final report

October 8, 2020
Revised June 3, 2021

Traffic Impact Study

Apartments
3402 Hikes Lane
Louisville, KY

Received
Via
Email
6/4/21

Prepared for

Louisville Metro Planning Commission

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INTRODUCTION

The development plan for an apartment community on Hikes Lane in Louisville, KY shows 276 apartment units. **Figure 1** displays a map of the site. Access to the community will be from two entrances on Hikes Lane. 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 Hikes Lane at Furman Boulevard and the proposed entrance on Hikes Lane.

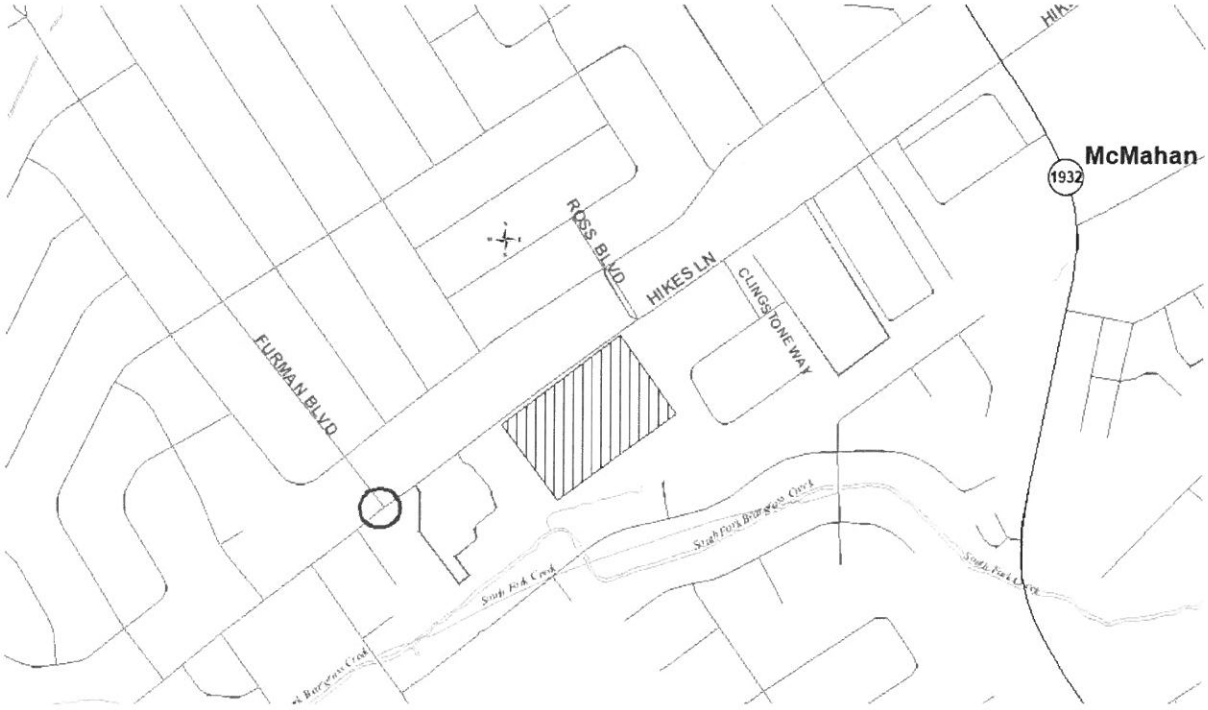


Figure 1. Site Map

EXISTING CONDITIONS

Hikes Lane is a Metro-maintained road with an estimated 2020 ADT of 17,500 vehicles per day between the Goldsmith Lane and Klondike Lane, as estimated from the Kentucky Transportation 2016 count at station 473. The road has four eleven-foot lanes with a raised eleven-foot median and curb and gutter. The speed limit is 35 mph. There are sidewalks. The intersection with Furman Boulevard is controlled with a traffic signal. There are dedicated left turn lanes on each approach at the intersection.

Due to the current COVID-19 pandemic, traffic patterns are irregular. Therefore, a combination of data sources was used to simulate 2020 traffic. Peak hour traffic counts for the intersection were obtained on July 6, 2010. The Kentucky Transportation Cabinet collected hourly data at two stations in January of 2020 – station 149 on Hikes Lane and 472 on Furman Boulevard. All of this data was input into a spreadsheet utilized by the Kentucky Transportation Cabinet to forecast turning movements. The a.m. peak was 7:30 to 8:30 and the p.m. peak hour was 4:15 to 5:15. **Figure 2** illustrates the existing a.m. and p.m. peak hour traffic volumes. The Appendix contains the full count data for the intersection and the hourly data for stations 149, 472 and 473.

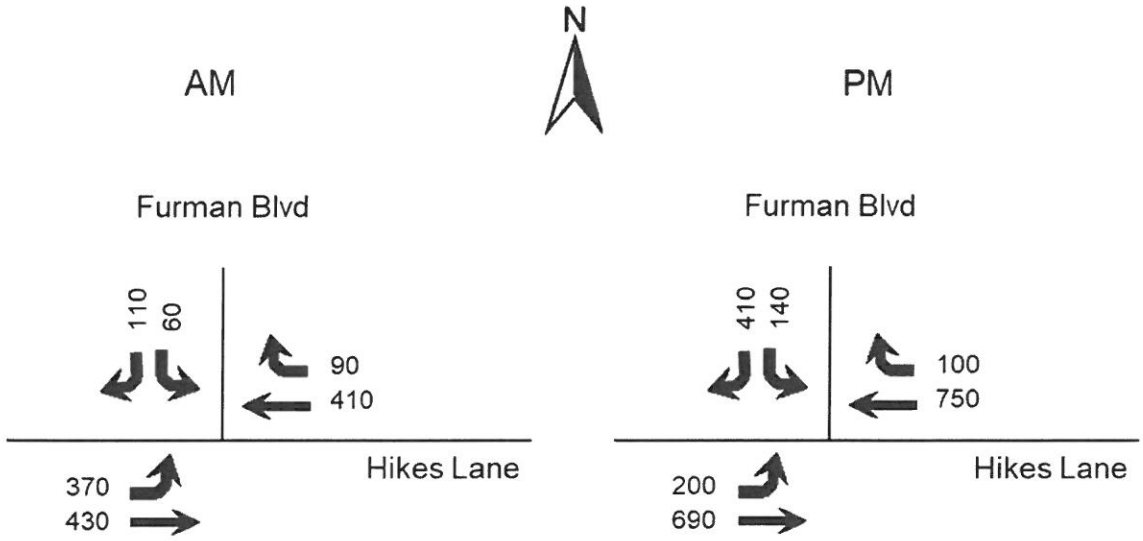


Figure 2. Existing Peak Hour Volumes

FUTURE CONDITIONS

The project completion date is 2023. A review of the the Kentucky Transportation Cabinet count stations in the vicinity (149 and 472) revealed moderate growth had occurred. An annual growth rate of 2% was selected and applied. **Figure 3** illustrates the 2023 traffic volumes without the development.

