

final report

October 25, 2018

Traffic Impact Study

Thornton
Old Henry Road at James Thornton Way
Louisville, KY

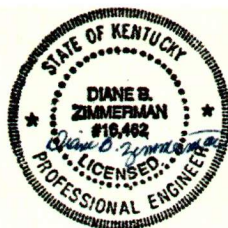
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DEC 14 2018

PLANNING &
DESIGN SERVICES

Prepared for

Louisville Metro Planning Commission
Kentucky Transportation Cabinet



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18 ZONE 1055

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INTRODUCTION

The development plan for two tracts on James Thornton Way in Louisville, KY shows a hotel, two restaurants, and a commercial building. These tracts were previously approved for office buildings. **Figure 1** displays a map of the site. Access to the buildings will be from entrances on James Thornton Way. The purpose of this study is to examine the traffic impacts of the development upon the adjacent highway system. For this study, the impact area was defined to be the intersections of Old Henry Road with James Thornton Way/High Wickham and Old Henry Road at Bush Farm Road.



Figure 1. Site Map

EXISTING CONDITIONS

Old Henry Road (KY 3084) is maintained by the Kentucky Transportation Cabinet with an estimated 2018 ADT of 21,100 vehicles per day between Terra Crossing Boulevard and High Wickham Place, as estimated from a Louisville Metro 2017 count. The road has four lanes with twelve-foot lanes with eight-foot paved shoulders and a 16-foot median. The posted speed limit is 35 mph. There are sidewalks where development has occurred. The intersection with Bush Farm Road is controlled with a traffic signal. There are left turn lanes at each intersection.

Peak hour traffic counts for the intersections were obtained on September 26, 2018. The a.m. peak hour is 7:45 to 8:45 and the p.m. peak hour is 4:45 to 5:45. **Figure 2** illustrates the existing a.m. and p.m. peak hour traffic volumes. The Appendix contains the full count data for each intersection.

the trips generated by this development and distributed throughout the road network during the peak hours. **Figure 6** displays the individual turning movements for the peak hours when the development is completed.

Table 1. Peak Hour Trips Generated by Site

Land Use	A.M. Peak Hour			P.M. Peak Hour			
	Trips	In	Out	Trips	In	Out	Pass-by
Business Hotel (110 rooms)	43	18	25	35	19	16	
High Turnover Sit-Down Restaurant (10,575 sf)	105	58	47	103	64	39	44
Shopping Center (11,520 sf)	158	98	60	110	53	57	25
TOTAL	306	174	132	248	136	112	

