final report

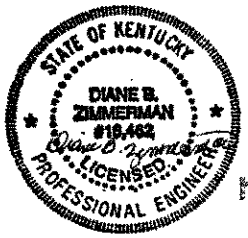
February 19, 2020

Traffic Impact Study

Heritage Creel Extension
1001 Cedar Creek Road (KY 864)
Louisville, KY

Prepared for

Louisville Metro Planning Commission
Kentucky Transportation Cabinet



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INTRODUCTION

The site plan for the proposed Heritage Creek Extension subdivision shows 247 single-family lots on Cedar Creek Road (KY 864) in Louisville, KY. **Figure 1** displays a map of the site. Access to the site will be from an entrance on Cedar Creek Road (KY 864). A connection will be made to United Boulevard to the south. 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 intersection of Cedar Creek Road with Loyal Drive and the proposed entrance.

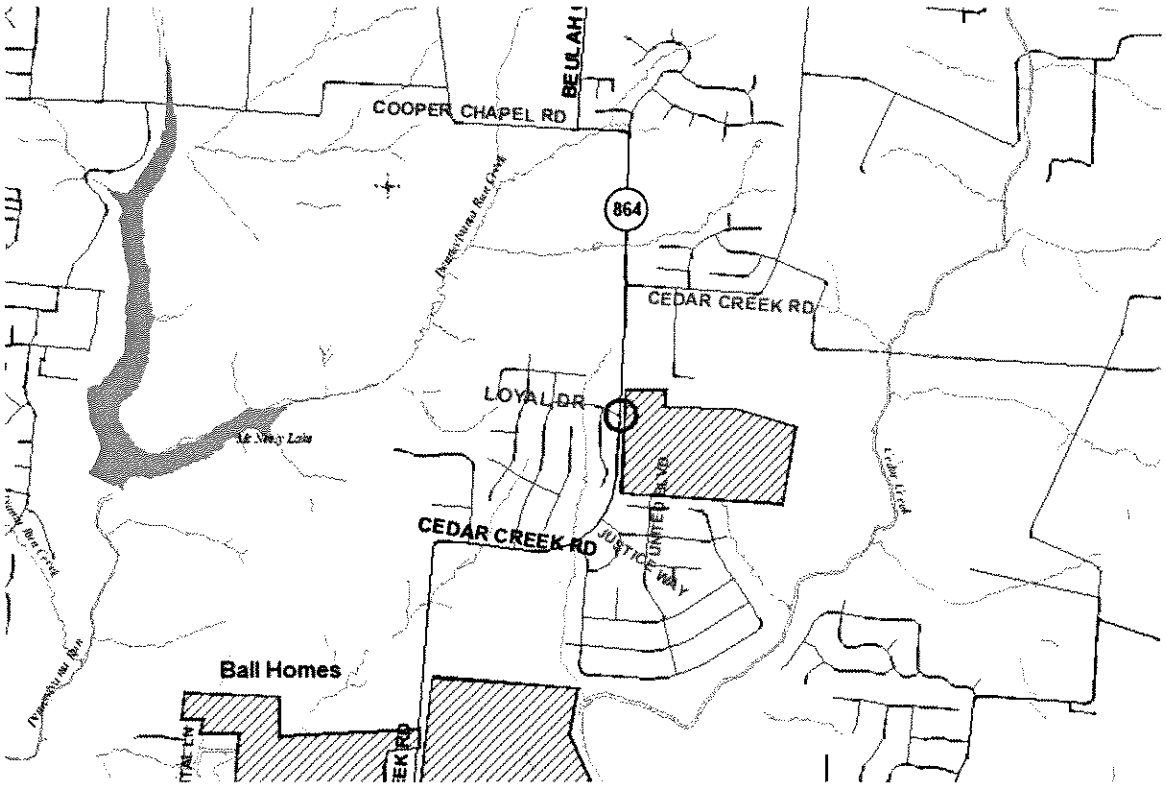


Figure 1. Site Map

EXISTING CONDITIONS

Cedar Creek Road, KY 864, is a state-maintained road with an estimated 2020 ADT of 2,400 vehicles per day between KY 2053 (Mt. Washington Road) and Cooper Chapel Road as estimated from the 2018 count at Kentucky Transportation Cabinet at station 279. The KYTC functional classification is Urban Major Collector. The road is a two-lane highway with ten-foot lanes with three-foot shoulders through the study area (provided by the Kentucky Transportation Cabinet). The speed limit is 35 mph. There are no sidewalks. The intersection at Loyal Drive is controlled with a stop sign on Loyal Drive.

