

KY 2154 & US 68 Lebanon Traffic Forecast Methodology Report

ITEM NO. 4-80152 & 4-80153 IN MARION COUNTY

Prepared for:



By:



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- C. 2045 No-Build Forecasts
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1. Introduction

Qk4 was tasked with preparing existing (2021) and future year (2045) traffic forecasts to support a scoping study for a new eastern connector (KYTC Item No.4-80153). The study evaluated traffic patterns in and around Lebanon as well as accessibility and connectivity of the eastern side. The study area (**Figure 1**) captures both ends of the existing Lebanon Bypass – KY 2154 at KY 208 and KY 2154 at KY 55.

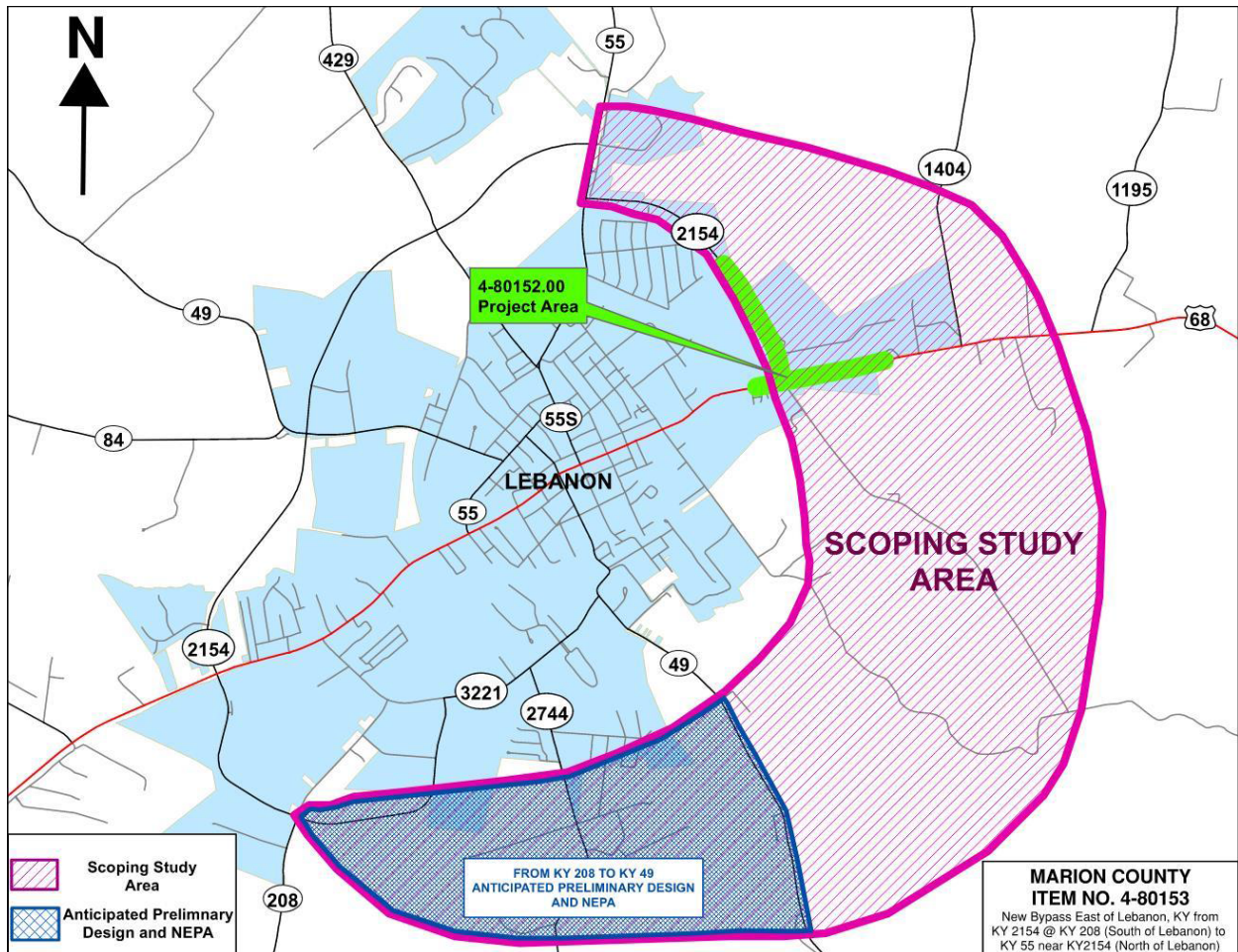


Figure 1: Study Area

Current traffic counts were conducted at six intersections in the region. Growth rates from the Statewide Travel Demand Model (version v7_KYSTMV19), recent traffic data from KYTC stations, input from local officials, and background socioeconomic growth assumptions were used to develop the forecasts. The following sections summarize these efforts.

2. Traffic Data Collection

During September 2021, 12-hour turning movement counts were conducted on six study area intersections, as well as collection of travel time data. **Figure 2** provides a map of these locations.

- KY 208 & KY 2154 (Adam Hughes Memorial Hwy)
- KY 2744 (Country Club Drive) & KY 3221 (Metts Drive)
- KY 49 & KY 3221 (Country Club Drive)
- US 68 & KY 2154 (Corporate Drive/Sulphur Springs Road)
- US 68 & KY 1195 (Short Line Pike)
- KY 55 & KY 2154 (Corporate Drive)

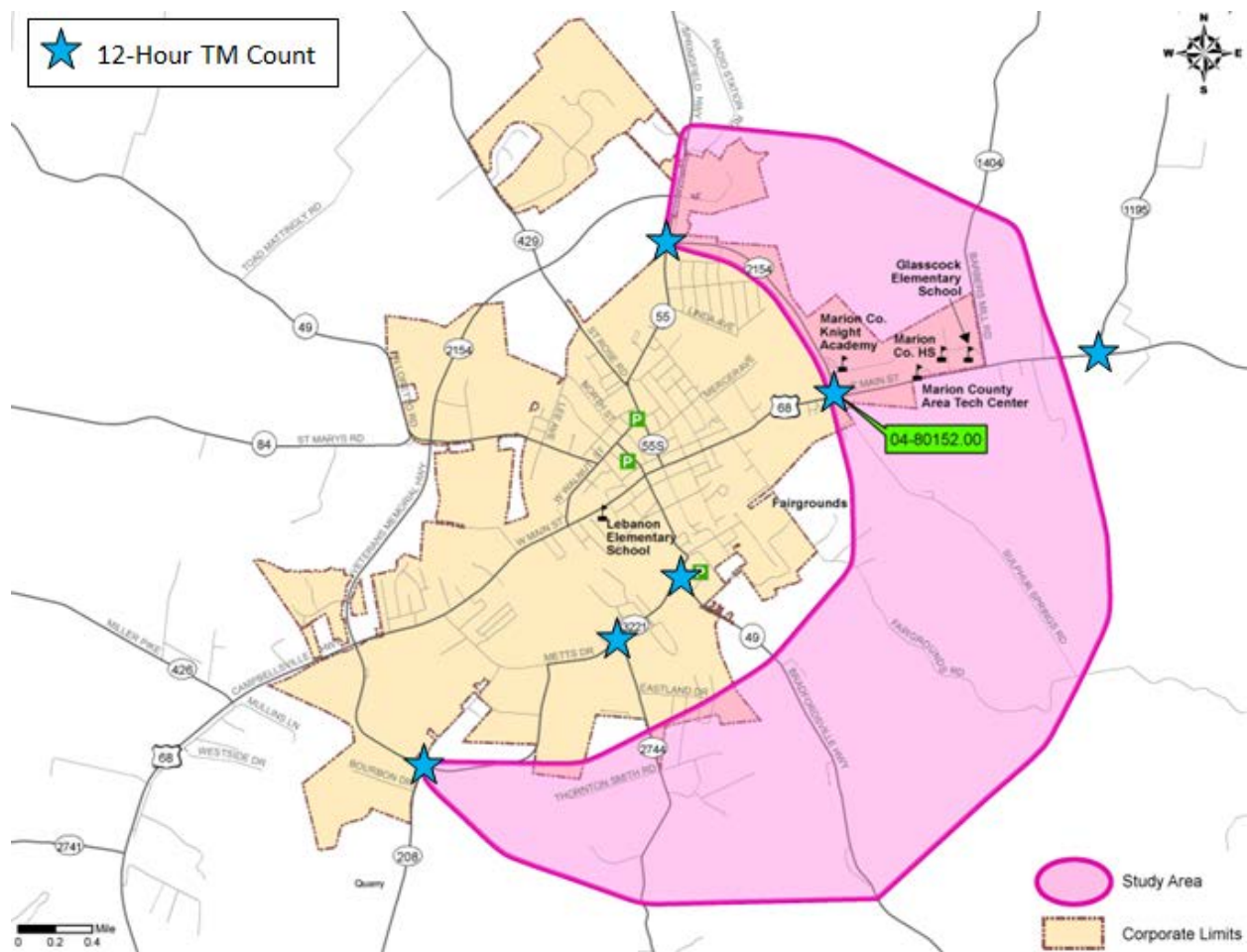


Figure 2: Data Collection Locations

The counts were collected using Miovision, classifying vehicles into one of five categories: motorcycles, cars, buses, single unit trucks, and articulated trucks. Travel time data were also collected using a Qstarz GPS datalogger provided by KYTC. Raw volumes from turning

movement counts are presented in **Appendix A**. Existing scenario forecasts at each study intersection are presented in **Appendix B**.

Trends from Historic KYTC Counts

KYTC provided Qk4 with available existing traffic volumes for study area roadways, including truck percentages, K factors, and peak hour directional distributions as available. Five US 68 count stations and four KY 2154 count stations were reviewed to assess corridor trends. Available ADT counts since 2000 at each are summarized in **Figure 3** and **Figure 4**. Historically, volumes along KY 2154 have steadily increased over time with US 68 trends remain relatively flat.

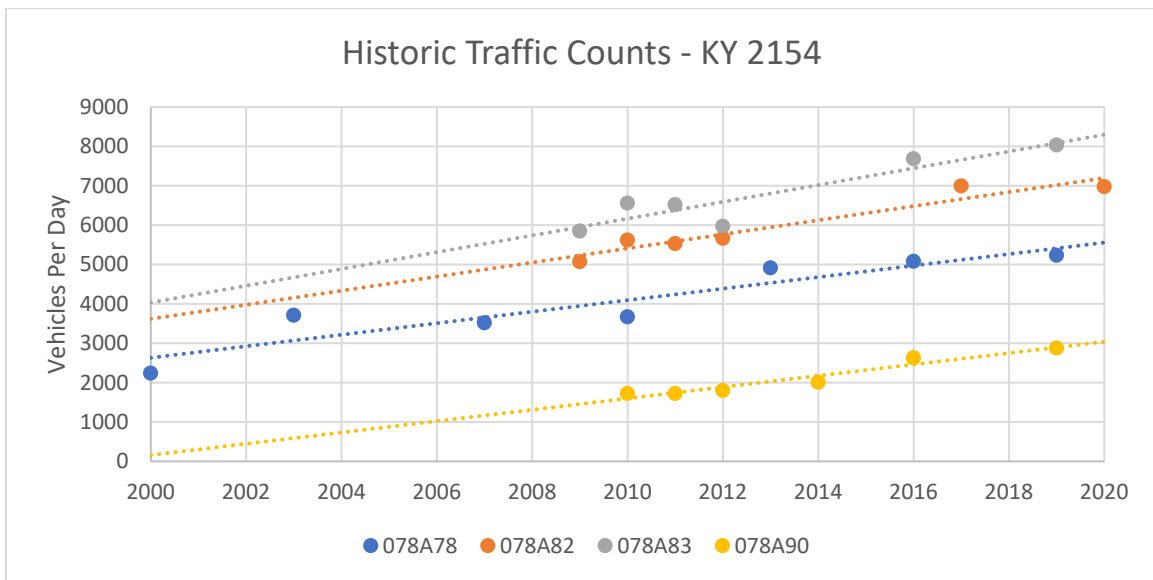


Figure 3: Historic Traffic Counts along KY 2154

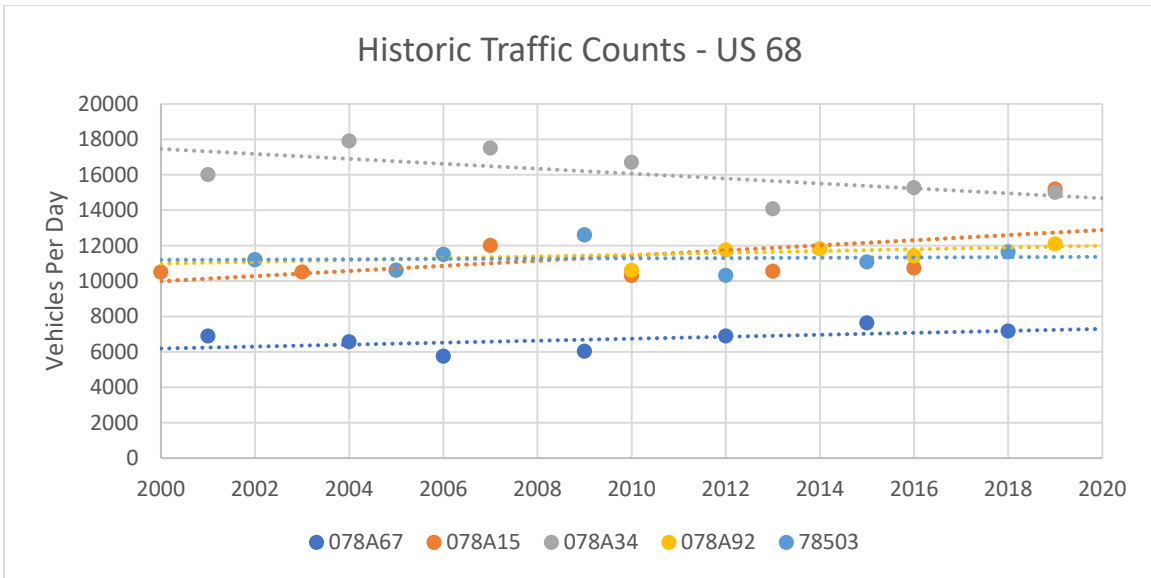


Figure 4: Historic Traffic Counts along US 68

Trends from Population Statistics

County-level population statistics provide another measure to gage potential traffic growth. Future forecasts are presented from the Kentucky State Data Center. The overall projected population growth in Marion County (**Table 1** and **Figure 5**) shows a flat trend, with a projected compound annual growth of 0.16% from 2020 to 2040.