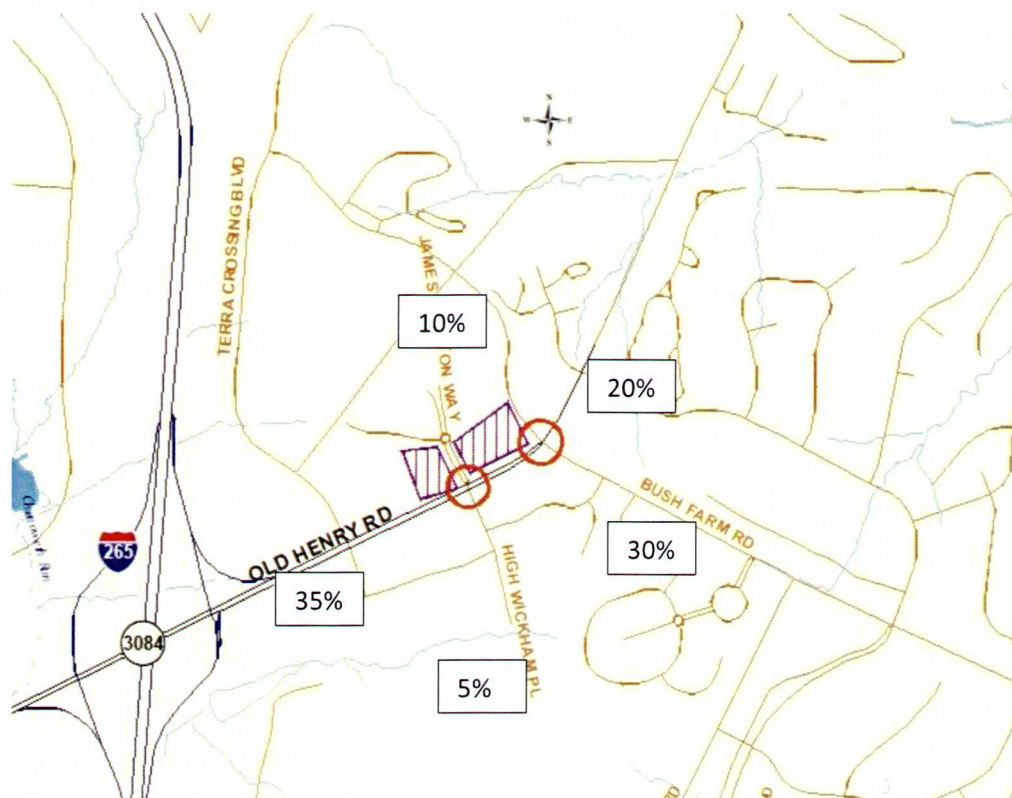


Figure 4. Trip Distribution Percentages

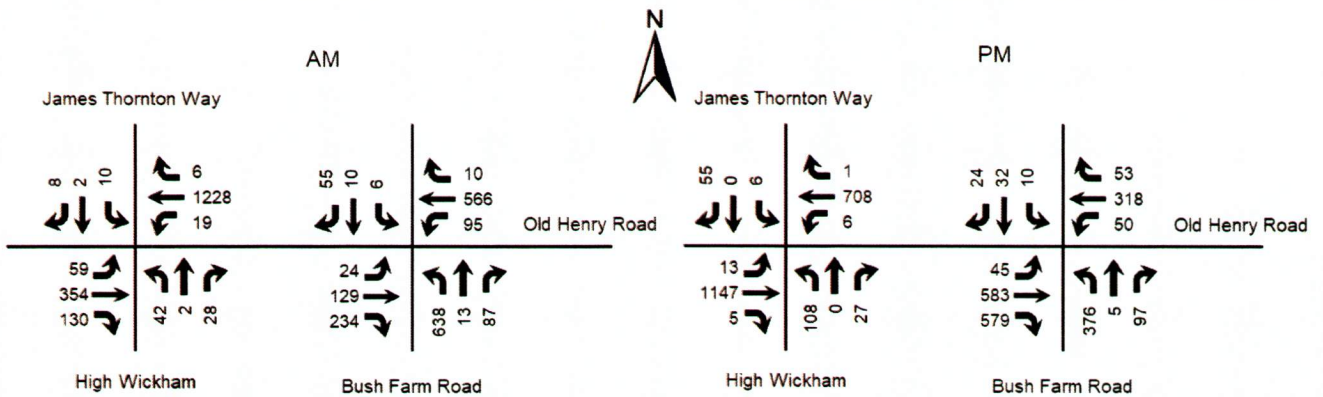


Figure 2. Existing Peak Hour Volumes

FUTURE CONDITIONS

The project completion date is 2022. An annual growth rate of 3.5 percent was applied to all 2018 volumes. This was determined from the Aiken Road and Johnson Road Vicinity Traffic Impact Study dated February 21, 2018. The 2025 Build volumes in that study included all approved developments in the vicinity of the Old Henry Road. **Figure 3** displays the 2022 No Build peak hour volumes.

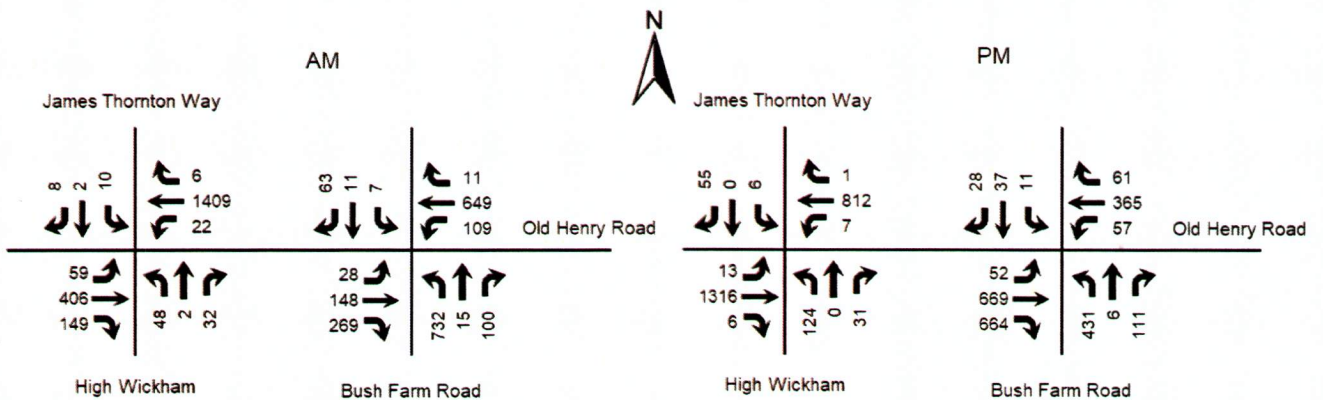


Figure 3. 2022 No Build Peak Hour Volumes

TRIP GENERATION

The Institute of Transportation Engineers Trip Generation Manual, 10th Edition contains trip generation rates for a wide range of developments. The land uses of “Business Hotel (312)”, “High Turnover Sit-Down Restaurant (931)” and “Shopping Center (820)” were reviewed and determined to be the best match. The trip generation results are listed in **Table 1**. The trips were assigned to the highway network with the percentages shown in **Figure 4**. **Figure 5** shows