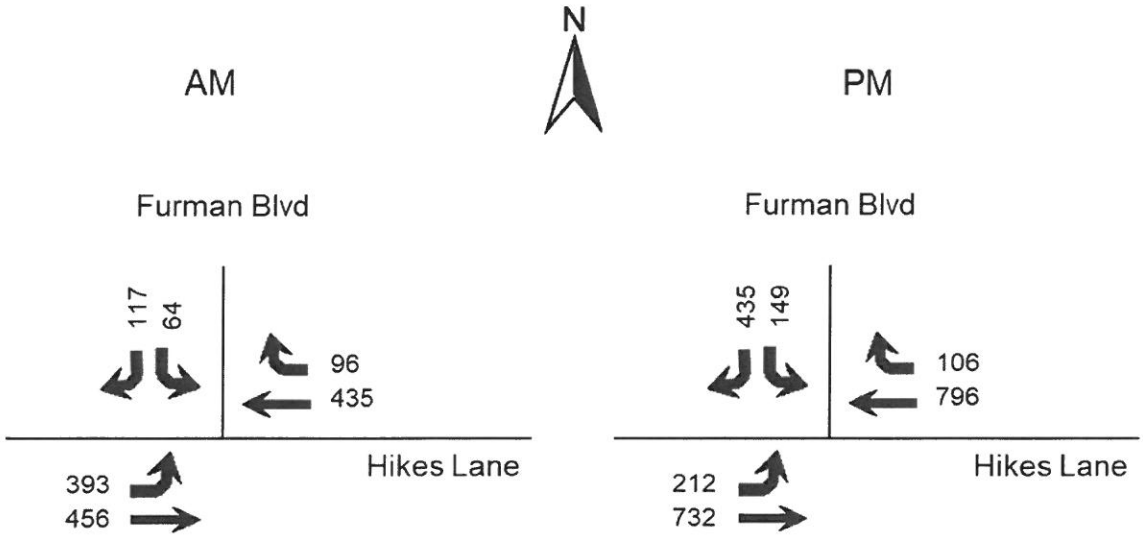


Figure 3. 2023 Peak Hour Volumes

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 "Multifamily Housing Mid-Rise (221)" 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
Multifamily Housing Mid-Rise (276 units)	93	24	69	117	71	46