Table 1: Marion County Population & Household Data

Marion County	Census 2010	Census 2020	KSDC Projections (Oct 2016)			
			2025	2030	2035	2040
Total Population	19,820	19,257	19,824	19,929	19,961	19,909
Population in Households	18,523	18,242	19,303	19,399	19,422	19,361
Population in Group Quarters	1,297	1,015	521	530	539	548
Total Households	7,358	7,433	8,237	8,431	8,605	8,701
Average Household Size	2.52	2.45	2.34	2.30	2.26	2.23

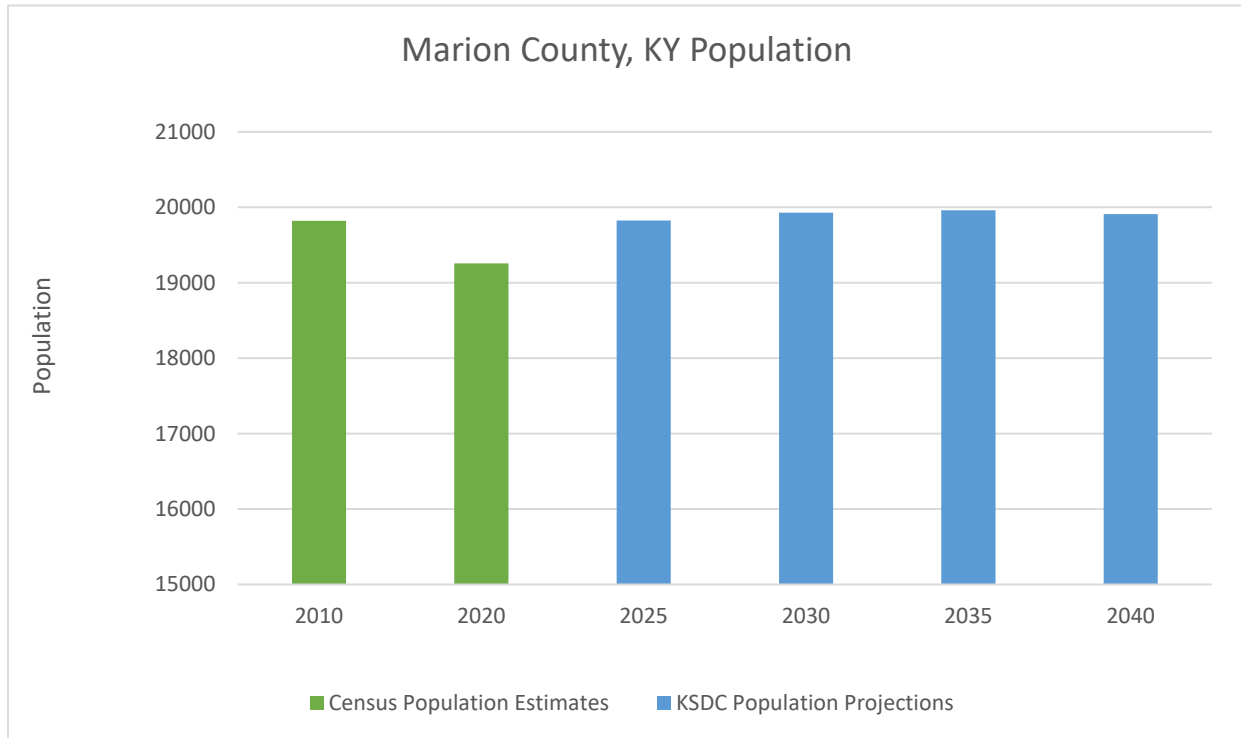


Figure 5: Marion County Population Forecasts

3. Kentucky Statewide Travel Demand Model

To project future year traffic forecasts, Version 19¹ of KYTC’s Statewide Travel Demand Model (KYSTM), was applied. The 2018 model base year served as the existing baseline scenario, while 2045 forecasts for No-Build and Build scenarios were also developed. The KYTC model runs in TransCAD 7 and provides a 24-hour daily forecast. To provide an improved resolution for this study, 4 traffic analysis zone (TAZ) boundaries within the study area were split into a total of 13 zones. Increasing the total zones of the statewide model from 5976 to 5985. **Figure 6** provides the adopted zone splits from the original 5976 zone system.

¹ v7_KYSTMv19 with an indicated release date of July 2020



Figure 6: KYSTM Zone Splits

Socioeconomic Growth Assumptions

KYTC provided an adjustment of the KYSTM socioeconomic assumptions to reflect current development patterns and the new boundaries of the 5985 TAZ system. **Figure 7** and **Figure 8** summarize anticipated household growth between 2018 and 2045 model scenarios for Marion County and Lebanon, with minimal growth throughout the county. **Figure 9** and **Figure 10** summarize anticipated changes in employment between 2018 and 2045 model scenarios for Marion County and Lebanon. As shown, projected employment growth is concentrated to Lebanon and its surrounding zones.

From discussions with the project team and local officials, no major future developments were expected in the region and the statewide model assumptions for population and employment provided by KYTC were unaltered.

