216.6	202.0	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		140.9			151.9			137.8			206.0	
Approach LOS		F			F			F			F	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	34.0	56.0	33.0	27.0	35.0	55.0	20.4	39.6
Change Period (Y+Rc), s	6.5	6.5	5.0	5.0	6.5	6.5	5.0	5.0
Max Green Setting (Gmax), s	27.5	49.5	28.0	22.0	28.5	48.5	19.4	30.6
Max Q Clear Time (g_c+I1), s	29.5	51.5	30.0	24.0	30.5	50.5	15.0	22.4
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.4	2.0

Intersection Summary	
HCM 6th Ctrl Delay	166.3
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	0
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)

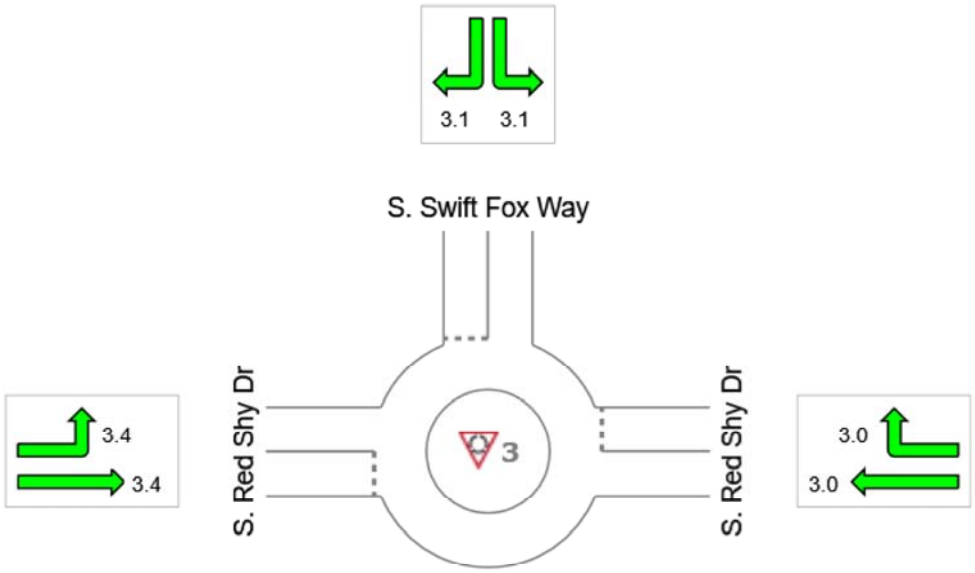
Average control delay per vehicle, or average pedestrian delay (seconds)

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

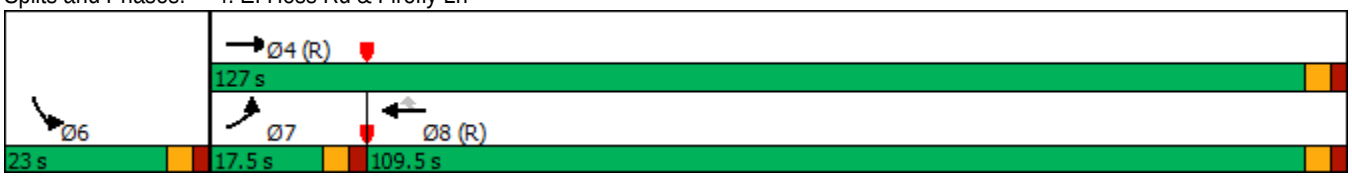
LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

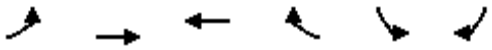
Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
NA (TWSC): Level of Service is not defined for major road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

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	15.0	15.0	15.0	11.0
Minimum Split (s)	17.5	24.5	24.5	24.5	23.0
Total Split (s)	17.5	127.0	109.5	109.5	23.0
Total Split (%)	11.7%	84.7%	73.0%	73.0%	15.3%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag	
Lead-Lag Optimize?	Yes		Yes	Yes	
Recall Mode	None	C-Max	C-Max	C-Max	Min
Act Effct Green (s)	11.0	129.0	122.6	122.6	11.0
Actuated g/C Ratio	0.07	0.86	0.82	0.82	0.07
v/c Ratio	0.12	0.76	0.61	0.02	0.18
Control Delay	47.5	17.0	6.9	3.8	69.0
Queue Delay	0.0	0.1	0.0	0.0	0.0
Total Delay	47.5	17.1	6.9	3.8	69.0
LOS	D	B	A	A	E
Approach Delay		17.3	6.9		69.0
Approach LOS		B	A		E

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 150	
Offset: 41.5 (28%), Referenced to phase 4:EBT and 8:WBT, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.76	
Intersection Signal Delay: 13.1	Intersection LOS: B
Intersection Capacity Utilization 76.2%	ICU Level of Service D
Analysis Period (min) 15	

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





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	64	3056	2811	1254	59	59
Arrive On Green	0.04	0.86	0.79	0.79	0.07	0.07
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	1.3	39.0	30.4	0.6	1.9	0.0
Cycle Q Clear(g_c), s	1.3	39.0	30.4	0.6	1.9	0.0
Prop In Lane	1.00			1.00	0.48	0.48
Lane Grp Cap(c), veh/h	64	3056	2811	1254	124	0
V/C Ratio(X)	0.25	0.76	0.62	0.02	0.19	0.00
Avail Cap(c_a), veh/h	148	3056	2811	1254	202	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	70.4	4.2	6.5	3.3	65.3	0.0
Incr Delay (d2), s/veh	2.0	1.8	1.0	0.0	0.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	8.2	9.3	0.2	0.9	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	72.4	6.0	7.5	3.4	66.0	0.0
LnGrp LOS	E	A	A	A	E	A
Approach Vol, veh/h		2326	1778		23	
Approach Delay, s/veh		6.5	7.4		66.0	
Approach LOS		A	A		E	

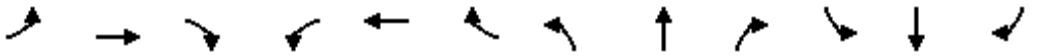
Timer - Assigned Phs	4	6	7	8
Phs Duration (G+Y+Rc), s	134.0	16.0	10.4	123.6
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	122.0	18.0	12.5	104.5
Max Q Clear Time (g_c+I1), s	41.0	3.9	3.3	32.4
Green Ext Time (p_c), s	43.7	0.0	0.0	23.0

Intersection Summary	
HCM 6th Ctrl Delay	7.2
HCM 6th LOS	A

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	211	385	490	699	509	610	800	1837	910	325	828	90
Future Volume (vph)	211	385	490	699	509	610	800	1837	910	325	828	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	15.0		11.0	15.0		11.0	15.0		11.0	15.0	
Minimum Split (s)	22.5	21.0		16.0	21.0		17.5	24.5		17.5	21.5	
Total Split (s)	22.5	22.0		38.0	37.5		49.3	67.2		22.8	40.7	
Total Split (%)	15.0%	14.7%		25.3%	25.0%		32.9%	44.8%		15.2%	27.1%	
Yellow Time (s)	3.0	3.0		3.0	3.0		4.5	4.5		4.5	4.5	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0		6.5	6.5		6.5	6.5	
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)	14.9	17.0	150.0	33.0	35.1	150.0	41.1	60.7	150.0	16.3	35.9	150.0
Actuated g/C Ratio	0.10	0.11	1.00	0.22	0.23	1.00	0.27	0.40	1.00	0.11	0.24	1.00
v/c Ratio	0.67	1.04	0.34	1.01	0.67	0.42	0.92	0.97	0.62	0.95	0.74	0.06
Control Delay	75.1	119.0	0.6	90.4	53.8	0.6	68.7	57.7	1.9	103.1	53.9	0.1
Queue Delay	0.2	0.0	0.0	0.0	0.0	0.1	0.0	37.8	0.0	0.0	0.0	0.0
Total Delay	75.3	119.0	0.6	90.4	53.8	0.7	68.7	95.5	1.9	103.1	53.9	0.1
LOS	E	F	A	F	D	A	E	F	A	F	D	A
Approach Delay		57.0			50.1			65.4			62.8	
Approach LOS		E			D			E			E	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 150	
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green	
Natural Cycle: 140	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.04	
Intersection Signal Delay: 60.2	Intersection LOS: E
Intersection Capacity Utilization 96.4%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 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	699	509	610	800	1837	910	325	828	90
Future Volume (veh/h)	211	385	490	699	509	610	800	1837	910	325	828	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	760	553	0	870	1997	0	353	900	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	279	403		760	897		928	2066		376	1250	
Arrive On Green	0.08	0.11	0.00	0.22	0.25	0.00	0.27	0.40	0.00	0.22	0.49	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	760	553	0	870	1997	0	353	900	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	9.8	17.0	0.0	33.0	20.7	0.0	36.9	57.4	0.0	15.1	20.8	0.0
Cycle Q Clear(g_c), s	9.8	17.0	0.0	33.0	20.7	0.0	36.9	57.4	0.0	15.1	20.8	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	279	403		760	897		928	2066		376	1250	
V/C Ratio(X)	0.82	1.04		1.00	0.62		0.94	0.97		0.94	0.72	
Avail Cap(c_a), veh/h	403	403		760	897		986	2066		376	1250	
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	0.95	0.95	0.00
Uniform Delay (d), s/veh	67.9	66.5	0.0	58.5	49.6	0.0	53.6	43.7	0.0	58.2	34.2	0.0
Incr Delay (d2), s/veh	8.5	55.0	0.0	32.6	1.3	0.0	15.3	13.3	0.0	30.4	3.4	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	10.7	0.0	17.5	9.2	0.0	17.6	25.8	0.0	7.3	6.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	76.4	121.5	0.0	91.0	50.9	0.0	69.0	57.0	0.0	88.6	37.7	0.0
LnGrp LOS	E	F		F	D		E	E		F	D	
Approach Vol, veh/h		647	A		1313	A		2867	A		1253	A
Approach Delay, s/veh		105.5			74.1			60.6			52.0	
Approach LOS		F			E			E			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	22.8	67.2	38.0	22.0	46.8	43.2	17.1	42.9
Change Period (Y+Rc), s	6.5	6.5	5.0	5.0	6.5	6.5	5.0	5.0
Max Green Setting (Gmax), s	16.3	60.7	33.0	17.0	42.8	34.2	17.5	32.5
Max Q Clear Time (g_c+I1), s	17.1	59.4	35.0	19.0	38.9	22.8	11.8	22.7
Green Ext Time (p_c), s	0.0	1.2	0.0	0.0	1.4	4.3	0.3	2.3