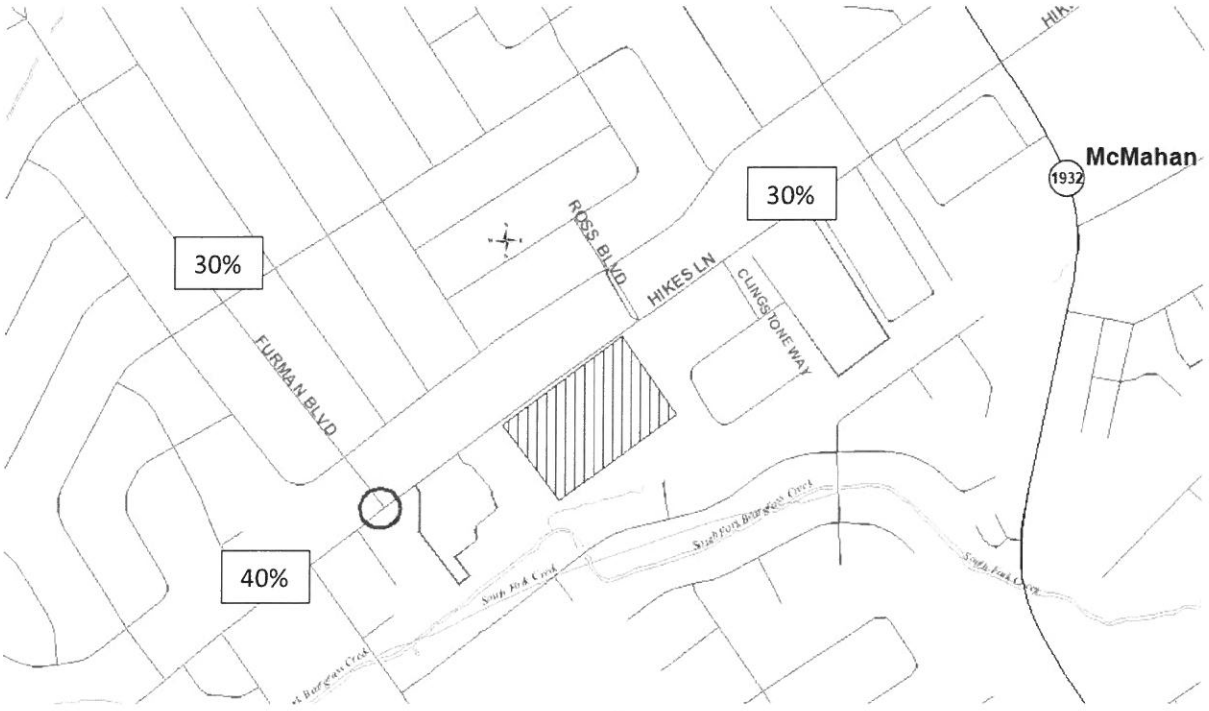


Figure 4. Trip Distribution Percentages

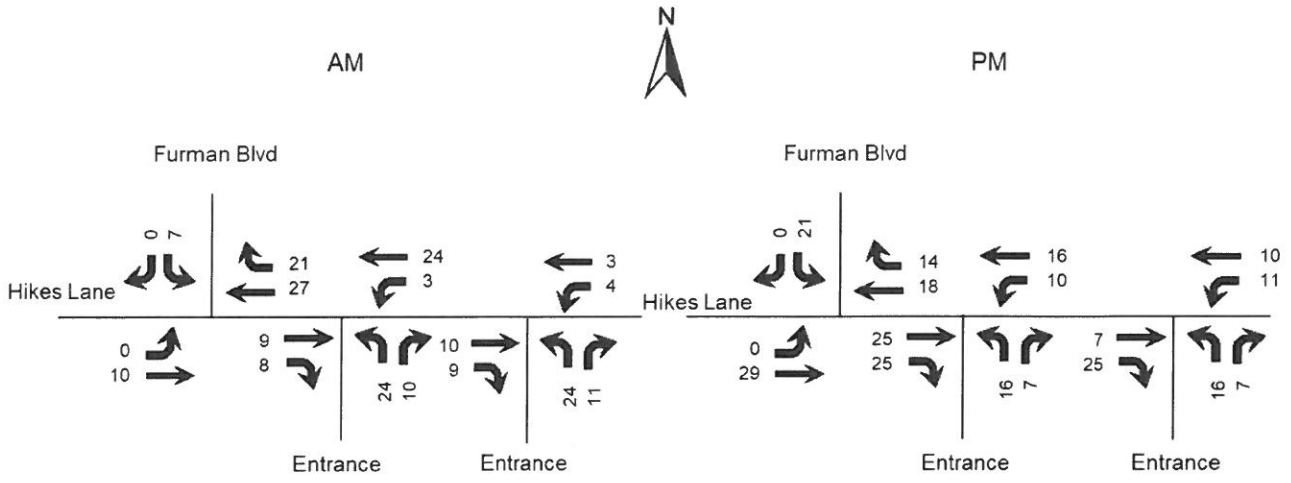


Figure 5. Peak Hour Trips Generated by Site

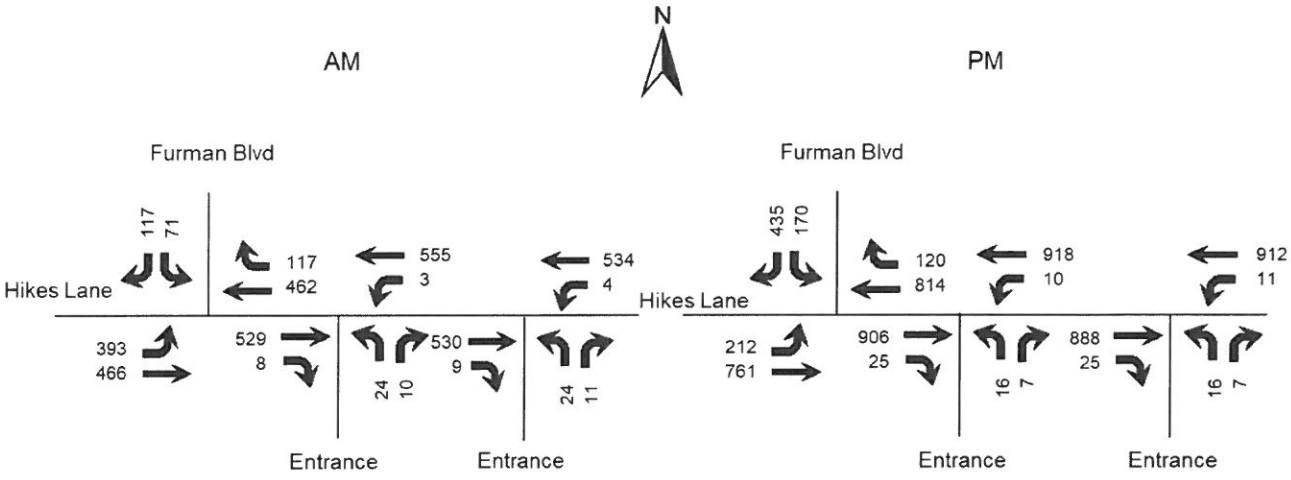


Figure 6. Build Peak Hour Volumes

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

Table 2. Peak Hour Level of Service

	A.M.			P.M.		
Approach	2020 Existing	2023 No Build	2023 Build	2020 Existing	2023 No Build	2023 Build
Hikes Lane at Furman Boulevard	**B 10.3**	**B 10.9**	**B 11.5**	**C 20.7**	**C 22.8**	**C 23.0**
Hikes Lane Eastbound	A 5.8	A 6.3	A 6.7	A 8.8	A 9.1	A 9.3
Hikes Lane Westbound	B 12.8	B 13.8	B 14.3	B 19.3	C 20.7	C 21.5
Furman Boulevard Southbound	C 24.4	C 23.9	C 24.3	D 42.0	D 48.0	D 47.5
Hikes Lane at West Entrance						
Hikes Lane Westbound (left)			A 8.6			B 10.3
Entrance Northbound			B 13.5			C 19.2
Hikes Lane at East Entrance						
Hikes Lane Westbound (left)			A 8.6			B 10.2
Entrance Northbound			B 13.5			C 18.9

Key: Level of Service, Delay in seconds per vehicle

The entrance was evaluated for turn lanes using the Kentucky Transportation Cabinet Highway Design Guidance Manual dated July, 2020. Using the volumes in Figure 6, right turn lanes are not required at the entrances. Both entrances will require left turn lanes.

CONCLUSIONS

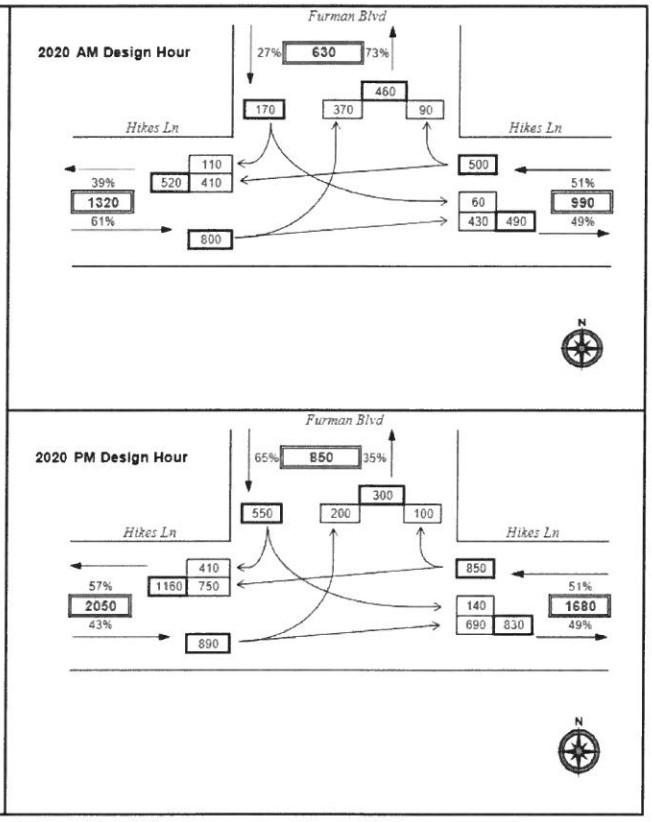
Based upon the volume of traffic generated by the development and the amount of traffic forecasted for the year 2023, there will be a minimal impact to the existing highway network, with the signalized intersection continuing to operate at acceptable levels of service. Left turn lanes will be required at each entrance.

APPENDIX

Traffic Counts

PROJECT: Hikes Lane
ITEM NUMBER: 0
MARS NUMBER: 0
REQUEST DATE: 7/1/2020
ANALYST: 0
YEAR: **2020 Design Hour Volumes**
INTERSECTION: Hikes Lane at Furman Blvd

TURN MOVEMENT (2020)



Metro Louisville
Traffic Engineering

File Name : Hikes Ln & Furman Blvd 2010
Site Code : 07065604
Start Date : 7/6/2010
Page No : 3

	Furman Blvd From North					Hikes Ln From East					From South					Hikes Ln From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 09:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	**12**	0	20	0	**32**	0	**96**	5	0	**101**	0	0	0	0	0	69	**112**	0	0	**181**	**314**
07:45 AM	10	0	15	0	25	0	82	10	0	92	0	0	0	0	0	**74**	78	0	0	152	269
08:00 AM	9	0	20	0	29	0	62	13	0	75	0	0	0	0	0	59	74	0	0	133	237
08:15 AM	6	0	**22**	0	28	0	84	**14**	0	98	0	0	0	0	0	53	105	0	0	158	284
Total Volume	37	0	77	0	114	0	324	42	0	366	0	0	0	0	0	255	369	0	0	624	1104
% App. Total	32.5	0	67.5	0		0	88.5	11.5	0		0	0	0	0		40.9	59.1	0	0		
PHF	.771	.000	.875	.000	.891	.000	.844	.750	.000	.906	.000	.000	.000	.000	.000	.861	.824	.000	.000	.862	.879
Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
04:15 PM	20	**3**	76	0	**99**	**1**	129	15	0	145	0	0	0	0	0	35	**152**	0	0	**187**	431
04:30 PM	15	1	76	0	92	0	**161**	11	0	172	0	0	0	0	0	41	132	0	0	173	437
04:45 PM	**22**	0	75	0	97	0	143	13	0	156	0	0	0	0	0	36	132	0	0	168	421
05:00 PM	17	1	**79**	0	97	1	160	**19**	0	**180**	0	0	0	0	0	**47**	137	0	0	184	**461**
Total Volume	74	5	306	0	385	2	593	58	0	653	0	0	0	0	0	159	553	0	0	712	1750
% App. Total	19.2	1.3	79.5	0		0.3	90.8	8.9	0		0	0	0	0		22.3	77.7	0	0		
PHF	.841	.417	.968	.000	.972	.500	.921	.763	.000	.907	.000	.000	.000	.000	.000	.846	.910	.000	.000	.952	.949