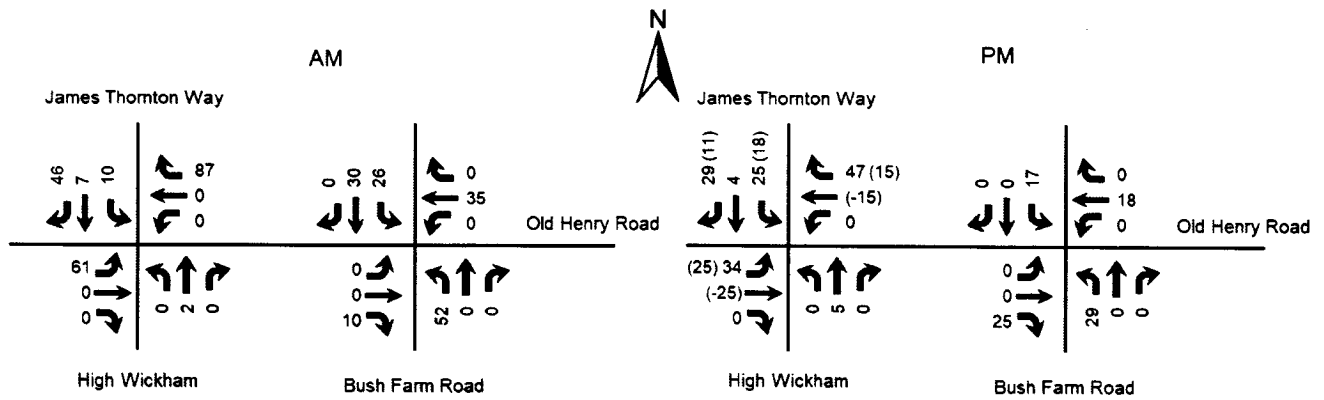


Figure 5. Peak Hour Trips Generated by Site

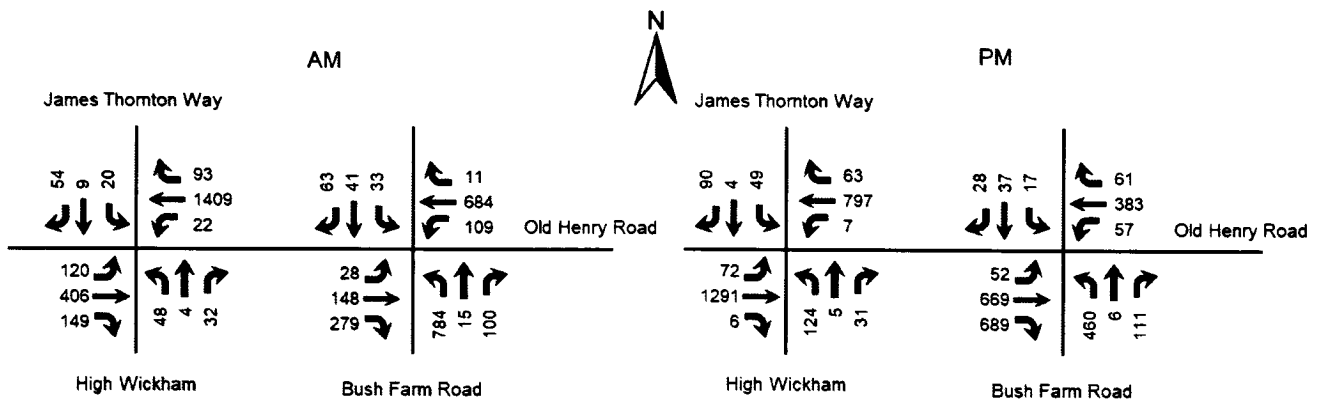


Figure 6. Build Peak Hour Volumes

ANALYSIS

The qualitative measure of operation for a roadway facility or intersection is evaluated by assigning a “Level of Service”. Level of Service is a ranking scale from A through F, “A” is the best operating condition and “F” is the worst. Level of Service results depend upon the facility that is analyzed. In this case, the Level of Service is based upon the total delay experienced at an intersection.

To evaluate the impact of the proposed development, the vehicle delays at the intersections were determined using procedures detailed in the Highway Capacity Manual, 6th edition. Future delays and Level of Service were determined for the intersections using the HCS Streets (version 7.6) software. The delays and Level of Service are summarized in **Table 2**.

Table 2. Peak Hour Level of Service

Approach	A.M.			P.M.		
	2018 Existing	2022 No Build	2022 Build	2018 Existing	2022 No Build	2022 Build
Old Henry Road at High Wickham/James Thornton						
Old Henry Road Eastbound	B 12.8	B 14.5	C 17.9	A 9.5	A 10.0	B 10.8
Old Henry Road Westbound	A 8.5	A 8.8	A 8.8	B 13.0	B 13.3	B 13.1
High Wickham Place Northbound	C 20.4	D 25.1	F 59.7	F 110.1	F 275.7	F 440.7
James Thornton Way Southbound	D 26.8	D 33.8	D 34.8	B 13.0	B 14.1	D 28.8
Old Henry Road at Bush Farm Road	C 34.0	C 28.9	D 44.5	B 16.3	B 19.8	C 21.2
Old Henry Road Eastbound	B 16.3	B 18.9	B 18.7	B 15.7	B 19.0	B 19.1
Old Henry Road Westbound	B 19.3	B 19.1	B 19.0	B 14.1	B 15.4	B 15.3
Bush Farm Road Northbound	E 61.3	D 45.7	F 87.1	B 20.0	C 26.1	C 31.5
Bush Farm Road Southbound	B 12.3	A 7.8	A 8.5	B 13.5	B 14.2	B 15.0

Key: Level of Service, Delay in seconds per vehicle

The intersection of James Thornton Way was evaluated for a right turn lane using the Kentucky Transportation Cabinet [Highway Design Guidance Manual](#) dated March, 2017. Using the volumes in Figure 6, a turn lanes should be provided at the intersection. Old Henry Road appears to have been constructed for a right turn lane, so this is a matter of striping.

As development progress along Old Henry Road, a traffic signal will be installed at the intersection of Terra Crossing Boulevard. This signal will provide an alternative for drivers making a left-turn onto Old Henry Road. Additionally, a dual left turn lane has been proposed to reduced the delays on the northbound approach of Bush Farm Road.

CONCLUSIONS

Based upon the volume of traffic generated by the development and the amount of traffic forecasted for the year 2022, there will be an impact to the existing highway network. The striping of Old Henry Road should be modified to provide a right turn lane at James Thornton Way.

APPENDIX

Thornton Commercial Traffic Impact Study

Traffic Counts

Jefferson County, KY
Classified Turn Movement Count

Site 1 of 1

Old Henry Rd (West)
Old Henry Rd (East)
Bush Farm Rd (South)
Bush Farm Rd (North)

Lat/Long 38.274131, -85.490549

Date Wednesday 26 September 2018

Weather Isolated T-Storms
Temp: 31°C

41 Peabody Street, Nashville, TN 37210
1 (615) 431-6750
1 (800) 615-3765



Eastbound	Old Henry Rd (West)				Old Henry Rd (East)				Northbound				Southbound			
	U-Turn	Left	Thru	Right	App	U-Turn	Left	Thru	Right	App	U-Turn	Left	Thru	Right	App	
0700 - 0715	0	7	15	36	58	18	170	0	188	158	0	158	10	169	18	
0715 - 0730	0	3	18	51	72	0	33	0	202	167	0	167	4	183	14	
0730 - 0745	0	2	12	15	29	0	28	0	176	174	0	174	4	197	18	
0745 - 0800	0	3	21	45	69	0	31	0	176	166	0	166	3	203	17	
0800 - 0815	0	0	7	40	69	0	23	0	181	152	0	152	23	179	20	
0815 - 0830	0	0	4	36	56	0	15	0	161	165	0	165	3	183	17	
0830 - 0845	0	0	10	32	64	0	26	0	153	155	0	155	3	173	17	
0845 - 0900	1	4	40	91	136	0	25	0	138	147	0	147	2	171	16	
1600 - 1615	0	0	10	109	126	0	23	0	101	99	0	99	1	121	10	
1615 - 1630	0	0	14	127	115	0	23	0	100	94	0	94	18	112	15	
1630 - 1645	0	0	12	135	131	0	25	0	98	73	0	73	2	91	8	
1645 - 1700	0	0	10	135	143	0	24	0	106	73	0	73	0	93	21	
1700 - 1715	0	7	134	1495	2934	0	341	0	2202	2011	0	2011	33	2368	508	
1715 - 1730	1	14	135	117	266	0	21	0	107	85	0	85	1	108	14	
1730 - 1745	0	0	15	155	299	0	19	0	100	100	0	100	3	123	13	
1745 - 1800	0	0	14	135	117	0	21	0	107	85	0	85	1	108	10	
Grand Total	100.00	96.27	98.54	97.99	98.16	0.00	97.07	98.94	95.83	98.55	0.00	98.46	90.91	97.84	93.90	
Cars (%)	0.00	3.73	1.46	2.01	1.84	0.00	2.93	1.06	4.17	1.54	0.00	1.54	9.09	2.16	6.10	
Trucks (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
P/Cycles (%)	0.00	0.00	0.00	0.07	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

