

final report

July 23, 2019

Traffic Impact Study

Shelbyville Road Vicinity
Louisville, KY

Prepared for

Louisville Metro Planning Commission



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Table of Contents

INTRODUCTION	2
Figure 1. Site Map.....	2
FUTURE CONDITIONS	2
Figure 2. 2026 No Build Peak Hour Volumes Shelbyville Road	3
Figure 4. 2026 Build Peak Hour Volumes Shelbyville Road	3
ANALYSIS	3
Table 3. Peak Hour Level of Service Shelbyville Road	4
RECOMMENDATIONS	4
CONCLUSIONS	5
APPENDIX	6

INTRODUCTION

A development plan for a residential subdivision has been submitted on Long Run Road for 199 single family lots on the Caudill Farm. **Figure 1** displays a map of the vicinity. The purpose of this study is to update a previous study dated February 21, 2018, Aiken Road and Johnson Road Vicinity, that examined the traffic impacts of several developments upon the adjacent highway system. For this study, the impact area was defined to be the intersections of Shelbyville Road with Eastwood Cut-off Road, Johnson Road, and Flat Rock Road. Each development has a separate traffic impact study analyzing the proposed entrances and adjacent intersections.

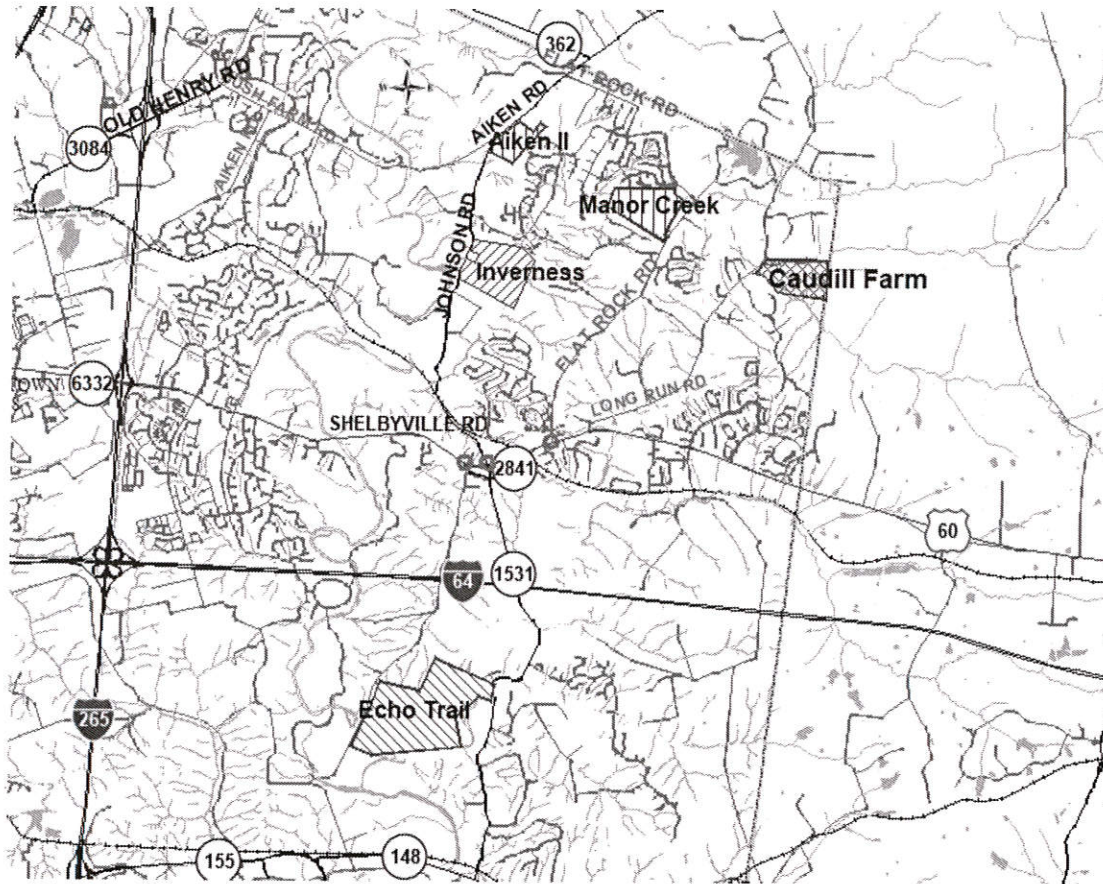


Figure 1. Site Map

FUTURE CONDITIONS

The projected full occupancy year for Caudill Farm is 2026. This study will update the 2025 data from the Aiken and Johnson Road Vicinity study (Figure 4) to 2026 using an additional 1 percent annual growth rate applied to the volumes on Shelbyville Road and 60% of the trips generated by the subdivision on Echo Trail. The intersection volumes at Flat Rock Road are taken from Manor Creek Traffic Impact Study Figure 6. The intersection volumes at Eastwood Cutoff Road are taken from Figure 7 of Echo Trail Subdivision Traffic Impact Study. **Figure 2** are the 2026 No Build peak hour volumes.