Kentucky Transportation Cabinet

Short-term Hourly Traffic Volume for01/29/202 through 01/31/2020

Site names: 056149
County: Jefferson
Funct Class: U Minor Arterial
Location: 056-CR-1002G -000 @ 2.794 From: KLONDIKE LANE To: KY 155

Seasonal Factor Grp: 3
Daily Factor Grp: 3
Axle Factor Grp: 16
Growth Factor Grp: 16

	Sun, Jan 26, 2020			Mon, Jan 27, 2020			Tue, Jan 28, 2020			Wed, Jan 29, 2020			Thu, Jan 30, 2020			Fri, Jan 31, 2020			Sat, Feb 1, 2020		
	Road	Pos	Neg	Road	Pos	Neg	Road	Pos	Neg	Road	Pos	Neg	Road	Pos	Neg	Road	Pos	Neg	Road	Pos	Neg
00:00													139	75	64	134	66	68			
01:00													64	31	33	100	58	42			
02:00													62	35	27	67	38	29			
03:00													54	29	25	67	39	28			
04:00													67	41	26	95	72	23			
05:00													173	116	57	170	108	62			
06:00													385	244	141	456	303	153			
07:00													847	491	356	998	619	379			
08:00													1,025	683	342	1,285	766	519			
09:00													820	472	348	1,073	694	379			
10:00													807	449	358	1,068	661	407			
11:00													967	542	425	1,210	735	475			
12:00													1,083	623	460	1,354	795	559			
13:00										1,083	594	489	1,154	669	485						
14:00										1,192	640	552	1,513	910	603						
15:00										1,356	771	585	1,452	833	619						
16:00										1,514	867	647	1,543	931	612						
17:00										1,549	835	714	1,585	887	698						
18:00										1,16*	588	573	1,269	666	603						
19:00										898	476	422	968	504	464						
20:00										677	349	328	667	346	321						
21:00										482	243	239	555	286	269						
22:00										338	151	187	334	163	171						
23:00										21*	94	117	227	99	128						
Total										10,46*	5,608	4,853	17,760	10,125	7,635	8,077	4,954	3,123			
AM Peak Vol													1,025	683	425	1,285	766	519			
AM Peak Fct													1	1	1	1	1	1			
AM Peak Hr													8: 00	8: 00	11: 00	8: 00	8: 00	8: 00			
PM Peak Vol													1,585	931	698						
PM Peak Fct													1	1	1						
PM Peak Hr													17: 00	16: 00	17: 00						
Seasonal Fct										1.123	1.123	1.123	1.123	1.123	1.123	1.123	1.123	1.123			
Daily Fct										.938	.938	.938	.916	.916	.916	.825	.825	.825			
Axle Fct										.492	.492	.492	.492	.492	.492	.492	.492	.492			
Pulse Fct										2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000			

Created 10/08/2020 12:18 PM ROAD AADT 18,101 NDIR AADT 7,807 PDIR AADT 10,294 DV03S: Page 1 of 1

Kentucky Transportation Cabinet

Short-term Hourly Traffic Volume for01/29/202 through 01/31/2020

Site names: 056472
County: Jefferson
Funct Class: U Collector
Location: 056-CS-1119G -000 @ .310 From: KY 155 (TAYLORSVILLE

Seasonal Factor Grp: 3
Daily Factor Grp: 3
Axle Factor Grp: 17
Growth Factor Grp: 17

	Sun, Jan 26, 2020			Mon, Jan 27, 2020			Tue, Jan 28, 2020			Wed, Jan 29, 2020			Thu, Jan 30, 2020			Fri, Jan 31, 2020			Sat, Feb 1, 2020		
	Road	Pos	Neg	Road	Pos	Neg	Road	Pos	Neg	Road	Pos	Neg	Road	Pos	Neg	Road	Pos	Neg	Road	Pos	Neg
00:00													59			73					
01:00													35			57					
02:00													27			50					
03:00													38			40					
04:00													68			66					
05:00													169			160					
06:00													429			388					
07:00													1,013			966					
08:00													895			1,005					
09:00													528			541					
10:00													449			494					
11:00													421			476					
12:00													526			515					
13:00										522			536								
14:00										669			704								
15:00										832			793								
16:00										1,108			1,126								
17:00										1,068			1,149								
18:00										725			727								
19:00										434			472								
20:00										405			387								
21:00										270			291								
22:00										190			164								
23:00										116			136								
Total										6,339			11,142			4,831					
AM Peak Vol													1,013			1,005					
AM Peak Fct													1			1					
AM Peak Hr													7: 00			8: 00					
PM Peak Vol													1,149								
PM Peak Fct													1								
PM Peak Hr													17: 00								
Seasonal Fct										1.123			1.123			1.123					
Daily Fct										.938			.916			.825					
Axle Fct										.497			.497			.497					
Pulse Fct										2.000			2.000			2.000					

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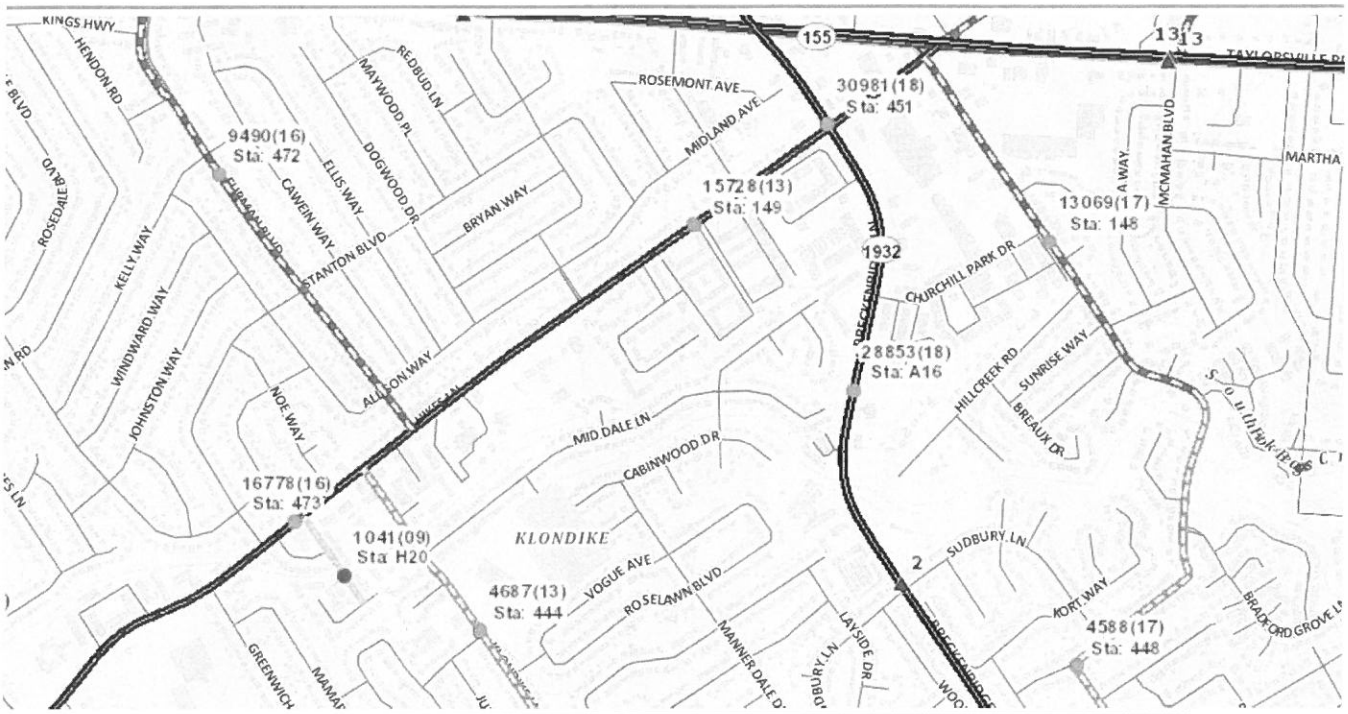


