

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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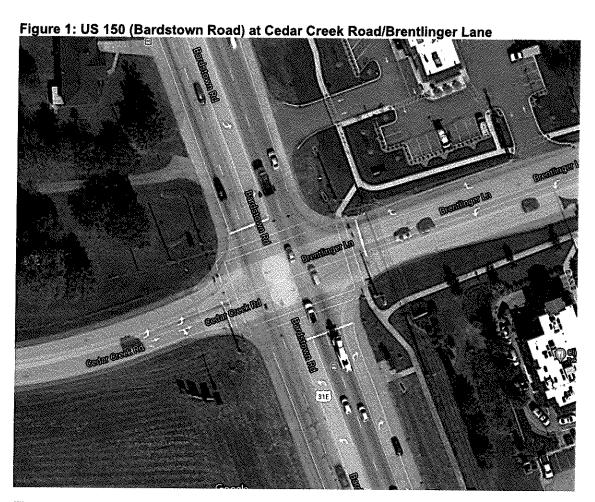
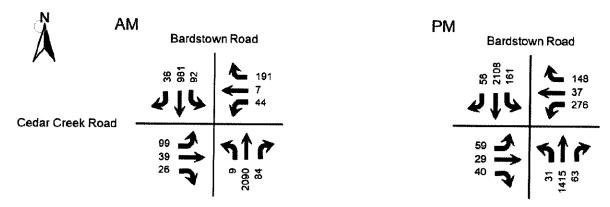


Figure 2: Existing Traffic Counts



Adjacent Development

In addition to the Highgates Development several other developments have been proportionally 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.

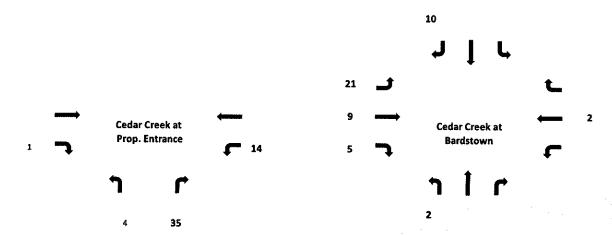
In addition to these approved adjacent developments, a 1 percent background growth rate was applied to background traffic to reflect year of opening conditions, 2023.

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)

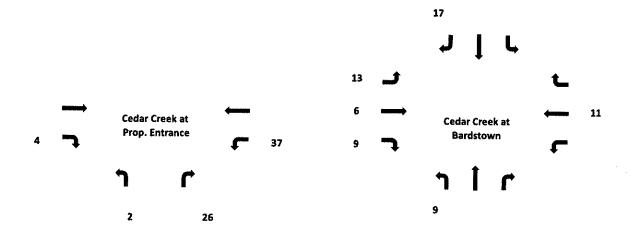


Figure 4a: 2023 Opening Year Build Volumes (AM Peak)

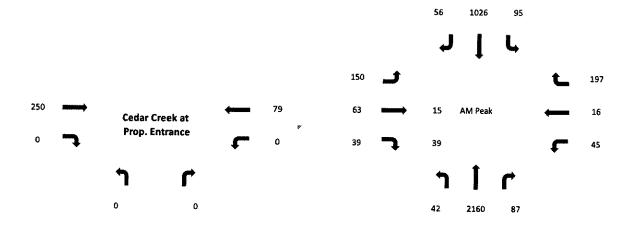
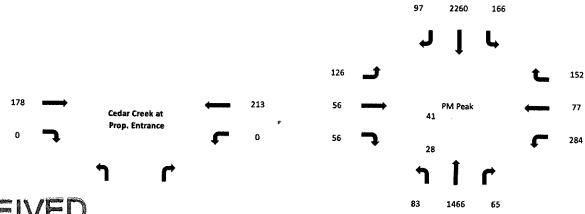


Figure 4b: 2023 Opening Year Build Volumes (PM Peak)



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Traffic Analysis

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

- 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/	2/02/3	No Build	2022	Build
Approach	LOS	DELAY (sec/ veh)	LOS	DELAY (sec/ veh)
Bardstown Road and Cedar Creek	С	23.0	С	24.7
EB Cedar Creek	Ē	74.8	E	74.1
WB Brentlinger	E	72.8	E	70.5
NB Bardstown Rd	В	18.1	С	20.2
SB Bardstown Rd	В	10.5	В	11.4

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Table 2: PM Peak Hour Analysis Summary