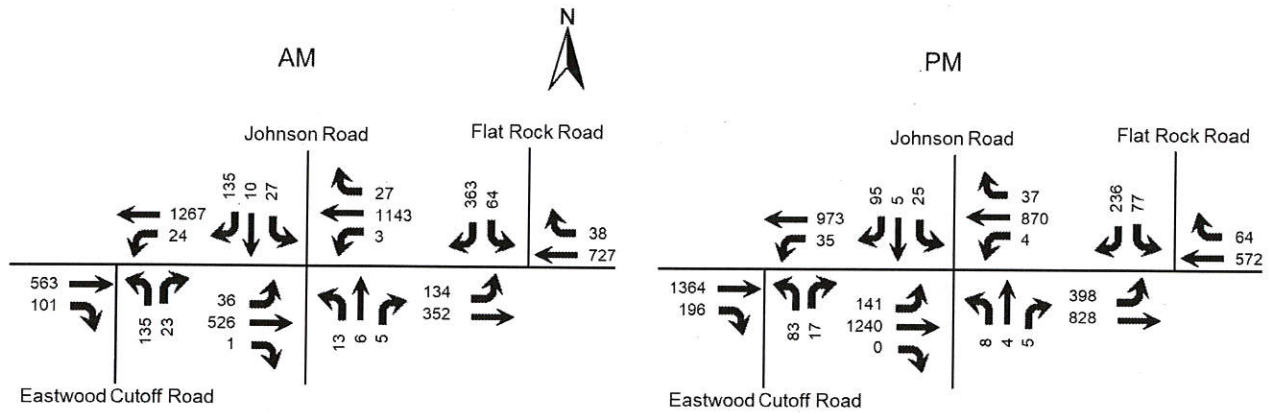


Figure 2. 2026 No Build Peak Hour Volumes Shelbyville Road

Figure 3 is the 2026 Build peak hour volumes. The Build volumes include the trips generated by the Caudill Farm 199 lots. See the Caudill Farm Traffic Impact Study, Figure 5 for trip distribution. 77% of the traffic from Caudill Farm will pass through these intersections.

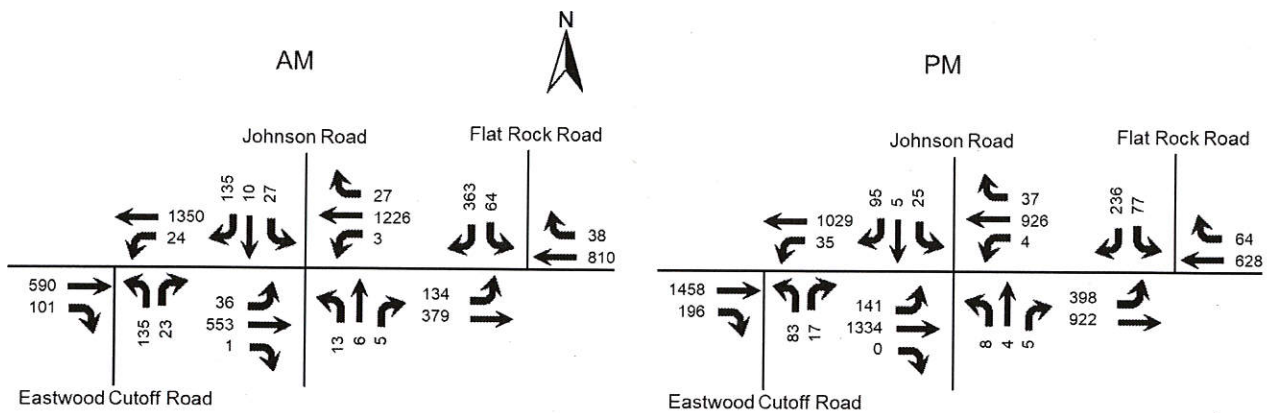


Figure 4. 2026 Build Peak Hour Volumes Shelbyville Road

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 7.8) software. The delays and Level of Service are summarized in Tables 3 and 4.

Table 3. Peak Hour Level of Service Shelbyville Road

Approach	A.M.				P.M.			
	2017 Existing	2026 No Build	2026 Build	2026 Improved	2017 Existing	2026 No Build	2026 Build	2026 Improved
Shelbyville Road at Eastwood Cutoff Road*								
Shelbyville Road Westbound (left)	A 8.7	A 9.2	A 9.3		B 11.7	C 15.1	C 16.1	
Eastwood Cutoff Northbound	F 83.6	F 755.4	F 1008.3		F 169.7	F 1638.0	F 2315.9	
Shelbyville Road at Johnson Road				C 23.2				C 31.3
Shelbyville Road Eastbound (left)	B 10.6	B 12.9	B 12.6	A 8.0	A 9.7	B 11.4		D 37.0
Shelbyville Road Westbound (left)	A 9.5	A 9.8	A 10.0	C 22.7	B 10.8	B 11.9		B 14.1
Eastwood Fishersville Road Northbound	F 63.2	F 712.8	F 1494.2	D 53.1	F 113.4	F ~		E 67.1
Johnson Road Southbound	D 31.6	F 355.8	F 498.0	D 51.1	F 59.3	F ~		E 73.4
Shelbyville Road at Flat Rock Road	C 21.1	C 29.7	D 36.8		B 13.6	B 19.7	B 23.2	
Shelbyville Road Eastbound	A 8.7	B 12.7	B 13.9		A 8.2	B 15.2	B 19.6	
Shelbyville Road Westbound	C 21.0	C 33.2	D 47.5		B 14.1	C 22.3	C 26.5	
Flat Rock Road Southbound	D 37.6	D 42.8	D 42.8		D 36.2	C 32.2	C 31.4	

Key: Level of Service, Delay in seconds per vehicle

*Existing year for Eastwood Cutoff Road is 2018

RECOMMENDATIONS

The column in the table above labeled “2026 Improved” reflects the projects below. Funding for these projects needs to be identified. The recommended projects are:

- Shelbyville Road at Johnson Road – construct left turn lanes on all approaches. A turn lane width of thirty feet on Shelbyville Road would allow thru vehicles on Johnson Road to cross one direction at a time and would reduce delays to northbound Johnson Road. The only other option to reduce delays on Johnson Road

would be to install a signal at this intersection. Signal installation is not warranted with the volumes in Figure 4. The Kentucky Transportation Cabinet Proposed Six-Year Plan for 2018-2024 does include funds for design of this intersection.

- A reconfiguration of Eastwood Cutoff Road with Johnson Road to provide a single intersection for left turns would provide enough volume to meet the signal warrant.

CONCLUSIONS

Based upon the volume of traffic forecasted for the year 2026, the projects identified in the Recommendations should be funded. The implementation of the roadway projects will result in acceptable Level of Service.