Historical Traffic Volume Summary

Station Details:

Sta ID:	056473
Sta Type:	Full Coverage
Map:	MapIt
District:	5
County:	Jefferson
Route:	056-CR-1002G -000
Route Desc:	HIKES LN

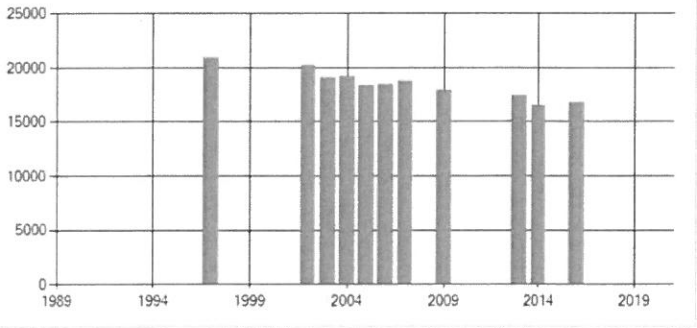
Begin MP:	1.5550
Begin Desc:	GOLDSMITH LANE
End Mp:	2.2140
End Desc:	KLONDIKE LANE
Impact Year:	
Year Added:	

Newest Count:

AADT:	16778
Year:	2016
% Single:	
% Combo:	
K Factor:	8.90
D Factor:	55

Definitions:
Sta. ID - Three digit county number + station number
MP - milepoint
Impact Year – year of significant change to traffic pattern within station segment
AADT – Annual Average Daily Traffic – the annualized average 24-hour volume of vehicles on a segment of roadway
% Single – single unit truck volume as a percentage of the AADT
% Combo – combination truck volume as a percentage of the AADT
K Factor – peak hour volume as a percentage of the AADT
D Factor – percentage of peak hour volume flowing in the peak direction

Year	AADT	Year	AADT	Year	AADT
2020		2010		2000	
2019		2009	17900	1999	
2018		2008		1998	
2017		2007	18800	1997	20900
2016	16778	2006	18400	1996	
2015		2005	18300	1995	
2014	16496	2004	19200	1994	
2013	17374	2003	19100	1993	
2012		2002	20200	1992	
2011		2001		1991	



Historical Traffic Volume Summary

Station Details:

Sta ID:	056149
Sta Type:	Full Coverage
Map:	MapIt
District:	5
County:	Jefferson
Route:	056-CR-1002G -000
Route Desc:	HIKES LN

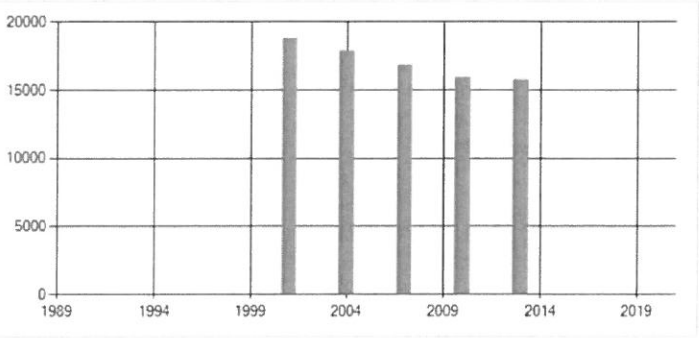
Begin MP:	2.2140
Begin Desc:	KLONDIKE LANE
End Mp:	3.2210
End Desc:	KY 155 (TAYLORSVILLE ROAD)
Impact Year:	
Year Added:	

Newest Count:

AADT:	15728
Year:	2013
% Single:	
% Combo:	
K Factor:	8.40
D Factor:	50

Definitions:
Sta. ID - Three digit county number + station number
MP - milepoint
Impact Year – year of significant change to traffic pattern within station segment
AADT – Annual Average Daily Traffic – the annualized average 24-hour volume of vehicles on a segment of roadway
% Single – single unit truck volume as a percentage of the AADT
% Combo – combination truck volume as a percentage of the AADT
K Factor – peak hour volume as a percentage of the AADT
D Factor – percentage of peak hour volume flowing in the peak direction

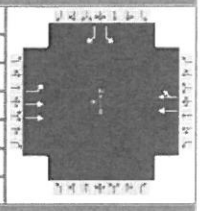
Year	AADT	Year	AADT	Year	AADT
2020		2010	15900	2000	
2019		2009		1999	
2018		2008		1998	
2017		2007	16800	1997	
2016		2006		1996	
2015		2005		1995	
2014		2004	17900	1994	
2013	15728	2003		1993	
2012		2002		1992	
2011		2001	18800	1991	



HCS Reports

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Diane B. Zimmerman Traffic Engineering			Duration, h	0.250
Analyst	DBZ	Analysis Date	10/6/2020	Area Type	Other
Jurisdiction		Time Period	AM Peak	PHF	0.92
Urban Street	Hikes Lane	Analysis Year	2020	Analysis Period	1> 7:30
Intersection	Furman Blvd	File Name	Hikes AM.xus		
Project Description	LDG Hikes Ln				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	370	430			410	90				60		110

Signal Information			
Cycle, s	68.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	10.9	31.1	6.4	0.0	0.0	0.0						
Yellow	3.6	3.6	3.6	0.0	0.0	0.0						
Red	2.9	2.9	3.0	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	17.4	55.0		37.6				13.0
Change Period, (*Y+R c*), s	6.5	6.5		6.5				6.6
Max Allow Headway (*MAH*), s	4.6	0.0		0.0				4.8
Queue Clearance Time (*g s*), s	9.0							6.1
Green Extension Time (*g e*), s	1.9	0.0		0.0				0.4
Phase Call Probability	1.00							0.97
Max Out Probability	0.00							0.23