Peak hour traffic count for the intersections was obtained on Wednesday, January 15, 2020. The a.m. peak hour occurred between 7:00 and 8:00 and the p.m. peak hour occurred between 4:45 and 5:45. **Figure 2** illustrates the existing a.m. and p.m. peak hour traffic volumes. The Appendix contains the full count data.

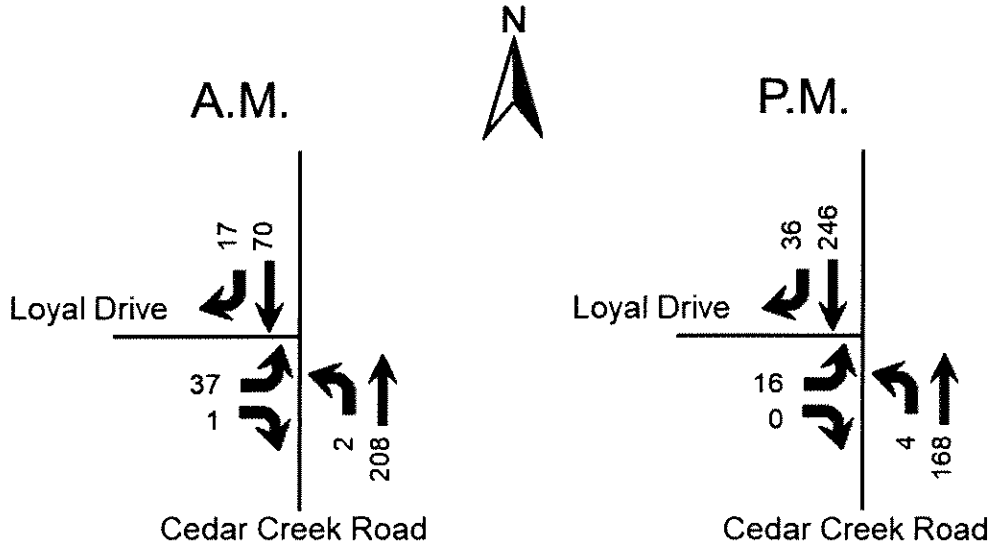


Figure 2. Existing Peak Hour Volumes

FUTURE CONDITIONS

The project completion date is 2030. An annual growth rate of 2 percent was applied to the 2020 thru volumes. This was determined by the historical growth at KYTC station 279. Trip generation for 523 lots from approved subdivisions to the south were included. Trip generation for the remaining 62 lots to be accessed from Loyal Drive have been included on Loyal Drive. **Figure 3** displays the 2030 No Build peak hour volumes.

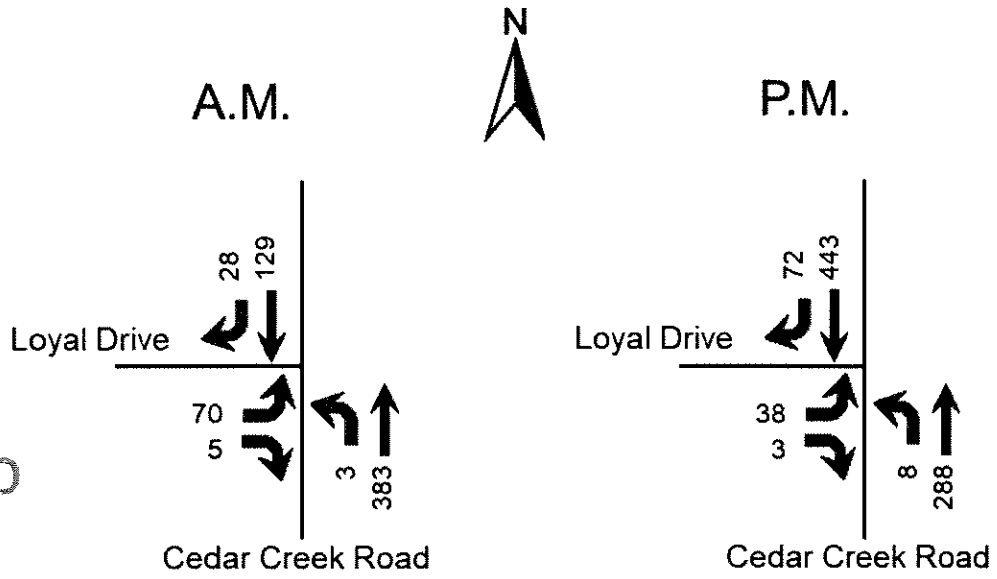


Figure 3. 2030 No Build Peak Hour Volumes

TRIP GENERATION

The Institute of Transportation Engineers Trip Generation Manual, 10th Edition contains trip generation rates for a wide range of developments. The land use of "Single-Family Detached (210)" was 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 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