Intersection Summary	
HCM 6th Ctrl Delay	66.5
HCM 6th LOS	E

Notes

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

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	202	211	2445	244	165	1060
Future Volume (vph)	202	211	2445	244	165	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	15.0	11.0	5.0	15.0
Minimum Split (s)	24.5	15.5	25.5	24.5	15.5	24.5
Total Split (s)	24.6	28.0	97.4	24.6	28.0	125.4
Total Split (%)	16.4%	18.7%	64.9%	16.4%	18.7%	83.6%
Yellow Time (s)	3.0	3.0	4.5	3.0	3.0	4.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	6.5	5.0	5.0	6.5
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)	14.9	39.5	99.0	120.4	19.6	123.6
Actuated g/C Ratio	0.10	0.26	0.66	0.80	0.13	0.82
v/c Ratio	0.65	0.55	0.79	0.20	0.77	0.28
Control Delay	73.7	51.2	12.6	0.4	84.6	3.3
Queue Delay	0.0	0.0	3.3	0.0	0.0	0.0
Total Delay	73.7	51.2	16.0	0.4	84.6	3.3
LOS	E	D	B	A	F	A
Approach Delay	62.2		14.6			14.3
Approach LOS	E		B			B

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 150	
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green	
Natural Cycle: 100	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.79	
Intersection Signal Delay: 19.0	Intersection LOS: B
Intersection Capacity Utilization 79.3%	ICU Level of Service D
Analysis Period (min) 15	

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

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	202	211	2445	244	165	1060
Future Volume (veh/h)	202	211	2445	244	165	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	220	229	2658	265	179	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	452	388	3296	1230	203	4047
Arrive On Green	0.13	0.13	1.00	1.00	0.11	0.79
Sat Flow, veh/h	3456	1585	5274	1585	1781	5274
Grp Volume(v), veh/h	220	229	2658	265	179	1152
Grp Sat Flow(s),veh/h/ln	1728	1585	1702	1585	1781	1702
Q Serve(g_s), s	8.9	19.1	0.0	0.0	14.8	9.1
Cycle Q Clear(g_c), s	8.9	19.1	0.0	0.0	14.8	9.1
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	452	388	3296	1230	203	4047
V/C Ratio(X)	0.49	0.59	0.81	0.22	0.88	0.28
Avail Cap(c_a), veh/h	452	388	3296	1230	273	4047
HCM Platoon Ratio	1.00	1.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.46	0.46	1.00	1.00
Uniform Delay (d), s/veh	60.5	50.0	0.0	0.0	65.5	4.2
Incr Delay (d2), s/veh	0.8	2.4	1.0	0.2	21.7	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	4.0	7.9	0.3	0.1	8.0	2.9
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	61.3	52.4	1.0	0.2	87.2	4.3
LnGrp LOS	E	D	A	A	F	A
Approach Vol, veh/h	449		2923			1331
Approach Delay, s/veh	56.8		1.0			15.5
Approach LOS	E		A			B

Timer - Assigned Phs	1	2			6	8
Phs Duration (G+Y+Rc), s	22.1	103.3			125.4	24.6
Change Period (Y+Rc), s	5.0	6.5			6.5	5.0
Max Green Setting (Gmax), s	23.0	90.9			118.9	19.6
Max Q Clear Time (g_c+I1), s	16.8	2.0			11.1	21.1
Green Ext Time (p_c), s	0.2	64.0			11.7	0.0

Intersection Summary	
HCM 6th Ctrl Delay	10.4
HCM 6th LOS	B

DELAY (CONTROL)

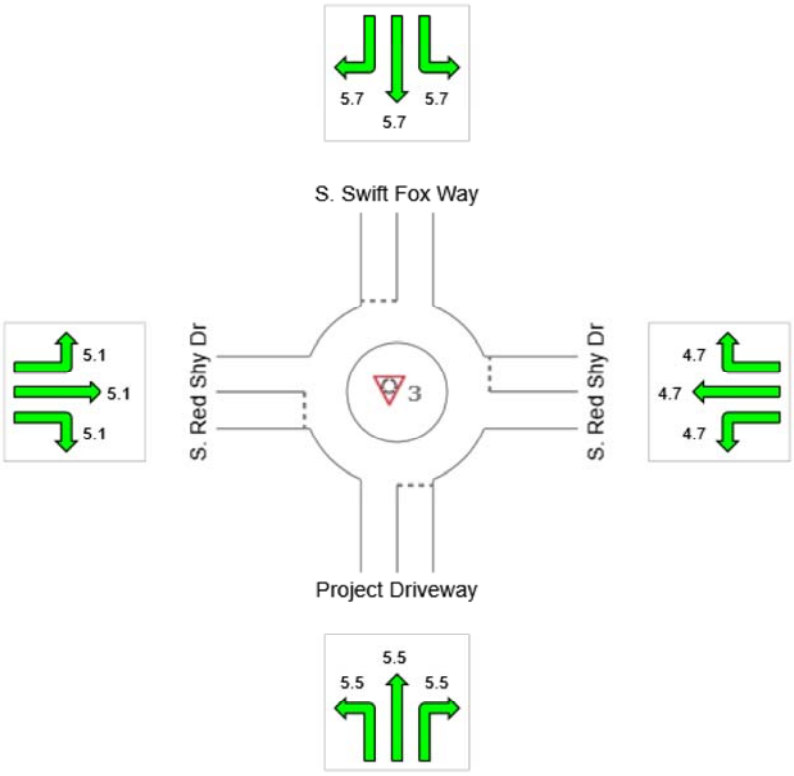
Average control delay per vehicle, or average pedestrian delay (seconds)

Site: 3 [2041+Project_AM]

New Site
Site Category: (None)
Roundabout

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Delay (Control)	5.5	4.7	5.7	5.1	5.4
LOS	A	A	A	A	A



Colour code based on Level of Service

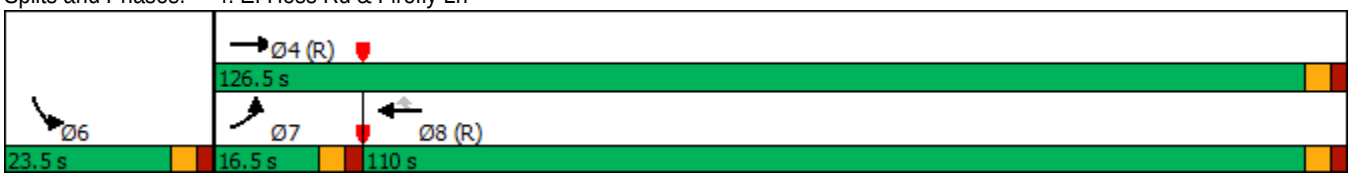
LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

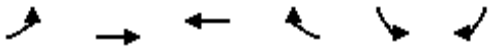
Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
NA (TWSC): Level of Service is not defined for major road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

Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Traffic Volume (vph)	14	1628	1822	16	10
Future Volume (vph)	14	1628	1822	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	15.0	15.0	15.0	11.0
Minimum Split (s)	16.5	23.5	23.5	23.5	23.5
Total Split (s)	16.5	126.5	110.0	110.0	23.5
Total Split (%)	11.0%	84.3%	73.3%	73.3%	15.7%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag	
Lead-Lag Optimize?	Yes		Yes	Yes	
Recall Mode	None	C-Max	C-Max	C-Max	Min
Act Effct Green (s)	11.0	129.0	122.6	122.6	11.0
Actuated g/C Ratio	0.07	0.86	0.82	0.82	0.07
v/c Ratio	0.12	0.58	0.68	0.01	0.21
Control Delay	62.6	4.5	8.3	3.9	69.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	62.6	4.5	8.3	3.9	69.9
LOS	E	A	A	A	E
Approach Delay		5.0	8.3		69.9
Approach LOS		A	A		E

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 150	
Offset: 41 (27%), Referenced to phase 4:EBT and 8:WBT, Start of Green	
Natural Cycle: 100	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.68	
Intersection Signal Delay: 7.2	Intersection LOS: A
Intersection Capacity Utilization 67.9%	ICU Level of Service C
Analysis Period (min) 15	

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





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	14	1628	1822	16	10	14
Future Volume (veh/h)	14	1628	1822	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	1770	1980	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	61	3056	2817	1256	50	68
Arrive On Green	0.03	0.86	0.79	0.79	0.07	0.07
Sat Flow, veh/h	1781	3647	3647	1585	680	927
Grp Volume(v), veh/h	15	1770	1980	17	27	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1585	1669	0
Q Serve(g_s), s	1.2	20.8	39.1	0.3	2.3	0.0
Cycle Q Clear(g_c), s	1.2	20.8	39.1	0.3	2.3	0.0
Prop In Lane	1.00			1.00	0.41	0.56
Lane Grp Cap(c), veh/h	61	3056	2817	1256	122	0
V/C Ratio(X)	0.25	0.58	0.70	0.01	0.22	0.00
Avail Cap(c_a), veh/h	137	3056	2817	1256	206	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	70.6	2.9	7.3	3.3	65.5	0.0
Incr Delay (d2), s/veh	2.1	0.8	1.5	0.0	0.9	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	4.3	12.0	0.1	1.0	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	72.7	3.7	8.8	3.3	66.4	0.0
LnGrp LOS	E	A	A	A	E	A
Approach Vol, veh/h		1785	1997		27	
Approach Delay, s/veh		4.3	8.7		66.4	
Approach LOS		A	A		E	

Timer - Assigned Phs			4		6	7	8
Phs Duration (G+Y+Rc), s			134.0		16.0	10.1	123.9
Change Period (Y+Rc), s			5.0		5.0	5.0	5.0
Max Green Setting (Gmax), s			121.5		18.5	11.5	105.0
Max Q Clear Time (g_c+I1), s			22.8		4.3	3.2	41.1
Green Ext Time (p_c), s			24.4		0.0	0.0	28.6

Intersection Summary	
HCM 6th Ctrl Delay	7.1
HCM 6th LOS	A

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	1642	1710	126	0	108
Future Vol, veh/h	0	1642	1710	126	0	108
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	1785	1859	137	0	117

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	-	998
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	208
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	-	-	-	-	-	208
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

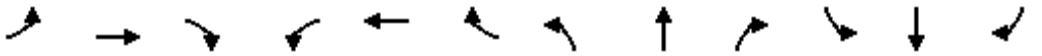
Approach	EB	WB	SB
HCM Control Delay, s	0	0	42.6
HCM LOS			E

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	208
HCM Lane V/C Ratio	-	-	-	0.564
HCM Control Delay (s)	-	-	-	42.6
HCM Lane LOS	-	-	-	E
HCM 95th %tile Q(veh)	-	-	-	3.1

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	301	575	980	887	512	345	700	1291	795	872	2091	120
Future Volume (vph)	301	575	980	887	512	345	700	1291	795	872	2091	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	15.0		11.0	15.0		11.0	15.0		11.0	15.0	
Minimum Split (s)	22.5	21.0		16.0	21.0		17.5	24.5		17.5	21.5	
Total Split (s)	24.6	27.0		35.0	37.4		32.0	51.0		37.0	56.0	
Total Split (%)	16.4%	18.0%		23.3%	24.9%		21.3%	34.0%		24.7%	37.3%	
Yellow Time (s)	3.0	3.0		3.0	3.0		4.5	4.5		4.5	4.5	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0		6.5	6.5		6.5	6.5	
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)	18.2	22.0	150.0	30.0	33.8	150.0	25.5	44.5	150.0	30.5	49.5	150.0
Actuated g/C Ratio	0.12	0.15	1.00	0.20	0.23	1.00	0.17	0.30	1.00	0.20	0.33	1.00
v/c Ratio	0.79	1.20	0.67	1.41	0.70	0.24	1.31	0.93	0.55	1.36	1.35	0.08
Control Delay	78.0	161.5	2.3	232.5	50.8	0.3	196.8	62.9	1.4	213.5	198.4	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	78.0	161.5	2.3	232.5	50.8	0.3	196.8	62.9	1.4	213.5	198.4	0.1
LOS	E	F	A	F	D	A	F	E	A	F	F	A
Approach Delay		63.9			133.2			79.0			195.0	
Approach LOS		E			F			E			F	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 150	
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green	
Natural Cycle: 150	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.41	
Intersection Signal Delay: 123.8	Intersection LOS: F
Intersection Capacity Utilization 120.7%	ICU Level of Service H
Analysis Period (min) 15	

Splits and Phases: 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	887	512	345	700	1291	795	872	2091	120
Future Volume (veh/h)	301	575	980	887	512	345	700	1291	795	872	2091	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	964	557	0	761	1403	0	948	2273	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	377	521		691	844		587	1515		703	1685	
Arrive On Green	0.11	0.15	0.00	0.07	0.08	0.00	0.17	0.30	0.00	0.14	0.22	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	964	557	0	761	1403	0	948	2273	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	14.0	22.0	0.0	30.0	22.8	0.0	25.5	40.0	0.0	30.5	49.5	0.0
Cycle Q Clear(g_c), s	14.0	22.0	0.0	30.0	22.8	0.0	25.5	40.0	0.0	30.5	49.5	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	377	521		691	844		587	1515		703	1685	
V/C Ratio(X)	0.87	1.20		1.39	0.66		1.30	0.93		1.35	1.35	
Avail Cap(c_a), veh/h	452	521		691	844		587	1515		703	1685	
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00	0.67	0.67	0.67
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	0.59	0.59	0.00
Uniform Delay (d), s/veh	65.8	64.0	0.0	70.1	63.2	0.0	62.3	51.2	0.0	64.8	58.4	0.0
Incr Delay (d2), s/veh	14.3	107.0	0.0	186.4	1.9	0.0	145.2	11.2	0.0	162.8	159.4	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	6.8	17.5	0.0	31.8	11.2	0.0	22.8	18.2	0.0	29.5	46.6	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	80.1	171.0	0.0	256.5	65.1	0.0	207.5	62.3	0.0	227.5	217.8	0.0
LnGrp LOS	F	F		F	E		F	E		F	F	
Approach Vol, veh/h		952	A		1521	A		2164	A		3221	A
Approach Delay, s/veh		139.8			186.4			113.4			220.7	
Approach LOS		F			F			F			F	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	37.0	51.0	35.0	27.0	32.0	56.0	21.4	40.6
Change Period (Y+Rc), s	6.5	6.5	5.0	5.0	6.5	6.5	5.0	5.0
Max Green Setting (Gmax), s	30.5	44.5	30.0	22.0	25.5	49.5	19.6	32.4
Max Q Clear Time (g_c+I1), s	32.5	42.0	32.0	24.0	27.5	51.5	16.0	24.8
Green Ext Time (p_c), s	0.0	1.9	0.0	0.0	0.0	0.0	0.4	2.0

Intersection Summary	
HCM 6th Ctrl Delay	174.7
HCM 6th LOS	F

Notes

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

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	201	143	1700	212	171	2885
Future Volume (vph)	201	143	1700	212	171	2885
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	15.0	11.0	5.0	15.0
Minimum Split (s)	24.5	15.5	25.5	24.5	15.5	24.5
Total Split (s)	26.0	33.0	91.0	26.0	33.0	124.0
Total Split (%)	17.3%	22.0%	60.7%	17.3%	22.0%	82.7%
Yellow Time (s)	3.0	3.0	4.5	3.0	3.0	4.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	6.5	5.0	5.0	6.5
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)	14.8	40.8	97.7	119.0	21.0	123.7
Actuated g/C Ratio	0.10	0.27	0.65	0.79	0.14	0.82
v/c Ratio	0.64	0.35	0.56	0.18	0.75	0.75
Control Delay	73.7	41.1	3.8	0.2	80.3	7.8
Queue Delay	0.0	0.0	0.1	0.0	0.0	0.0
Total Delay	73.7	41.1	3.9	0.2	80.3	7.8
LOS	E	D	A	A	F	A
Approach Delay	60.1		3.5			11.8
Approach LOS	E		A			B