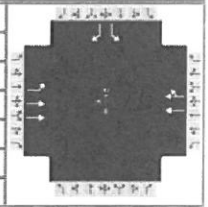
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	402	467			279	265				65		120
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1781			1870	1754				1781		1585
Queue Service Time (*g s*), s	7.0	2.9			10.2	6.6				2.3		4.1
Cycle Queue Clearance Time (*g c*), s	7.0	2.9			10.2	6.6				2.3		4.1
Green Ratio (*g/C*)	0.65	0.71			0.46	0.46				0.09		0.25
Capacity (*c*), veh/h	657	2542			856	803				167		403
Volume-to-Capacity Ratio (*X*)	0.612	0.184			0.326	0.330				0.391		0.297
Back of Queue (*Q*), ft/ln (90 th percentile)	92.1	30.8			117.7	110.9				47.2		67.4
Back of Queue (*Q*), veh/ln (90 th percentile)	3.6	1.2			4.6	4.4				1.9		2.7
Queue Storage Ratio (*RQ*) (90 th percentile)	0.27	0.00			0.00	0.00				0.24		0.84
Uniform Delay (*d 1*), s/veh	7.5	3.2			11.7	11.8				29.0		20.5
Incremental Delay (*d 2*), s/veh	1.1	0.2			1.0	1.1				1.8		0.5
Initial Queue Delay (*d 3*), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	8.6	3.4			12.8	12.9				30.8		21.0
Level of Service (LOS)	A	A			B	B				C		C
Approach Delay, s/veh / LOS	5.8	A		12.8	B		0.0			24.4	C	
Intersection Delay, s/veh / LOS	10.3						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.64	A	1.89	B	2.14	B	2.31	B
Bicycle LOS Score / LOS	1.20	A	0.94	A				F

 HCS™ Streets Version 7.9 Generated: 10/8/2020 5:47:06 PM

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Diane B. Zimmerman Traffic Engineering			Duration, h	0.250
Analyst	DBZ	Analysis Date	10/6/2020	Area Type	Other
Jurisdiction		Time Period	AM Peak	PHF	0.92
Urban Street	Hikes Lane	Analysis Year	2023 No Build	Analysis Period	1> 7:30
Intersection	Furman Blvd	File Name	Hikes AM 23 NB.xus		
Project Description	LDG Hikes Ln				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	393	456			435	96				64		117

Signal Information			
Cycle, s	68.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	11.7	30.1	6.6	0.0	0.0	0.0	
Yellow	3.6	3.6	3.6	0.0	0.0	0.0	
Red	2.9	2.9	3.0	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	18.2	54.8		36.6				13.2
Change Period, (*Y+R c*), s	6.5	6.5		6.5				6.6
Max Allow Headway (*MAH*), s	4.6	0.0		0.0				4.8
Queue Clearance Time (*g s*), s	9.6							6.3
Green Extension Time (*g e*), s	2.1	0.0		0.0				0.5
Phase Call Probability	1.00							0.98
Max Out Probability	0.00							0.27

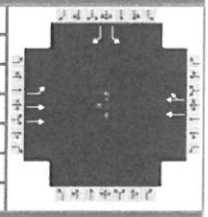
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	427	496			296	281				70		127
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1781			1870	1753				1781		1585
Queue Service Time (*g s*), s	7.6	3.2			11.0	7.2				2.5		4.3
Cycle Queue Clearance Time (*g c*), s	7.6	3.2			11.0	7.2				2.5		4.3
Green Ratio (*g/C*)	0.64	0.71			0.44	0.44				0.10		0.27
Capacity (*c*), veh/h	647	2528			827	776				173		427
Volume-to-Capacity Ratio (*X*)	0.660	0.196			0.358	0.362				0.401		0.298
Back of Queue (*Q*), ft/ln (90 th percentile)	104.2	33.9			128.9	122.5				50.1		69.9
Back of Queue (*Q*), veh/ln (90 th percentile)	4.1	1.3			5.1	4.9				2.0		2.8
Queue Storage Ratio (*RQ*) (90 th percentile)	0.30	0.00			0.00	0.00				0.25		0.87
Uniform Delay (*d 1*), s/veh	8.2	3.3			12.6	12.6				28.8		19.7
Incremental Delay (*d 2*), s/veh	1.4	0.2			1.2	1.3				1.8		0.5
Initial Queue Delay (*d 3*), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	9.6	3.5			13.8	13.9				30.6		20.2
Level of Service (LOS)	A	A			B	B				C		C
Approach Delay, s/veh / LOS	6.3	A		13.8	B		0.0			23.9	C	
Intersection Delay, s/veh / LOS	10.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.64	A	1.89	B	2.14	B	2.31	B
Bicycle LOS Score / LOS	1.25	A	0.96	A				F

 HCS™ Streets Version 7.9 Generated: 10/8/2020 5:47:06 PM

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Diane B. Zimmerman Traffic Engineering			Duration, h	0.250
Analyst	DBZ	Analysis Date	Jun 3, 2021	Area Type	Other
Jurisdiction		Time Period	AM Peak	PHF	0.92
Urban Street	Hikes Lane	Analysis Year	2023	Analysis Period	1> 7:30
Intersection	Furman Blvd	File Name	Hikes AM 23 B.xus		
Project Description	LDG Hikes Ln				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	393	466			462	117				71		117

Signal Information			
Cycle, s	68.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	11.7	30.0	6.7	0.0	0.0	0.0	
Yellow	3.6	3.6	3.6	0.0	0.0	0.0	
Red	2.9	2.9	3.0	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	18.2	54.7		36.5				13.3
Change Period, (*Y+R c*), s	6.5	6.5		6.5				6.6
Max Allow Headway (*MAH*), s	4.6	0.0		0.0				4.8
Queue Clearance Time (*g s*), s	9.7							6.3
Green Extension Time (*g e*), s	2.1	0.0		0.0				0.5
Phase Call Probability	1.00							0.98
Max Out Probability	0.00							0.27

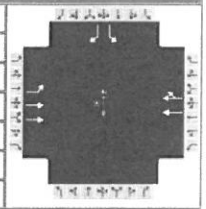
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	427	507			325	305				77		127
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1781			1870	1740				1781		1585
Queue Service Time (*g s*), s	7.7	3.3			12.2	8.1				2.8		4.3
Cycle Queue Clearance Time (*g c*), s	7.7	3.3			12.2	8.1				2.8		4.3
Green Ratio (*g/C*)	0.64	0.71			0.44	0.44				0.10		0.27
Capacity (*c*), veh/h	621	2526			826	768				174		428
Volume-to-Capacity Ratio (*X*)	0.687	0.200			0.393	0.397				0.442		0.297
Back of Queue (*Q*), ft/ln (90 th percentile)	104.6	35			141	132.8				56		69.9
Back of Queue (*Q*), veh/ln (90 th percentile)	4.1	1.4			5.5	5.3				2.2		2.8
Queue Storage Ratio (*RQ*) (90 th percentile)	0.30	0.00			0.00	0.00				0.28		0.87
Uniform Delay (*d 1*), s/veh	8.9	3.3			12.8	12.9				28.9		19.7
Incremental Delay (*d 2*), s/veh	1.6	0.2			1.4	1.5				2.1		0.5
Initial Queue Delay (*d 3*), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	10.5	3.5			14.2	14.4				31.0		20.2
Level of Service (LOS)	B	A			B	B				C		C
Approach Delay, s/veh / LOS	6.7	A		14.3	B		0.0			24.3	C	
Intersection Delay, s/veh / LOS	11.5						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.64	A	1.89	B	2.14	B	2.31	B
Bicycle LOS Score / LOS	1.26	A	1.01	A				F