AM Peak	1645 - 1700	1700 - 1715	1715 - 1730	1730 - 1745	PM Peak
0	0	0	1	0	1
24	129	234	387	0	44
129	234	387	0	0	583
129	234	387	0	0	579
129	234	387	0	0	1207
0	0	0	0	0	0
95	95	95	95	95	50
95	95	95	95	95	318
10	10	10	10	10	53
671	671	671	671	671	421
0	0	0	0	0	0
166	166	166	166	166	376
3	3	3	3	3	5
34	34	34	34	34	97
203	203	203	203	203	478
0	0	0	0	0	0
1	1	1	1	1	10
1	1	1	1	1	32
3	3	3	3	3	24
16	16	16	16	16	24
20	20	20	20	20	66
496	496	496	496	496	2172

18 ZONE 1055

**Diane B. Zimmerman
Traffic Engineering, LLC**

ounted by: Andrew Zimmerman
rash at Terra Crossing at blocked 7:45

File Name : Thornton Way
Site Code : 00000033
Start Date : 9/26/2018
Page No : 1

Start Time	James Thornton Way			Old Henry Rd			High Wickham			Old Henry Rd			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
07:00 AM	0	0	2	2	348	1	6	0	0	6	0	0	82
07:15 AM	0	0	2	2	335	1	16	0	0	16	0	0	98
07:30 AM	6	1	2	9	334	2	341	0	20	47	0	0	397
07:45 AM	9	2	1	12	310	2	317	9	2	27	2	11	434
08:00 AM	0	0	3	3	320	0	320	5	0	20	0	5	502
08:15 AM	0	0	1	1	314	2	321	8	0	22	0	10	488
08:30 AM	1	0	3	4	284	2	295	20	0	4	0	19	488
08:45 AM	0	0	4	4	260	1	269	9	0	3	0	19	482
Total	1	1	11	13	1178	5	1205	42	0	9	0	51	1936
Grand Total	16	4	18	38	2505	11	2554	100	2	51	14	42	3664
Apprch %	42	10	47	38	98	0	69	65	1	33	0	10	919
Total %	0	0	0	0	0	0	0	0	0	0	0	0	25

Start Time	James Thornton Way			Old Henry Rd			High Wickham			Old Henry Rd			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
04:00 PM	1	0	11	12	183	0	186	14	0	4	0	18	250
04:15 PM	0	0	3	3	175	0	175	8	0	1	0	9	244
04:30 PM	2	0	7	9	148	0	150	23	0	5	0	22	273
04:45 PM	1	0	5	6	161	0	163	17	0	6	0	23	279
Total	4	0	26	30	667	0	674	62	0	16	0	78	1046
Grand Total	9	0	76	85	1385	1	1397	175	0	43	0	218	2192
Apprch %	10	0	89	2	99	0	99	80	0	19	0	8	56
Total %	0	0	0	0	0	0	0	0	0	0	0	0	0

Start Time	James Thornton Way			Old Henry Rd			High Wickham			Old Henry Rd			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
05:00 PM	0	0	22	22	167	1	169	35	0	12	0	47	270
05:15 PM	4	0	9	13	198	3	201	29	0	6	0	35	343
05:30 PM	1	0	14	15	182	0	182	27	0	3	0	30	273
05:45 PM	0	0	5	5	171	0	171	22	0	6	0	28	260
Total	5	0	50	55	718	4	723	113	0	27	0	140	1146
Grand Total	9	0	76	85	1385	1	1397	175	0	43	0	218	2192
Apprch %	10	0	89	2	99	0	99	80	0	19	0	8	56
Total %	0	0	0	0	0	0	0	0	0	0	0	0	0

Start Time	James Thornton Way			Old Henry Rd			High Wickham			Old Henry Rd			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
04:45 PM	1	0	6	7	161	2	163	17	0	6	0	23	279
05:00 PM	0	0	22	22	167	1	169	35	0	12	0	47	270
05:15 PM	4	0	9	13	198	3	201	29	0	6	0	35	343
05:30 PM	1	0	14	15	182	0	182	27	0	3	0	30	273
05:45 PM	0	0	5	5	171	0	171	22	0	6	0	28	260
Total	6	0	56	62	718	6	724	113	0	27	0	140	1146
Grand Total	9	0	76	85	1385	1	1397	175	0	43	0	218	2192
Apprch %	10	0	89	2	99	0	99	80	0	19	0	8	56
Total %	0	0	0	0	0	0	0	0	0	0	0	0	0

Peak Hour for Entire Intersection Begins at 04:45 PM

Peak 1 of 1

Start Time Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

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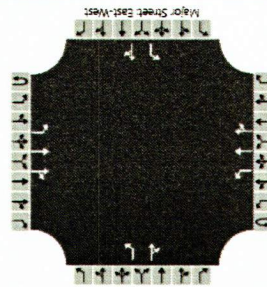
Start Time Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Start Time Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	D&Z	Intersection	Old Henry at High Wickham
Agency/Co.	Diane B Zimmerman Traffic	Jurisdiction	
Date Performed	10/24/18	East/West Street	Old Henry Road
Analysis Year	2018	North/South Street	High Wickham
Time Analyzed	AM Peak	Peak Hour Factor	0.94
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Thorntons		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound		Westbound		Northbound		Southbound	
Movement	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6
Number of Lanes	0	1	2	0	0	1	1	0
Configuration	L	T	TR	TR	L	L	TR	TR
Volume (veh/h)	0	59	354	130	0	19	1228	6
Percent Heavy Vehicles (%)	3	2			3	2		
Proportion Time Blocked								
Percent Grade (%)								
Right Turn Channelized								
Median Type Storage								

Critical and Follow-up Headways

Base Critical Headway (sec)	4.1								
Critical Headway (sec)	4.14								
Base Follow-Up Headway (sec)	2.2								
Follow-Up Headway (sec)	2.22								