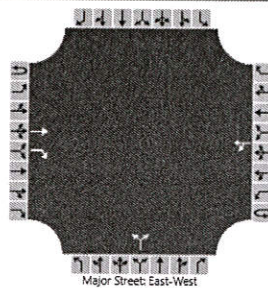
APPENDIX

HCS Reports

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	DBZ	Intersection	Shelbyville at Eastwood
Agency/Co.	Diane B Zimmerman Traffic Engineering	Jurisdiction	
Date Performed	7/23/19	East/West Street	Shelbyville Rd
Analysis Year	2026	North/South Street	Eastwood Cutoff
Time Analyzed	AM Peak No Build	Peak Hour Factor	0.95
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Caudill Farm Vicinity		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	0	1	1	0	0	1	0		0	1	0		0	0	0
Configuration			T	R			LT					LR				
Volume (veh/h)			563	101			24	1267				135				23
Percent Heavy Vehicles (%)							5					1				0
Proportion Time Blocked																
Percent Grade (%)												0				
Right Turn Channelized			No													
Median Type Storage																Undivided

Critical and Follow-up Headways

Base Critical Headway (sec)							4.1					7.1		6.2		
Critical Headway (sec)							4.15					6.41		6.20		
Base Follow-Up Headway (sec)							2.2					3.5		3.3		
Follow-Up Headway (sec)							2.25					3.51		3.30		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							25							166		
Capacity, c (veh/h)							884							70		
v/c Ratio							0.03							2.38		
95% Queue Length, Q ₉₅ (veh)							0.1							16.0		
Control Delay (s/veh)							9.2							755.4		
Level of Service (LOS)							A							F		
Approach Delay (s/veh)									1.2					755.4		
Approach LOS														F		

Shelbyville Road
Vicinity Traffic Impact Study

HCS7 Two-Way Stop-Control Report																
General Information								Site Information								
Analyst	DBZ							Intersection	Shelbyville at Eastwood							
Agency/Co.	Diane B Zimmerman Traffic Engineering							Jurisdiction								
Date Performed	7/23/19							East/West Street	Shelbyville Rd							
Analysis Year	2026							North/South Street	Eastwood Cutoff							
Time Analyzed	AM Peak Build							Peak Hour Factor	0.95							
Intersection Orientation	East-West							Analysis Time Period (hrs)	0.25							
Project Description	Caudill Farm Vicinity															
Lanes																
<p style="text-align: center;">Major Street: East-West</p>																
Vehicle Volumes and Adjustments																
Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6	7	8	9		10	11	12	
Number of Lanes	0	0	1	1	0	0	1	0	0	1	0		0	0	0	
Configuration			T	R		LT					LR					
Volume (veh/h)			590	101		24	1350			135		23				
Percent Heavy Vehicles (%)						5				1		0				
Proportion Time Blocked																
Percent Grade (%)									0							
Right Turn Channelized	No															
Median Type Storage	Undivided															
Critical and Follow-up Headways																
Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.15				6.41		6.20				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.25				3.51		3.30				
Delay, Queue Length, and Level of Service																
Flow Rate, v (veh/h)						25						166				
Capacity, c (veh/h)						862						57				
v/c Ratio						0.03						2.90				
95% Queue Length, Q ₉₅ (veh)						0.1						17.2				
Control Delay (s/veh)						9.3						1008.3				
Level of Service (LOS)						A						F				
Approach Delay (s/veh)					1.4				1008.3							
Approach LOS					A				F							

Shelbyville Road
Vicinity Traffic Impact Study

HCS7 Two-Way Stop-Control Report																	
General Information								Site Information									
Analyst	DBZ							Intersection	Shelbyville at Eastwood								
Agency/Co.	Diane B Zimmerman Traffic Engineering							Jurisdiction									
Date Performed	7/23/19							East/West Street	Shelbyville Rd								
Analysis Year	2026							North/South Street	Eastwood Cutoff								
Time Analyzed	PM Peak No Build							Peak Hour Factor	0.94								
Intersection Orientation	East-West							Analysis Time Period (hrs)	0.25								
Project Description	Caudill Farm Vicinity																
Lanes																	
Vehicle Volumes and Adjustments																	
Approach	Eastbound				Westbound				Northbound				Southbound				
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	
Priority	1U	1	2	3	4U	4	5	6			7	8	9		10	11	12
Number of Lanes	0	0	1	1	0	0	1	0			0	1	0		0	0	0
Configuration			T	R		LT					LR						
Volume (veh/h)			1364	196		35	973				83		17				
Percent Heavy Vehicles (%)						0					0		10				
Proportion Time Blocked																	
Percent Grade (%)									0								
Right Turn Channelized	No																
Median Type Storage	Undivided																
Critical and Follow-up Headways																	
Base Critical Headway (sec)						4.1					7.1		6.2				
Critical Headway (sec)						4.10					6.40		6.30				
Base Follow-Up Headway (sec)						2.2					3.5		3.3				
Follow-Up Headway (sec)						2.20					3.50		3.39				
Delay, Queue Length, and Level of Service																	
Flow Rate, v (veh/h)						37					106						
Capacity, c (veh/h)						393					27						
v/c Ratio						0.09					3.97						
95% Queue Length, Q ₉₅ (veh)						0.3					13.0						
Control Delay (s/veh)						15.1					1638.0						
Level of Service (LOS)						C					F						
Approach Delay (s/veh)					3.8				1638.0								
Approach LOS									F								

Shelbyville Road
Vicinity Traffic Impact Study

HCS7 Two-Way Stop-Control Report																	
General Information								Site Information									
Analyst	DBZ							Intersection	Shelbyville at Eastwood								
Agency/Co.	Diane B Zimmerman Traffic Engineering							Jurisdiction									
Date Performed	7/23/19							East/West Street	Shelbyville Rd								
Analysis Year	2026							North/South Street	Eastwood Cutoff								
Time Analyzed	PM Peak Build							Peak Hour Factor	0.94								
Intersection Orientation	East-West							Analysis Time Period (hrs)	0.25								
Project Description	Caudill Farm Vicinity																
Lanes																	
<p style="text-align: center;">Major Street: East-West</p>																	
Vehicle Volumes and Adjustments																	
Approach	Eastbound				Westbound				Northbound				Southbound				
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	
Priority	1U	1	2	3	4U	4	5	6			7	8	9		10	11	12
Number of Lanes	0	0	1	1	0	0	1	0			0	1	0		0	0	0
Configuration			T	R			LT					LR					
Volume (veh/h)			1458	196			35	1029			83		17				
Percent Heavy Vehicles (%)							0				0		10				
Proportion Time Blocked																	
Percent Grade (%)									0								
Right Turn Channelized	No																
Median Type Storage	Undivided																
Critical and Follow-up Headways																	
Base Critical Headway (sec)							4.1				7.1		6.2				
Critical Headway (sec)							4.10				6.40		6.30				
Base Follow-Up Headway (sec)							2.2				3.5		3.3				
Follow-Up Headway (sec)							2.20				3.50		3.39				
Delay, Queue Length, and Level of Service																	
Flow Rate, v (veh/h)							37						106				
Capacity, c (veh/h)							360						20				
v/c Ratio							0.10						5.29				
95% Queue Length, Q ₉₅ (veh)							0.3						13.7				
Control Delay (s/veh)							16.1						2315.9				
Level of Service (LOS)							C						F				
Approach Delay (s/veh)					4.7				2315.9								
Approach LOS									F								

