adam kirk engineering

MEMORANDUM

TO: Joseph Waldman
The Highgates Group
(347) 424-5431

FROM: Adam Kirk
Adam Kirk Engineering
137 McClelland Springs Drive
Georgetown, KY 40324

DATE: November 8, 2020

RE: Highgates Development Traffic Assessment

The purpose of this memorandum is to summarize the methodology and result of the traffic analysis conducted to determine the impact and necessary improvements associated with the Highgates Multifamily development on Cedar Creek Road. The 168 unit development is proposed on the southside of Cedar Creek Road, with access 300 feet west of the intersection with US 150 (Bardstown Road) and Brentlinger Lane

Existing Conditions
The intersection of US 150 (Bardstown Road) and Cedar Creek Road is a 4-leg signal-controlled intersection. All approaches have exclusive left-turn lanes with a single through lane on the cross-streets and two through lanes on US 150. The northbound and westbound approaches also provide exclusive right turn lanes. Cedar Creek Road and Brentlinger Lane operate on a single phase with permissive left turn movements, while protected-permitted left turn phase are provided for left turn phases on US 150. Figure 1 shows an aerial of the critical intersection.

Existing traffic counts were collected on Tuesday March 3, 2020, prior to COVID-19 impacts, as part of a July 8 Traffic Study by Diane Zimmerman. Figure 2 summarizes the AM (7-8 a.m) and PM (4:45-5:45 p.m.) peak hour turning volumes.

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Figure 1: US 150 (Bardstown Road) at Cedar Creek Road/Brentlinger Lane

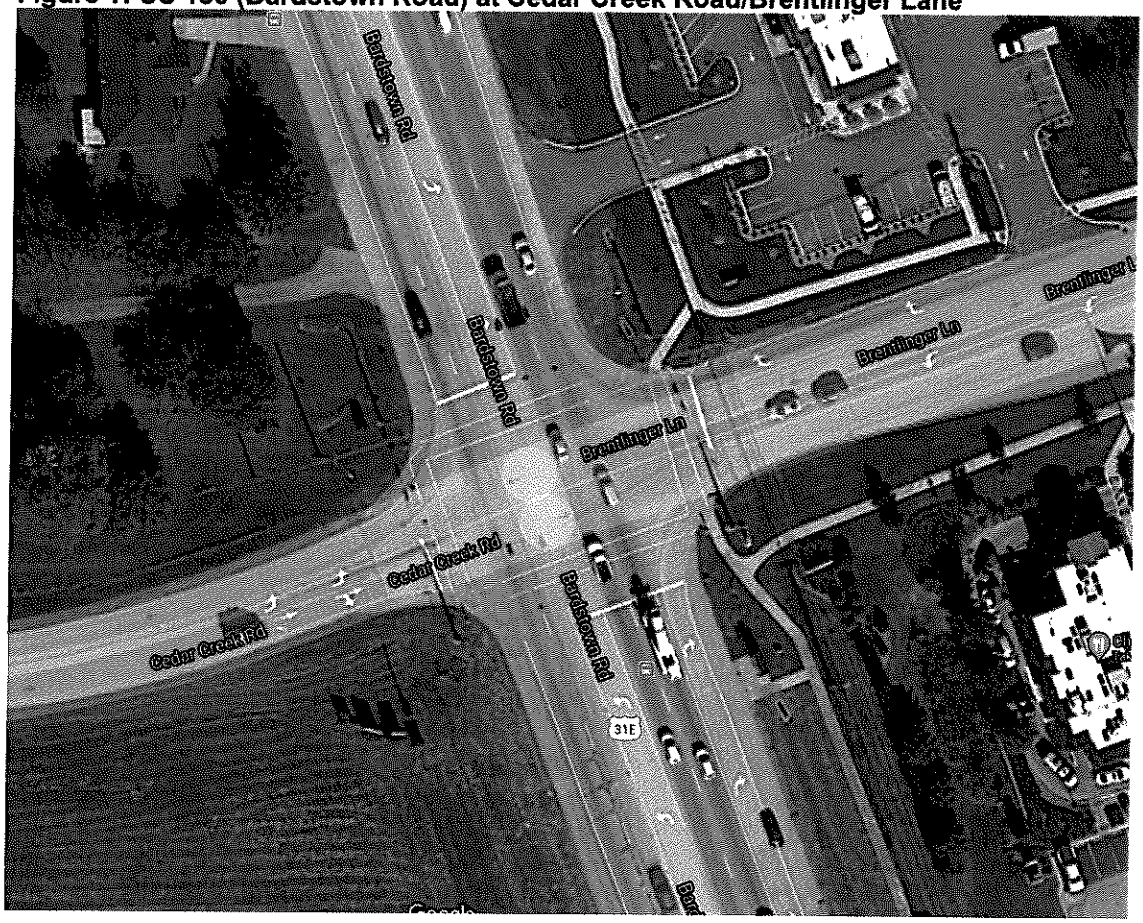
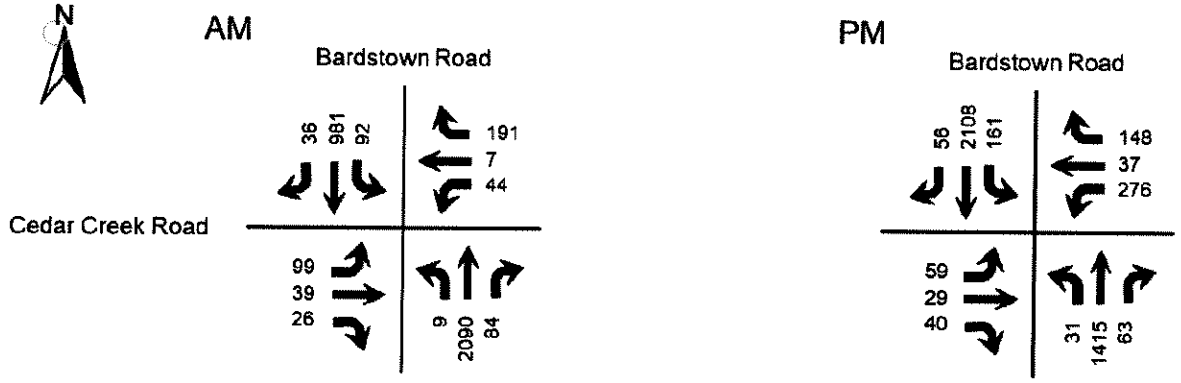