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)	Capacity, c (veh/h)	v/c Ratio	95% Queue Length, Q ₉₅ (veh)	Control Delay (s/veh)	Level of Service (LOS)	Approach Delay (s/veh)	Approach LOS
63	523	0.12	0.4	12.8	B	1.4	
20	1047	0.02	0.1	0.8	A	0.1	
45	213	0.21	0.2	26.4	D	20.4	
32	551	0.06	0.2	11.9	B		
11	126	0.08	0.3	36.2	E	26.8	
11	301	0.04	0.1	17.4	C		

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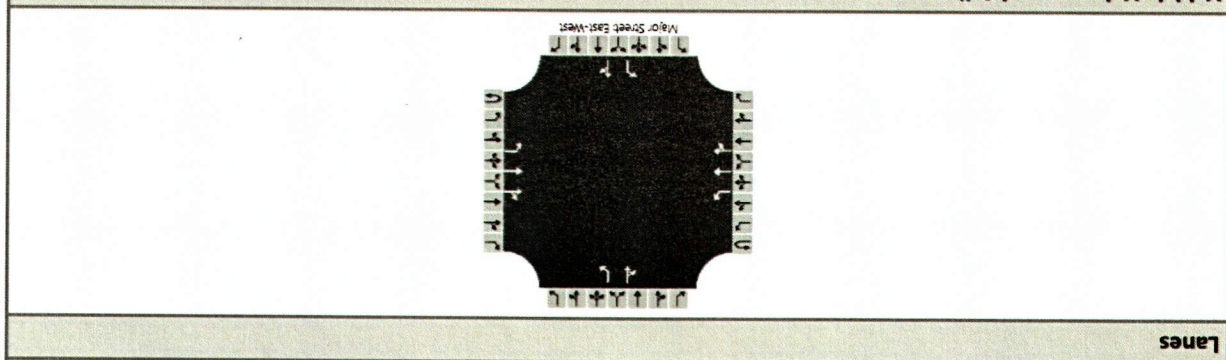
HCS™ TWSC Version 7.6

High AM 18xtw

Generated: 10/24/2018 4:36:52 PM

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	DBZ	Intersection	Old Henry at High Wickham
Agency/Co.	Diane B Zimmerman Traffic	Jurisdiction	
Date Performed	10/24/18	East/West Street	Old Henry Road
Analysis Year	2022	North/South Street	High Wickham
Time Analyzed	AM Peak No Build	Peak Hour Factor	0.94
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Thornions		



Vehicle Volumes and Adjustments												
Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	U	L	T	R	T	U	L	T	R	U	L	T
Priority	1U	1	2	3	4U	4	5	6	7	8	9	10
Number of Lanes	0	1	2	0	1	2	0	1	1	0	1	1
Configuration		L	T	TR	L	T	TR	L	TR	L	L	TR
Volume (veh/h)	0	59	406	149	0	22	1409	6	48	2	32	10
Percent Heavy Vehicles (%)	3	2			3	2			2	2	2	2
Proportion Time Blocked												
Percent Grade (%)												
Right Turn Channelized												
Median Type Storage	Left + Thru			1								

Critical and Follow-up Headways											
Base Critical Headway (sec)	4.1			4.1			7.5	6.5	6.9	7.5	6.5
Critical Headway (sec)	4.14			4.14			7.54	6.54	6.94	7.54	6.54
Base Follow-up Headway (sec)	2.2			2.2			3.5	4.0	3.3	3.5	4.0
Follow-up Headway (sec)	2.22			2.22			3.52	4.02	3.32	3.52	4.02

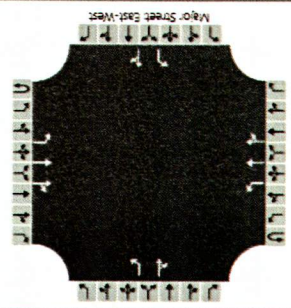
Delay, Queue Length, and Level of Service												
Flow Rate, v (veh/h)	63			23			51		36		11	
Capacity, c (veh/h)	441			981			175		495		95	
v/c Ratio	0.14			0.02			0.29		0.07		0.11	
95% Queue Length, Q ₉₅ (veh)	0.5			0.1			1.1		0.2		0.4	
Control Delay (s/veh)	14.5			8.8			33.8		12.8		47.6	
Level of Service (LOS)	B			A			D		B		E	
Approach Delay (s/veh)	1.4			0.1			25.1			33.8		
Approach LOS	D			D			D			D		

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HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	DBZ	Intersection	Old Henry at High Wickham
Agency/Co.	Diane B Zimmerman Traffic	Jurisdiction	
Date Performed	10/24/18	East/West Street	Old Henry Road
Analysis Year	2022	North/South Street	High Wickham
Time Analyzed	AM Peak Build	Peak Hour Factor	0.94
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Thorntons		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound		Westbound		Northbound		Southbound	
Movement	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6
Number of Lanes	0	1	1	2	0	1	1	0
Configuration	L	T	TR	TR	L	TR	TR	L
Volume (veh/h)	0	120	406	149	0	22	1409	93
Percent Heavy Vehicles (%)	3	2		3	2	2	2	2
Proportion Time Blocked								
Percent Grade (%)					0			
Right Turn Channelized								
Median Type Storage	Left + Thru						1	

Critical and Follow-up Headways

Base Critical Headway (sec)	4.1	4.1	4.1	4.1	7.5	6.5	6.9	7.5	6.5	6.9
Critical Headway (sec)	4.14	4.14	4.14	4.14	7.54	6.54	6.94	7.54	6.54	6.94
Base Follow-up Headway (sec)	2.2	2.2	2.2	2.2	3.5	4.0	3.3	3.5	4.0	3.3
Follow-up Headway (sec)	2.22	2.22	2.22	2.22	3.52	4.02	3.32	3.52	4.02	3.32

Delay, Queue Length, and Level of Service

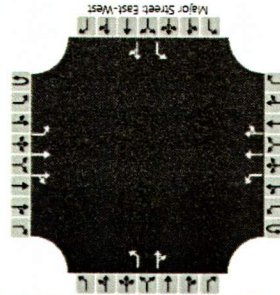
Flow Rate, v (veh/h)	128	23	51	38	21	67
Capacity, c (veh/h)	406	981	96	159	81	244
v/c Ratio	0.31	0.02	0.53	0.24	0.26	0.27
95% Queue Length, Q ₉₅ (veh)	1.3	0.1	2.4	0.9	1.0	1.1
Control Delay (s/veh)	17.9	8.8	78.6	34.6	64.9	25.2
Level of Service (LOS)	C	A	F	D	F	D
Approach Delay (s/veh)	3.2	0.1	59.7	34.8		
Approach LOS						