	A.M. Peak Hour			P.M. Peak Hour		
Land Use	**Trips**	**In**	**Out**	**Trips**	**In**	**Out**
Single-Family (247 units)	180	45	135	242	152	90

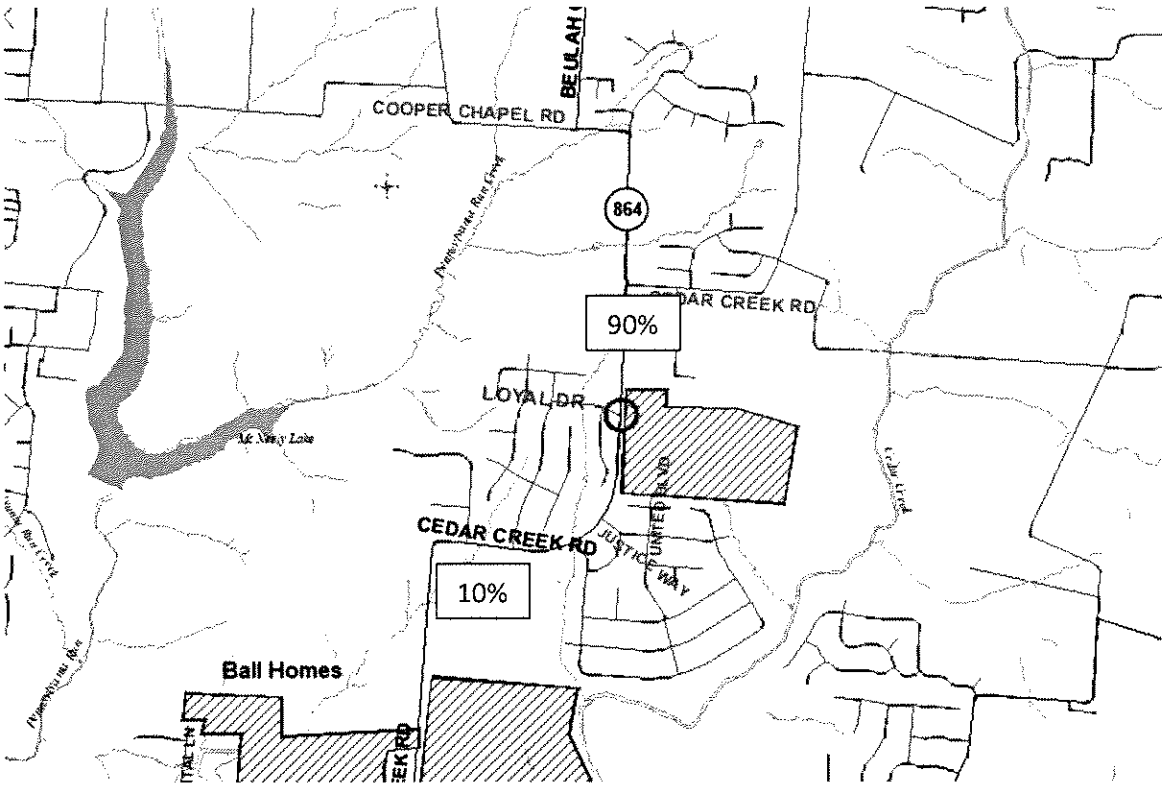


Figure 4. Trip Distribution Percentages

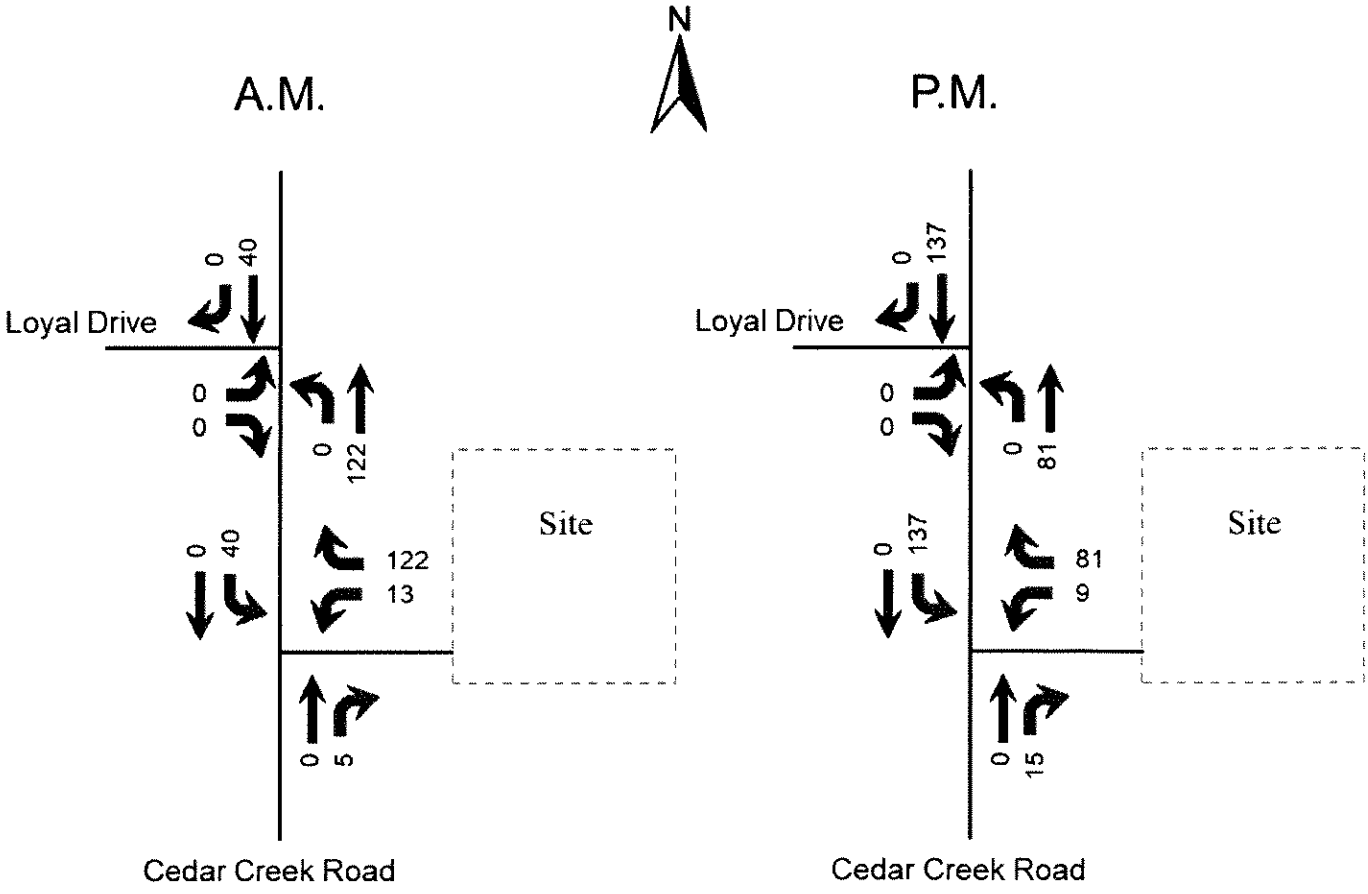


Figure 5. Peak Hour Trips Generated by Site

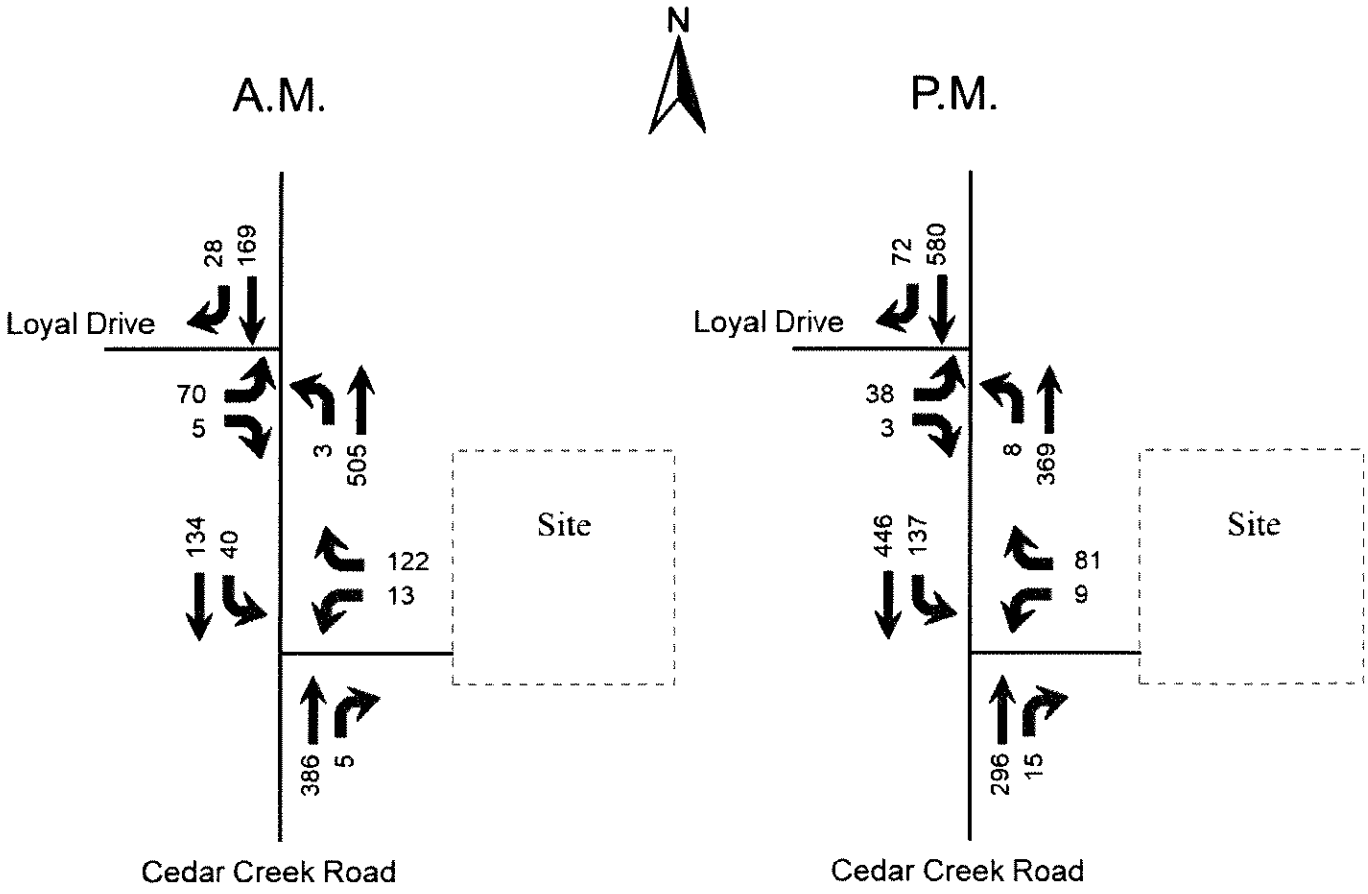


Figure 6. 2030 Build Peak Hour Volumes

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 for lanes at stop-controlled intersections.

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 7.8.5) software. The delays and Level of Service are summarized in **Table 2**.

Table 2. Peak Hour Level of Service

Approach	A.M.			P.M.		
	2020 Existing	2024 No Build	2024 Build	2020 Existing	2024 No Build	2024 Build