Figure 2: Existing Traffic Counts



Adjacent Development

In addition to the Highgates Development several other developments have been proposed and/or approved in the immediate area. These include

- Cedar Ridge Section 1 Completion (16 Single Family Homes)
- Cedar Ridge Section 2 (43 Single Family Homes) (20-Zone-0092)

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- Cedar Creek Springs Conservation Subdivision (88 Single Family Homes) (19-MSUB-0007) (8 (28)/25 (17)
- Neighborhood Commercial Development (Walgreens) (38,500 sf retail)
- Lone Hickory Development (19-MSUB-0009) (50 Single Family Homes)

Traffic from the residential developments on Cedar Ridge and Cedar Creek were added to the study area, assuming 90 percent of generated traffic accessed Bardstown Road via Cedar Creek Drive. Traffic generated by the Neighborhood Commercial Development was assigned as identified in the Traffic Impact Study prepared by Jordan, Jones & Goulding, Inc. for the development dated January, 2008. Traffic from the Lone Hickory development, which is expected to generate 52 trips during the PM peak hour was assumed not to impact the study area, as closer alternative routes to I-265 and Bardstown Road exist for the development.

In addition to these approved adjacent developments, a 1 percent background growth rate was applied to background traffic to reflect year of opening conditions, 2023.

Trip Generation

Trip generation was conducted using the ITE Trip Generation Manual, 10th Edition, for Land Use Code 221 (Multi-Family Housing Mid-Rise). Based on this land use, the 168 units is projected to generate 54 trips during the AM peak and 69 trips during the PM peak period.

90 Percent of Traffic was assumed to access Bardstown Road with 10 percent turning left down Cedar Creek Road. Traffic was then distributed through the intersection based on existing traffic patterns. Figures 3a and 3b shows the AM and PM peak hour trips generated, respectively. Figures 4a and 4b shows the AM and PM Peak Hour Build volumes.

Figure 3a: Trip Distribution (AM Peak)