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HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	DBZ	Intersection	Old Henry at High Wickham
Agency/Co.	Diane B Zimmerman Traffic	Jurisdiction	
Date Performed	10/24/18	East/West Street	Old Henry Road
Analysis Year	2018	North/South Street	High Wickham
Time Analyzed	PM Peak	Peak Hour Factor	0.88
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Thorntons		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound		Westbound		Northbound		Southbound	
Movement	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6
Number of Lanes	0	1	2	0	0	1	1	0
Configuration	L	T	TR	L	TR	L	TR	L
Volume (veh/h)	0	13	1147	5	0	6	708	1
Percent Heavy Vehicles (%)	3	2		3	2	2	2	2
Proportion Time Blocked								
Percent Grade (%)					0			0
Right Turn Channelized								
Median Type Storage	Left + Thru						1	

Critical and Follow-up Headways

Base Critical Headway (sec)	4.1	4.1	4.1	7.5	6.5	6.9	7.5	6.5	6.9
Critical Headway (sec)	4.14	4.14	4.14	7.54	6.54	6.94	7.54	6.54	6.94
Base Follow-Up Headway (sec)	2.2	2.2	2.2	3.5	4.0	3.3	3.5	4.0	3.3
Follow-Up Headway (sec)	2.22	2.22	2.22	3.52	4.02	3.32	3.52	4.02	3.32

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)	15	7	123	31	7	57
Capacity, c (veh/h)	815	524	125	409	193	597
v/c Ratio	0.02	0.01	0.98	0.08	0.04	0.10
95% Queue Length, Q ₉₅ (veh)	0.1	0.0	6.6	0.2	0.1	0.3
Control Delay (s/veh)	9.5	12.0	141.5	14.5	24.4	11.7
Level of Service (LOS)	A	B	F	B	C	B
Approach Delay (s/veh)	0.1		0.1		13.0	
Approach LOS	F		F		B	

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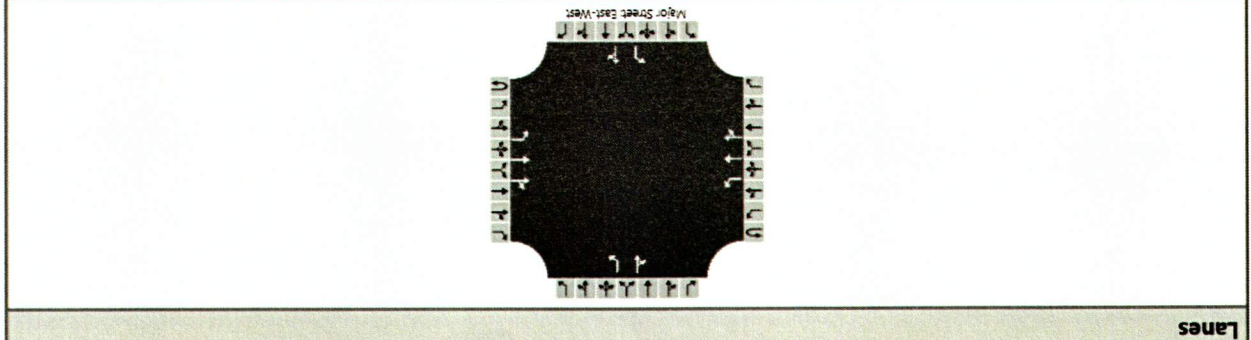
HCS7 Two-Way Stop-Control Report

General Information		Site Information								
Analyst	DBZ	Intersection	Old Henry at High Wickham							
Agency/Co.	Diane B Zimmerman Traffic	Jurisdiction								
Date Performed	10/24/18	East/West Street	Old Henry Road							
Analysis Year	2022	North/South Street	High Wickham							
Time Analyzed	PM Peak No Build	Peak Hour Factor	0.88							
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25							
Project Description	Thorntons									
Lanes										
Vehicle Volumes and Adjustments										
Approach	Eastbound	Westbound	Northbound	Southbound						
Movement	U L T	R U L T	U L T	R U L T						
Priority	1U 1 2	3 4U 4 5 6	7 8 9	10 11 12						
Number of Lanes	0 1 2	0 1 2	1 1 0	1 1 0						
Configuration	L T TR	L T TR	L TR	L TR						
Volume (veh/h)	0 13 1316	6 0 7 812 1	124 0 31	6 0 50						
Percent Heavy Vehicles (%)	3 2	3 2	2 2 2	2 2 2						
Proportion Time Blocked										
Percent Grade (%)			0	0						
Right Turn Channelized										
Median Type Storage		Left + Thru		1						
Critical and Follow-up Headways										
Base Critical Headway (sec)	4.1	4.1	7.5	6.5	6.9	7.5	6.5	6.9	7.5	6.5
Critical Headway (sec)	4.14	4.14	7.54	6.54	6.94	7.54	6.54	6.94	7.54	6.54
Base Follow-Up Headway (sec)	2.2	2.2	3.5	4.0	3.3	3.5	4.0	3.3	3.5	4.0
Follow-Up Headway (sec)	2.22	2.22	3.52	4.02	3.32	3.52	4.02	3.32	3.52	4.02
Delay, Queue Length, and Level of Service										
Flow Rate, v (veh/h)	15	8	141	35	7	156	547	57	156	547
Capacity, c (veh/h)	735	442	96	353	156	547	57	156	547	57
v/c Ratio	0.02	0.02	1.48	0.10	0.04	0.10	0.10	0.10	0.04	0.10
95% Queue Length, Q ₉₅ (veh)	0.1	0.1	10.6	0.3	0.1	0.3	0.3	0.3	0.1	0.3
Control Delay (s/veh)	10.0	13.3	340.6	16.3	29.1	12.3	12.3	12.3	29.1	12.3
Level of Service (LOS)	A	B	F	C	D	B	B	B	D	B
Approach Delay (s/veh)	0.1	0.1	275.7		14.1				14.1	
Approach LOS			F		B				B	