Shelbyville Road
Vicinity Traffic Impact Study

HCS7 Two-Way Stop-Control Report																	
General Information								Site Information									
Analyst	Diane Zimmerman							Intersection	Shelbyville at Johnson								
Agency/Co.	Diane B Zimmerman Traffic Engineering							Jurisdiction									
Date Performed	7/23/19							East/West Street	Shelbyville Rd								
Analysis Year	2026							North/South Street	Johnson Rd								
Time Analyzed	AM Peak No Build							Peak Hour Factor	0.92								
Intersection Orientation	East-West							Analysis Time Period (hrs)	0.25								
Project Description	Caudill Farm Vicinity																
Lanes																	
Vehicle Volumes and Adjustments																	
Approach	Eastbound				Westbound				Northbound				Southbound				
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	
Priority	1U	1	2	3	4U	4	5	6			7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0			0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR		
Volume (veh/h)		36	526	1		3	1143	27			13	6	5		27	10	135
Percent Heavy Vehicles (%)		0				66					10	0	0		0	0	0
Proportion Time Blocked																	
Percent Grade (%)											0					0	
Right Turn Channelized																	
Median Type Storage	Undivided																
Critical and Follow-up Headways																	
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2	
Critical Headway (sec)		4.10				4.76				7.20	6.50	6.20		7.10	6.50	6.20	
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3	
Follow-Up Headway (sec)		2.20				2.79				3.59	4.00	3.30		3.50	4.00	3.30	
Delay, Queue Length, and Level of Service																	
Flow Rate, v (veh/h)		39				3					26					187	
Capacity, c (veh/h)		553				749					17					119	
v/c Ratio		0.07				0.00					1.50					1.57	
95% Queue Length, Q ₉₅ (veh)		0.2				0.0					3.7					13.6	
Control Delay (s/veh)		12.0				9.8					712.8					355.8	
Level of Service (LOS)		B				A					F					F	
Approach Delay (s/veh)	1.9				0.2				712.8				355.8				
Approach LOS	B				A				F				F				

Shelbyville Road
Vicinity Traffic Impact Study

HCS7 Two-Way Stop-Control Report																		
General Information								Site Information										
Analyst	Diane Zimmerman							Intersection	Shelbyville at Johnson									
Agency/Co.	Diane B Zimmerman Traffic Engineering							Jurisdiction										
Date Performed	7/23/19							East/West Street	Shelbyville Rd									
Analysis Year	2026							North/South Street	Johnson Rd									
Time Analyzed	AM Peak Build							Peak Hour Factor	0.92									
Intersection Orientation	East-West							Analysis Time Period (hrs)	0.25									
Project Description	Caudill Farm Vicinity																	
Lanes																		
<p style="text-align: center;">Major Street: East-West</p>																		
Vehicle Volumes and Adjustments																		
Approach	Eastbound				Westbound				Northbound				Southbound					
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R		
Priority	1U	1	2	3	4U	4	5	6			7	8	9			10	11	12
Number of Lanes	0	0	1	0	0	0	1	0			0	1	0			0	1	0
Configuration			LTR				LTR				LTR				LTR			
Volume (veh/h)		36	553	1		3	1226	27			13	6	5			27	10	135
Percent Heavy Vehicles (%)		0				66					10	0	0			0	0	0
Proportion Time Blocked																		
Percent Grade (%)									0				0					
Right Turn Channelized																		
Median Type Storage	Undivided																	
Critical and Follow-up Headways																		
Base Critical Headway (sec)		4.1				4.1					7.1	6.5	6.2			7.1	6.5	6.2
Critical Headway (sec)		4.10				4.76					7.20	6.50	6.20			7.10	6.50	6.20
Base Follow-Up Headway (sec)		2.2				2.2					3.5	4.0	3.3			3.5	4.0	3.3
Follow-Up Headway (sec)		2.20				2.79					3.59	4.00	3.30			3.50	4.00	3.30
Delay, Queue Length, and Level of Service																		
Flow Rate, v (veh/h)		39				3					26							187
Capacity, c (veh/h)		511				728					10							100
v/c Ratio		0.08				0.00					2.64							1.87
95% Queue Length, Q ₉₅ (veh)		0.2				0.0					4.3							15.4
Control Delay (s/veh)		12.6				10.0					1494.2							498.0
Level of Service (LOS)		B				A					F							F
Approach Delay (s/veh)	2.1				0.2				1494.2				498.0					
Approach LOS									F				F					