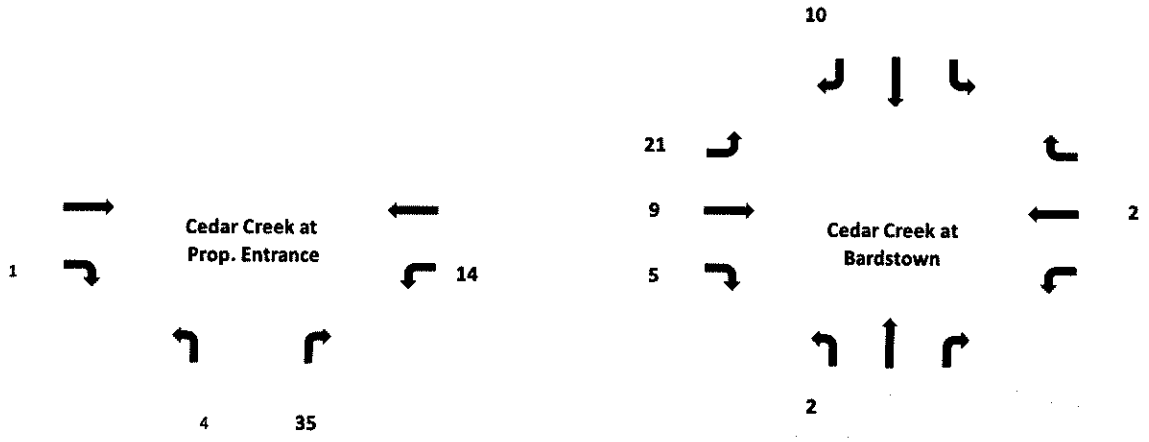

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Figure 3b: Trip Distribution (PM Peak)

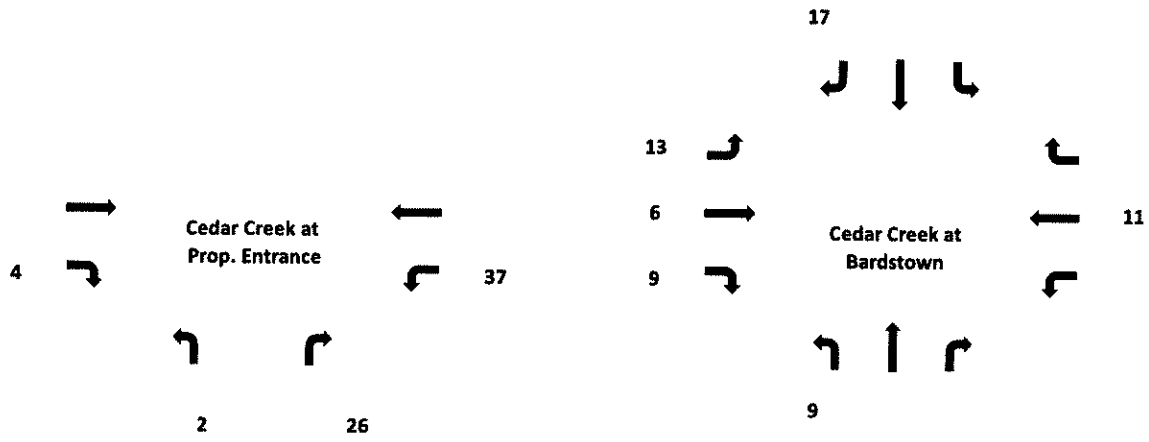


Figure 4a: 2023 Opening Year Build Volumes (AM Peak)

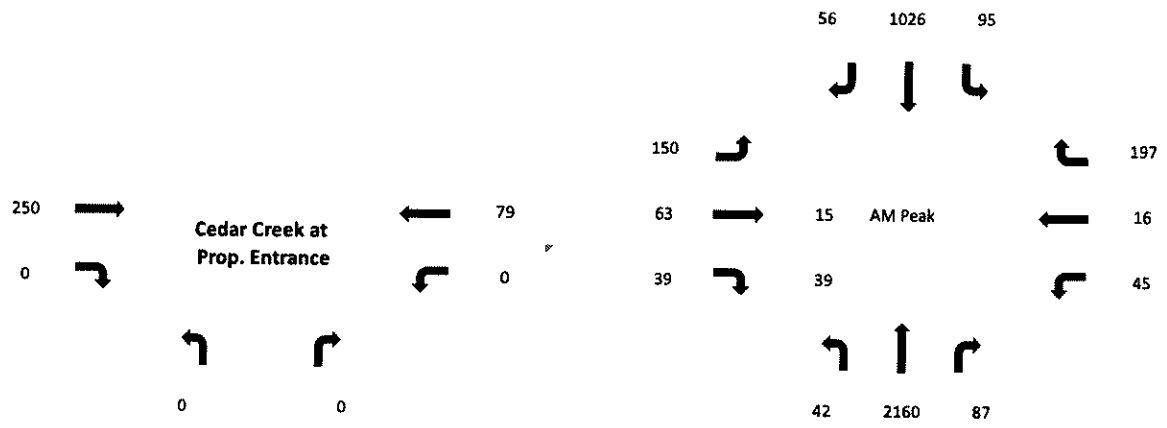
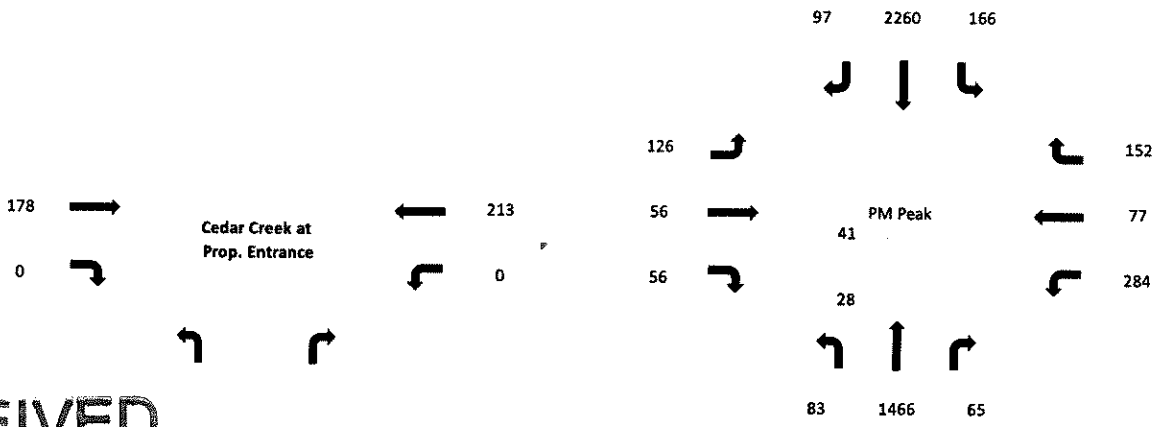