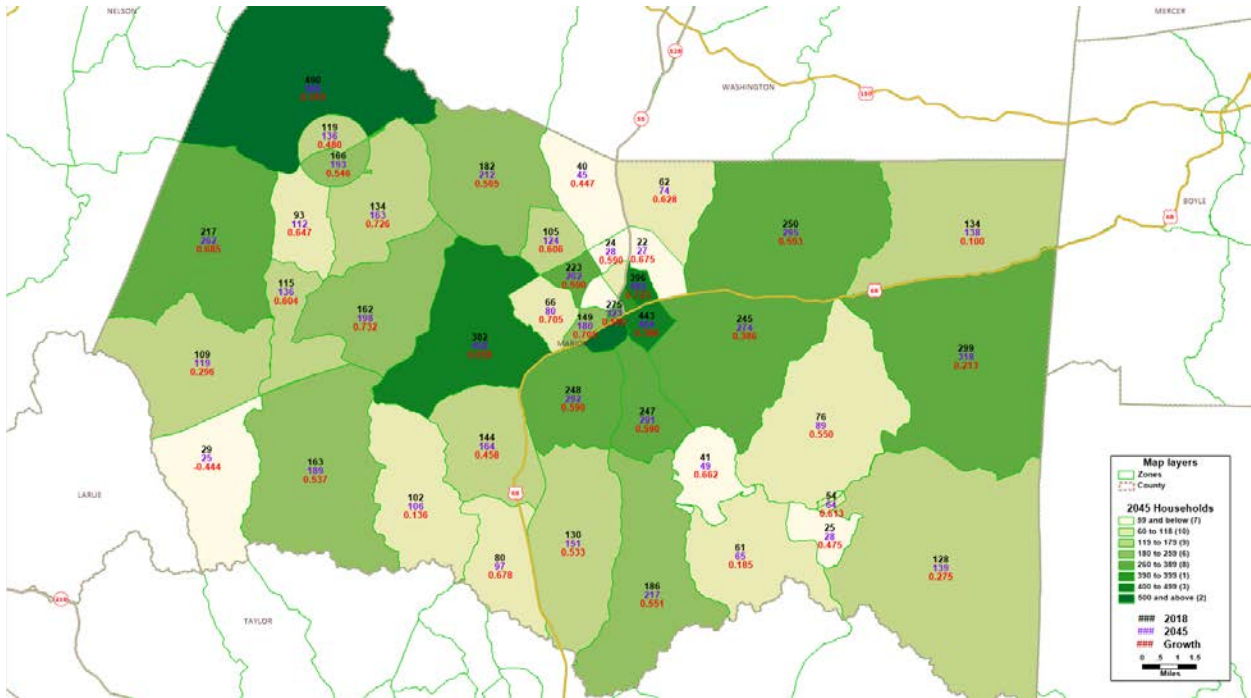


Figure 7: Projected Household Growth for Marion County, 2018 to 2045

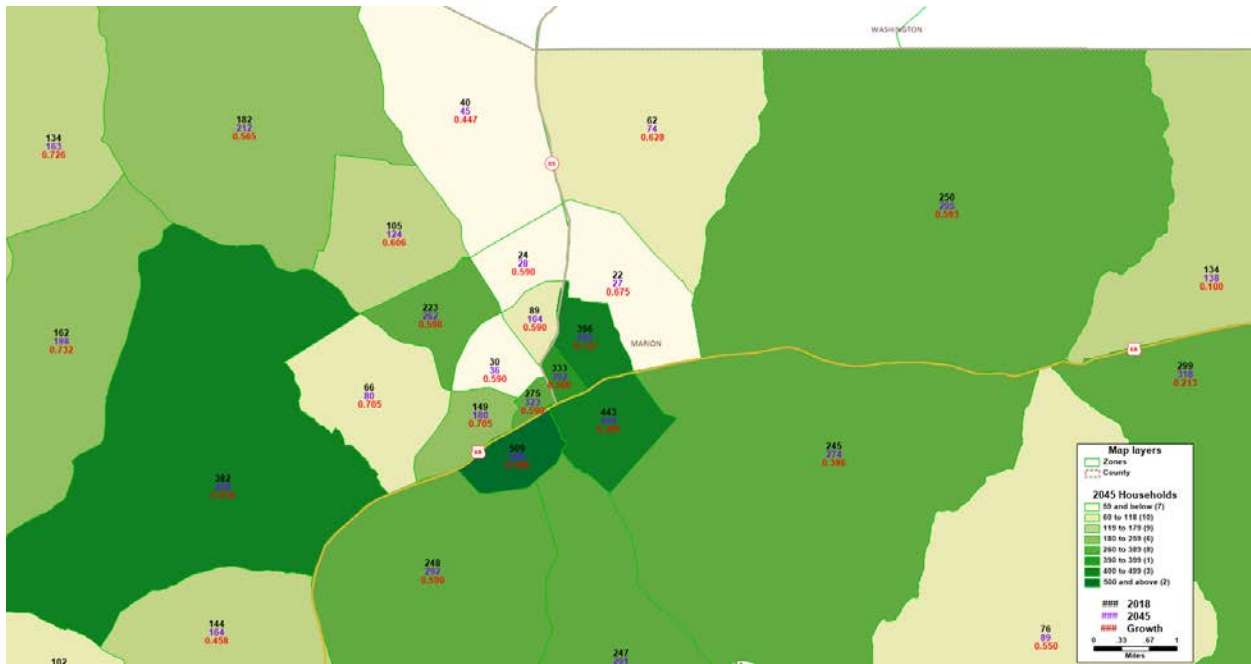


Figure 8: Projected Household Growth for Lebanon, 2018 to 2045

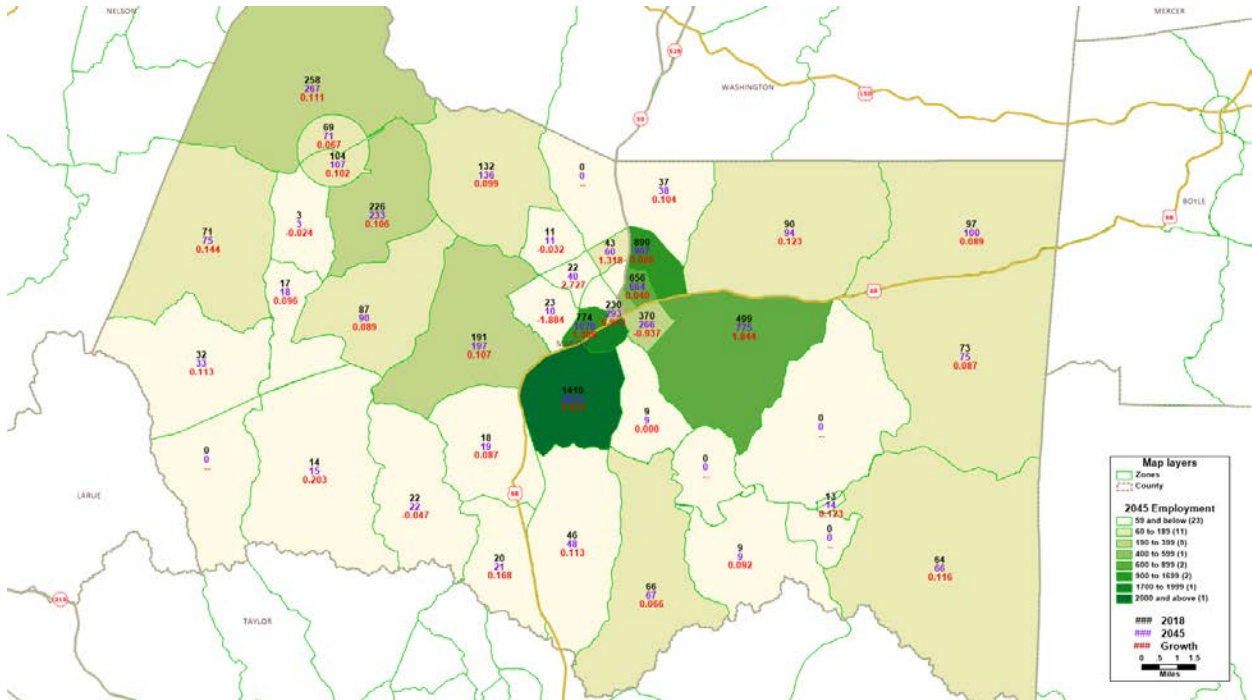


Figure 9: Projected Employment Growth for Marion County, 2018 to 2045

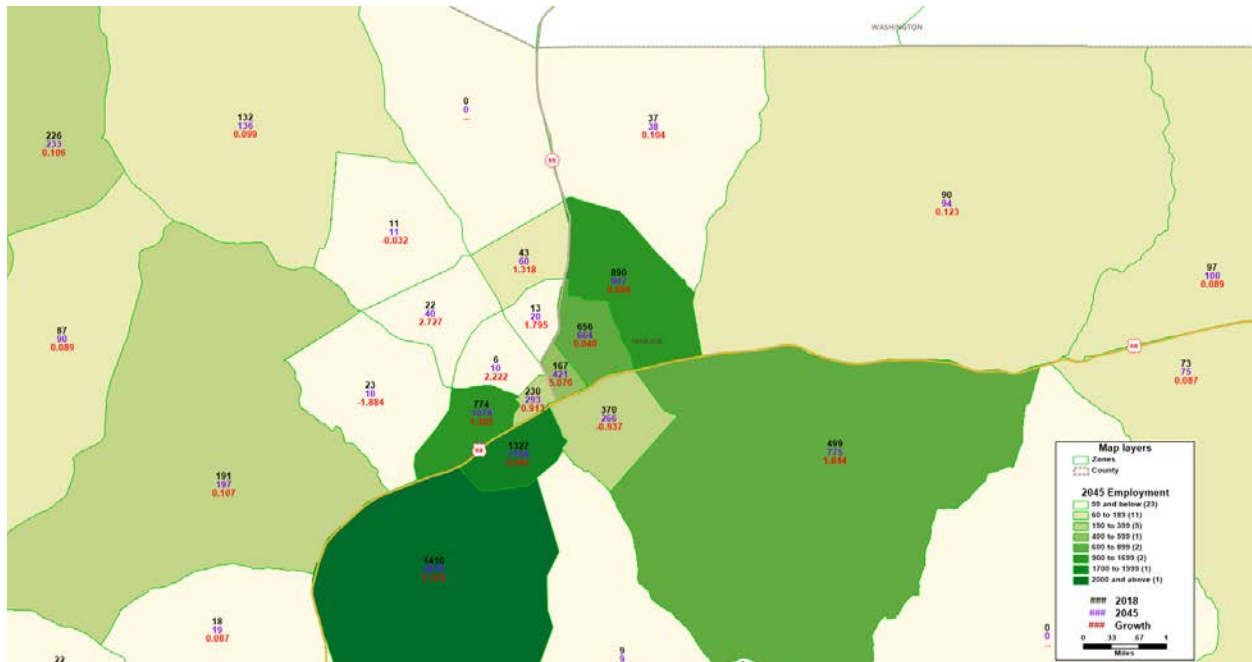


Figure 10: Projected Employment Growth for Lebanon, 2018 to 2045

E+C Projects

One existing/committed highway projects in the vicinity (**Figure 11**) was assumed to be constructed as part of the 2045 No-Build scenario:

- US 68 / KY 2154 intersection, Item No. 4-80152. Includes widening along US 68 and a culvert to support pedestrian safety for visitors accessing the Kentucky Cooperage.

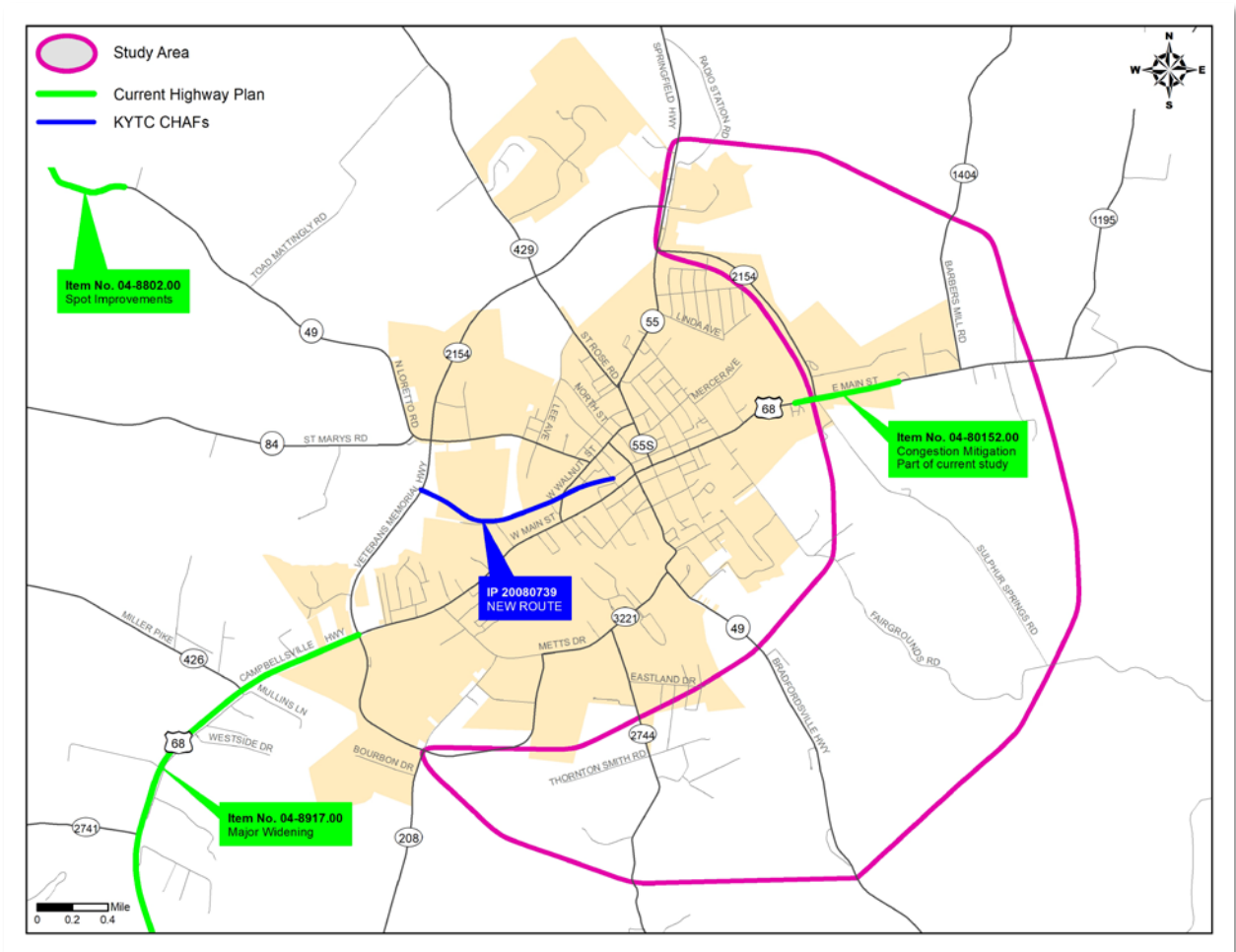


Figure 11: Potential Transportation Projects in Vicinity, including E+C

4. Future Year Projections

2045 No-Build

Considering historic traffic growth rates, population projections, anticipated development, and STDM projections, a compounded growth rate of 0.584% was applied to the 2021 existing scenario to project future 2045 No-Build traffic. Future year 2045 No-Build forecasts are included in **Appendix C**.

2045 Build

For the study, five improvement concepts were developed (**Figure 12**) to provide connectivity to the existing termini of KY 2154 and improve traffic flows throughout Lebanon. These concepts are defined below:

- Concept A forms an outer loop south and east of the city. It stretches from the southern industrial park then outside neighborhoods, fairgrounds, and schools. On the north side, it meets KY 55 opposite the existing bypass.
- Concept B forms an “inner loop” closer to Lebanon. It starts at Metts Drive, runs outside the park and fairgrounds, then along a section of Corporate Drive before meeting KY 55 opposite the existing bypass.
- Concept C combines parts of Concepts A and B. It travels east from the southern industrial park then follows a section of KY 49 (Bradfordsville Road) towards town. It then swings east on new alignment outside the park and fairgrounds then follows a section of Corporate Drive before meeting KY 55 opposite the existing bypass.
- Concept D also combines parts of Concepts A and B. It starts at Metts Drive then runs outside the park, fairgrounds, and schools. To the north, it stretches from Barbers Mill Road to meet KY 55 opposite the existing bypass.
- Concept F forms an outer loop south and east of the city but not quite as far out as Concept A. It stretches from the southern industrial park then outside the fairgrounds and schools. To the north, it stretches from Barbers Mill Road to meet KY 55 opposite the existing bypass.



Figure 12: Range of Improvement Concepts

All five concepts were coded into the 2045 statewide model and assessed individually on traffic volumes and impacts to US 68. Each resulted in varied volumes on the build connector routes, mainly driven by proximity to the town center. All concepts forecasted a decrease of US 68 volumes west of Corporate Dr compared to No-Build volumes, ranging from 7-12%. US 68 volumes east of Corporate Dr varied based on concept route, ranging from a 3% increase (Concept B) to a maximum 28% decrease (Concept D). Forecast 2045 spreadsheets of each study intersection are included in **Appendix D**.

	NO-BUILD	CONCEPT A	CONCEPT B	CONCEPT C	CONCEPT D	CONCEPT F
Connector: south of US 68	N/A	1,600	1,900	1,600	2,800	1,600
Connector: north of US 68	N/A	3,000 +4,500 Corporate	7,600	7,600	3,100 +4000 Corporate	3,000 +4500 Corporate
US 68 West of Corporate Dr	11,600	10,700	10,600	10,700	10,200	10,700
US 68 East of Corporate Dr	10,900	8,900	11,200	8,900	7,900	8,900

5. Capacity Analysis

Segment and intersection capacities were assessed using Highway Capacity Software (HCS, Version 7) for each of the study intersections for existing (2021) and future (2045) conditions. **Table 2** and **Table 2** provide a summary this data for 2021 and 2045, respectively.

Table 2: Existing (2021) Intersection Capacity Analysis

Intersection	Control Type	AM LOS	PM LOS	Worst Approach	Max V/C
US 68 & KY 2154	Signal	C	B	WB	0.88
KY 2744 & KY 3221	2-Way Stop	B	B	NB	0.35
KY 49 & KY 3221	2-Way Stop	C	B	EB	0.53
US 68 & KY 1195	2-Way Stop	B	B	SB	0.13
KY 55 & KY 2154	2-Way Stop	F	C	WB	1.38
KY 2154 & KY 208	4-Way Stop	A	A	NB	0.20

Table 3: No-Build (2045) Intersection Capacity Analysis

Intersection	Control Type	AM LOS	PM LOS	Worst Approach	Max V/C
US 68 & KY 2154	Signal	D	C	WB	0.93
KY 2744 & KY 3221	2-Way Stop	B	B	NB	0.43
KY 49 & KY 3221	2-Way Stop	C	C	EB	0.67
US 68 & KY 1195	2-Way Stop	B	B	SB	0.17
KY 55 & KY 2154	2-Way Stop	F	C	WB	2.78
KY 2154 & KY 208	4-Way Stop	A	A	NB	0.25

Capacity impacts to intersection improvements at US 68 & KY 2154 (Main St / Corporate Dr) and KY 2154 & KY 208 with future year bypass build volumes were also reviewed. **Table 4** provides an AM comparison between a signalized and roundabout intersection at US 68 & KY 2154 while **Table 5** compares PM volumes for a signalized and roundabout intersection at KY 2154 / KY 208. Either configuration provides adequate capacity for anticipated volumes.