 HCS™ Streets Version 7.9.5 Generated: 6/4/2021 11:20:53 AM

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Diane B. Zimmerman Traffic Engineering			Duration, h	0.250
Analyst	DBZ	Analysis Date	10/6/2020	Area Type	Other
Jurisdiction		Time Period	PM Peak	PHF	0.92
Urban Street	Hikes Lane	Analysis Year	2020	Analysis Period	1> 4:15
Intersection	Furman Blvd	File Name	Hikes PM.xus		
Project Description	LDG Hikes Ln				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	200	690			750	100				140		410

Signal Information			
Cycle, s	68.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4	
Green	7.0	28.0	13.4	0.0	0.0	0.0					
Yellow	3.6	3.6	3.6	0.0	0.0	0.0					
Red	2.9	2.9	3.0	0.0	0.0	0.0	5	6	7	8	

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	13.5	48.0		34.5				20.0
Change Period, (*Y+R c*), s	6.5	6.5		6.5				6.6
Max Allow Headway (*MAH*), s	4.6	0.0		0.0				4.8
Queue Clearance Time (*g s*), s	6.3							15.4
Green Extension Time (*g e*), s	0.9	0.0		0.0				0.0
Phase Call Probability	0.98							1.00
Max Out Probability	0.00							1.00

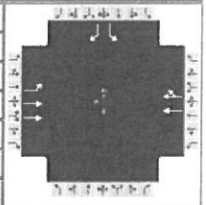
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	217	750			472	452				152		446
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1795	1795			1885	1807				1795		1598
Queue Service Time (*g s*), s	4.3	7.0			19.4	13.4				5.1		13.4
Cycle Queue Clearance Time (*g c*), s	4.3	7.0			19.4	13.4				5.1		13.4
Green Ratio (*g/C*)	0.54	0.61			0.41	0.41				0.20		0.30
Capacity (*c*), veh/h	368	2191			776	744				354		480
Volume-to-Capacity Ratio (*X*)	0.591	0.342			0.608	0.608				0.430		0.929
Back of Queue (*Q*), ft/ln (90 th percentile)	69.8	97.1			224	215.6				95.5		339.9
Back of Queue (*Q*), veh/ln (90 th percentile)	2.8	3.9			8.9	8.6				3.8		13.5
Queue Storage Ratio (*RQ*) (90 th percentile)	0.20	0.00			0.00	0.00				0.48		4.25
Uniform Delay (*d 1*), s/veh	13.1	6.5			15.7	15.7				24.0		23.1
Incremental Delay (*d 2*), s/veh	1.8	0.4			3.5	3.7				1.0		24.8
Initial Queue Delay (*d 3*), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	15.0	7.0			19.2	19.4				24.9		47.8
Level of Service (LOS)	B	A			B	B				C		D
Approach Delay, s/veh / LOS	8.8	A		19.3	B		0.0			42.0	D	
Intersection Delay, s/veh / LOS	20.7				C							

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.67	A	1.90	B	2.14	B	2.31	B
Bicycle LOS Score / LOS	1.29	A	1.25	A				F

 HCS™ Streets Version 7.9 Generated: 10/8/2020 5:54:46 PM

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Diane B. Zimmerman Traffic Engineering			Duration, h	0.250
Analyst	DBZ	Analysis Date	10/6/2020	Area Type	Other
Jurisdiction		Time Period	PM Peak	PHF	0.92
Urban Street	Hikes Lane	Analysis Year	2023 No Build	Analysis Period	1> 4:15
Intersection	Furman Blvd	File Name	Hikes PM 23 NB.xus		
Project Description	LDG Hikes Ln				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	212	732			796	106				149		435

Signal Information			
Cycle, s	68.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	7.4	27.6	13.4	0.0	0.0	0.0	
Yellow	3.6	3.6	3.6	0.0	0.0	0.0	
Red	2.9	2.9	3.0	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	13.9	48.0		34.1				20.0
Change Period, (*Y+R c*), s	6.5	6.5		6.5				6.6
Max Allow Headway (*MAH*), s	4.6	0.0		0.0				4.8
Queue Clearance Time (*g s*), s	6.6							15.4
Green Extension Time (*g e*), s	0.9	0.0		0.0				0.0
Phase Call Probability	0.99							1.00
Max Out Probability	0.00							1.00

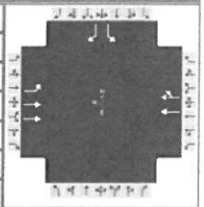
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	230	796			501	480				162		473
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1795	1795			1885	1807				1795		1598
Queue Service Time (*g s*), s	4.6	7.5			21.1	14.6				5.4		13.4
Cycle Queue Clearance Time (*g c*), s	4.6	7.5			21.1	14.6				5.4		13.4
Green Ratio (*g/C*)	0.54	0.61			0.41	0.41				0.20		0.31
Capacity (*c*), veh/h	357	2191			765	734				354		488
Volume-to-Capacity Ratio (*X*)	0.646	0.363			0.654	0.654				0.458		0.968
Back of Queue (*Q*), ft/ln (90 th percentile)	76.3	104.7			244.1	235				102.5		388
Back of Queue (*Q*), veh/ln (90 th percentile)	3.0	4.2			9.7	9.4				4.1		15.4
Queue Storage Ratio (*RQ*) (90 th percentile)	0.22	0.00			0.00	0.00				0.51		4.85
Uniform Delay (*d 1*), s/veh	13.8	6.6			16.3	16.3				24.1		23.3
Incremental Delay (*d 2*), s/veh	2.4	0.5			4.3	4.5				1.1		32.5
Initial Queue Delay (*d 3*), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	16.1	7.1			20.7	20.8				25.2		55.8
Level of Service (LOS)	B	A			C	C				C		E
Approach Delay, s/veh / LOS	9.1	A		20.7	C		0.0			48.0	D	
Intersection Delay, s/veh / LOS	22.8						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.67	A	1.90	B	2.14	B	2.31	B
Bicycle LOS Score / LOS	1.33	A	1.30	A				F

 HCS™ Streets Version 7.9 Generated: 10/8/2020 5:54:46 PM

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Diane B. Zimmerman Traffic Engineering			Duration, h	0.250
Analyst	DBZ	Analysis Date	Jun 3, 2021	Area Type	Other
Jurisdiction		Time Period	PM Peak	PHF	0.92
Urban Street	Hikes Lane	Analysis Year	2023 Build	Analysis Period	1> 4:15
Intersection	Furman Blvd	File Name	Hikes PM 23 B.xus		
Project Description	LDG Hikes Ln				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	212	761			814	120				170		435

Signal Information			
Cycle, s	68.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