Figure 4b: 2023 Opening Year Build Volumes (PM Peak)



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Traffic Analysis

Two different scenarios were evaluated for both the AM and PM peak hours

1) 2023 No Build, demonstrates operations with approved adjacent development but without Highgates development traffic. The No Build Scenario assumes the construction of a southbound right-turn lane on Bardstown Road as identified in the approved plan.

2) 2023 Build with Highgates Development.

Traffic analysis was conducted using HCS 7 software for signalized intersections. Existing signal cycle lengths of 180 (AM) and 225 (PM) seconds were used for all scenarios, with signal timing adjusted to accommodate the change in traffic demand. Tables 1 and 2 summarize the level of service, delay and volume to capacity ratios for all approaches and scenarios. HCS output is provided in **Attachment A**.

Table 1: AM Peak Hour Analysis Summary

Intersection/ Approach	2023 No Build		2023 Build	
	LOS	DELAY (sec/ veh)	LOS	DELAY (sec/ veh)
Bardstown Road and Cedar Creek	**C**	**23.0**	**C**	**24.7**
EB Cedar Creek	E	74.8	E	74.1
WB Brentlinger	E	72.8	E	70.5
NB Bardstown Rd	B	18.1	C	20.2
SB Bardstown Rd	B	10.5	B	11.4

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Table 2: PM Peak Hour Analysis Summary

Intersection/ Approach	2023 No Build		2023 Build	
	LOS	DELAY (sec/ veh)	LOS	DELAY (sec/ veh)
Bardstown Road and Cedar Creek	**E**	**56.7**	**E**	**59.8**
EB Cedar Creek	E	75.1	E	76.6
WB Brentlinger	F	138.3	F	150.1
NB Bardstown Rd	C	27.1	C	27.6
SB Bardstown Rd	E	57.4	E	60.0

Proposed Entrance

Capacity and Turn Lane Warrant Analysis was also conducted for the proposed entrance to Highgates Development on Cedar Creek Road. Capacity Analysis was conducted using HCS-7 two-way stop-controlled procedures. Table 3 summarizes the results of this analysis. **Attachment A** provides the TWSC analysis output.

Intersection/ Approach	AM Peak		PM Peak	
	LOS	Delay	LOS	DELAY (sec/ veh)
Cedar Creek WB LT	A	1.3	A	1.4
NB HG Entrance	B	10.1	A	9.6

Turn Lane Warrant Analysis was conducted in accordance with KYTC turn lane warrant policy, as applied by the *"Warrant Calcs Interactive.xlsx"* spreadsheet maintained by KYTC. Based on this analysis a left-turn lane is not warranted at the proposed driveway due to the low turning volumes and low through traffic volumes on Cedar Creek Road. Graphical output of this analysis is provided in **Attachment B**.