Cedar Creek Road at Loyal Drive						
Loyal Drive Eastbound	B 11.0	C 15.2	C 19.3	B 12.3	C 18.6	D 26.8
Cedar Creek Road Northbound (left)	A 7.4	A 7.6	A 7.7	A 7.9	A 8.7	A 9.3
Cedar Creek Road at Entrance						
Entrance Westbound			B 14.2			B 13.7
Cedar Creek Road Southbound (left)			A 8.5			A 8.5

Key: Level of Service, Delay in seconds per vehicle

The entrances were evaluated for turn lanes using the Kentucky Transportation Cabinet Highway Design Guidance Manual dated March, 2017. The traffic impact policy requires using volumes for ten years beyond opening date, or 2030. Using the volumes in Figure 6, a southbound left-turn lane will be required at the entrance.

CONCLUSIONS

Based upon the volume of traffic generated by the development and the amount of traffic forecasted for the year 2030, there will be a slight impact to the existing highway network. A left-turn lane will be required at the entrance. No other improvements are required.

APPENDIX

Traffic Counts

Jefferson County, KY
Classified Turn Movement Count

Site 6 of 6
KY-864 Cedar Creek Rd (North)

KY-864 Cedar Creek Rd (South)
Loyal Dr

Lat/Long
38.099388°, -85.614268°

Weather
Cloudy
51°F

Date
Wednesday, January 15, 2020

Marr Traffic
Transportation Data Collection

41 Peabody Street, Nashville, TN 37210
10 Glenlake Parkway, Suite 130, Atlanta, GA 30328
555 Fayetteville Street, Suite 201, Raleigh, NC 27601
1229 South Shelby Street, Louisville, KY 40203
6565 North MacArthur Boulevard, Suite 225, Dallas, TX 75039