Shelbyville Road
Vicinity Traffic Impact Study

HCS7 Signalized Intersection Results Summary																			
General Information						Intersection Information													
Agency	Diane B. Zimmerman Traffic Engineering					Duration, h	0.25												
Analyst	DBZ	Analysis Date	Jul 24, 2019			Area Type	Other												
Jurisdiction		Time Period	AM Peak			PHF	0.92												
Urban Street	Shelbyville Road		Analysis Year	2026		Analysis Period	1> 7:00												
Intersection	Johnson Road		File Name	Johnson AM 26.xus															
Project Description	Caudill Vicinity																		
Demand Information				EB			WB			NB			SB						
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R							
Demand (v), veh/h	36	553	1	27	1226	27	148	6	5	27	10	135							
Signal Information																			
Cycle, s	120.0	Reference Phase	2																
Offset, s	0	Reference Point	End																
Uncoordinated	No	Simult. Gap E/W	On	Green	92.7	16.5	0.0	0.0	0.0	0.0									
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	3.6	3.6	0.0	0.0	0.0	0.0									
				Red	1.8	1.8	0.0	0.0	0.0	0.0									
Timer Results				EBL		EBT		WBL		WBT		NBL		NBT		SBL		SBT	
Assigned Phase			2		6		8		4										
Case Number			6.0		6.0		7.0		7.0										
Phase Duration, s			98.1		98.1		21.9		21.9										
Change Period, (Y+R), s			5.4		5.4		5.4		5.4										
Max Allow Headway (MAH), s			0.0		0.0		4.1		4.1										
Queue Clearance Time (g _s), s							15.6		12.4										
Green Extension Time (g _e), s			0.0		0.0		0.8		1.0										
Phase Call Probability							1.00		1.00										
Max Out Probability							0.08		0.02										
Movement Group Results				EB			WB			NB			SB						
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							
Adjusted Flow Rate (v), veh/h	39	602		29	1362		167	5		40	147								
Adjusted Saturation Flow Rate (s), veh/h/ln	406	1899		830	1893		1440	1610		1550	1610								
Queue Service Time (g _s), s	10.4	12.7		1.5	70.0		11.0	0.4		0.0	10.4								
Cycle Queue Clearance Time (g _c), s	80.3	12.7		14.1	70.0		13.6	0.4		2.6	10.4								
Green Ratio (g/C)	0.77	0.77		0.77	0.77		0.14	0.14		0.14	0.14								
Capacity (c), veh/h	137	1468		614	1463		256	221		265	221								
Volume-to-Capacity Ratio (X)	0.286	0.410		0.048	0.931		0.653	0.025		0.152	0.664								
Back of Queue (Q), ft/ln (95 th percentile)	54.6	175.2		11.4	813.5		215.8	6.3		47.6	191.9								
Back of Queue (Q), veh/ln (95 th percentile)	2.2	7.0		0.5	32.5		8.6	0.3		1.9	7.7								
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00								
Uniform Delay (d ₁), s/veh	43.6	4.5		6.9	11.0		50.5	44.8		45.7	49.1								
Incremental Delay (d ₂), s/veh	5.2	0.9		0.1	12.0		2.8	0.0		0.3	3.4								
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), s/veh	48.8	5.4		7.0	23.0		53.3	44.9		46.0	52.6								
Level of Service (LOS)	D	A		A	C		D	D		D	D								
Approach Delay, s/veh / LOS	8.0		A		22.7		C		53.1		D		51.1		D				
Intersection Delay, s/veh / LOS				23.2						C									
Multimodal Results				EB			WB			NB			SB						
Pedestrian LOS Score / LOS	1.84		B		1.84		B		1.95		B		1.95		B				
Bicycle LOS Score / LOS	1.55		B		2.78		C		0.77		A		0.80		A				

Shelbyville Road
Vicinity Traffic Impact Study

HCS7 Two-Way Stop-Control Report																
General Information								Site Information								
Analyst	Diane Zimmerman							Intersection	Shelbyville at Johnson							
Agency/Co.	Diane B Zimmerman Traffic Engineering							Jurisdiction								
Date Performed	7/23/19							East/West Street	Shelbyville Rd							
Analysis Year	2026							North/South Street	Johnson Rd							
Time Analyzed	PM Peak No Build							Peak Hour Factor	0.93							
Intersection Orientation	East-West							Analysis Time Period (hrs)	0.25							
Project Description	Caudill Farm Vicinity															
Lanes																
<p style="text-align: center;">Major Street: East-West</p>																
Vehicle Volumes and Adjustments																
Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6	7	8	9		10	11	12	
Number of Lanes	0	0	1	0	0	0	1	0	0	1	0		0	1	0	
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		141	1240	0		4	870	37		8	4	5		25	5	95
Percent Heavy Vehicles (%)		0				0				0	0	0		0	0	0
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized																
Median Type Storage					Undivided											
Critical and Follow-up Headways																
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.10				4.10				7.10	6.50	6.20		7.10	6.50	6.20
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.20				2.20				3.50	4.00	3.30		3.50	4.00	3.30
Delay, Queue Length, and Level of Service																
Flow Rate, v (veh/h)		152				4				18						134
Capacity, c (veh/h)		715				524										3
v/c Ratio		0.21				0.01										49.87
95% Queue Length, Q ₉₅ (veh)		0.8				0.0										19.1
Control Delay (s/veh)		11.4				11.9										24620.9
Level of Service (LOS)		B				B										F
Approach Delay (s/veh)		9.5				0.3					24620.9					
Approach LOS											F					

Shelbyville Road
Vicinity Traffic Impact Study

HCS7 Two-Way Stop-Control Report																	
General Information								Site Information									
Analyst	Diane Zimmerman							Intersection	Shelbyville at Johnson								
Agency/Co.	Diane B Zimmerman Traffic Engineering							Jurisdiction									
Date Performed	7/23/19							East/West Street	Shelbyville Rd								
Analysis Year	2026							North/South Street	Johnson Rd								
Time Analyzed	PM Peak Build							Peak Hour Factor	0.93								
Intersection Orientation	East-West							Analysis Time Period (hrs)	0.25								
Project Description	Caudill Farm Vicinity																
Lanes																	
<p style="text-align: center;">Major Street: East-West</p>																	
Vehicle Volumes and Adjustments																	
Approach	Eastbound				Westbound				Northbound				Southbound				
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	
Priority	1U	1	2	3	4U	4	5	6			7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0			0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR		
Volume (veh/h)		141	1334	0		4	926	37			8	4	5		25	5	95
Percent Heavy Vehicles (%)		0				0					0	0	0		0	0	0
Proportion Time Blocked																	
Percent Grade (%)									0				0				
Right Turn Channelized																	
Median Type Storage	Undivided																
Critical and Follow-up Headways																	
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2	
Critical Headway (sec)		4.10				4.10				7.10	6.50	6.20		7.10	6.50	6.20	
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3	
Follow-Up Headway (sec)		2.20				2.20				3.50	4.00	3.30		3.50	4.00	3.30	
Delay, Queue Length, and Level of Service																	
Flow Rate, v (veh/h)		152				4					18					134	
Capacity, c (veh/h)		679				480											
v/c Ratio		0.22				0.01											
95% Queue Length, Q ₉₅ (veh)		0.9				0.0											
Control Delay (s/veh)		11.8				12.6											
Level of Service (LOS)		B				B											
Approach Delay (s/veh)	1.1				0.3												
Approach LOS																	