Conclusion

As can be seen from the tables, the PM peak period presents the worst analysis period, with Cedar Creek Road and Brentlinger operating at LOS E and F, respectively. Total intersection delay increases 3.1 seconds due to the proposed Highgates Development. The primary delay at this intersection is due to the heavy demand for the westbound left turn from Brentlinger Lane, which is not increased with the proposed development. Overall delays at the intersection remain relatively unaffected with the additional 54 AM trips and 69 PM trips generated by the development.

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ATTACHMENT A

CAPACITY ANALYSIS OUTPUT

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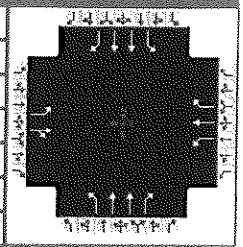
HCS ignalized Intersection Results Sur.ary

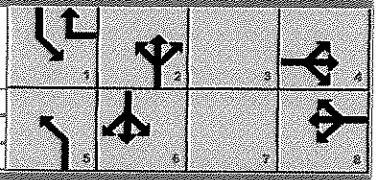
General Information				Intersection Information	
Agency	AKE			Duration, h	0.250
Analyst	AJK	Analysis Date	Jul 31, 2020	Area Type	Other
Jurisdiction	Louisville	Time Period	AM Peak	PHF	0.92
Urban Street	Bardstown	Analysis Year	2023	Analysis Period	1> 7:00
Intersection	Cedar Creek	File Name	NB_AM.xus		
Project Description	No Build AM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	150	63	39	45	16	197	42	2160	87	95	1026	56

Signal Information			
Cycle, s	180.0	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	4.5	1.5	136.3	25.8	0.0	0.0	
Yellow	4.0	0.0	4.0	4.0	0.0	0.0	
Red	0.0	0.0	0.0	0.0	0.0	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		6.0		5.0	1.1	3.0	1.1	3.0
Phase Duration, s		29.8		29.8	8.5	140.3	10.0	141.7
Change Period, (*Y+R c*), s		4.0		4.0	4.0	4.0	4.0	4.0
Max Allow Headway (*MAH*), s		3.1		3.1	3.0	0.0	3.0	0.0
Queue Clearance Time (*g s*), s		23.6		24.7	3.0		4.3	
Green Extension Time (*g e*), s		1.0		1.0	0.1	0.0	0.2	0.0
Phase Call Probability		1.00		1.00	0.90		0.99	
Max Out Probability		0.00		0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	163	111		49	17	214	46	2348	95	103	1115	61
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1418	1778		1303	1900	1610	1810	1809	1610	1810	1809	1610
Queue Service Time (*g s*), s	20.2	10.3		6.4	1.4	22.7	1.0	80.9	2.7	2.3	18.8	1.7
Cycle Queue Clearance Time (*g c*), s	21.6	10.3		16.7	1.4	22.7	1.0	80.9	2.7	2.3	18.8	1.7
Green Ratio (*g/C*)	0.14	0.14		0.14	0.14	0.18	0.78	0.76	0.76	0.79	0.77	0.77
Capacity (*c*), veh/h	232	254		152	272	284	418	2739	1219	148	2768	1232
Volume-to-Capacity Ratio (*X*)	0.703	0.436		0.321	0.064	0.754	0.109	0.857	0.078	0.699	0.403	0.049
Back of Queue (*Q*), ft/ln (50 th percentile)	185	117		54	17.3	235.3	8.7	754.5	22.6	90.9	169.2	13.6
Back of Queue (*Q*), veh/ln (50 th percentile)	7.4	4.7		2.2	0.7	9.4	0.3	30.2	0.9	3.6	6.8	0.5
Queue Storage Ratio (*RQ*) (50 th percentile)	0.92	0.00		0.21	0.00	0.90	0.03	0.00	0.08	0.36	0.00	0.04
Uniform Delay (*d 1*), s/veh	76.0	70.5		78.1	66.7	70.4	5.5	15.1	5.6	43.0	7.2	5.2
Incremental Delay (*d 2*), s/veh	1.5	0.4		0.4	0.0	1.5	0.0	3.7	0.1	2.2	0.4	0.1
Initial Queue Delay (*d 3*), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	77.5	70.9		78.5	66.7	72.0	5.6	18.9	5.8	45.2	7.6	5.2
Level of Service (LOS)	E	E		E	E	E	A	B	A	D	A	A
Approach Delay, s/veh / LOS	74.8	E		72.8	E		18.1	B		10.5	B	
Intersection Delay, s/veh / LOS	23.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.48	B	2.48	B	2.06	B	1.86	B
Bicycle LOS Score / LOS	0.94	A	0.95	A	2.54	C	1.54	B