hello@marrtraffic.com
www.marrtraffic.com

1 (800) 615-3765

	Southbound					Northbound					Eastbound					
	KY-864 Cedar Creek Rd (North)					KY-864 Cedar Creek Rd (South)					Loyal Dr					
	U-Turn	Thru	Right	Peds	App	U-Turn	Left	Thru	Peds	App	U-Turn	Left	Right	Peds	App	Int
0700 - 0715	0	11	6	0	17	0	0	64	0	64	0	18	1	0	19	100
0715 - 0730	0	19	4	0	23	0	1	69	0	70	0	11	0	0	11	104
0730 - 0745	0	12	2	0	14	0	0	30	0	30	0	3	0	0	3	47
0745 - 0800	0	28	5	0	33	0	1	45	0	46	0	5	0	0	5	84
0800 - 0815	0	17	4	0	21	0	0	45	0	45	0	7	0	0	7	73
0815 - 0830	0	21	3	0	24	0	0	40	0	40	0	7	1	0	8	72
0830 - 0845	0	12	1	0	13	0	0	41	0	41	0	4	0	0	4	58
0845 - 0900	0	14	5	0	19	0	1	31	0	32	0	7	1	0	8	59
1600 - 1615	0	46	12	0	58	0	0	35	0	35	0	4	0	0	4	97
1615 - 1630	0	51	5	0	56	0	0	24	0	24	0	4	0	0	4	84
1630 - 1645	0	55	10	0	65	0	1	38	0	39	0	9	0	0	9	113
1645 - 1700	**0**	**65**	**11**	**0**	**76**	**0**	**1**	**33**	**0**	**34**	**0**	**2**	**0**	**0**	**2**	**112**
1700 - 1715	**0**	**54**	**5**	**0**	**59**	**0**	**1**	**74**	**0**	**75**	**0**	**4**	**0**	**2**	**6**	**140**
1715 - 1730	**0**	**59**	**8**	**0**	**67**	**0**	**0**	**33**	**0**	**33**	**0**	**4**	**0**	**0**	**4**	**104**
1730 - 1745	**0**	**68**	**12**	**0**	**80**	**0**	**2**	**28**	**0**	**30**	**0**	**6**	**0**	**0**	**6**	**116**
1745 - 1800	0	52	5	1	58	0	1	38	0	39	0	7	4	0	11	108

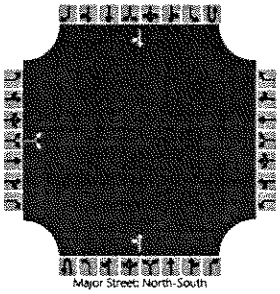
0700 - 0715	0	11	6	0	17	0	0	64	0	64	0	18	1	0	19	100
0715 - 0730	0	19	4	0	23	0	1	69	0	70	0	11	0	0	11	104
0730 - 0745	0	12	2	0	14	0	0	30	0	30	0	3	0	0	3	47
0745 - 0800	0	28	5	0	33	0	1	45	0	46	0	5	0	0	5	84
AM PEAK TOTAL	**0**	**70**	**17**	**0**	**87**	**0**	**2**	**208**	**0**	**210**	**0**	**37**	**1**	**0**	**38**	**335**
1645 - 1700	**0**	**65**	**11**	**0**	**76**	**0**	**1**	**33**	**0**	**34**	**0**	**2**	**0**	**0**	**2**	**112**
1700 - 1715	**0**	**54**	**5**	**0**	**59**	**0**	**1**	**74**	**0**	**75**	**0**	**4**	**0**	**2**	**6**	**140**
1715 - 1730	**0**	**59**	**8**	**0**	**67**	**0**	**0**	**33**	**0**	**33**	**0**	**4**	**0**	**0**	**4**	**104**
1730 - 1745	**0**	**68**	**12**	**0**	**80**	**0**	**2**	**28**	**0**	**30**	**0**	**6**	**0**	**0**	**6**	**116**
PM PEAK TOTAL	**0**	**246**	**36**	**0**	**282**	**0**	**4**	**168**	**0**	**172**	**0**	**16**	**0**	**2**	**18**	**472**

HCS Reports

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	DBZ	Intersection	Cedar Creek at Loyal Dr
Agency/Co.	Diane B Zimmerman Traffic Engineering	Jurisdiction	
Date Performed	2/20/2020	East/West Street	Loyal Dr
Analysis Year	2020	North/South Street	Cedar Creek Rd
Time Analyzed	AM Peak	Peak Hour Factor	0.81
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Heritage Creek Ext		

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume (veh/h)		37		1						2	208				70	17
Percent Heavy Vehicles (%)		0		0						0						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized																
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.40		6.20						4.10						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.50		3.30						2.20						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			47							2						
Capacity, c (veh/h)			648							1496						
v/c Ratio			0.07							0.00						
95% Queue Length, Q_{95} (veh)			0.2							0.0						
Control Delay (s/veh)			11.0							7.4						
Level of Service (LOS)			B							A						
Approach Delay (s/veh)		11.0								0.1						
Approach LOS		B														