								1	2	3	4	
Green	7.4	27.6	13.4	0.0	0.0	0.0						
Yellow	3.6	3.6	3.6	0.0	0.0	0.0	5	6	7	8		
Red	2.9	2.9	3.0	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	13.9	48.0		34.1				20.0
Change Period, (*Y+R c*), s	6.5	6.5		6.5				6.6
Max Allow Headway (*MAH*), s	4.6	0.0		0.0				4.8
Queue Clearance Time (*g s*), s	6.6							15.4
Green Extension Time (*g e*), s	0.9	0.0		0.0				0.0
Phase Call Probability	0.99							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	230	827			519	496				185		473
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1795	1795			1885	1800				1795		1598
Queue Service Time (*g s*), s	4.6	7.9			22.1	15.4				6.3		13.4
Cycle Queue Clearance Time (*g c*), s	4.6	7.9			22.1	15.4				6.3		13.4
Green Ratio (*g/C*)	0.54	0.61			0.41	0.41				0.20		0.31
Capacity (*c*), veh/h	346	2191			765	731				354		488
Volume-to-Capacity Ratio (*X*)	0.666	0.378			0.679	0.679				0.522		0.968
Back of Queue (*Q*), ft/ln (90 th percentile)	77.2	110			256.6	246.3				119.1		388
Back of Queue (*Q*), veh/ln (90 th percentile)	3.1	4.4			10.2	9.9				4.7		15.4
Queue Storage Ratio (*RQ*) (90 th percentile)	0.22	0.00			0.00	0.00				0.60		4.85
Uniform Delay (*d 1*), s/veh	14.0	6.7			16.6	16.6				24.4		23.3
Incremental Delay (*d 2*), s/veh	2.7	0.5			4.8	5.0				1.6		32.5
Initial Queue Delay (*d 3*), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	16.7	7.2			21.4	21.6				26.1		55.8
Level of Service (LOS)	B	A			C	C				C		E
Approach Delay, s/veh / LOS	9.3	A		21.5	C		0.0			47.5	D	
Intersection Delay, s/veh / LOS	23.0						C					

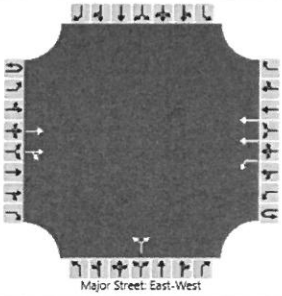
Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.67	A	1.90	B	2.14	B	2.31	B
Bicycle LOS Score / LOS	1.36	A	1.33	A				F

 HCS™ Streets Version 7.9.5 Generated: 6/4/2021 11:24:55 AM

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	DBZ	Intersection	Hikes Lane at Entrance We
Agency/Co.	Diane B Zimmerman Traffic Engineering	Jurisdiction	
Date Performed	6/4/21	East/West Street	Hikes Lane
Analysis Year	2023	North/South Street	Entrance West
Time Analyzed	AM Peak	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	LDG Hikes Lane		

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	2	0	0	1	2	0		0	1	0		0	0	0
Configuration			T	TR		L	T				LR					
Volume (veh/h)			529	8	0	3	555			24		10				
Percent Heavy Vehicles (%)					3	0				0		0				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.5		6.9				
Critical Headway (sec)						4.10				6.80		6.90				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						3					37					
Capacity, c (veh/h)						1001					462					
v/c Ratio						0.00					0.08					
95% Queue Length, Q_{95} (veh)						0.0					0.3					
Control Delay (s/veh)						8.6					13.5					
Level of Service (LOS)						A					B					
Approach Delay (s/veh)					0.0				13.5							
Approach LOS									B							

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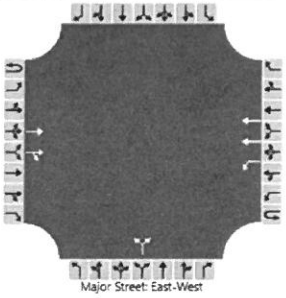
HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	DBZ	Intersection	Hikes Lane at Entrance We
Agency/Co.	Diane B Zimmerman Traffic Engineering	Jurisdiction	
Date Performed	6/3/21	East/West Street	Hikes Lane
Analysis Year	2023	North/South Street	Entrance West
Time Analyzed	PM Peak	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	LDG Hikes Lane		

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	2	0	0	1	2	0		0	1	0		0	0	0
Configuration			T	TR		L	T				LR					
Volume (veh/h)			906	25	0	10	918			16		7				
Percent Heavy Vehicles (%)					3	0				0		0				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.5		6.9				
Critical Headway (sec)						4.10				6.80		6.90				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

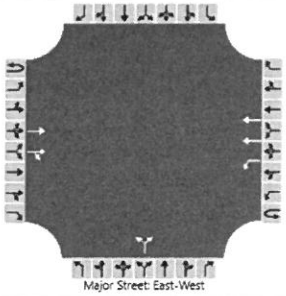
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						11					25					
Capacity, c (veh/h)						693					278					
v/c Ratio						0.02					0.09					
95% Queue Length, Q_{95} (veh)						0.0					0.3					
Control Delay (s/veh)						10.3					19.2					
Level of Service (LOS)						B					C					
Approach Delay (s/veh)					0.1				19.2							
Approach LOS									C							

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	DBZ	Intersection	Hikes Lane at Entrance Ea
Agency/Co.	Diane B Zimmerman Traffic Engineering	Jurisdiction	
Date Performed	6/4/21	East/West Street	Hikes Lane
Analysis Year	2023	North/South Street	Entrance East
Time Analyzed	AM Peak	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	LDG Hikes Lane		

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	2	0	0	1	2	0		0	1	0		0	0	0
Configuration			T	TR		L	T				LR					
Volume (veh/h)			530	9	0	4	534			24		11				
Percent Heavy Vehicles (%)					3	0				0		0				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.5		6.9				
Critical Headway (sec)						4.10				6.80		6.90				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						4					38					
Capacity, c (veh/h)						999					468					
v/c Ratio						0.00					0.08					
95% Queue Length, Q_{95} (veh)						0.0					0.3					
Control Delay (s/veh)						8.6					13.4					
Level of Service (LOS)						A					B					
Approach Delay (s/veh)					0.1				13.4							
Approach LOS									B							

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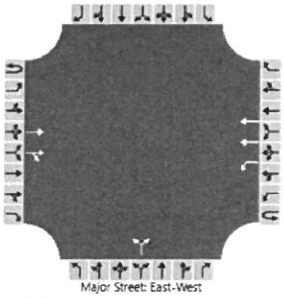
HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	DBZ	Intersection	Hikes Lane at Entrance Ea
Agency/Co.	Diane B Zimmerman Traffic Engineering	Jurisdiction	
Date Performed	6/3/21	East/West Street	Hikes Lane
Analysis Year	2023	North/South Street	Entrance East
Time Analyzed	PM Peak	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	LDG Hikes Lane		

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	2	0	0	1	2	0		0	1	0		0	0	0
Configuration			T	TR		L	T				LR					
Volume (veh/h)			888	25	0	11	912			16		7				
Percent Heavy Vehicles (%)					3	0				0		0				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.5		6.9				
Critical Headway (sec)						4.10				6.80		6.90				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						12					25					
Capacity, c (veh/h)						705					284					
v/c Ratio						0.02					0.09					
95% Queue Length, Q_{95} (veh)						0.1					0.3					
Control Delay (s/veh)						10.2					18.9					
Level of Service (LOS)						B					C					
Approach Delay (s/veh)					0.1				18.9							
Approach LOS									C							

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