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HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	DBZ	Intersection	Old Henry at High Wickham
Agency/Co.	Diane B Zimmerman Traffic	Jurisdiction	
Date Performed	10/24/18	East/West Street	Old Henry Road
Analysis Year	2022	North/South Street	High Wickham
Time Analyzed	PM Peak Build	Peak Hour Factor	0.88
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Thorntons		



Vehicle Volumes and Adjustments													
Approach	Eastbound			Westbound			Northbound			Southbound			
Movement	U	L	T	R	U	L	U	L	T	R	U	L	T
Priority	1U	1	2	3	4U	4	5	6	7	8	9	10	11
Number of Lanes	0	1	2	0	1	2	0	1	1	0	1	1	0
Configuration		L	T	TR		L	T	TR		L	TR		L
Volume (veh/h)	0	72	1291	6	0	7	797	63		124	5	31	49
Percent Heavy Vehicles (%)	3	2			3	2				2	2	2	2
Proportion Time Blocked													
Percent Grade (%)										0			0
Right Turn Channelized													
Median Type / Storage													1

Critical and Follow-up Headways													
Base Critical Headway (sec)	4.1									4.1	6.5	6.9	7.5
Critical Headway (sec)	4.14									7.54	6.54	6.94	7.54
Base Follow-up Headway (sec)	2.2									3.5	4.0	3.3	3.5
Follow-up Headway (sec)	2.22									3.52	4.02	3.32	3.52

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)	82									141	41	56	107
Capacity, c (veh/h)	702									73	253	127	439
v/c Ratio	0.12									1.94	0.16	0.44	0.24
95% Queue Length, Q ₉₅ (veh)	0.4									12.7	0.6	1.9	0.9
Control Delay (s/veh)	10.8									562.2	22.0	53.7	15.8
Level of Service (LOS)	B									F	C	F	C
Approach Delay (s/veh)	0.6									440.7			28.8
Approach LOS													D

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HCS7 Signalized Intersection Results Summary

General Information			
Agency	Diane B Zimmerman Traffic		
Analyst	DBZ	Analysis Date	Oct 25, 2018
Jurisdiction		Time Period	AM Peak
Urban Street	Old Henry Road	Analysis Year	2022 No Build
Intersection	Bush Farm Road	File Name	Old Henry AM 22 NB.xus
Project Description	Thornions		

Demand Information			
Approach Movement	EB	WB	NB
Demand (v), veh/h	L 28 T 148 R 269	L 109 T 649 R 649	L 11 T 732 R 15
	SB	NB	SB
	L 7 T 11 R 63	L 7 T 11 R 100	L 7 T 11 R 63

Signal Information			
Cycle, s	59.5	Reference Phase	2
Offset, s	0	Reference Point	End
Green	17.3	30.0	0.0
Yellow	3.6	4.3	0.0
Red	3.0	1.3	0.0
Force Mode	Fixed	Simult. Gap N/S	On
Uncoordinated	Yes	Simult. Gap E/W	On

Timer Results			
Assigned Phase	EBL	EBT	WBL
Case Number	2	6	6
Phase Duration, s	5.0	6.0	6.0
Change Period, (Y+R), s	23.9	23.9	23.9
Max Allow Headway (MAH), s	6.6	6.6	6.6
Queue Clearance Time (g _s), s	14.3	11.7	11.7
Green Extension Time (g _e), s	3.0	3.0	3.0
Phase Call Probability	1.00	1.00	1.00
Max Out Probability	0.00	0.00	0.00

Movement Group Results			
Approach Movement	EB	WB	NB
Assigned Movement	L T R	L T R	L T R
Adjusted Flow Rate (v), veh/h	33 175 319	116 352 350	3 779 122
Adjusted Saturation Flow Rate (s), veh/h/m	733 1811 1560	1180 1885 1874	1320 1553 957
Queue Service Time (g _s), s	2.5	4.5	10.8
Cycle Queue Clearance Time (g _c), s	12.3	4.5	10.8
Green Ratio (g/C)	0.29	0.29	0.29
Capacity (c), veh/h	213	526	453
Volume-to-Capacity Ratio (X)	0.156	0.333	0.704
Back of Queue (Q), ft/in (90th percentile)	18.6	79.8	152.7
Back of Queue (Q), veh/in (90th percentile)	0.7	3.0	5.9
Queue Storage Ratio (R _Q) (90th percentile)	0.11	0.14	0.26
Uniform Delay (d ₁), s/veh	23.8	16.6	18.8
Incremental Delay (d ₂), s/veh	0.1	0.1	0.7
Initial Queue Delay (d ₃), s/veh	0.0	0.0	0.0
Control Delay (d ₄), s/veh	23.9	16.7	19.6
Level of Service (LOS)	C	B	B
Approach Delay, s/veh / LOS	18.9	B	19.1
Intersection Delay, s/veh / LOS	28.9		
Multimodal Results	EB	WB	NB
Pedestrian LOS Score / LOS	1.91	B	1.91
Bicycle LOS Score / LOS	1.27	A	1.16

HCS7 Signalized Intersection Results Summary

General Information			
Agency	Diane B Zimmerman Traffic		
Analyst	DBZ	Analysis Date	Oct 25, 2018
Jurisdiction	AM Peak	Time Period	0.94
Urban Street	Old Henry Road	Analysis Year	2022 Build
Intersection	Bush Farm Road	File Name	Old Henry AM 22 B.xus
Project Description	Thorntons		

Demand Information			
Approach Movement	EB	WB	NB
Demand (v), veh/h	L 28 T 148 R 279	L 109 T 684 R 11	L 784 T 15 R 100

Signal Information			
Cycle, s	60.3	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On
Green Extension Time (g _e), s	3.1	Green	18.1
Queue Clearance Time (g _s), s	14.9	Yellow	3.6
Max Allow Headway (MAH), s	3.2	Red	3.0
Change Period, (Y+R _c), s	6.6		
Phase Duration, s	24.7		

Timer Results			
Assigned Phase	EBL	EBT	WBL
Case Number	5.0	6.0	6.0
Phase Duration, s	24.7	24.7	24.7
Change Period, (Y+R _c), s	6.6	6.6	6.6
Max Allow Headway (MAH), s	3.2	3.2	3.2
Queue Clearance Time (g _s), s	14.9	12.3	12.3
Green Extension Time (g _e), s	3.1	3.1	3.1
Phase Call Probability	1.00	1.00	1.00
Max Out Probability	0.00	0.00	0.00