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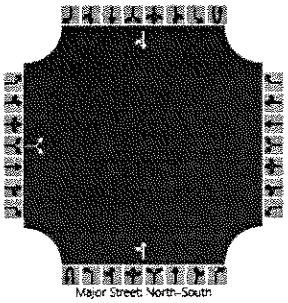
HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	DBZ	Intersection	Cedar Creek at Loyal Dr
Agency/Co.	Diane B Zimmerman Traffic Engineering	Jurisdiction	
Date Performed	2/20/2020	East/West Street	Loyal Dr
Analysis Year	2030	North/South Street	Cedar Creek Rd
Time Analyzed	AM Peak No Build	Peak Hour Factor	0.81
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Heritage Creek Ext		

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume (veh/h)		70		5						3	383				129	28
Percent Heavy Vehicles (%)		0		0						0						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized																
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.40		6.20						4.10						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.50		3.30						2.20						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			93							4						
Capacity, c (veh/h)			446							1391						
v/c Ratio			0.21							0.00						
95% Queue Length, Q_{95} (veh)			0.8							0.0						
Control Delay (s/veh)			15.2							7.6						
Level of Service (LOS)			C							A						
Approach Delay (s/veh)		15.2								0.1						
Approach LOS		C														

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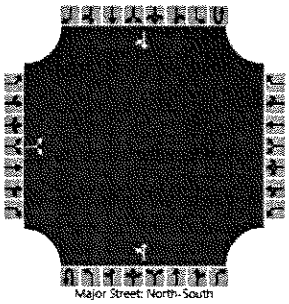
HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	DBZ	Intersection	Cedar Creek at Loyal Dr
Agency/Co.	Diane B Zimmerman Traffic Engineering	Jurisdiction	
Date Performed	2/20/2020	East/West Street	Loyal Dr
Analysis Year	2030	North/South Street	Cedar Creek Rd
Time Analyzed	AM Peak Build	Peak Hour Factor	0.81
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Heritage Creek Ext		

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume (veh/h)		70		5						3	505				169	28
Percent Heavy Vehicles (%)		0		0						0						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized																
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.40		6.20						4.10						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.50		3.30						2.20						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			93							4						
Capacity, c (veh/h)			343							1335						
v/c Ratio			0.27							0.00						
95% Queue Length, Q_{95} (veh)			1.1							0.0						
Control Delay (s/veh)			19.3							7.7						
Level of Service (LOS)			C							A						
Approach Delay (s/veh)		19.3								0.1						
Approach LOS		C														

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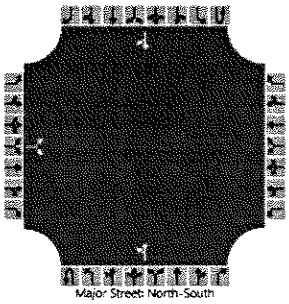
General Information		Site Information	
Analyst	DBZ	Intersection	Cedar Creek at Loyal Dr
Agency/Co.	Diane B Zimmerman Traffic Engineering	Jurisdiction	
Date Performed	2/20/2020	East/West Street	Loyal Dr
Analysis Year	2020	North/South Street	Cedar Creek Rd
Time Analyzed	PM Peak	Peak Hour Factor	0.84
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Heritage Creek Ext		

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume (veh/h)		16		0						4	168				246	36
Percent Heavy Vehicles (%)		0		0						0						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized																
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.40		6.20						4.10						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.50		3.30						2.20						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			19							5						
Capacity, c (veh/h)			515							1235						
v/c Ratio			0.04							0.00						
95% Queue Length, Q_{95} (veh)			0.1							0.0						
Control Delay (s/veh)			12.3							7.9						
Level of Service (LOS)			B							A						
Approach Delay (s/veh)		12.3								0.2						
Approach LOS		B														

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HCS7 Two-Way Stop-Control Report

General Information		Site Information	
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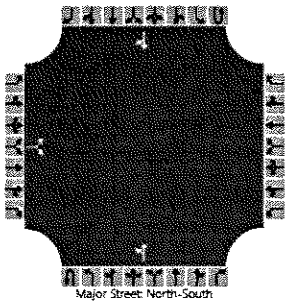
Lanes



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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume (veh/h)		38		3						8	268				446	72
Percent Heavy Vehicles (%)		0		0						0						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized																
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.40		6.20						4.10						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.50		3.30						2.20						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			49							10						
Capacity, c (veh/h)			313							973						
v/c Ratio			0.16							0.01						
95% Queue Length, Q_{95} (veh)			0.5							0.0						
Control Delay (s/veh)			18.6							8.7						
Level of Service (LOS)			C							A						
Approach Delay (s/veh)		18.6								0.4						
Approach LOS		C														

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HCS7 Two-Way Stop-Control Report