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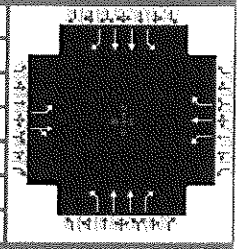
HCS7 ...gnalized Intersection Results Sum...ary

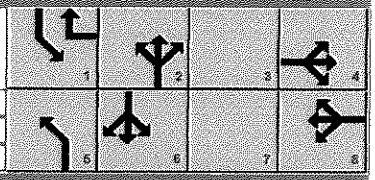
General Information				Intersection Information	
Agency	AKE			Duration, h	0.250
Analyst	AJK	Analysis Date	Jul 31, 2020	Area Type	Other
Jurisdiction	Louisville	Time Period	PM Peak	PHF	0.92
Urban Street	Bardstown	Analysis Year	2023	Analysis Period	1> 7:00
Intersection	Cedar Creek	File Name	NB_PM2.xus		
Project Description	No Build PM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	126	56	56	284	77	152	83	1466	65	166	2260	97

Signal Information			
Cycle, s	225.0	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	9.2	0.4	149.4	54.0	0.0	0.0	
Yellow	4.0	0.0	4.0	4.0	0.0	0.0	
Red	0.0	0.0	0.0	0.0	0.0	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		6.0		5.0	1.1	3.0	1.1	3.0
Phase Duration, s		58.0		58.0	13.2	153.4	13.6	153.8
Change Period, ($Y+R_c$), s		4.0		4.0	4.0	4.0	4.0	4.0
Max Allow Headway (*MAH*), s		3.2		3.2	3.0	0.0	3.0	0.0
Queue Clearance Time (g_s), s		30.3		56.0	9.1		9.3	
Green Extension Time (g_e), s		1.6		0.0	0.1	0.0	0.3	0.0
Phase Call Probability		1.00		1.00	1.00		1.00	
Max Out Probability		0.00		1.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	137	122		309	84	165	90	1593	71	180	2457	105
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1335	1743		1290	1900	1610	1810	1809	1610	1810	1809	1610
Queue Service Time (g_s), s	20.4	12.8		41.2	7.9	18.5	7.1	59.5	3.5	7.3	149.8	5.3
Cycle Queue Clearance Time (g_c), s	28.3	12.8		54.0	7.9	18.5	7.1	59.5	3.5	7.3	149.8	5.3
Green Ratio (*g/C*)	0.24	0.24		0.24	0.24	0.28	0.70	0.66	0.66	0.71	0.67	0.67
Capacity (*c*), veh/h	306	418		268	456	455	106	2402	1069	239	2408	1072
Volume-to-Capacity Ratio (*X*)	0.448	0.291		1.152	0.184	0.363	0.849	0.663	0.066	0.755	1.020	0.098
Back of Queue (*Q*), ft/ln (50 th percentile)	176.7	144		585.3	96.3	190.4	136.2	634.1	33.1	135.1	1760.1	50.3
Back of Queue (*Q*), veh/ln (50 th percentile)	7.1	5.8		23.4	3.9	7.6	5.4	25.4	1.3	5.4	70.4	2.0
Queue Storage Ratio (*RQ*) (50 th percentile)	0.88	0.00		2.25	0.00	0.73	0.45	0.00	0.11	0.54	0.00	0.14
Uniform Delay (d_1), s/veh	79.2	69.9		94.4	68.0	64.5	82.1	22.7	13.3	28.5	37.6	13.5
Incremental Delay (d_2), s/veh	0.4	0.1		102.4	0.1	0.2	6.9	1.5	0.1	1.8	23.6	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	79.6	70.0		196.8	68.0	64.7	89.0	24.2	13.4	30.4	61.2	13.6
Level of Service (LOS)	E	E		F	E	E	F	C	B	C	F	B
Approach Delay, s/veh / LOS	75.1	E		138.3	F		27.1	C		57.4	E	
Intersection Delay, s/veh / LOS	56.7						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.48	B	2.48	B	2.09	B	1.90	B
Bicycle LOS Score / LOS	0.91	A	1.41	A	1.93	B	2.75	C

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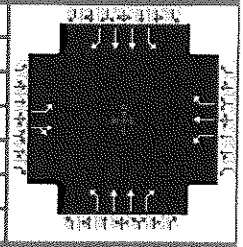
HCS7 Signalized Intersection Results Summary