Table 4: HCS7 AM Summary of Improvements to US 68 & KY 2154

Movement	Signal								Single-Lane Roundabout			
	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	EB	WB	NB	SB
V/C Ratio	0.65	0.39	0.09	0.91	0.07	0.20	0.65	0.40	0.59	0.59	0.17	0.47
Delay (s/veh)	17.8	9.6	14.8	26.3	26.2	21.8	30.2	23.4	12.3	11.0	8.0	10.2
95% Queue (veh)	2.7	5.6	0.8	15.5	0.6	2.1	7.9	4.6	4.0	4.0	0.6	2.6
95% Queue (ft)	72	141	21	393	15	54	197	117	100	100	15	65
Approach Delay	12.1		25.6		22.7		27.4		12.3	11	8	10.2
Approach LOS	B		C		C		C		B	B	A	B
Intersection Delay	21.5								11.0			
Intersection LOS	C								B			

Table 5: HCS7 PM Summary of Improvements to KY 2154 & KY 208

	Signal								Single-Lane Roundabout			
Movement	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	EB	WB	NB	SB
V/C Ratio	0.19	0.10	0.21	0.23	0.31	0.29	0.03	0.46	0.23	0.32	0.21	0.09
Delay (s/veh)	5.9	5.5	7.5	6.0	17.3	13.5	14.3	14.6	5.5	6.8	5.2	5.0
95% Queue (veh)	0.8	0.3	0.8	0.9	1.3	1.1	0.1	1.9	0.9	1.4	0.8	0.3
95% Queue (ft)	21	9	23	24	33	29	3	50	23	35	20	8
Approach Delay	5.8		6.6		15.3		14.6		5.5	6.8	5.2	5.0
Approach LOS	A		A		B		B		A	A	A	A
Intersection Delay	9.7								5.9			
Intersection LOS	A								A			

Appendix A

2021 Turning Movement Counts

Study Name KY 2154 & KY 208
 Start Date 09/15/2021
 Start Time 7:00 AM
 Site Code

Start Time	KY 208 Southbound				KY 2154 Westbound				KY 208 Northbound				KY 2154 Eastbound			
	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn
7:00 AM	3	6	1	0	0	12	1	0	3	12	13	0	13	8	4	0
7:15 AM	4	5	0	0	0	5	1	0	1	11	13	0	10	3	3	0
7:30 AM	5	7	0	0	0	1	2	0	4	27	23	0	6	8	4	0
7:45 AM	6	13	0	0	0	6	2	0	7	29	18	0	16	7	7	0
8:00 AM	6	3	0	0	0	2	1	0	3	11	9	0	13	4	3	0
8:15 AM	5	7	0	0	0	2	2	0	1	9	11	0	13	4	4	0
8:30 AM	3	5	0	0	1	2	0	0	0	9	9	0	5	3	1	0
8:45 AM	2	6	0	0	0	1	0	0	0	5	11	0	2	2	5	0
9:00 AM	3	5	0	0	0	1	0	0	0	6	7	0	4	1	5	0
9:15 AM	1	4	1	0	0	1	0	0	0	18	6	0	9	3	2	0
9:30 AM	4	23	0	0	1	1	0	0	2	8	13	0	10	9	3	0
9:45 AM	2	6	0	0	0	3	0	0	0	11	7	0	8	1	6	0
10:00 AM	5	4	2	0	0	1	2	0	0	4	6	0	4	4	3	0
10:15 AM	4	5	0	0	1	1	0	0	0	10	7	0	4	6	4	0
10:30 AM	3	9	0	0	0	2	0	0	0	7	6	0	9	2	4	0
10:45 AM	3	6	0	1	0	3	0	0	0	7	3	0	7	3	5	0
11:00 AM	4	6	1	0	1	5	2	0	0	10	8	0	7	2	0	0
11:15 AM	4	8	1	0	0	4	1	0	1	12	6	0	6	12	4	0
11:30 AM	4	11	0	0	1	4	3	0	2	13	11	0	9	7	5	0
11:45 AM	11	8	0	0	0	2	0	0	1	20	11	0	9	7	2	0
12:00 PM	3	21	0	0	1	5	4	0	0	10	9	0	3	5	1	0
12:15 PM	3	7	0	0	1	4	0	0	2	7	8	0	8	2	4	0
12:30 PM	8	16	1	0	0	3	0	0	3	6	11	0	11	4	1	0
12:45 PM	5	7	0	0	0	0	1	0	3	5	10	0	9	10	8	0
1:00 PM	6	8	0	0	1	2	2	0	1	6	6	0	8	4	4	0
1:15 PM	5	6	1	0	0	3	1	0	0	9	7	0	6	9	3	0
1:30 PM	4	5	1	0	0	9	2	0	3	5	9	0	11	4	3	0
1:45 PM	5	6	1	0	1	2	2	0	2	7	8	0	6	8	2	0
2:00 PM	7	8	0	0	0	7	2	0	0	11	11	0	11	13	5	0
2:15 PM	4	15	1	0	0	3	2	0	4	7	8	0	6	7	4	0
2:30 PM	15	9	1	1	0	8	5	0	2	9	11	0	9	15	9	0
2:45 PM	12	13	0	0	0	4	2	0	0	7	15	1	10	11	4	0
3:00 PM	12	18	1	0	1	23	2	0	4	16	10	0	14	8	3	0
3:15 PM	13	16	0	0	0	2	1	0	2	25	37	0	16	9	6	1
3:30 PM	18	18	1	0	0	14	8	0	1	12	14	0	18	12	2	0
3:45 PM	14	11	0	0	0	18	6	0	3	12	11	0	4	14	5	0
4:00 PM	9	9	0	0	1	12	11	0	3	9	15	0	13	9	5	0
4:15 PM	10	18	1	0	0	5	6	0	1	7	8	0	15	4	3	0
4:30 PM	13	10	0	0	0	7	1	0	1	9	19	0	9	8	8	0
4:45 PM	7	12	0	0	0	6	4	0	1	7	2	0	10	8	4	0
5:00 PM	15	19	0	0	0	5	5	0	1	6	13	0	19	7	5	0
5:15 PM	8	16	0	0	1	3	3	0	1	12	4	0	14	6	4	0
5:30 PM	9	13	1	0	0	6	0	0	1	12	10	0	11	9	3	0
5:45 PM	7	2	1	0	0	1	2	0	1	11	8	0	13	4	5	0
6:00 PM	3	9	0	0	0	4	0	0	1	3	4	0	6	3	5	1
6:15 PM	4	5	0	0	0	4	1	0	0	3	2	0	8	8	4	0
6:30 PM	6	6	0	0	0	5	0	0	0	7	10	0	9	7	1	0
6:45 PM	4	8	1	0	0	2	0	0	0	3	4	0	13	4	3	0

Study Name Country Club Dr & Metts Dr
 Start Date 09/15/2021
 Start Time 7:00 AM
 Site Code

Start Time	County Club Dr Westbound			Country Club Dr Northbound			Metts Dr Eastbound		
	Thru	Left	U-Turn	Right	Left	U-Turn	Right	Thru	U-Turn
7:00 AM	22	7	0	18	7	0	5	21	0
7:15 AM	22	3	0	16	10	0	3	11	0
7:30 AM	32	5	0	39	11	0	8	25	0
7:45 AM	42	5	0	51	21	0	9	20	0
8:00 AM	30	14	0	12	15	0	6	11	0
8:15 AM	22	5	0	10	11	0	7	14	0
8:30 AM	14	10	0	8	4	0	4	9	0
8:45 AM	12	1	0	12	6	0	2	9	0
9:00 AM	8	9	0	7	3	0	2	8	0
9:15 AM	10	4	0	7	5	0	8	10	0
9:30 AM	6	2	0	7	4	0	8	19	0
9:45 AM	10	3	0	9	5	1	8	15	0
10:00 AM	21	7	0	8	2	0	2	12	0
10:15 AM	10	6	0	6	6	0	9	16	0
10:30 AM	21	5	0	12	7	0	4	15	0
10:45 AM	23	6	0	8	6	0	5	20	0
11:00 AM	21	7	0	9	11	0	9	24	0
11:15 AM	34	10	0	6	3	0	10	24	0
11:30 AM	13	10	0	6	8	0	16	23	0
11:45 AM	24	6	0	9	11	1	7	16	0
12:00 PM	17	14	0	5	4	0	12	19	0
12:15 PM	18	11	0	5	9	0	8	24	0
12:30 PM	27	14	0	4	8	0	5	24	0
12:45 PM	21	4	0	11	16	0	13	29	0
1:00 PM	25	10	0	15	10	0	9	22	0
1:15 PM	17	6	0	11	7	0	9	15	0
1:30 PM	18	6	0	15	7	0	4	18	0
1:45 PM	22	5	0	7	8	0	9	18	0
2:00 PM	16	7	0	16	15	0	9	17	0
2:15 PM	19	6	0	13	8	0	7	37	0
2:30 PM	36	18	0	9	10	0	22	43	0
2:45 PM	39	17	0	10	6	0	9	38	0
3:00 PM	27	11	0	11	10	0	8	50	0
3:15 PM	27	35	0	14	11	0	15	38	0
3:30 PM	32	15	0	14	8	0	16	50	0
3:45 PM	30	20	0	22	10	1	18	38	0
4:00 PM	28	21	0	17	11	1	23	46	0
4:15 PM	28	14	0	14	9	0	16	32	0
4:30 PM	19	25	0	10	6	0	20	38	0
4:45 PM	17	15	0	13	9	0	16	37	0
5:00 PM	22	20	0	9	8	0	19	48	0
5:15 PM	15	25	0	14	15	0	16	36	0
5:30 PM	28	16	0	13	9	0	14	19	0
5:45 PM	19	10	0	20	16	0	14	20	0
6:00 PM	13	15	0	14	6	0	15	20	0
6:15 PM	16	7	0	9	10	0	9	26	0
6:30 PM	16	12	0	8	10	0	7	20	0
6:45 PM	17	7	0	6	8	0	12	15	0

Study Name KY 49 & Country Club Dr
 Start Date 09/15/2021
 Start Time 7:00 AM
 Site Code

Start Time	KY 49 Southbound			KY 49 Northbound			Country Club Dr Eastbound		
	Right	Thru	U-Turn	Thru	Left	U-Turn	Right	Left	U-Turn
7:00 AM	10	0	0	12	8	0	4	38	1
7:15 AM	15	5	0	17	10	0	2	25	0
7:30 AM	19	9	0	27	14	0	5	55	0
7:45 AM	38	9	0	25	10	0	5	81	0
8:00 AM	36	8	0	14	8	0	5	20	0
8:15 AM	18	6	0	18	7	0	6	25	0
8:30 AM	22	6	0	14	5	0	2	17	0
8:45 AM	11	9	0	15	3	0	5	21	0
9:00 AM	14	8	0	11	3	0	2	8	0
9:15 AM	11	5	0	9	2	0	4	20	0
9:30 AM	6	6	0	10	1	0	6	21	0
9:45 AM	16	11	0	8	4	0	7	17	0
10:00 AM	21	12	0	8	8	0	4	16	0
10:15 AM	14	2	0	9	6	0	3	16	0
10:30 AM	23	9	0	13	6	0	7	25	0
10:45 AM	21	14	0	10	4	0	6	23	0
11:00 AM	21	8	0	7	12	0	8	25	0
11:15 AM	35	6	0	8	6	0	8	22	0
11:30 AM	22	10	0	5	8	0	9	23	0
11:45 AM	25	8	0	7	4	0	2	21	0
12:00 PM	31	11	0	9	3	0	7	21	0
12:15 PM	23	15	0	11	8	0	8	20	0
12:30 PM	28	13	0	11	10	0	7	23	0
12:45 PM	25	7	0	12	4	0	6	32	0
1:00 PM	23	9	0	15	7	0	6	33	0
1:15 PM	15	10	0	8	6	0	6	27	0
1:30 PM	18	7	0	7	4	0	10	24	0
1:45 PM	23	5	0	12	4	0	7	21	0
2:00 PM	28	4	0	13	4	0	7	25	0
2:15 PM	18	5	0	11	5	0	6	39	0
2:30 PM	45	28	0	20	14	0	15	36	0
2:45 PM	51	11	0	14	7	0	10	38	0
3:00 PM	23	14	0	10	13	0	8	49	0
3:15 PM	58	16	0	7	8	0	19	31	0
3:30 PM	37	13	0	11	10	0	19	40	0
3:45 PM	45	16	0	14	8	0	14	41	0
4:00 PM	46	22	0	10	5	0	14	48	0
4:15 PM	37	19	0	5	8	0	11	31	0
4:30 PM	31	32	0	15	7	0	15	26	0
4:45 PM	39	22	0	11	4	0	11	37	0
5:00 PM	36	26	0	14	9	0	17	39	0
5:15 PM	42	27	0	5	8	0	19	28	0
5:30 PM	36	10	0	7	9	0	11	22	0
5:45 PM	23	13	0	6	7	0	13	24	0
6:00 PM	19	13	0	10	11	0	3	25	0
6:15 PM	18	8	0	14	6	0	17	22	0
6:30 PM	22	15	0	6	7	0	14	13	0
6:45 PM	18	5	0	13	7	0	5	16	0

Study Name KY 52 & Corporate Dr
 Start Date 09/15/2021
 Start Time 7:00 AM
 Site Code