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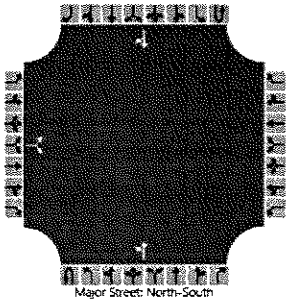
Project Description	Heritage Creek Ext		

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume (veh/h)		38		3						8	369				580	72
Percent Heavy Vehicles (%)		0		0						0						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.40		6.20						4.10						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.50		3.30						2.20						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			49							10						
Capacity, c (veh/h)			214							849						
v/c Ratio			0.23							0.01						
95% Queue Length, Q_{95} (veh)			0.9							0.0						
Control Delay (s/veh)			26.8							9.3						
Level of Service (LOS)			D							A						
Approach Delay (s/veh)	26.8								0.3							
Approach LOS	D															

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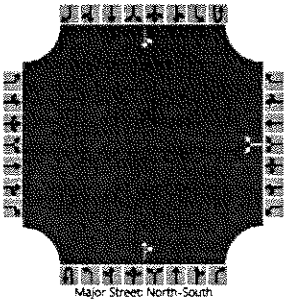
HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	DBZ	Intersection	Cedar Creek at Entrance
Agency/Co.	Diane B Zimmerman Traffic Engineering	Jurisdiction	
Date Performed	2/20/2020	East/West Street	Entrance
Analysis Year	2030	North/South Street	Cedar Creek
Time Analyzed	AM Peak	Peak Hour Factor	0.81
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Heritage Creek Ext		

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume (veh/h)						13		122			386	5		40	134	
Percent Heavy Vehicles (%)						0		0						0		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.40		6.20						4.10		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.50		3.30						2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							167							49		
Capacity, c (veh/h)							557							1090		
v/c Ratio							0.30							0.05		
95% Queue Length, Q_{95} (veh)							1.2							0.1		
Control Delay (s/veh)							14.2							8.5		
Level of Service (LOS)							B							A		
Approach Delay (s/veh)						14.2								2.3		
Approach LOS						B										

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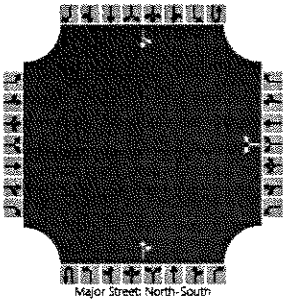
HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	DBZ	Intersection	Cedar Creek at Entrance
Agency/Co.	Diane B Zimmerman Traffic Engineering	Jurisdiction	
Date Performed	2/20/2020	East/West Street	Entrance
Analysis Year	2030	North/South Street	Cedar Creek
Time Analyzed	PM Peak	Peak Hour Factor	0.84
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Heritage Creek Ext		

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume (veh/h)						9		81			296	15		137	446	
Percent Heavy Vehicles (%)						0		0						0		
Proportion Time Blocked																
Percent Grade (%)							0									
Right Turn Channelized																
Median Type | Storage			Undivided													

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.40		6.20						4.10		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.50		3.30						2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							107							163		
Capacity, c (veh/h)							520							1199		
v/c Ratio							0.21							0.14		
95% Queue Length, Q_{95} (veh)							0.8							0.5		
Control Delay (s/veh)							13.7							8.5		
Level of Service (LOS)							B							A		
Approach Delay (s/veh)							13.7							3.2		
Approach LOS							B									

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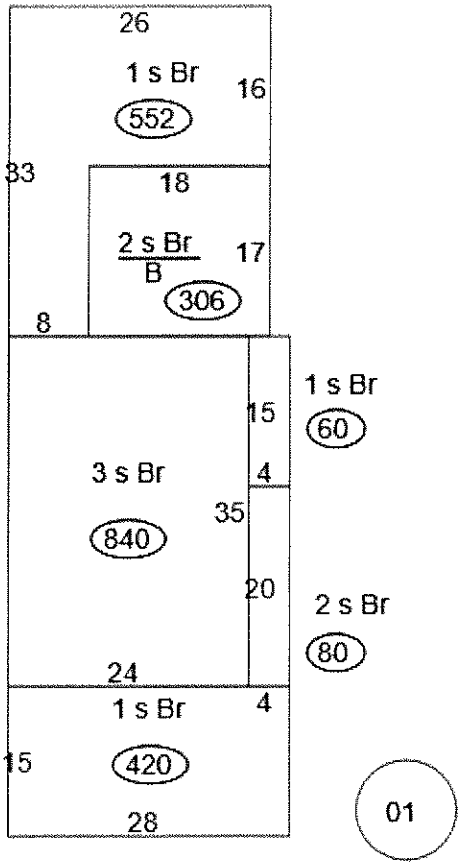

713 E BROADWAY