Shelbyville Road
Vicinity Traffic Impact Study

HCS7 Signalized Intersection Results Summary															
General Information						Intersection Information									
Agency	Diane B. Zimmerman Traffic Engineering					Duration, h	0.25								
Analyst	DBZ	Analysis Date	Jul 24, 2019			Area Type	Other								
Jurisdiction		Time Period	PM Peak			PHF	0.92								
Urban Street	Shelbyville Road		Analysis Year	2026		Analysis Period	1 > 5:00								
Intersection	Johnson Road		File Name	Johnson PM 26.xus											
Project Description	Caudill Vicinity														
Demand Information				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h				141	1334	1	39	926	37	91	4	5	25	5	95
Signal Information															
Cycle, s	140.0	Reference Phase	2												
Offset, s	0	Reference Point	End												
Uncoordinated	No	Simult. Gap E/W	On	Green	4.8	1.1	105.7	12.1	0.0	0.0					
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	3.6	0.0	3.6	3.6	0.0	0.0					
				Red	1.8	0.0	1.8	1.8	0.0	0.0					
Timer Results				EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT				
Assigned Phase				5	2	1	6		8		4				
Case Number				1.1	4.0	1.1	4.0		7.0		7.0				
Phase Duration, s				11.4	112.2	10.2	111.1		17.5		17.5				
Change Period, (Y+R _c), s				5.4	5.4	5.4	5.4		5.4		5.4				
Max Allow Headway (MAH), s				4.0	0.0	4.0	0.0		5.1		5.1				
Queue Clearance Time (g _s), s				4.6		2.7			11.8		10.8				
Green Extension Time (g _e), s				0.5	0.0	0.1	0.0		0.3		0.4				
Phase Call Probability				1.00		0.81			1.00		1.00				
Max Out Probability				0.00		0.00			1.00		1.00				
Movement Group Results				EB			WB			NB			SB		
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
Adjusted Flow Rate (v), veh/h				153	1451		42	1047		103	5		33	103	
Adjusted Saturation Flow Rate (s), veh/h/ln				1810	1900		1810	1887		1448	1610		1509	1610	
Queue Service Time (g _s), s				2.6	104.1		0.7	42.8		7.1	0.4		0.0	8.8	
Cycle Queue Clearance Time (g _c), s				2.6	104.1		0.7	42.8		9.8	0.4		2.7	8.8	
Green Ratio (g/C)				0.80	0.77		0.79	0.75		0.09	0.09		0.09	0.09	
Capacity (c), veh/h				375	1449		116	1424		176	140		178	140	
Volume-to-Capacity Ratio (X)				0.409	1.001		0.366	0.735		0.587	0.039		0.183	0.740	
Back of Queue (Q), ft/ln (95 th percentile)				83.1	1337.4		52	547.4		170.1	8.1		49.4	185.1	
Back of Queue (Q), veh/ln (95 th percentile)				3.3	53.5		2.1	21.9		6.8	0.3		2.0	7.4	
Queue Storage Ratio (RQ) (95 th percentile)				0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00	
Uniform Delay (d ₁), s/veh				12.2	15.7		43.1	9.4		62.9	58.6		59.6	62.4	
Incremental Delay (d ₂), s/veh				0.7	23.9		1.9	3.4		4.6	0.2		0.7	15.2	
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), s/veh				12.9	39.6		45.0	12.9		67.5	58.8		60.3	77.6	
Level of Service (LOS)				B	F		D	B		E	E		E	E	
Approach Delay, s/veh / LOS				37.0		D	14.1		B	67.1		E	73.4		E
Intersection Delay, s/veh / LOS				31.3				C							
Multimodal Results				EB			WB			NB			SB		
Pedestrian LOS Score / LOS				1.85		B	1.86		B	1.96		B	1.96		B
Bicycle LOS Score / LOS				3.13		C	2.28		B	0.67		A	0.71		A