Start Time	Corporate Dr Southbound				KY 52 Westbound				Sulpher Springs Rd Northbound				KY 52 Eastbound			
	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn
7:00 AM	5	0	5	0	13	29	0	0	3	1	0	0	4	17	9	0
7:15 AM	4	2	18	0	19	51	2	0	4	0	0	1	1	50	15	0
7:30 AM	17	4	46	0	51	65	2	0	4	6	0	0	3	79	45	1
7:45 AM	17	4	75	0	50	111	7	0	7	3	2	0	3	86	26	0
8:00 AM	26	4	47	0	32	113	5	0	5	2	2	0	2	84	42	0
8:15 AM	16	2	10	0	17	52	1	0	2	0	4	0	3	26	14	0
8:30 AM	15	1	11	0	12	36	5	0	3	2	2	0	6	31	14	0
8:45 AM	17	1	18	0	17	35	7	0	5	1	4	0	5	35	12	0
9:00 AM	18	3	8	0	3	33	2	0	4	4	1	0	4	29	15	0
9:15 AM	17	2	6	0	14	30	0	0	2	3	4	0	4	26	20	1
9:30 AM	11	4	5	0	17	36	2	0	6	3	1	0	3	27	13	1
9:45 AM	13	1	12	0	5	41	1	0	0	2	2	0	3	49	12	0
10:00 AM	17	5	10	0	10	40	1	0	1	0	6	0	3	29	12	0
10:15 AM	16	2	9	0	17	44	4	1	2	1	0	0	3	41	11	0
10:30 AM	11	3	8	0	11	57	1	0	2	0	1	0	3	51	19	0
10:45 AM	25	6	10	0	9	37	1	0	6	3	4	0	5	31	11	0
11:00 AM	22	2	8	0	6	45	5	0	5	4	4	0	5	42	9	0
11:15 AM	14	3	11	0	8	36	3	0	1	2	8	0	8	46	5	0
11:30 AM	20	1	7	0	8	31	3	0	3	3	3	0	5	48	11	0
11:45 AM	13	0	11	0	10	31	1	0	4	3	7	0	3	32	11	0
12:00 PM	21	1	19	0	7	34	2	0	3	0	4	0	3	58	13	0
12:15 PM	17	2	12	0	23	72	2	0	3	1	4	0	2	41	14	0
12:30 PM	14	2	13	0	12	47	1	0	2	2	6	0	4	48	16	0
12:45 PM	12	3	8	0	15	51	0	0	2	2	3	0	4	42	17	0
1:00 PM	16	1	12	0	15	38	1	0	1	1	4	0	0	46	9	0
1:15 PM	17	3	7	0	23	53	3	0	0	1	3	0	4	49	17	0
1:30 PM	17	2	8	0	22	43	2	0	2	1	2	0	8	48	9	0
1:45 PM	24	2	13	0	14	61	4	0	2	1	3	0	5	48	9	0
2:00 PM	11	7	18	0	12	42	3	0	4	4	3	1	3	60	19	1
2:15 PM	17	2	15	0	25	51	2	0	3	1	5	0	4	63	11	0
2:30 PM	35	4	36	0	17	65	2	0	9	2	4	0	4	98	20	1
2:45 PM	20	3	28	0	15	53	5	0	4	4	4	0	3	86	25	2
3:00 PM	45	2	21	0	34	87	5	0	2	2	6	0	7	63	18	1
3:15 PM	40	1	20	0	55	113	3	0	4	8	2	0	5	67	18	0
3:30 PM	31	3	26	0	25	70	3	0	3	5	6	0	6	67	14	0
3:45 PM	17	3	20	0	17	89	6	0	3	3	6	0	6	86	11	0
4:00 PM	19	6	15	0	28	58	4	0	6	4	9	0	4	77	12	0
4:15 PM	16	6	19	0	16	77	5	0	3	3	6	0	6	75	10	0
4:30 PM	23	3	25	0	30	74	1	0	7	2	9	0	7	78	9	0
4:45 PM	18	4	16	0	20	68	6	0	3	5	9	0	5	72	14	0
5:00 PM	22	4	21	0	11	45	1	0	4	1	2	0	8	104	17	1
5:15 PM	24	2	15	0	17	52	0	0	5	4	6	0	3	75	22	0
5:30 PM	16	4	16	0	11	59	1	0	4	1	3	0	4	70	12	0
5:45 PM	15	1	15	0	10	55	5	0	3	3	3	0	3	64	6	0
6:00 PM	11	1	17	0	14	50	3	0	3	1	3	0	0	67	9	0
6:15 PM	13	1	19	0	12	34	1	0	4	0	1	0	7	70	8	0
6:30 PM	14	0	12	0	8	34	4	0	5	2	5	0	4	45	10	0
6:45 PM	11	3	9	0	8	44	1	0	4	4	2	0	4	43	10	0

Study Name KY 52 & Short Line Rd

Start Date 09/15/2021

Start Time 7:00 AM

Site Code

Start Time	Short Line Rd Southbound			KY 52 Westbound			KY 52 Eastbound		
	Right	Left	U-Turn	Right	Thru	U-Turn	Thru	Left	U-Turn
7:00 AM	4	0	0	1	49	0	12	1	0
7:15 AM	8	0	1	2	56	0	30	3	0
7:30 AM	12	2	0	1	79	0	23	1	0
7:45 AM	11	0	0	0	106	0	30	3	0
8:00 AM	5	1	0	0	45	0	33	6	0
8:15 AM	6	1	0	0	34	0	26	2	0
8:30 AM	2	0	1	0	29	0	19	1	0
8:45 AM	7	0	0	1	28	0	16	1	0
9:00 AM	4	0	0	0	11	0	24	4	0
9:15 AM	1	1	0	0	34	0	17	2	0
9:30 AM	5	0	0	0	30	0	17	4	0
9:45 AM	4	0	0	0	15	0	22	1	0
10:00 AM	2	0	0	0	29	0	21	5	0
10:15 AM	4	1	0	0	30	0	26	4	0
10:30 AM	4	1	1	0	22	0	27	3	0
10:45 AM	3	0	0	0	22	0	18	3	0
11:00 AM	0	2	0	0	28	0	27	2	0
11:15 AM	1	0	0	0	26	0	23	2	0
11:30 AM	4	0	0	0	22	0	26	2	0
11:45 AM	3	1	0	1	23	0	24	6	0
12:00 PM	2	1	0	0	22	0	34	3	0
12:15 PM	1	0	0	0	25	0	29	9	0
12:30 PM	8	0	0	0	24	0	27	3	0
12:45 PM	5	0	0	2	36	0	32	8	0
1:00 PM	6	0	0	0	27	0	33	8	0
1:15 PM	7	0	0	0	39	0	20	0	0
1:30 PM	8	0	0	1	30	0	26	9	0
1:45 PM	5	0	0	0	36	0	22	7	0
2:00 PM	7	0	0	0	29	0	35	3	0
2:15 PM	9	0	0	1	32	0	30	6	0
2:30 PM	6	0	0	0	38	0	40	8	0
2:45 PM	6	0	0	0	33	0	36	4	0
3:00 PM	4	0	0	2	26	0	43	11	0
3:15 PM	5	1	0	2	30	0	54	11	0
3:30 PM	4	0	0	0	30	0	68	10	0
3:45 PM	4	0	0	1	27	0	56	13	0
4:00 PM	7	0	0	1	41	0	54	10	0
4:15 PM	4	1	0	1	44	0	56	9	0
4:30 PM	5	2	0	2	43	0	67	12	0
4:45 PM	4	0	0	1	44	0	63	4	0
5:00 PM	3	0	0	0	33	0	63	13	0
5:15 PM	4	0	0	2	33	0	68	8	0
5:30 PM	4	1	0	0	34	0	55	9	0
5:45 PM	8	1	0	0	35	0	41	6	0
6:00 PM	11	0	0	0	39	0	41	9	0
6:15 PM	5	1	0	2	27	0	37	14	0
6:30 PM	4	1	0	1	31	0	35	6	0
6:45 PM	7	0	0	3	34	0	30	13	0

Study Name KY 2154 & N Spaulding Ave
 Start Date 09/15/2021
 Start Time 7:00 AM
 Site Code

Start Time	KY 2154 Southbound			KY 2154 Westbound			N Spaulding Ave Northbound		
	Thru	Left	U-Turn	Right	Left	U-Turn	Right	Thru	U-Turn
7:00 AM	17	18	0	20	1	0	11	41	0
7:15 AM	26	49	0	27	4	0	15	40	0
7:30 AM	34	93	0	41	7	0	33	55	0
7:45 AM	72	122	0	71	12	0	38	45	0
8:00 AM	51	69	0	62	29	0	14	36	0
8:15 AM	30	19	0	20	6	0	6	31	0
8:30 AM	38	19	0	12	4	0	8	38	0
8:45 AM	33	28	0	22	7	0	6	25	0
9:00 AM	34	18	0	13	7	0	10	29	0
9:15 AM	32	24	0	18	2	0	6	33	1
9:30 AM	28	17	0	23	4	0	6	40	1
9:45 AM	36	22	0	27	6	0	7	32	0
10:00 AM	41	21	0	19	5	0	3	38	0
10:15 AM	30	15	0	25	4	0	9	37	0
10:30 AM	48	21	0	23	7	0	6	34	0
10:45 AM	46	18	0	23	9	0	13	29	0
11:00 AM	38	21	0	15	8	0	2	40	0
11:15 AM	40	17	0	22	3	0	7	32	0
11:30 AM	46	20	0	25	3	0	2	35	0
11:45 AM	44	24	0	25	7	0	14	35	0
12:00 PM	56	20	0	26	10	0	10	40	0
12:15 PM	52	20	0	30	15	0	6	39	0
12:30 PM	32	25	0	25	8	0	10	56	0
12:45 PM	43	34	0	25	5	0	9	42	0
1:00 PM	32	28	0	20	6	0	6	40	0
1:15 PM	30	32	0	34	8	0	10	46	0
1:30 PM	49	35	0	39	5	0	12	36	0
1:45 PM	41	29	0	38	6	0	13	44	0
2:00 PM	53	25	0	38	12	0	11	57	0
2:15 PM	42	20	0	43	7	0	19	58	0
2:30 PM	62	36	0	73	18	0	24	59	1
2:45 PM	58	44	0	41	18	0	16	48	0
3:00 PM	44	26	0	47	20	0	11	61	1
3:15 PM	41	31	0	96	22	0	10	45	0
3:30 PM	59	28	0	87	19	0	11	42	0
3:45 PM	47	36	0	40	8	0	7	51	0
4:00 PM	54	32	0	54	13	0	7	57	0
4:15 PM	54	35	0	39	6	0	16	61	0
4:30 PM	60	32	0	46	17	0	14	67	0
4:45 PM	67	31	0	35	10	0	12	50	0
5:00 PM	59	31	0	62	12	0	17	60	1
5:15 PM	59	38	0	62	11	0	6	44	0
5:30 PM	43	27	0	39	3	0	3	51	0
5:45 PM	45	33	0	30	12	0	9	33	0
6:00 PM	27	21	0	30	6	0	8	31	0
6:15 PM	41	23	0	22	6	0	11	36	0
6:30 PM	28	20	0	13	11	0	6	23	0
6:45 PM	30	14	0	20	8	0	7	18	0