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 150	
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.75	
Intersection Signal Delay: 11.9	Intersection LOS: B
Intersection Capacity Utilization 74.5%	ICU Level of Service D
Analysis Period (min) 15	

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

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	201	143	1700	212	171	2885
Future Volume (veh/h)	201	143	1700	212	171	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	218	155	1848	230	186	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	354	350	3416	1223	211	4191
Arrive On Green	0.10	0.10	1.00	1.00	0.12	0.82
Sat Flow, veh/h	3456	1585	5274	1585	1781	5274
Grp Volume(v), veh/h	218	155	1848	230	186	3136
Grp Sat Flow(s),veh/h/ln	1728	1585	1702	1585	1781	1702
Q Serve(g_s), s	9.1	12.7	0.0	0.0	15.4	42.8
Cycle Q Clear(g_c), s	9.1	12.7	0.0	0.0	15.4	42.8
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	354	350	3416	1223	211	4191
V/C Ratio(X)	0.62	0.44	0.54	0.19	0.88	0.75
Avail Cap(c_a), veh/h	484	410	3416	1223	333	4191
HCM Platoon Ratio	1.00	1.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.52	0.52	1.00	1.00
Uniform Delay (d), s/veh	64.5	50.4	0.0	0.0	65.1	6.2
Incr Delay (d2), s/veh	1.7	0.9	0.3	0.2	15.3	1.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.1	5.2	0.1	0.1	7.9	12.9
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	66.2	51.3	0.3	0.2	80.3	7.5
LnGrp LOS	E	D	A	A	F	A
Approach Vol, veh/h	373		2078			3322
Approach Delay, s/veh	60.0		0.3			11.6
Approach LOS	E		A			B

Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	22.8	106.8				129.6	20.4
Change Period (Y+Rc), s	5.0	6.5				6.5	5.0
Max Green Setting (Gmax), s	28.0	84.5				117.5	21.0
Max Q Clear Time (g_c+I1), s	17.4	2.0				44.8	14.7
Green Ext Time (p_c), s	0.4	31.1				63.7	0.7

Intersection Summary		
HCM 6th Ctrl Delay	10.7	
HCM 6th LOS	B	

DELAY (CONTROL)

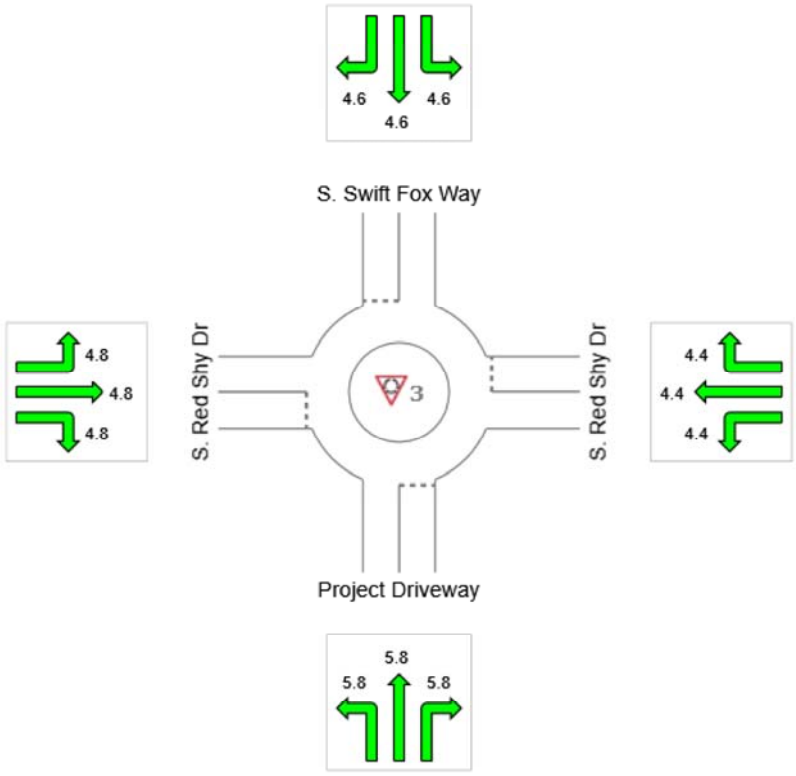
Average control delay per vehicle, or average pedestrian delay (seconds)

Site: 3 [2041+Project_PM]

New Site
Site Category: (None)
Roundabout

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Delay (Control)	5.8	4.4	4.6	4.8	5.3
LOS	A	A	A	A	A



Colour code based on Level of Service

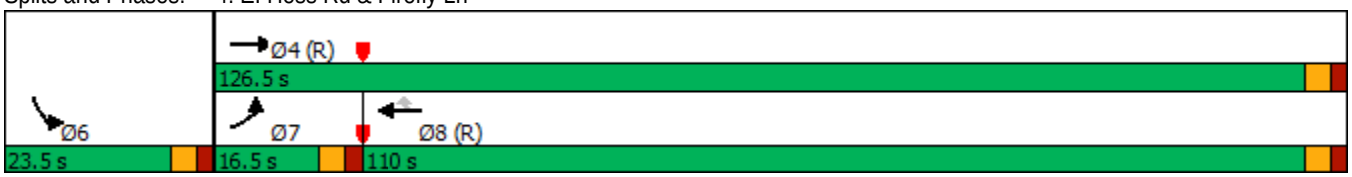
LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

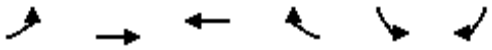
Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
NA (TWSC): Level of Service is not defined for major road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

Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Traffic Volume (vph)	19	2250	1730	26	15
Future Volume (vph)	19	2250	1730	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	15.0	15.0	15.0	11.0
Minimum Split (s)	16.5	23.5	23.5	23.5	23.5
Total Split (s)	16.5	126.5	110.0	110.0	23.5
Total Split (%)	11.0%	84.3%	73.3%	73.3%	15.7%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag	
Lead-Lag Optimize?	Yes		Yes	Yes	
Recall Mode	None	C-Max	C-Max	C-Max	Min
Act Effct Green (s)	11.0	129.0	119.4	119.4	11.0
Actuated g/C Ratio	0.07	0.86	0.80	0.80	0.07
v/c Ratio	0.16	0.80	0.67	0.02	0.21
Control Delay	46.2	20.2	9.1	4.4	69.8
Queue Delay	0.0	0.1	0.0	0.0	0.0
Total Delay	46.2	20.3	9.1	4.4	69.8
LOS	D	C	A	A	E
Approach Delay		20.5	9.0		69.8
Approach LOS		C	A		E

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 150	
Offset: 40.4 (27%), Referenced to phase 4:EBT and 8:WBT, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.80	
Intersection Signal Delay: 15.8	Intersection LOS: B
Intersection Capacity Utilization 79.7%	ICU Level of Service D
Analysis Period (min) 15	

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





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	19	2250	1730	26	15	9
Future Volume (veh/h)	19	2250	1730	26	15	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	21	2446	1880	28	16	10
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	76	3056	2786	1243	74	46
Arrive On Green	0.04	0.86	0.78	0.78	0.07	0.07
Sat Flow, veh/h	1781	3647	3647	1585	1011	632
Grp Volume(v), veh/h	21	2446	1880	28	27	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1585	1706	0
Q Serve(g_s), s	1.7	46.4	36.4	0.6	2.2	0.0
Cycle Q Clear(g_c), s	1.7	46.4	36.4	0.6	2.2	0.0
Prop In Lane	1.00			1.00	0.59	0.37
Lane Grp Cap(c), veh/h	76	3056	2786	1243	125	0
V/C Ratio(X)	0.28	0.80	0.67	0.02	0.22	0.00
Avail Cap(c_a), veh/h	137	3056	2786	1243	210	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	69.5	4.7	7.4	3.6	65.4	0.0
Incr Delay (d2), s/veh	1.9	2.3	1.3	0.0	0.9	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	0.8	9.9	11.4	0.2	1.0	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	71.5	7.0	8.8	3.6	66.3	0.0
LnGrp LOS	E	A	A	A	E	A
Approach Vol, veh/h		2467	1908		27	
Approach Delay, s/veh		7.6	8.7		66.3	
Approach LOS		A	A		E	

Timer - Assigned Phs			4		6	7	8
Phs Duration (G+Y+Rc), s			134.0		16.0	11.4	122.6
Change Period (Y+Rc), s			5.0		5.0	5.0	5.0
Max Green Setting (Gmax), s			121.5		18.5	11.5	105.0
Max Q Clear Time (g_c+I1), s			48.4		4.2	3.7	38.4
Green Ext Time (p_c), s			46.4		0.0	0.0	26.2

Intersection Summary	
HCM 6th Ctrl Delay	8.4
HCM 6th LOS	A

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	2269	1615	124	0	129
Future Vol, veh/h	0	2269	1615	124	0	129
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	2466	1755	135	0	140

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	-	945
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	43.9
HCM LOS			E

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	226
HCM Lane V/C Ratio	-	-	-	0.62
HCM Control Delay (s)	-	-	-	43.9
HCM Lane LOS	-	-	-	E
HCM 95th %tile Q(veh)	-	-	-	3.7

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

	Urban		
	Number of Lanes		
Roadway Classification	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

FEHR PEERS

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:

External Vehicle Trips = Raw ITE Trips * (1- Pinternal) * (1 – Pwalk – 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**

1. Average model error measures the difference between the estimated trip generation and the observed counted trip generation

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

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.