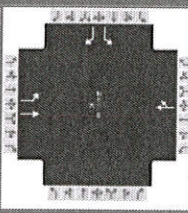
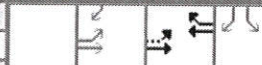
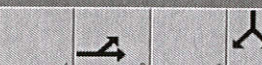
HCS7 Signalized Intersection Results Summary																			
General Information						Intersection Information													
Agency	Diane B. Zimmerman Traffic Engineering					Duration, h	0.25												
Analyst	DBZ		Analysis Date	Jul 24, 2019		Area Type	Other												
Jurisdiction			Time Period	AM Peak		PHF	0.91												
Urban Street	US 60		Analysis Year	2026 No Build		Analysis Period	1> 7:15												
Intersection	Flat Rock Road		File Name	Flat Rock AM 26 NB.xus															
Project Description	Caudill Farm Vicinity																		
Demand Information						EB			WB				NB			SB			
Approach Movement						L	T	R	L	T	R	L	T	R	L	T	R		
Demand (v), veh/h						134	352			727	38				64			363	
Signal Information																			
Cycle, s	100.0	Reference Phase	2																
Offset, s	0	Reference Point	End																
Uncoordinated	No	Simult. Gap E/W	On	Green	5.9	51.1	24.0	0.0	0.0	0.0									
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	5.0	4.0	0.0	0.0	0.0									
				Red	2.0	2.0	2.0	0.0	0.0	0.0									
Timer Results				EBL		EBT		WBL		WBT		NBL		NBT		SBL		SBT	
Assigned Phase				5		2				6								4	
Case Number				1.0		4.0				8.3								9.0	
Phase Duration, s				11.9		70.0				58.1								30.0	
Change Period, (Y+Rc), s				6.0		7.0				7.0								6.0	
Max Allow Headway (MAH), s				2.9		0.0				0.0								3.1	
Queue Clearance Time (gs), s				5.8														25.6	
Green Extension Time (ge), s				0.1		0.0				0.0								0.0	
Phase Call Probability				0.98														1.00	
Max Out Probability				0.00														1.00	
Movement Group Results				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Assigned Movement				5	2			6	16				7		14				
Adjusted Flow Rate (v), veh/h				147	387			841				70		399					
Adjusted Saturation Flow Rate (s), veh/h/ln				1753	1841			1868				1640		1585					
Queue Service Time (gs), s				3.8	9.8			40.0				3.4		23.6					
Cycle Queue Clearance Time (gc), s				3.8	9.8			40.0				3.4		23.6					
Green Ratio (g/C)				0.59	0.63			0.51				0.24		0.30					
Capacity (c), veh/h				247	1160			955				394		474					
Volume-to-Capacity Ratio (X)				0.596	0.334			0.880				0.179		0.842					
Back of Queue (Q), ft/ln (90 th percentile)				70.7	145.5			582.5				62.4		352.3					
Back of Queue (Q), veh/ln (90 th percentile)				2.7	5.6			23.1				2.3		13.9					
Queue Storage Ratio (RQ) (90 th percentile)				0.57	0.00			0.00				0.16		0.88					
Uniform Delay (d1), s/veh				20.6	8.7			21.7				30.2		32.8					
Incremental Delay (d2), s/veh				0.9	0.8			11.4				0.1		12.2					
Initial Queue Delay (d3), s/veh				0.0	0.0			0.0				0.0		0.0					
Control Delay (d), s/veh				21.4	9.4			33.2				30.3		45.0					
Level of Service (LOS)				C	A			C				C		D					
Approach Delay, s/veh / LOS				12.7		B	33.2		C	0.0			42.8		D				
Intersection Delay, s/veh / LOS				29.7					C										
Multimodal Results				EB			WB			NB			SB						
Pedestrian LOS Score / LOS				0.68	A	1.90	B	1.73	B	1.96	B								
Bicycle LOS Score / LOS				1.37	A	1.87	B				F								

HCS7 Signalized Intersection Results Summary															
General Information							Intersection Information								
Agency	Diane B. Zimmerman Traffic Engineering						Duration, h	0.25							
Analyst	DBZ		Analysis Date	Jul 24, 2019			Area Type	Other							
Jurisdiction							Time Period	AM Peak							
Urban Street	US 60		Analysis Year	2026 Build			PHF	0.91							
Intersection	Flat Rock Road		File Name	Flat Rock AM 26 B.xus											
Project Description	Caudill Farm Vicinity														
Demand Information				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h				134	379			810	38				64		363
Signal Information															
Cycle, s	100.0	Reference Phase	2												
Offset, s	0	Reference Point	End												
Uncoordinated	No	Simult. Gap E/W	On	Green	5.9	51.1	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	5.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
				Red	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Timer Results				EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT				
Assigned Phase				5	2		6					4			
Case Number				1.0	4.0		8.3					9.0			
Phase Duration, s				11.9	70.0		58.1					30.0			
Change Period, (Y+R), s				6.0	7.0		7.0					6.0			
Max Allow Headway (MAH), s				2.9	0.0		0.0					3.1			
Queue Clearance Time (g _s), s				5.8								25.6			
Green Extension Time (g _e), s				0.1	0.0		0.0					0.0			
Phase Call Probability				0.98								1.00			
Max Out Probability				0.00								1.00			
Movement Group Results				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				5	2			6	16				7		14
Adjusted Flow Rate (v), veh/h				147	416			932				70		399	
Adjusted Saturation Flow Rate (s), veh/h/ln				1753	1841			1870				1640		1585	
Queue Service Time (g _s), s				3.8	10.8			48.6				3.4		23.6	
Cycle Queue Clearance Time (g _c), s				3.8	10.8			48.6				3.4		23.6	
Green Ratio (g/C)				0.59	0.63			0.51				0.24		0.30	
Capacity (c), veh/h				190	1160			956				394		474	
Volume-to-Capacity Ratio (X)				0.774	0.359			0.975				0.179		0.842	
Back of Queue (Q), ft/ln (90 th percentile)				79.5	157.5			766.4				62.4		352.3	
Back of Queue (Q), veh/ln (90 th percentile)				3.1	6.1			30.4				2.3		13.9	
Queue Storage Ratio (RQ) (90 th percentile)				0.64	0.00			0.00				0.16		0.88	
Uniform Delay (d ₁), s/veh				23.1	8.8			23.8				30.2		32.8	
Incremental Delay (d ₂), s/veh				2.5	0.9			23.7				0.1		12.2	
Initial Queue Delay (d ₃), s/veh				0.0	0.0			0.0				0.0		0.0	
Control Delay (d), s/veh				25.7	9.7			47.5				30.3		45.0	
Level of Service (LOS)				C	A			D				C		D	
Approach Delay, s/veh / LOS				13.9		B	47.5		D	0.0			42.8		D
Intersection Delay, s/veh / LOS				36.8						D					
Multimodal Results				EB			WB			NB			SB		
Pedestrian LOS Score / LOS				0.68	A	1.90	B	1.73	B	1.96	B				
Bicycle LOS Score / LOS				1.42	A	2.03	B				F				