Appendix B

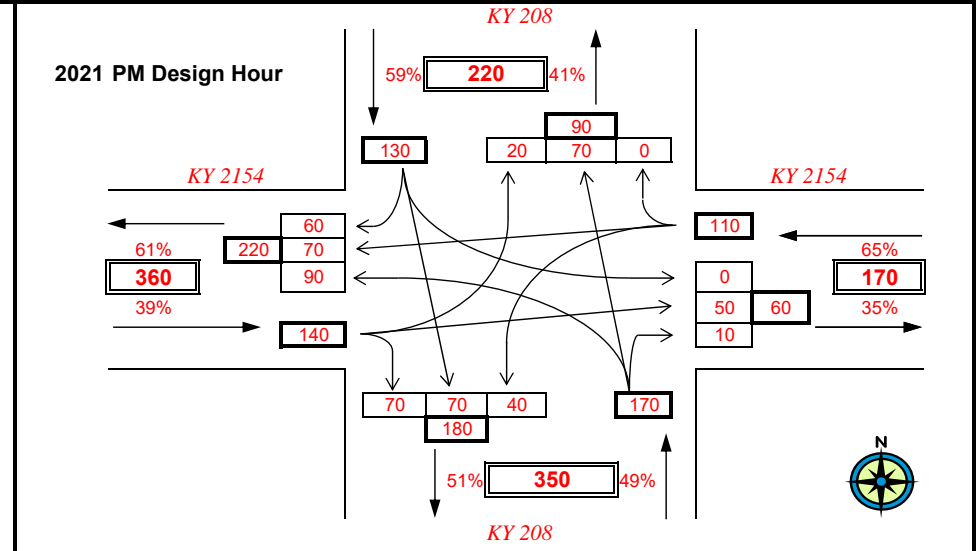
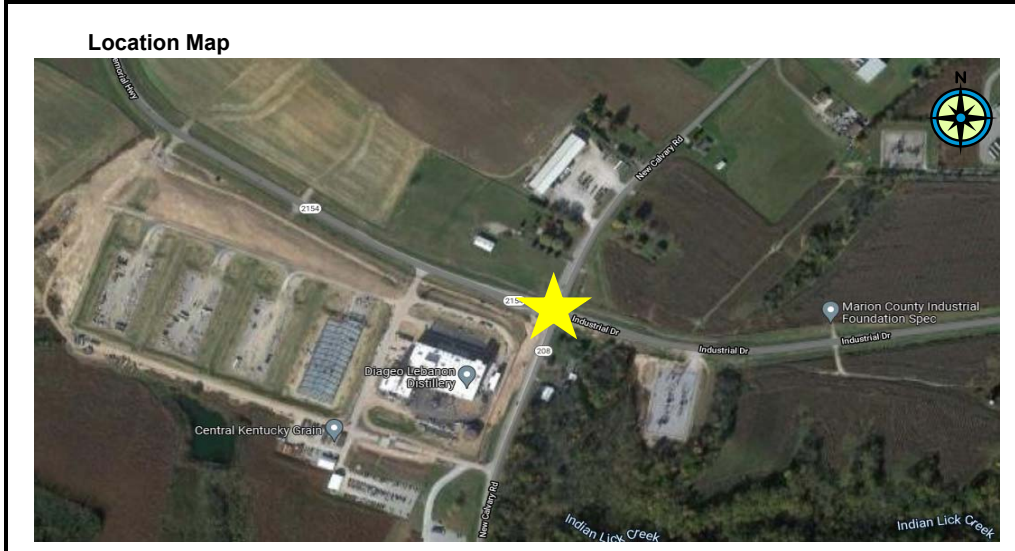
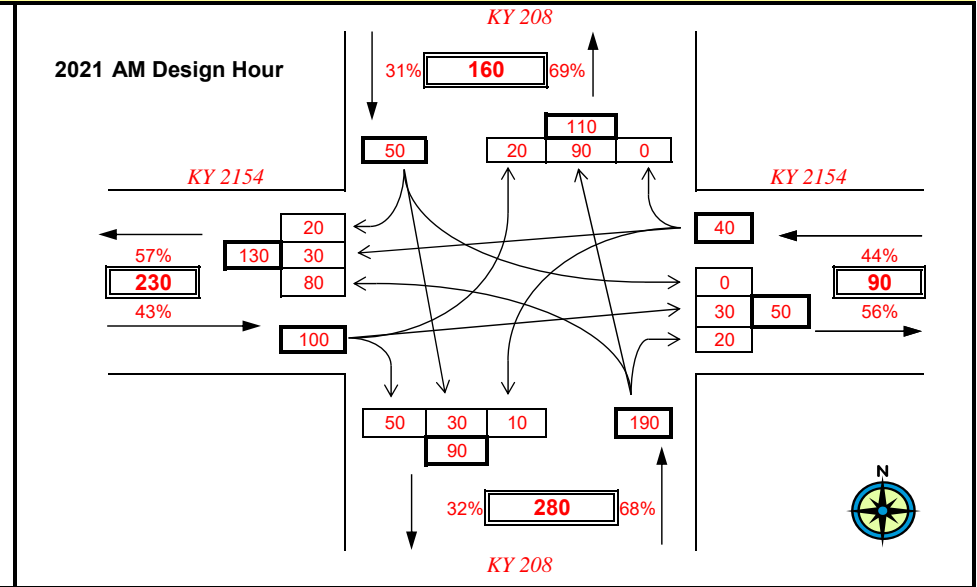
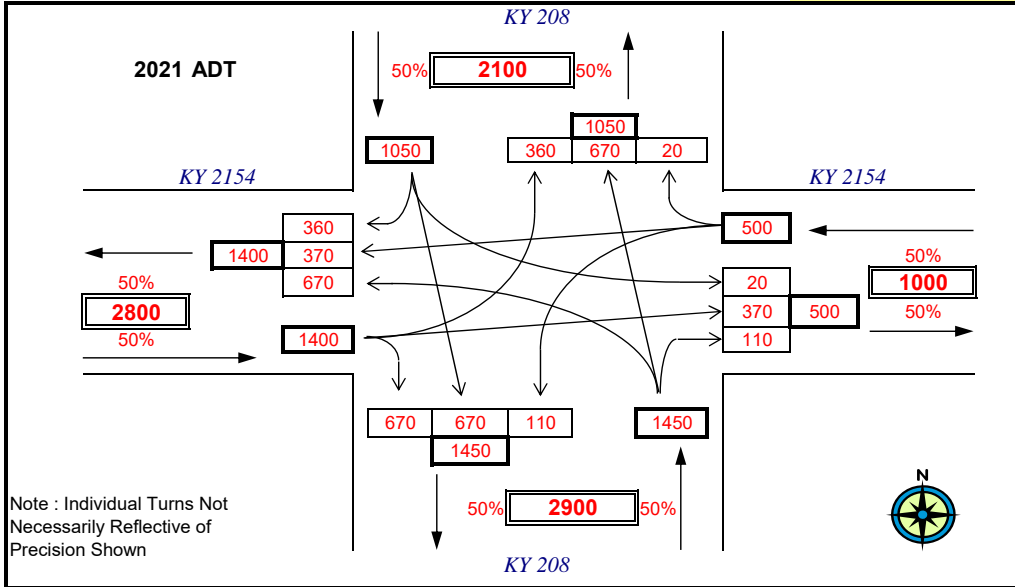
2021 Forecasts

PROJECT: Lebanon Bypass
 ITEM NUMBER: 0
 MARS NUMBER: 0
 REQUEST DATE: Tuesday, January 11, 2022
 ANALYST: ST
 YEAR: 2021 ADT and Design Hour Volumes
 INTERSECTION: KY 2154 & KY 208

NOTE: K-Factors, Directional Distributions, and Peak Hour Factors were determined from a 2021 Turning Movement Count. AM and PM DHVs represent 30th highest hour estimates for each turn maneuver.

TURN MOVEMENT (2021)

****DHV TURN MOVEMENT FORECASTS SHOULD NOT BE USED FOR SIGNAL TIMING OR WARRANT ANALYSIS**

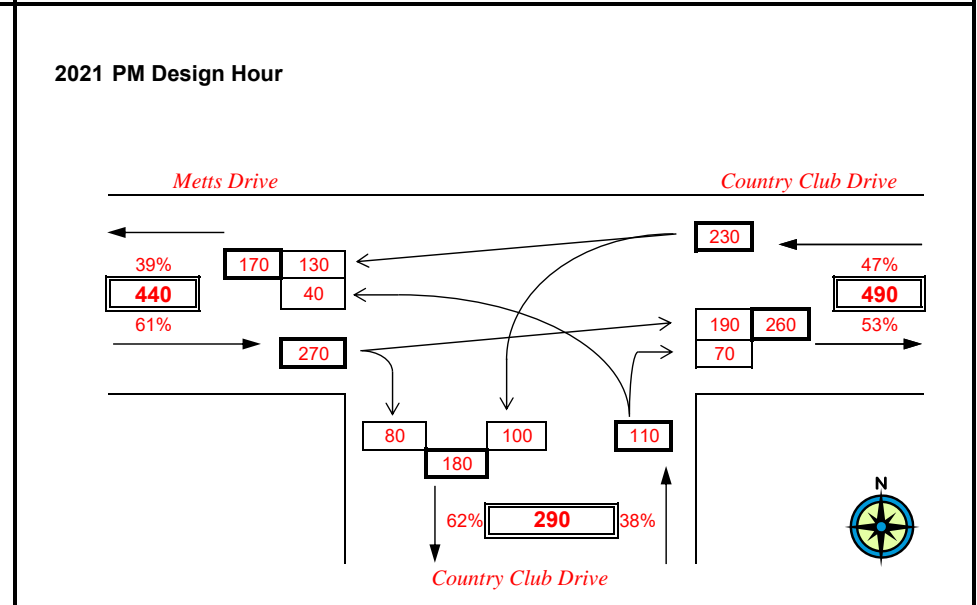
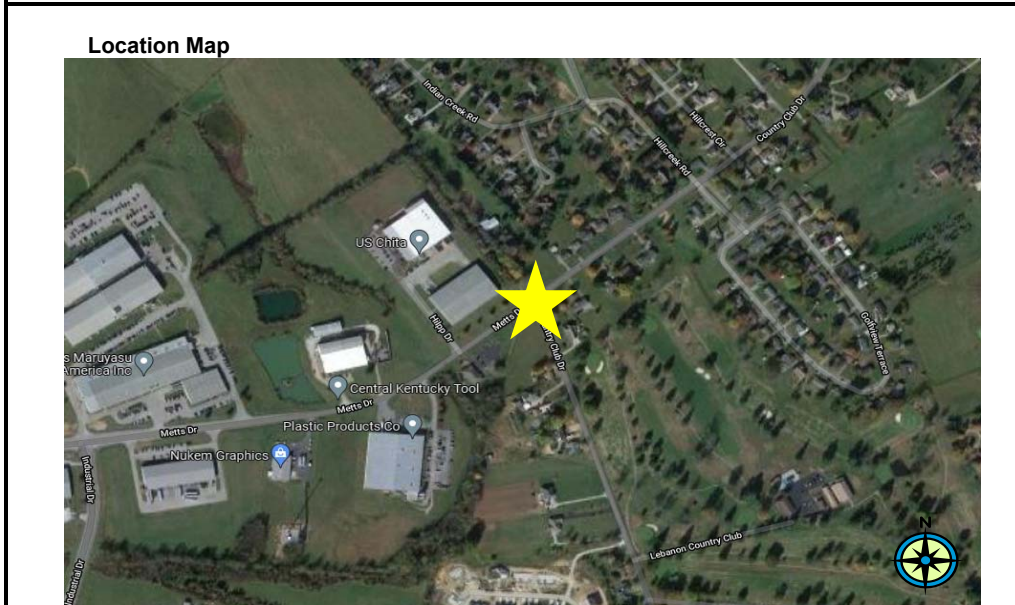
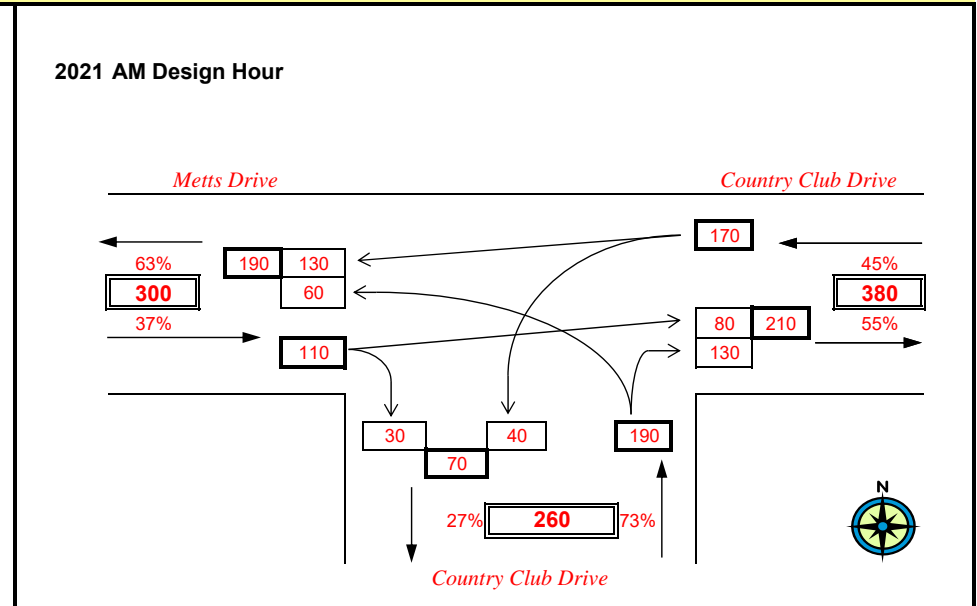
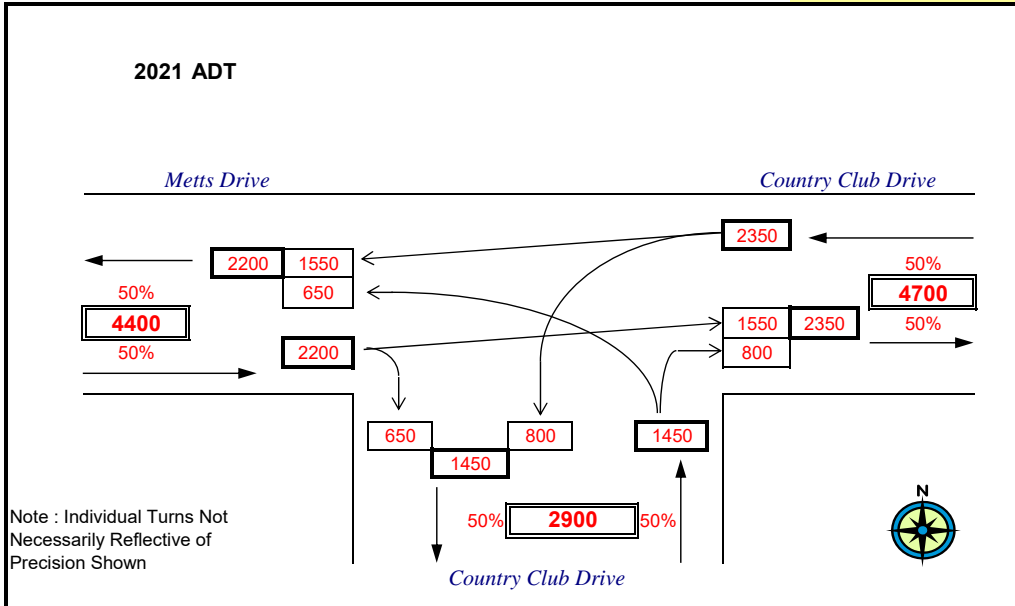


PROJECT: Lebanon Bypass
 ITEM NUMBER: 0
 MARS NUMBER: 0
 REQUEST DATE: Tuesday, January 11, 2022
 ANALYST: ST
 YEAR: 2021 ADT and Design Hour Volumes
 INTERSECTION: Country Club Drive & Metts Drive

NOTE: K-Factors, Directional Distributions, and Peak Hour Factors were determined from a 2021 Turning Movement Count. AM and PM DHVs represent 30th highest hour estimates for each turn maneuver.