Source: Fehr & Peers, 2013.

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**

1. Average model error measures the difference between the estimated trip generation and the observed counted trip generation

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

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.

Source: Fehr & Peers, 2013.

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 EPA[1]. It has also been peer-reviewed in the American Society of Civil Engineers (ASCE) Journal of Urban Planning and Development[2], peer-reviewed in a 2012 Transportation Research Board (TRB) paper evaluating various smart growth trip generation methodologies[3], recommended by the San Diego Association of Governments (SANDAG) for use on mixed-use smart growth developments[4], 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

APPENDIX E

ANTHOLOGY BUILDOUT VOLUMES

ANTHOLOGY NORTH TRAFFIC IMPACT ANALYSIS

April 2015

Prepared by

DAVID EVANS AND ASSOCIATES INC.

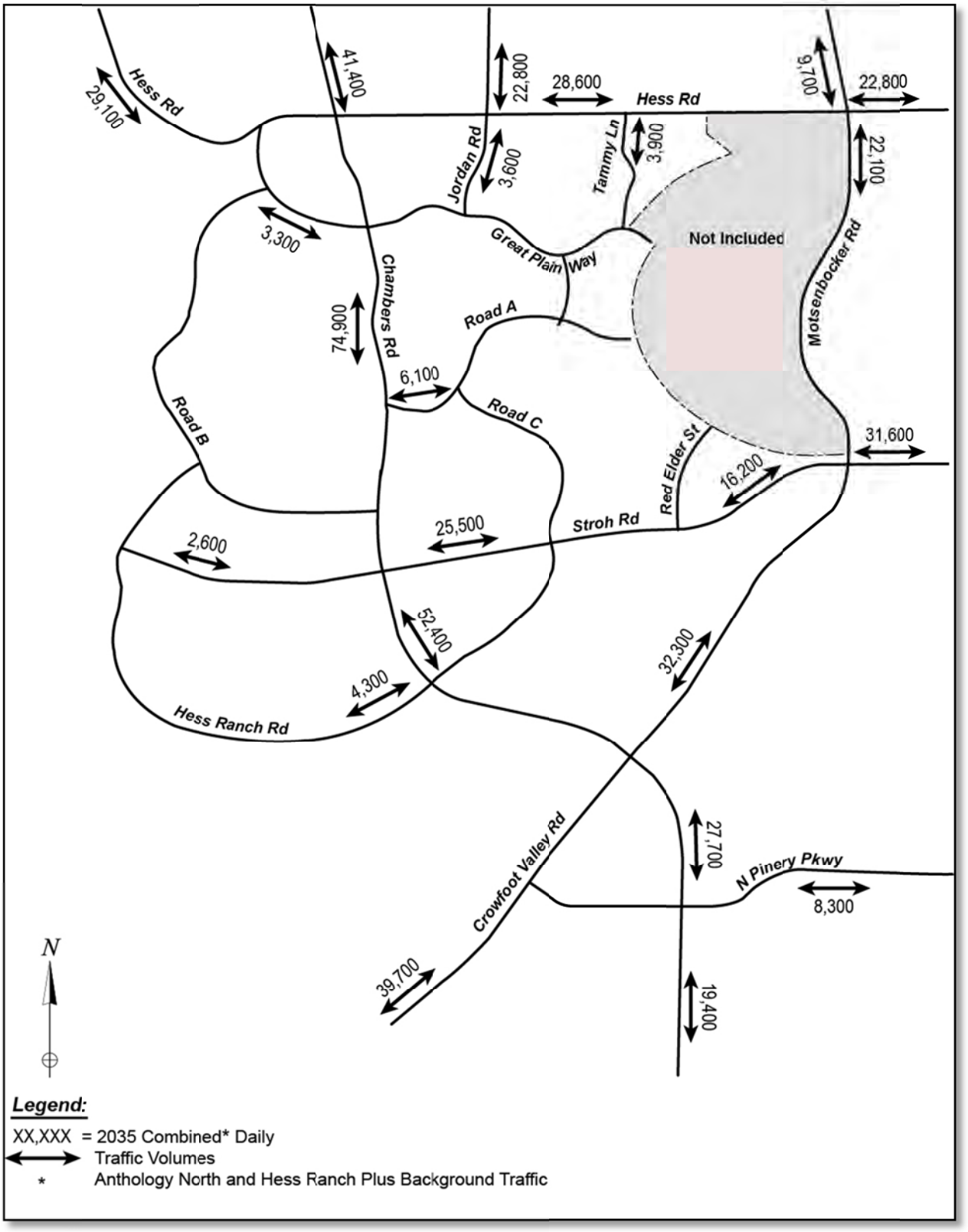


Figure 7. 2035 Total Site Plus Background Traffic Volumes

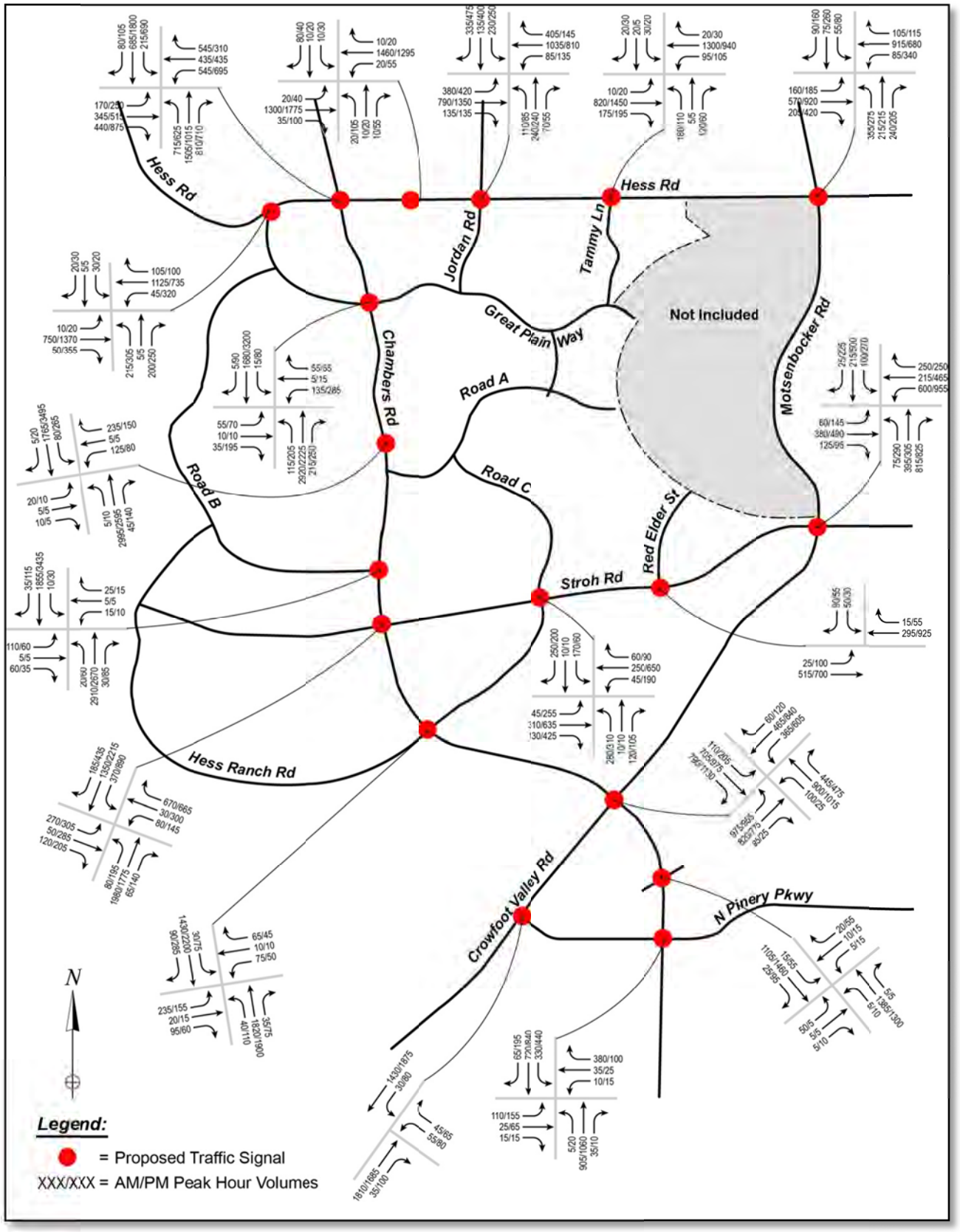


Figure 9. 2035 Peak Hour Intersection Traffic Volumes

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 ¾ 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