Movement Group Results			
Approach Movement	EB	WB	NB
Assigned Movement	L T R	L T R	L T R
Adjusted Flow Rate (v), veh/h	32 172 324	116 371 369	3 8 834
Adjusted Saturation Flow Rate (s), veh/h/in	708 1811 1560	1185 1885 1874	1282 1553
Queue Service Time (g _s), s	2.5 4.4 11.0	5.1 10.3 10.3	28.7 2.6
Cycle Queue Clearance Time (g _c), s	12.9 4.4 11.0	9.6 10.3 10.3	31.0 2.6
Green Ratio (g/c)	0.30 0.30 0.30	0.30 0.30 0.30	0.50 0.50
Capacity (c), veh/h	210 544 469	387 566 563	729 772
Volume-to-Capacity Ratio (X)	0.155 0.315 0.690	0.300 0.654 0.655	1.144 0.158
Back of Queue (Q _b), ft/in (90 th percentile)	18.5 77.7 154.8	60.2 166.6 164.6	908.3 33.9
Back of Queue (Q _a), veh/in (90 th percentile)	0.7 3.0 6.0	2.3 6.6 6.6	35.8 1.3
Queue Storage Ratio (RS) (90 th percentile)	0.11 0.13 0.26	0.80 0.11 0.11	1.82 0.07
Uniform Delay (d ₁), s/veh	24.0 16.3 18.6	20.0 18.4 18.4	18.2 8.3
Incremental Delay (d ₂), s/veh	0.1 0.1 0.7	0.2 0.5 0.5	80.5 0.0
Initial Queue Delay (d ₃), s/veh	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0
Control Delay (d ₄), s/veh	24.2 16.4 19.3	20.2 18.9 18.9	98.7 8.3
Level of Service (LOS)	C B B	C B B	F A A
Approach Delay, s/veh / LOS	18.7 B	19.0 B	87.1 F
Intersection Delay, s/veh / LOS	44.5		

Multimodal Results			
Bicycle LOS Score / LOS	1.29 A	1.19 A	2.07 B
Pedestrian LOS Score / LOS	1.91 B	1.91 B	2.07 B

HCS7 Signalized Intersection Results Summary

General Information		Agency	Diane B Zimmerman Traffic	
Analyst	DBZ	Analysis Date	Oct 25, 2018	
Jurisdiction		Time Period	PM Peak	PHF
Urban Street	Old Henry Road	Analysis Year	2022 Build	Analysis Period
Intersection	Bush Farm Road	File Name	Old Henry PM 2022 B.xus	
Project Description	Thornton's			

Demand Information		Approach Movement	L	T	R	L	R	L	T	R	L	T	R
Demand (v), veh/h			52	669	689	57	383	61	460	6	111	28	37
			SB	EB	WB	WB	NB	NB	NB	SB	SB	SB	SB

Signal Information		Cycle, s	75.3	Reference Phase	2
Offset, s	0	Reference Point	End	Green	33.1
Uncoordinated	Yes	Simult. Gap E/W	On	Yellow	3.6
Force Mode	Fixed	Simult. Gap N/S	On	Red	3.0

Timer Results		Assigned Phase	2	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Case Number	5.0		6.0		6.0		6.0		6.0	
Phase Duration, s	39.7		39.7		39.7		35.6		35.6	
Change Period, (Y+R+c), s	6.6		6.6		6.6		5.6		5.6	
Max Allow Headway (MAH), s	3.2		3.2		3.2		3.2		3.2	
Queue Clearance Time (g _s), s	28.4		26.4		26.4		32.0		32.0	
Green Extension Time (g _e), s	4.7		4.7		4.7		0.0		0.0	
Phase Call Probability	1.00		1.00		1.00		1.00		1.00	
Max Out Probability	0.03		0.03		0.03		0.00		0.00	

Movement Group Results		Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14		
Assigned Flow Rate (v), veh/h	46	597	615	63	251	242	511	130	18	31	72			
Adjusted Saturation Flow Rate (s), veh/h/in	918	1900	1598	834	1870	1781	1338	1610		1180	1736			
Queue Service Time (g _s), s	2.6	19.3	26.4	5.1	6.5	6.6	28.0	4.0		1.3	2.0			
Cycle Queue Clearance Time (g _c), s	9.2	19.3	26.4	24.4	6.5	6.6	30.0	4.0		5.3	2.0			
Green Ratio (g/C)	0.44	0.44	0.44	0.44	0.44	0.44	0.40	0.40		0.40	0.40			
Capacity (c), veh/h	418	836	703	248	822	783	594	641		503	691			
Volume-to-Capacity Ratio (X)	0.111	0.715	0.875	0.255	0.306	0.309	0.861	0.203		0.062	0.104			
Back of Queue (Q), ft/in (90 th percentile)	23.2	263.7	306	43.8	115.1	109.1	361	61.4		16.6	32.9			
Back of Queue (Q), veh/in (90 th percentile)	0.9	10.5	12.1	1.8	4.5	4.4	14.3	2.4		0.6	1.3			
Queue Storage Ratio (RQ) (90 th percentile)	0.13	0.45	0.52	0.58	0.08	0.07	0.72	0.12		0.03	0.06			
Uniform Delay (d ₁), s/veh	16.7	17.2	19.2	27.2	13.7	13.7	24.0	14.8		16.6	14.2			
Incremental Delay (d ₂), s/veh	0.0	0.3	1.6	0.2	0.1	0.1	11.8	0.1		0.0	0.0			
Initial Queue Delay (d ₃), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0			
Control Delay (d), s/veh	16.7	17.5	20.8	27.4	13.7	13.8	35.8	14.9		16.6	14.3			
Level of Service (LOS)	B	B	C	C	B	B	D	B		B	B			
Approach Delay, s/veh / LOS	19.1	B	15.3	B	31.5	C	15.0	B		15.0	B			
Intersection Delay, s/veh / LOS	21.2													
Multimodal Results		EB	WB	NB	SB									
Pedestrian LOS Score / LOS	1.90	B	1.90	B	2.09	B	2.26	B						
Bicycle LOS Score / LOS	3.07	C	0.95	A	1.55	B	0.66	A						