TURN MOVEMENT (2021)

****DHV TURN MOVEMENT FORECASTS SHOULD NOT BE USED FOR SIGNAL TIMING OR WARRANT ANALYSIS**

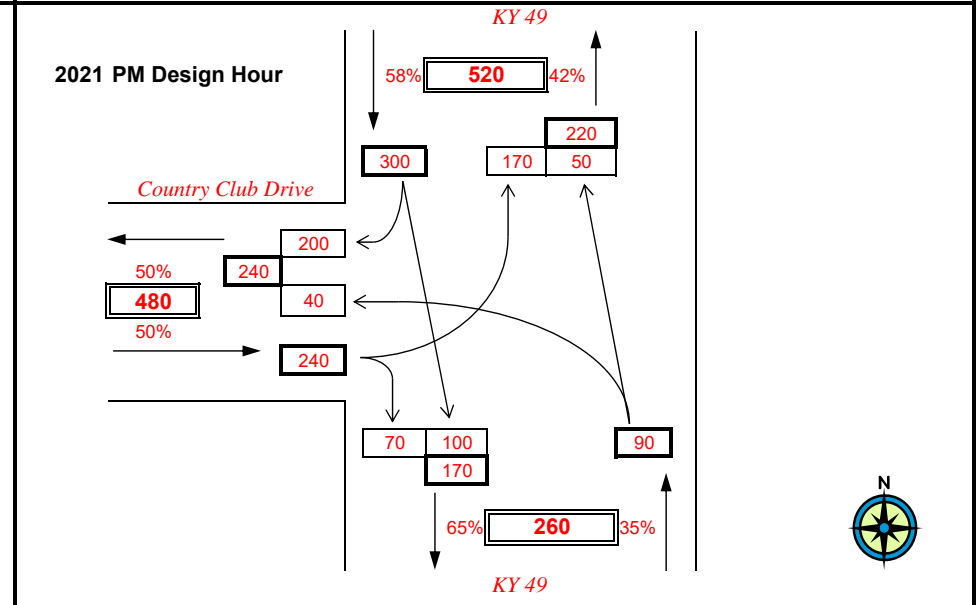
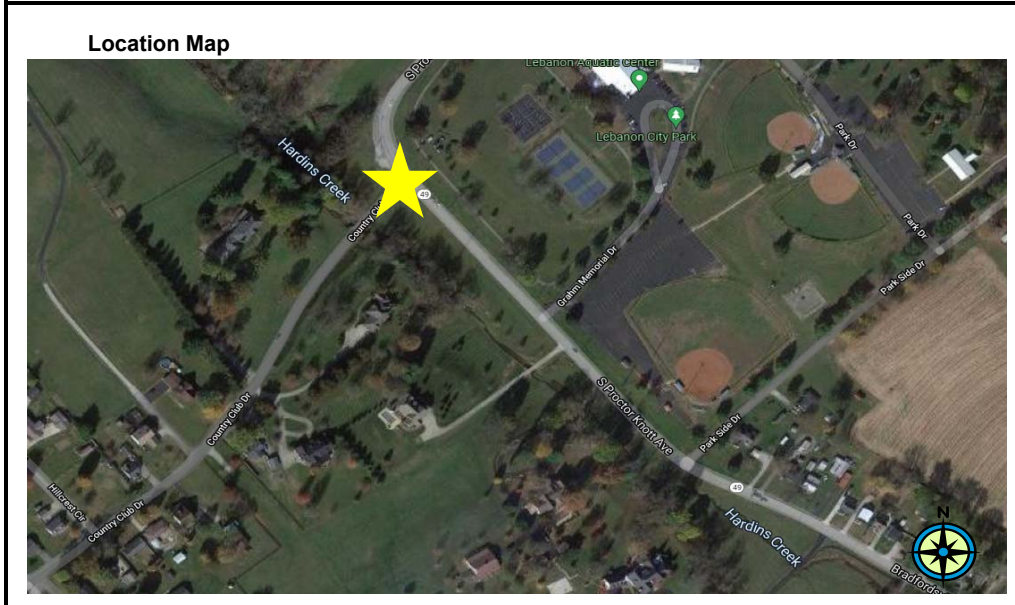
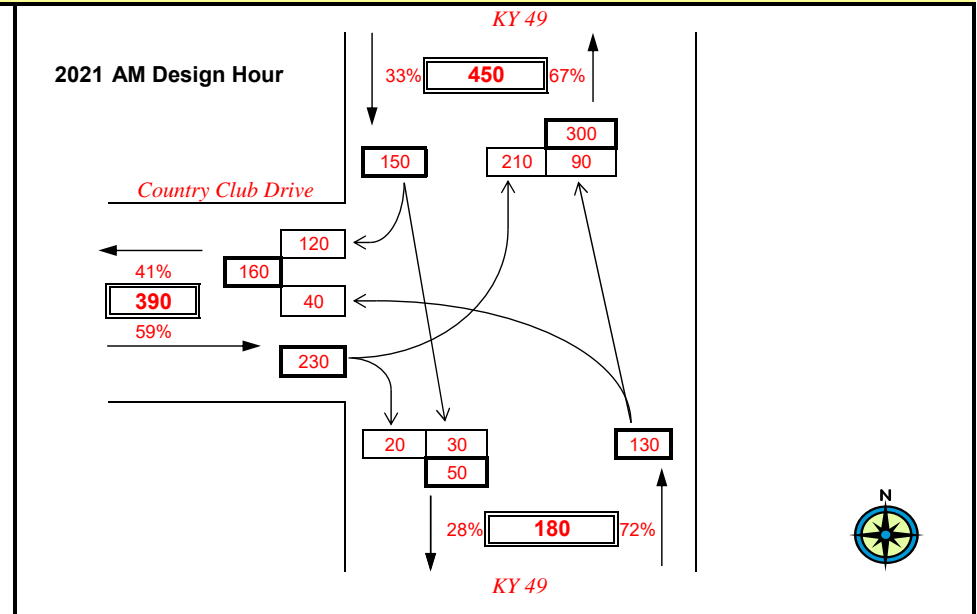
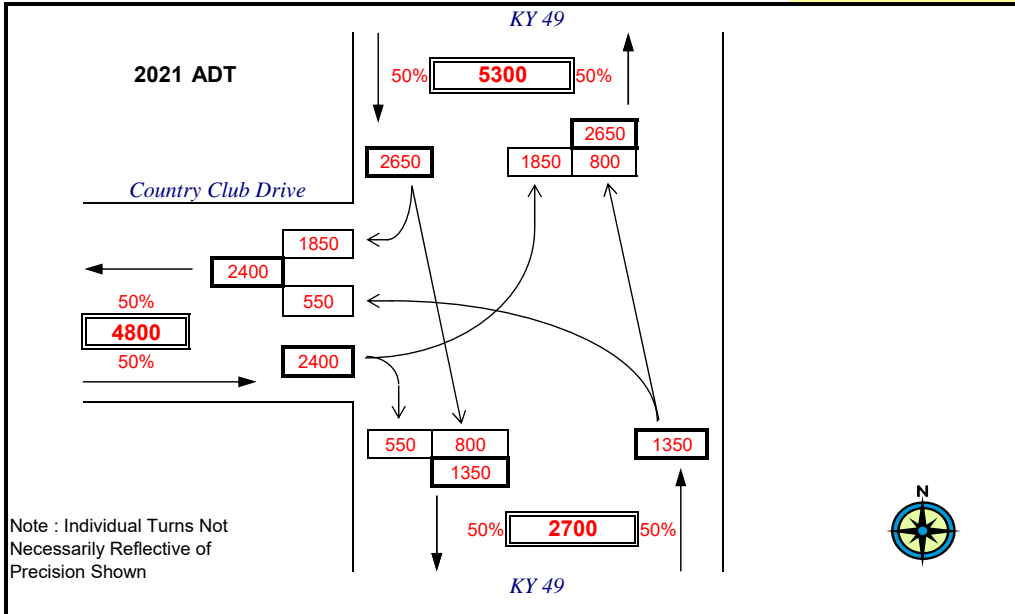


PROJECT: Lebanon Bypass
 ITEM NUMBER: 0
 MARS NUMBER: 0
 REQUEST DATE: Tuesday, January 11, 2022
 ANALYST: ST
 YEAR: 2021 ADT and Design Hour Volumes
 INTERSECTION: KY 49 & Country Club Drive

NOTE: K-Factors, Directional Distributions, and Peak Hour Factors were determined from a 2021 Turning Movement Count. AM and PM DHVs represent 30th highest hour estimates for each turn maneuver.

TURN MOVEMENT (2021)

****DHV TURN MOVEMENT FORECASTS SHOULD NOT BE USED FOR SIGNAL TIMING OR WARRANT ANALYSIS**

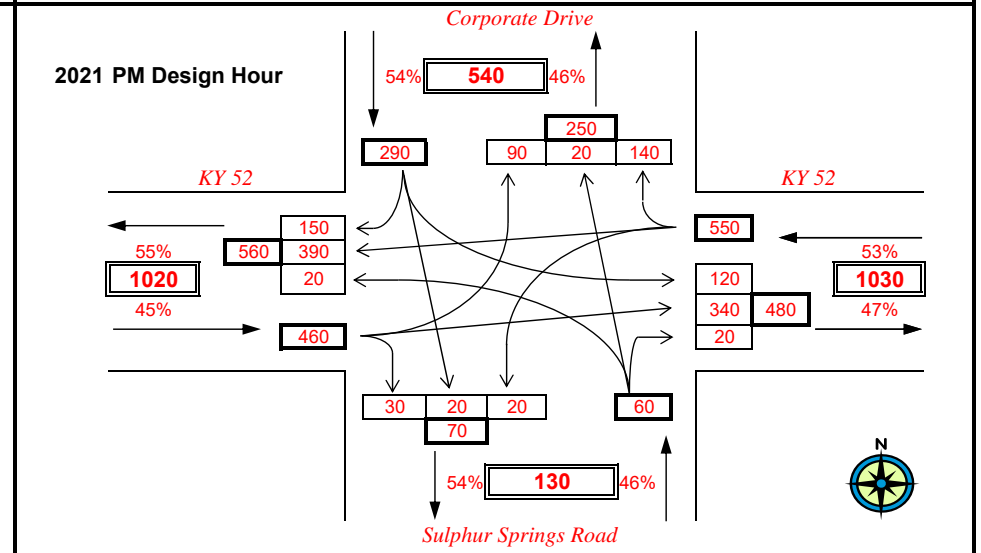
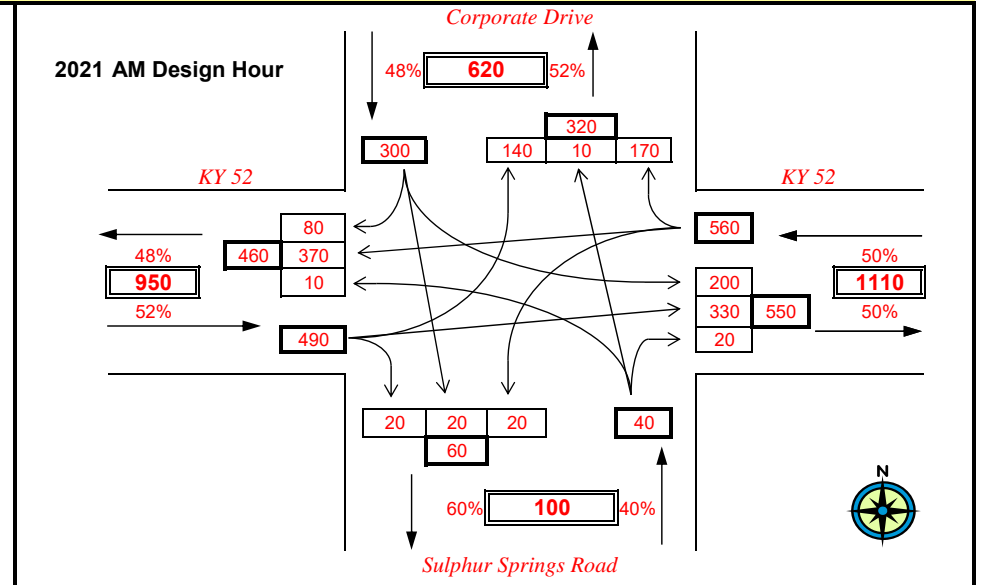
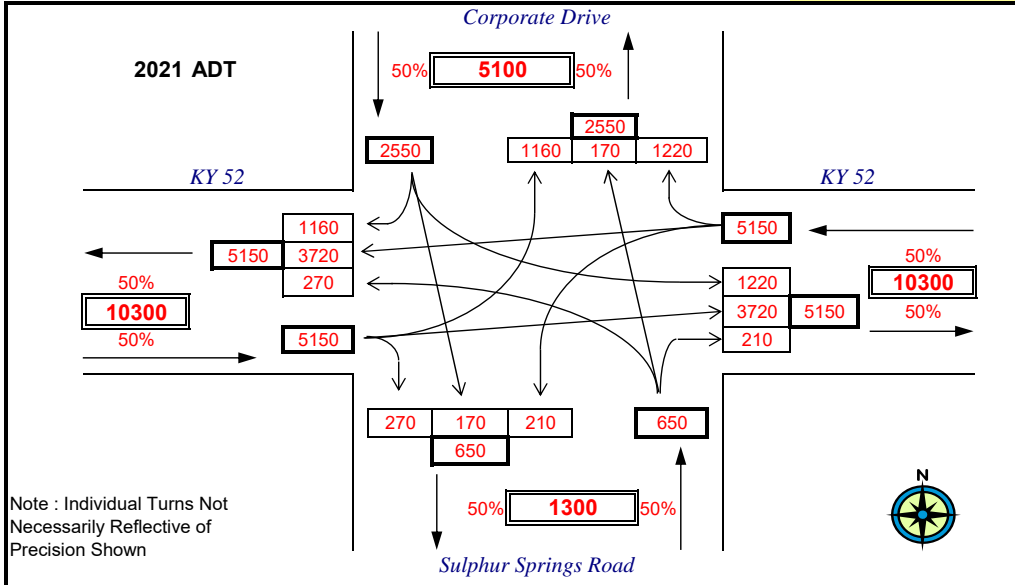


PROJECT: Lebanon Bypass
 ITEM NUMBER: 0
 MARS NUMBER: 0
 REQUEST DATE: Tuesday, January 11, 2022
 ANALYST: ST
 YEAR: 2021 ADT and Design Hour Volumes
 INTERSECTION: KY 52 & Corporate Drive

NOTE: K-Factors, Directional Distributions, and Peak Hour Factors were determined from a 2021 Turning Movement Count. AM and PM DHVs represent 30th highest hour estimates for each turn maneuver.