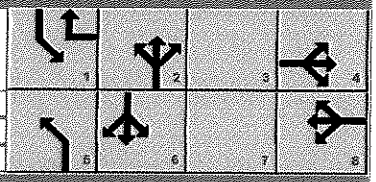
General Information				Intersection Information	
Agency	AKE			Duration, h	0.250
Analyst	AJK	Analysis Date	Jul 31, 2020	Area Type	Other
Jurisdiction	Louisville	Time Period	AM Peak	PHF	0.92
Urban Street	Bardstown	Analysis Year	2023	Analysis Period	1> 7:00
Intersection	Cedar Creek	File Name	Build_AM.xus		
Project Description	Build AM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	172	72	44	45	18	197	44	2160	87	95	1026	66

Signal Information			
Cycle, s	180.0	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	4.5	1.4	134.0	28.0	0.0	0.0
Yellow	4.0	0.0	4.0	4.0	0.0	0.0
Red	0.0	0.0	0.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		6.0		5.0	1.1	3.0	1.1	3.0
Phase Duration, s		32.0		32.0	8.5	138.0	10.0	139.4
Change Period, ($Y+R_c$), s		4.0		4.0	4.0	4.0	4.0	4.0
Max Allow Headway (*MAH*), s		3.1		3.1	3.0	0.0	3.0	0.0
Queue Clearance Time (g_s), s		26.9		24.4	3.1		4.4	
Green Extension Time (g_e), s		1.0		1.1	0.1	0.0	0.2	0.0
Phase Call Probability		1.00		1.00	0.91		0.99	
Max Out Probability		0.00		0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	187	126		49	20	214	48	2348	95	103	1115	72
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1415	1779		1285	1900	1610	1810	1809	1610	1810	1809	1610
Queue Service Time (g_s), s	23.4	11.6		6.5	1.6	22.4	1.1	85.1	2.9	2.4	19.9	2.1
Cycle Queue Clearance Time (g_c), s	24.9	11.6		18.0	1.6	22.4	1.1	85.1	2.9	2.4	19.9	2.1
Green Ratio (*g/C*)	0.16	0.16		0.16	0.16	0.19	0.77	0.74	0.74	0.78	0.75	0.75
Capacity (*c*), veh/h	248	277		158	296	304	409	2693	1198	142	2721	1211
Volume-to-Capacity Ratio (*X*)	0.753	0.455		0.310	0.066	0.703	0.117	0.872	0.079	0.728	0.410	0.059
Back of Queue (*Q*), ft/ln (50 th percentile)	213.5	132		53.6	19.2	230.7	9.9	811.7	24.2	89.5	182.8	17.3
Back of Queue (*Q*), veh/ln (50 th percentile)	8.5	5.3		2.1	0.8	9.2	0.4	32.5	1.0	3.6	7.3	0.7
Queue Storage Ratio (*RQ*) (50 th percentile)	1.07	0.00		0.21	0.00	0.89	0.03	0.00	0.08	0.36	0.00	0.05
Uniform Delay (d_1), s/veh	75.4	69.0		77.2	64.8	68.3	6.2	16.8	6.3	44.7	8.0	5.8
Incremental Delay (d_2), s/veh	1.8	0.4		0.4	0.0	1.1	0.0	4.2	0.1	2.7	0.5	0.1
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	77.2	69.5		77.6	64.8	69.4	6.3	21.0	6.4	47.4	8.4	5.9
Level of Service (LOS)	E	E		E	E	E	A	C	A	D	A	A
Approach Delay, s/veh / LOS	74.1	E		70.5	E		20.2	C		11.4	B	
Intersection Delay, s/veh / LOS	24.7						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.48	B	2.48	B	2.06	B	1.87	B
Bicycle LOS Score / LOS	1.00	A	0.95	A	2.54	C	1.55	B

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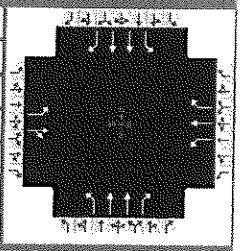
HCS. ignalized Intersection Results Su..nary

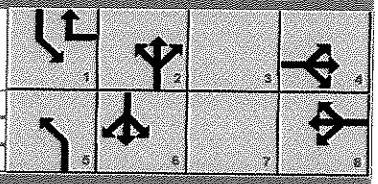
General Information				Intersection Information	
Agency	AKE			Duration, h	0.250
Analyst	AJK	Analysis Date	Jul 31, 2020	Area Type	Other
Jurisdiction	Louisville	Time Period	PM Peak	PHF	0.92
Urban Street	Bardstown	Analysis Year	2023	Analysis Period	1> 7:00
Intersection	Cedar Creek	File Name	Build_PM.xus		
Project Description	Build PM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	139	62	64	284	88	152	92	1466	65	166	2260	114