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)	177	262	288	256	417	445	458	463	458	467	500	558
Average Queue (ft)	114	164	220	178	127	319	336	189	191	298	367	461
95th Queue (ft)	197	218	273	245	278	469	471	384	342	529	509	605
Link Distance (ft)			758	758				459	459	459		
Upstream Blk Time (%)						0	0	0	0	0		1
Queuing Penalty (veh)						0	0	1	0	3		0
Storage Bay Dist (ft)	400	400			400	450	450				535	535
Storage Blk Time (%)					0	0	0	0				4
Queuing Penalty (veh)					1	0	1	1				27

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	610	622	460	363	395	398	356	318	78
Average Queue (ft)	484	489	528	430	215	223	250	234	192	14
95th Queue (ft)	601	607	660	544	335	367	341	306	271	55
Link Distance (ft)	559	559	559			712	712	712	712	
Upstream Blk Time (%)	1	2	12							
Queuing Penalty (veh)	0	0	0							
Storage Bay Dist (ft)				435	450					550
Storage Blk Time (%)	1		2	15						
Queuing Penalty (veh)	9		19	92						

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

Movement	WB	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	L	R	T	T	T	R	L	T	T	T
Maximum Queue (ft)	151	175	274	538	567	304	91	415	119	185	134
Average Queue (ft)	70	119	131	123	188	185	27	163	38	85	46
95th Queue (ft)	148	183	236	284	345	276	71	294	86	150	105
Link Distance (ft)			227	712	712	712	712		749	749	749
Upstream Blk Time (%)			2								
Queuing Penalty (veh)			7								
Storage Bay Dist (ft)	150	150						450			
Storage Blk Time (%)	0	2	7								
Queuing Penalty (veh)	0	5	13								

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

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	101	32	57	75
Average Queue (ft)	12	8	17	24
95th Queue (ft)	51	31	48	57
Link Distance (ft)	227	317	72	336
Upstream Blk Time (%)			0	
Queuing Penalty (veh)			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)	240	639	631	631	631	32	52
Average Queue (ft)	20	226	224	270	241	2	19
95th Queue (ft)	93	547	528	612	598	15	51
Link Distance (ft)		626	626	616	616		243
Upstream Blk Time (%)		0	0	4	3		
Queuing Penalty (veh)		2	3	0	0		
Storage Bay Dist (ft)	215					215	
Storage Blk Time (%)		9			12		
Queuing Penalty (veh)		1			2		

Intersection: 5: E. Hess Rd & ProjDwy

Movement	EB	EB	WB	SB
Directions Served	T	T	TR	R
Maximum Queue (ft)	54	56	130	140
Average Queue (ft)	2	2	13	64
95th Queue (ft)	18	18	61	113
Link Distance (ft)	459	459	626	83
Upstream Blk Time (%)				13
Queuing Penalty (veh)				0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 6: S. Red Sky Dr.

Movement	EB	WB	WB
Directions Served	TR	T	T
Maximum Queue (ft)	74	129	132
Average Queue (ft)	6	56	79
95th Queue (ft)	38	136	151
Link Distance (ft)	94	81	81
Upstream Blk Time (%)	0	8	16
Queuing Penalty (veh)	0	16	33
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

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)	269	244	758	797	425	455	459	521	266	118	547	559
Average Queue (ft)	93	151	541	776	425	446	453	486	140	33	540	558
95th Queue (ft)	206	237	888	788	425	452	459	514	219	92	552	560
Link Distance (ft)			758	758				460	460	460		
Upstream Blk Time (%)			0	76		16	32	57			1	38
Queuing Penalty (veh)			0	0		0	0	329			0	0
Storage Bay Dist (ft)	400	400			400	450	450				535	535
Storage Blk Time (%)			1	0	74	35	51	56			5	71
Queuing Penalty (veh)			3	2	211	88	130	500			20	306

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)	589	559	267	318	475	770	754	754	749	575
Average Queue (ft)	574	297	157	95	468	726	725	724	723	295
95th Queue (ft)	580	560	267	240	501	781	741	742	741	758
Link Distance (ft)	559	559	559			712	712	712	712	
Upstream Blk Time (%)	44	0				28	30	23	22	
Queuing Penalty (veh)	0	0				216	233	177	171	
Storage Bay Dist (ft)				435	450					550
Storage Blk Time (%)	14				15	44			67	0
Queuing Penalty (veh)	99				65	193			81	0

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	218	155	1848	230	186	3136
v/c Ratio	0.64	0.35	0.56	0.18	0.75	0.75
Control Delay	73.7	41.1	3.9	0.2	80.3	7.8
Queue Delay	0.0	0.0	0.1	0.0	0.0	0.0
Total Delay	73.7	41.1	4.0	0.2	80.3	7.8
Queue Length 50th (ft)	107	113	64	0	178	423
Queue Length 95th (ft)	148	163	105	m0	252	547
Internal Link Dist (ft)	266		726			708
Turn Bay Length (ft)	150				450	
Base Capacity (vph)	480	512	3312	1359	330	4192
Starvation Cap Reductn	0	0	355	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.30	0.62	0.17	0.56	0.75

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

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

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	227	74	87	334
Average Queue (ft)	41	8	32	52
95th Queue (ft)	166	38	88	187
Link Distance (ft)	227	317	72	336
Upstream Blk Time (%)	11		18	1
Queuing Penalty (veh)	43		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)	72	190	247	668	650	240	52
Average Queue (ft)	17	111	137	636	632	36	14
95th Queue (ft)	46	209	253	652	646	168	46
Link Distance (ft)		626	626	616	616		243
Upstream Blk Time (%)				73	30		
Queuing Penalty (veh)				0	0		
Storage Bay Dist (ft)	215					215	
Storage Blk Time (%)					6	0	
Queuing Penalty (veh)					2	0	

Intersection: 5: E. Hess Rd & ProjDwy

Movement	WB	WB	WB	SB
Directions Served	T	T	TR	R
Maximum Queue (ft)	644	617	64	263
Average Queue (ft)	633	21	2	263
95th Queue (ft)	648	203	21	263
Link Distance (ft)	626	626	626	271
Upstream Blk Time (%)	34	0		100
Queuing Penalty (veh)	194	0		0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 6: S. Red Sky Dr.

Movement	EB	WB	WB
Directions Served	TR	T	T
Maximum Queue (ft)	100	180	121
Average Queue (ft)	46	136	78
95th Queue (ft)	114	182	136
Link Distance (ft)	79	96	96
Upstream Blk Time (%)	27	66	18
Queuing Penalty (veh)	105	114	31
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

APPENDIX G

SIGNAL WARRANT WORKSHEETS

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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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]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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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]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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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]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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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	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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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**

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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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]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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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]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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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]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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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]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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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]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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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]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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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]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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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]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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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]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
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
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]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

RICK ENGINEERING COMPANY
Traffic Division

SIGNAL WARRANT SUMMARY TABLE
CHAMBERS AND HESS DEVELOPMENT

#	INTERSECTION	EXISTING (2019)		2021 BACKGROUND		2021 TOTAL		2041 BACKGROUND		2041 TOTAL	
		Warrant Number Met		Warrant Number Met		Warrant Number Met		Warrant Number Met		Warrant Number 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