Intersection/	2023	No Build	2023 Build					
Approach	oach LOS		LOS	DELAY (sec/ veh)				
Bardstown Road and Cedar Creek	E	56.7	E	59.8				
EB Cedar Creek	E	75.1	<u>E</u>	76.6				
WB Brentlinger	F	138.3	F	150.1				
NB Bardstown Rd	c	27.1	С	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/	Afv	Peak	PM Peak				
Approach	LOS	Delay	LOS	DELAY (sec/ veh)			
Cedar Creek WB LT	Α	1.3	Α	1.4			
NB HG Entrance	В	10.1	Α	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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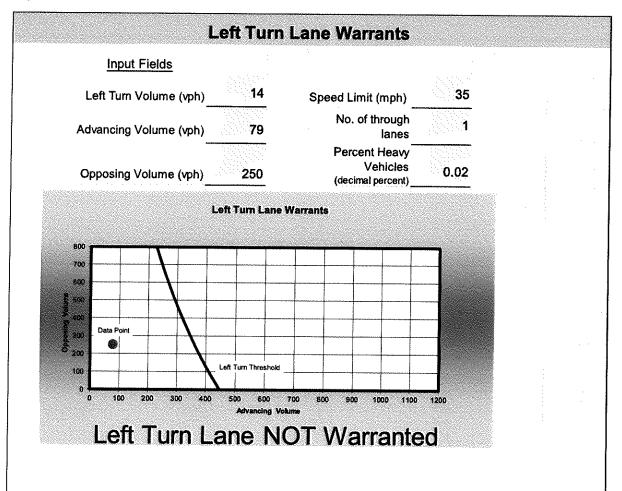
HCS: ignalized Intersection Results Suitary **General Information** 7235751 **7111** Intersection Information Agency AKE 0.250 Duration, h Analyst AJK Analysis Date Jul 31, 2020 Area Type Other Jurisdiction Louisville Time Period AM Peak PHF 0.92 Urban Street Bardstown Analysis Year 2023 1> 7:00 Analysis Period Intersection Cedar Creek File Name Build AM.xus **Project Description** Build AM **Demand Information** EB WB NB SB Approach Movement L Т R L Т R R R L Demand (v), veh/h 172 72 44 45 18 197 44 2160 87 95 1026 66 Signal Information JUL JUL Cycle, s 180.0 Reference Phase 2 Offset, s Reference Point 0 End Green 4.5 1.4 134.0 28.0 0.0 0.0 Uncoordinated No Simult, Gap E/W On Yellow 4.0 0.0 4.0 4.0 0.0 0.0 Force Mode Fixed | Simult. Gap N/S 0.0 0.0 On Red 0.0 0.0 0.0 0.0 **Timer Results** EBL WBL EBT WBT **NBL NBT** SBL SBT Assigned Phase 4 8 5 2 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+Rc), 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 T L R L T R R L Т 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 1809 1810 1610 Queue Service Time (gs), s 23.4 11.6 6,5 22.4 1,6 1.1 85.1 2.9 2.4 2.1 19.9 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/in (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 8.0 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) Ε Ε E Α C D Α Α Α Approach Delay, s/veh / LOS 74.1 E 70.5 E 20.2 C 11.4 В Intersection Delay, s/veh / LOS 24.7 C **Multimodal Results** EB WB NB SB Pedestrian LOS Score / LOS 2.48 2,48 В 2.06 В 1.87 В Bicycle LOS Score / LOS 1.00 Α 0.95 Α 2.54 C 1.55 В

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Cycle Queue Clearai	nce 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
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	ft/In (50 th percentile)		199.4	163.7		598	110.9	190.3	150.9	634.7	33.1	138.9	1771.2	60.9
	veh/In (50 th percentile		0.8	6.5		23,9	4.4	7.6	6.0	25.4	1.3	5.6	70.8	2.4
	(RQ) (50 th percentile	B)	1.00	0.00		2.30	0.00	0.73	0.50	0.00	0.11	0.56	0.00	0.17
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ATTACHMENT B

AUXILLIARY TURN LANE WARRANT

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

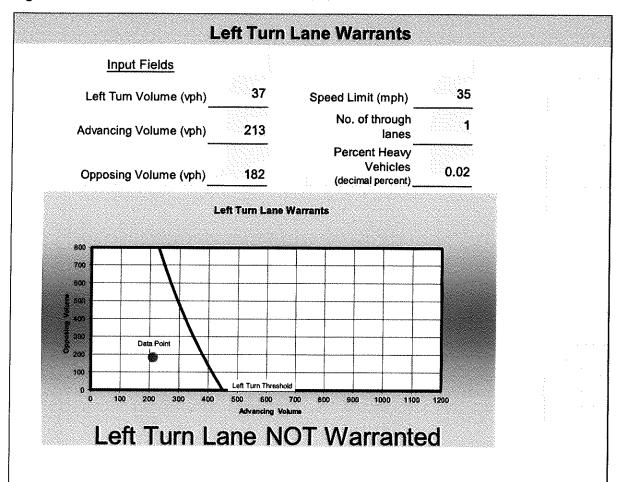


Note: This spreadsheet is intended to supplement the guidance provided in the Auxiliary Turn Lane policy outlined in the KYTC Highway Design Manual. This policy should be fully reviewed and understood prior to using this application.

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



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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