Signal Information			
Cycle, s	225.0	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	9.7	0.8	148.5	54.0	0.0	0.0	
Yellow	4.0	0.0	4.0	4.0	0.0	0.0	
Red	0.0	0.0	0.0	0.0	0.0	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		6.0		5.0	1.1	3.0	1.1	3.0
Phase Duration, s		58.0		58.0	14.5	153.3	13.7	152.5
Change Period, (*Y+R c*), s		4.0		4.0	4.0	4.0	4.0	4.0
Max Allow Headway (*MAH*), s		3.2		3.2	3.0	0.0	3.0	0.0
Queue Clearance Time (*g s*), s		34.3		56.0	10.3		9.4	
Green Extension Time (*g e*), s		1.7		0.0	0.2	0.0	0.3	0.0
Phase Call Probability		1.00		1.00	1.00		1.00	
Max Out Probability		0.00		1.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	151	137		309	96	165	100	1593	71	180	2457	124
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1321	1741		1272	1900	1610	1810	1809	1610	1810	1809	1610
Queue Service Time (*g s*), s	23.3	14.6		39.4	9.1	18.4	8.3	59.6	3.5	7.4	148.5	6.4
Cycle Queue Clearance Time (*g c*), s	32.3	14.6		54.0	9.1	18.4	8.3	59.6	3.5	7.4	148.5	6.4
Green Ratio (*g/C*)	0.24	0.24		0.24	0.24	0.28	0.71	0.66	0.66	0.70	0.66	0.66
Capacity (*c*), veh/h	296	418		255	456	456	116	2400	1068	237	2388	1063
Volume-to-Capacity Ratio (*X*)	0.511	0.328		1.212	0.210	0.362	0.861	0.664	0.066	0.763	1.029	0.117
Back of Queue (*Q*), ft/ln (50 th percentile)	199.4	163.7		598	110.9	190.3	150.9	634.7	33.1	138.9	1771.2	60.9
Back of Queue (*Q*), veh/ln (50 th percentile)	8.0	6.5		23.9	4.4	7.6	6.0	25.4	1.3	5.6	70.8	2.4
Queue Storage Ratio (*RQ*) (50 th percentile)	1.00	0.00		2.30	0.00	0.73	0.50	0.00	0.11	0.56	0.00	0.17
Uniform Delay (*d 1*), s/veh	81.4	70.5		95.3	68.4	64.4	83.8	22.8	13.3	29.5	38.2	14.1
Incremental Delay (*d 2*), s/veh	0.6	0.2		125.9	0.1	0.2	6.9	1.5	0.1	1.9	26.2	0.2
Initial Queue Delay (*d 3*), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	82.0	70.7		221.2	68.5	64.6	90.7	24.2	13.4	31.5	64.4	14.3
Level of Service (LOS)	F	E		F	E	E	F	C	B	C	F	B
Approach Delay, s/veh / LOS	76.6	E		150.1	F		27.6	C		60.0	E	
Intersection Delay, s/veh / LOS	59.8						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.48	B	2.48	B	2.09	B	1.90	B
Bicycle LOS Score / LOS	0.96	A	1.43	A	1.94	B	2.77	C

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20-ZONE-0080

ATTACHMENT B

AUXILLIARY TURN LANE WARRANT

Figure B-1: AM Peak Hour Left Turn Lane Warrant

Left Turn Lane Warrants

Input Fields

Left Turn Volume (vph)	14	Speed Limit (mph)	35
Advancing Volume (vph)	79	No. of through lanes	1
Opposing Volume (vph)	250	Percent Heavy Vehicles (decimal percent)	0.02

Left Turn Lane NOT Warranted

Note: This spreadsheet is intended to supplement the guidance provided in the Auxiliary Turn Lane policy outlined in the KYTC Highway Design Manual. This policy should be fully reviewed and understood prior to using this application.

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Figure B-2: PM Peak Hour Left Turn Lane Warrant

Left Turn Lane Warrants

Input Fields

Left Turn Volume (vph)	37	Speed Limit (mph)	35
Advancing Volume (vph)	213	No. of through lanes	1
Opposing Volume (vph)	182	Percent Heavy Vehicles (decimal percent)	0.02

Left Turn Lane NOT Warranted

Note: This spreadsheet is intended to supplement the guidance provided in the Auxiliary Turn Lane policy outlined in the KYTC Highway Design Manual. This policy should be fully reviewed and understood prior to using this application.

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