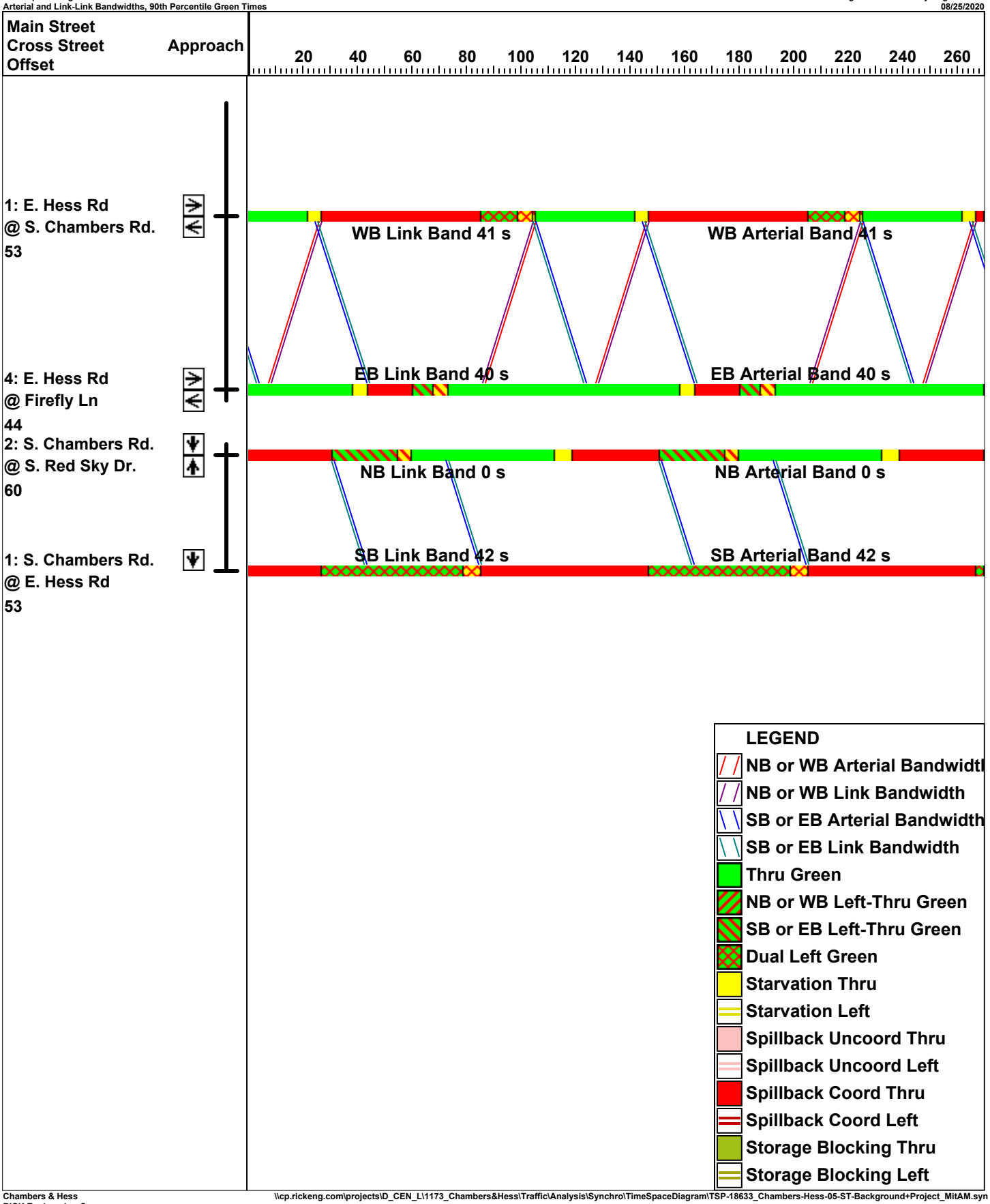
Footnotes:

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

* = Met in previous year study scenario

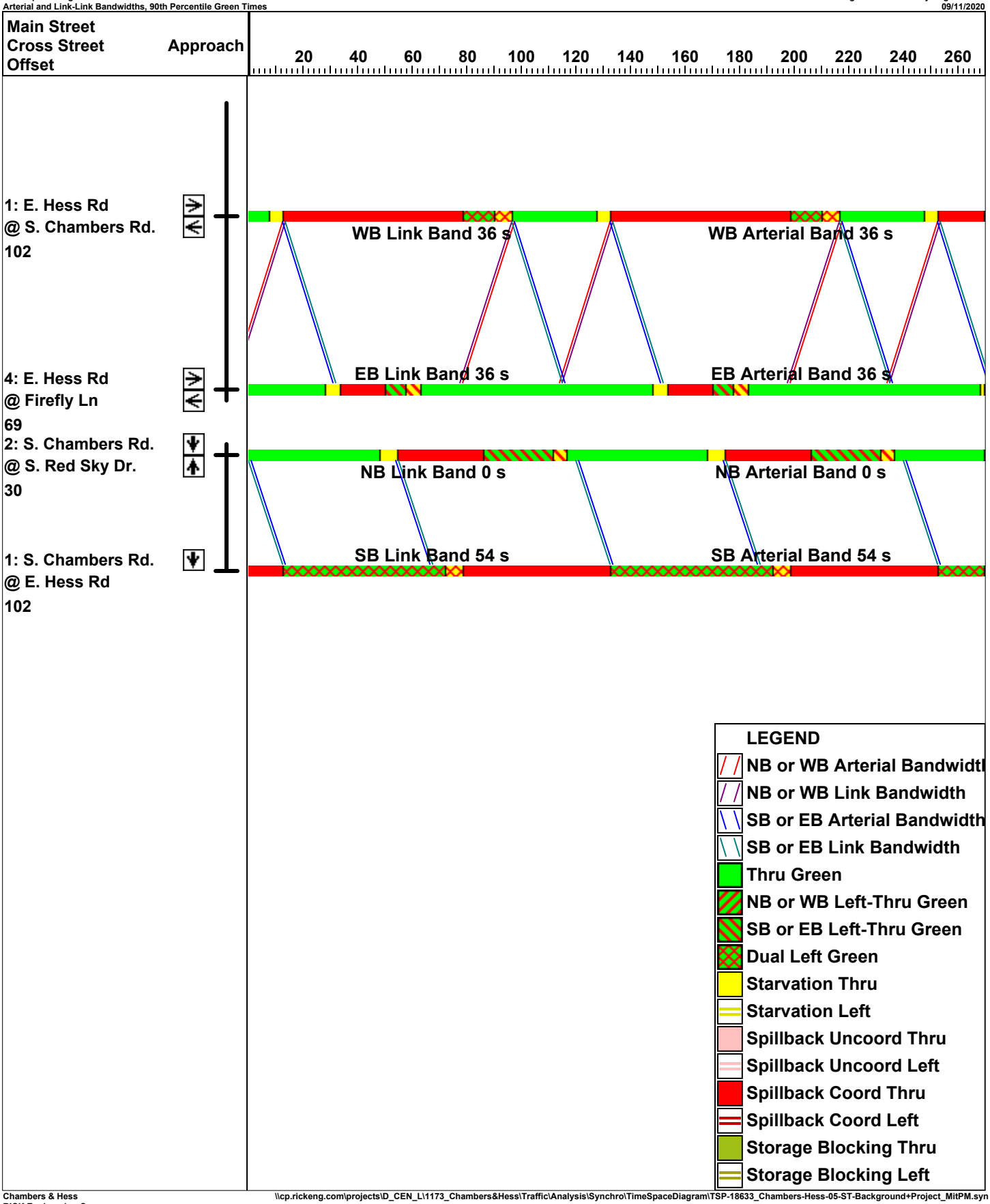
APPENDIX H

TRAFFIC SIGNAL PROGRESSION


Main Street
Cross Street
Offset
Approach
20
40
60
80
100
120
140
160
180
200
220
240
260
1: E. Hess Rd
@ S. Chambers Rd.
53
WB Link Band 41 s
WB Arterial Band 41 s
4: E. Hess Rd
@ Firefly Ln
44
EB Link Band 40 s
EB Arterial Band 40 s
2: S. Chambers Rd.
@ S. Red Sky Dr.
60
NB Link Band 0 s
NB Arterial Band 0 s
1: S. Chambers Rd.
@ E. Hess Rd
53
SB Link Band 42 s
SB Arterial Band 42 s
LEGEND
NB or WB Arterial Bandwidth
NB or WB Link Bandwidth
SB or EB Arterial Bandwidth
SB or EB Link Bandwidth
Thru Green
NB or WB Left-Thru Green
SB or EB Left-Thru Green
Dual Left Green
Starvation Thru
Starvation Left
Spillback Uncoord Thru
Spillback Uncoord Left
Spillback Coord Thru
Spillback Coord Left
Storage Blocking Thru
Storage Blocking Left