Shelbyville Road
Vicinity Traffic Impact Study

HCS7 Signalized Intersection Results Summary																
General Information						Intersection Information										
Agency	Diane B. Zimmerman Traffic Engineering					Duration, h	0.25									
Analyst	DBZ	Analysis Date	Jul 24, 2019			Area Type	Other									
Jurisdiction		Time Period	PM Peak			PHF	0.94									
Urban Street	US 60		Analysis Year	2026 No Build		Analysis Period	1> 5:00									
Intersection	Flat Rock Road		File Name	Flat Rock PM 26 NB.xus												
Project Description	Manor Creek															
Demand Information				EB			WB			NB			SB			
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R	
Demand (v), veh/h				398	828			572	64				77		236	
Signal Information																
Cycle, s	100.0	Reference Phase	2													
Offset, s	0	Reference Point	End	Green	13.0	52.1	15.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Uncoordinated	No	Simult. Gap E/W	On	Yellow	4.0	5.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Force Mode	Fixed	Simult. Gap N/S	On	Red	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Timer Results				EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT					
Assigned Phase				5	2		6					4				
Case Number				1.0	4.0		8.3					9.0				
Phase Duration, s				19.0	78.2		59.1					21.8				
Change Period, (Y+R), s				6.0	7.0		7.0					6.0				
Max Allow Headway (MAH), s				2.9	0.0		0.0					3.1				
Queue Clearance Time (g _s), s				12.5								15.4				
Green Extension Time (g _e), s				0.6	0.0		0.0					0.4				
Phase Call Probability				1.00								1.00				
Max Out Probability				0.01								0.01				
Movement Group Results				EB			WB			NB			SB			
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R	
Assigned Movement				5	2			6	16				7		14	
Adjusted Flow Rate (v), veh/h				423	881			677				82		251		
Adjusted Saturation Flow Rate (s), veh/h/ln				1753	1841			1852				1640		1585		
Queue Service Time (g _s), s				10.5	26.5			27.6				4.4		13.4		
Cycle Queue Clearance Time (g _c), s				10.5	26.5			27.6				4.4		13.4		
Green Ratio (g/C)				0.67	0.71			0.52				0.16		0.29		
Capacity (c), veh/h				485	1310			966				260		457		
Volume-to-Capacity Ratio (X)				0.873	0.672			0.701				0.316		0.549		
Back of Queue (Q), ft/ln (90 th percentile)				209.5	293.8			385.4				83.3		191.4		
Back of Queue (Q), veh/ln (90 th percentile)				8.1	11.4			15.3				3.0		7.5		
Queue Storage Ratio (RQ) (90 th percentile)				1.68	0.00			0.00				0.21		0.48		
Uniform Delay (d ₁), s/veh				16.4	8.0			18.0				37.3		30.1		
Incremental Delay (d ₂), s/veh				8.2	2.8			4.2				0.3		0.4		
Initial Queue Delay (d ₃), s/veh				0.0	0.0			0.0				0.0		0.0		
Control Delay (d), s/veh				24.6	10.7			22.3				37.5		30.5		
Level of Service (LOS)				C	B			C				D		C		
Approach Delay, s/veh / LOS				15.2	B		22.3	C		0.0			32.2	C		
Intersection Delay, s/veh / LOS				19.7						B						
Multimodal Results				EB			WB			NB			SB			
Pedestrian LOS Score / LOS				0.66	A		1.90	B		1.73	B		1.96	B		
Bicycle LOS Score / LOS				2.64	C		1.60	B					F			

Shelbyville Road
Vicinity Traffic Impact Study

HCS7 Signalized Intersection Results Summary																											
General Information						Intersection Information																					
Agency	Diane B. Zimmerman Traffic Engineering					Duration, h	0.25																				
Analyst	DBZ	Analysis Date	Jul 24, 2019			Area Type	Other																				
Jurisdiction		Time Period	PM Peak			PHF	0.94																				
Urban Street	US 60		Analysis Year	2026 Build		Analysis Period	1> 5:00																				
Intersection	Flat Rock Road		File Name	Flat Rock PM 26 B.xus																							
Project Description	Manor Creek																										
Demand Information				EB			WB			NB			SB														
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R												
Demand (v), veh/h				398	922			628	64				77		236												
Signal Information																											
Cycle, s	100.0	Reference Phase	2																								
Offset, s	0	Reference Point	End	Green	14.6	50.8	15.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0												
Uncoordinated	No	Simult. Gap E/W	On	Yellow	4.0	5.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0												
Force Mode	Fixed	Simult. Gap N/S	On	Red	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0												
Timer Results				EBL			EBT			WBL			WBT			NBL			NBT			SBL			SBT		
Assigned Phase				5			2						6												4		
Case Number				1.0			4.0						8.3												9.0		
Phase Duration, s				20.6			78.4						57.8												21.6		
Change Period, (Y+Rc), s				6.0			7.0						7.0												6.0		
Max Allow Headway (MAH), s				2.9			0.0						0.0												3.1		
Queue Clearance Time (gs), s				14.0																					15.1		
Green Extension Time (ge), s				0.5			0.0						0.0												0.4		
Phase Call Probability				1.00																					1.00		
Max Out Probability				0.02																					0.01		
Movement Group Results				EB			WB			NB			SB														
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R												
Assigned Movement				5	2			6	16				7		14												
Adjusted Flow Rate (v), veh/h				423	981			736				82		251													
Adjusted Saturation Flow Rate (s), veh/h/ln				1753	1841			1854				1640		1585													
Queue Service Time (gs), s				12.0	32.6			32.4				4.4		13.1													
Cycle Queue Clearance Time (gc), s				12.0	32.6			32.4				4.4		13.1													
Green Ratio (g/C)				0.67	0.71			0.51				0.16		0.30													
Capacity (c), veh/h				458	1315			942				255		479													
Volume-to-Capacity Ratio (X)				0.924	0.746			0.782				0.321		0.524													
Back of Queue (Q), ft/ln (90th percentile)				251.1	352.3			458.7				83.6		187.6													
Back of Queue (Q), veh/ln (90th percentile)				9.7	13.7			18.2				3.1		7.4													
Queue Storage Ratio (RQ) (90th percentile)				2.01	0.00			0.00				0.21		0.47													
Uniform Delay (d1), s/veh				20.4	8.7			20.1				37.5		28.9													
Incremental Delay (d2), s/veh				15.4	3.9			6.4				0.3		0.3													
Initial Queue Delay (d3), s/veh				0.0	0.0			0.0				0.0		0.0													
Control Delay (d), s/veh				35.8	12.6			26.5				37.8		29.3													
Level of Service (LOS)				D	B			C				D		C													
Approach Delay, s/veh / LOS				19.6		B	26.5		C	0.0			31.4		C												
Intersection Delay, s/veh / LOS							23.2						C														
Multimodal Results				EB			WB			NB			SB														
Pedestrian LOS Score / LOS				0.66		A	1.90		B	1.73		B	1.96		B												
Bicycle LOS Score / LOS				2.80		C	1.70		B					F													