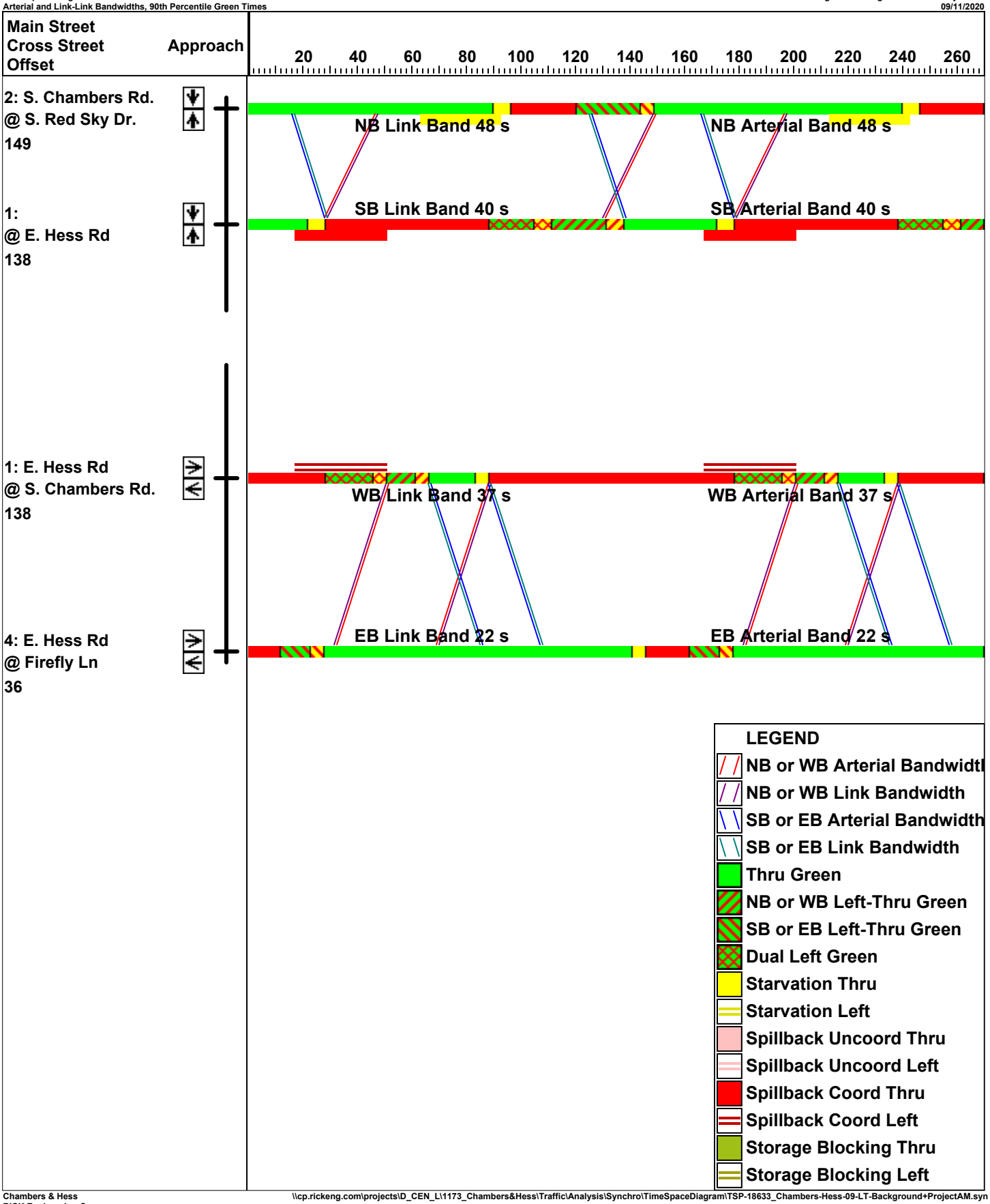
Time-Space Diagram - E. Hess Rd & S. Chambers Rd.
Arterial and Link-Link Bandwidths, 90th Percentile Green Times

Short-Term Background 2021 + ProjMitigation PM
09/11/2020



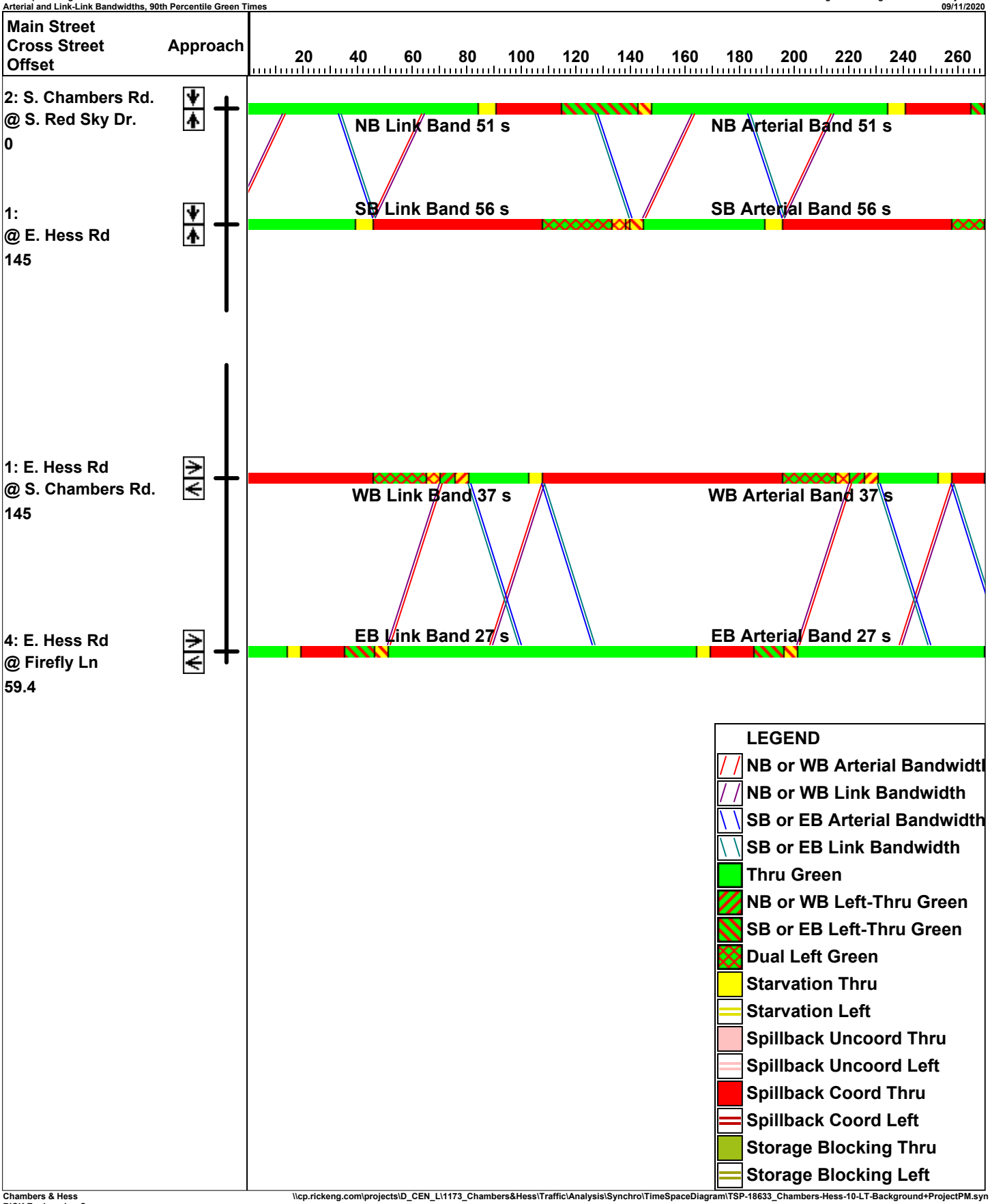
Chambers & Hess
RICK Engineering Co

\\cp.rickeng.com\projects\D_CEN_L\1173_Chambers&Hess\Traffic\Analysis\Synchro\TimeSpaceDiagram\TSP-18633_Chambers-Hess-05-ST-Background+Project_MitPM.syn


Main Street
Cross Street
Offset
Approach
20
40
60
80
100
120
140
160
180
200
220
240
260
2: S. Chambers Rd.
@ S. Red Sky Dr.
149
NB Link Band 48 s
NB Arterial Band 48 s
1:
@ E. Hess Rd
138
SB Link Band 40 s
SB Arterial Band 40 s
1: E. Hess Rd
@ S. Chambers Rd.
138
WB Link Band 37 s
WB Arterial Band 37 s
4: E. Hess Rd
@ Firefly Ln
36
EB Link Band 22 s
EB Arterial Band 22 s
LEGEND
NB or WB Arterial Bandwidth
NB or WB Link Bandwidth
SB or EB Arterial Bandwidth
SB or EB Link Bandwidth
Thru Green
NB or WB Left-Thru Green
SB or EB Left-Thru Green
Dual Left Green
Starvation Thru
Starvation Left
Spillback Uncoord Thru
Spillback Uncoord Left
Spillback Coord Thru
Spillback Coord Left
Storage Blocking Thru
Storage Blocking Left

Time-Space Diagram - E. Hess Rd & S. Chambers Rd.
Arterial and Link-Link Bandwidths, 90th Percentile Green Times

Long-Term Background 2041 + Project PM
09/11/2020



Chambers & Hess
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