TURN MOVEMENT (2021)

****DHV TURN MOVEMENT FORECASTS SHOULD NOT BE USED FOR SIGNAL TIMING OR WARRANT ANALYSIS**

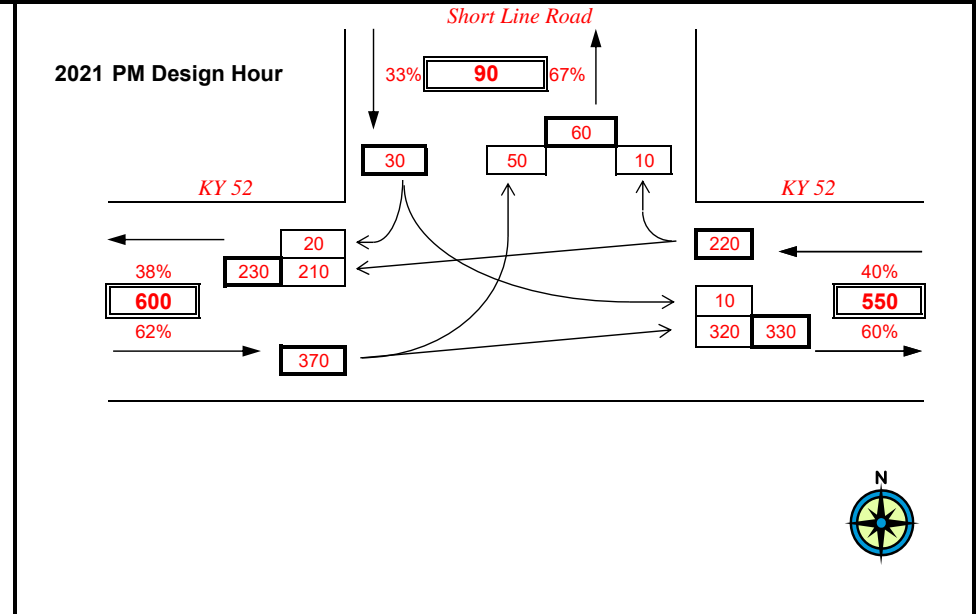
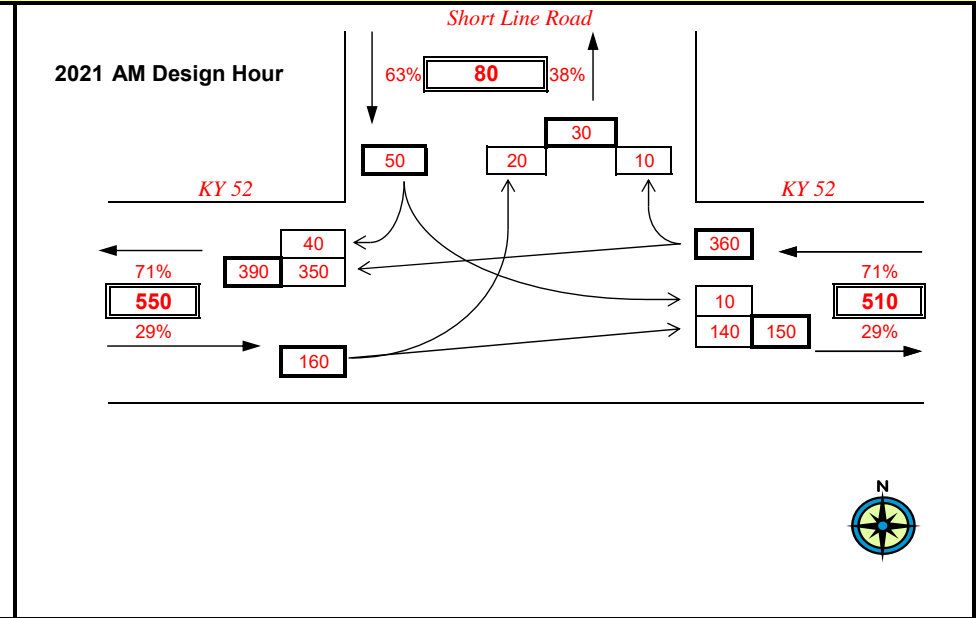
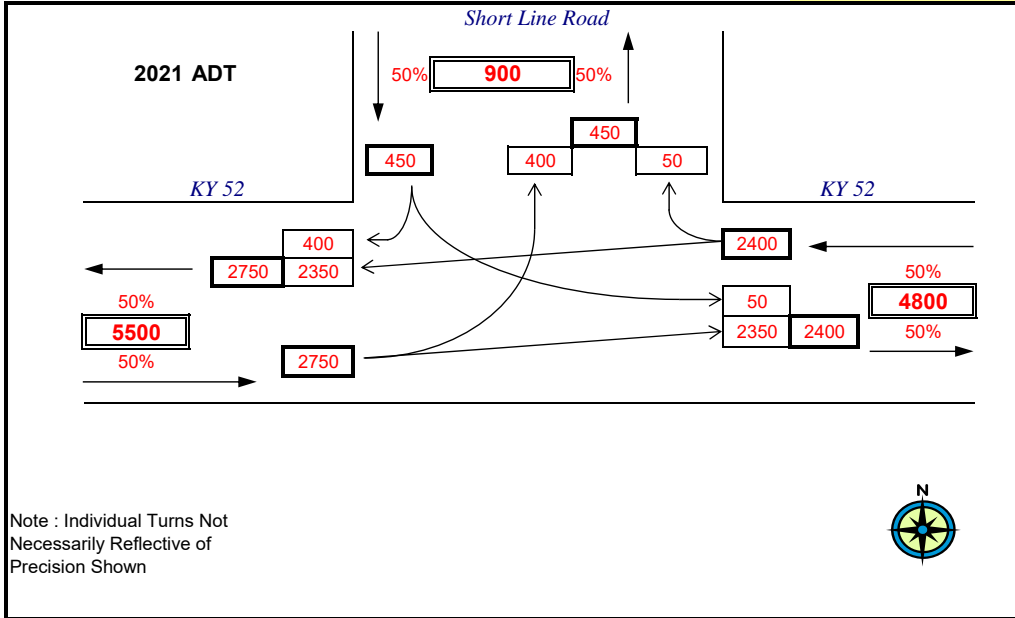


PROJECT: Lebanon Bypass
 ITEM NUMBER: 0
 MARS NUMBER: 0
 REQUEST DATE: Tuesday, January 11, 2022
 ANALYST: ST
 YEAR: 2021 ADT and Design Hour Volumes
 INTERSECTION: KY 52 & Short Line Road

NOTE: K-Factors, Directional Distributions, and Peak Hour Factors were determined from a 2021 Turning Movement Count. AM and PM DHVs represent 30th highest hour estimates for each turn maneuver.

TURN MOVEMENT (2021)

****DHV TURN MOVEMENT FORECASTS SHOULD NOT BE USED FOR SIGNAL TIMING OR WARRANT ANALYSIS**

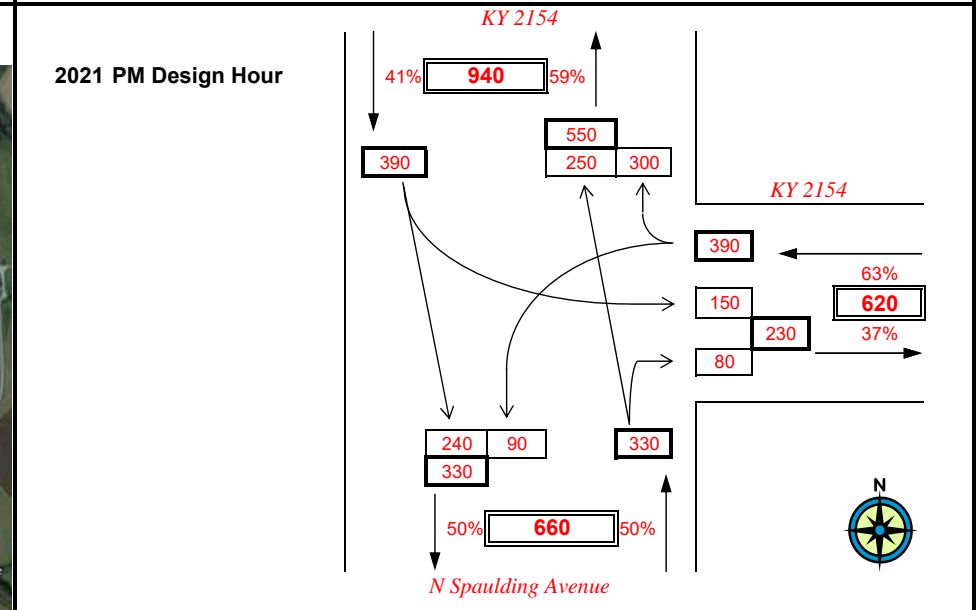
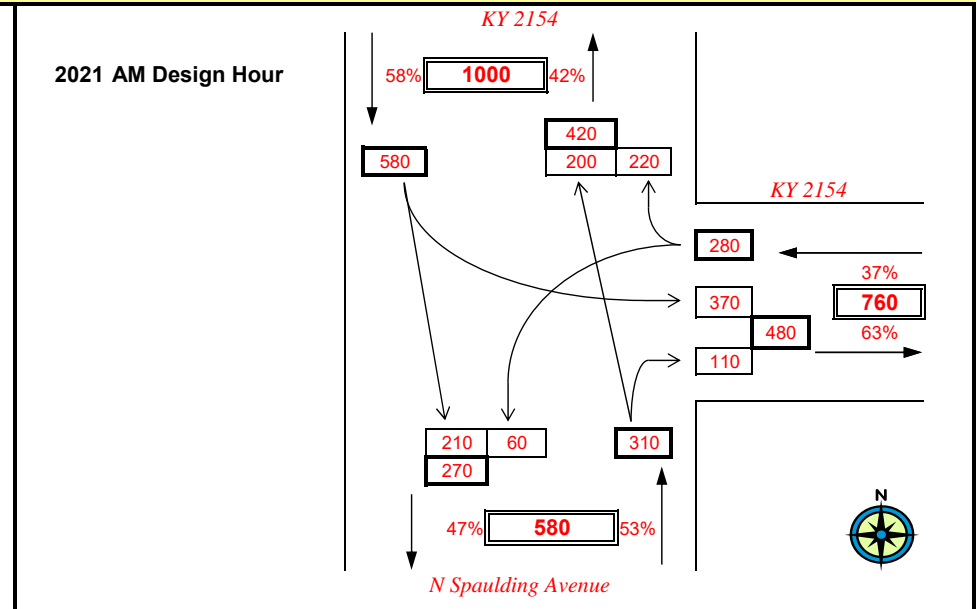
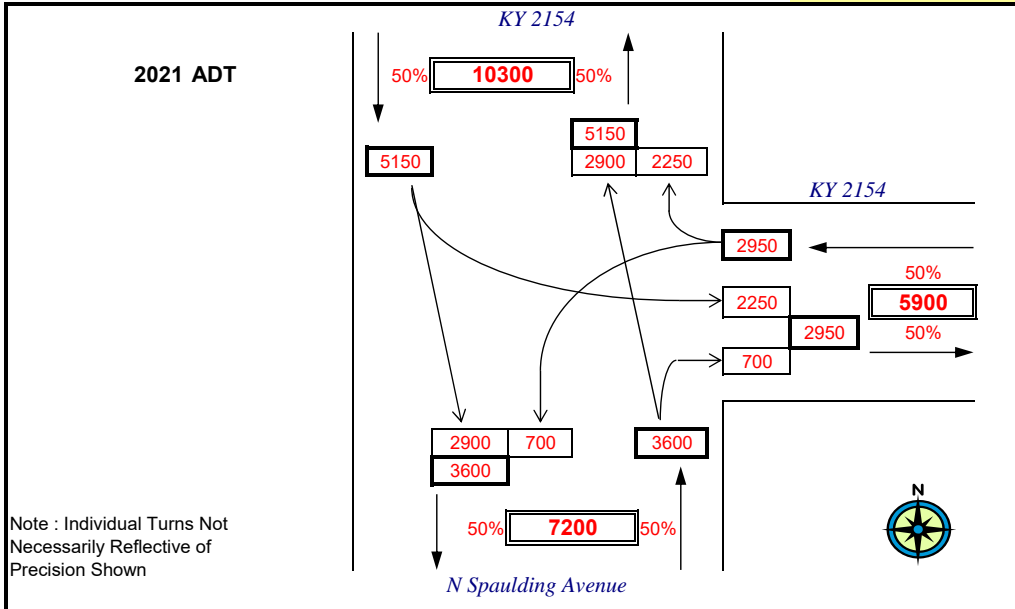


PROJECT: Lebanon Bypass
 ITEM NUMBER: 0
 MARS NUMBER: 0
 REQUEST DATE: Tuesday, January 11, 2022
 ANALYST: ST
 YEAR: 2021 **ADT and Design Hour Volumes**
 INTERSECTION: KY 2154 & N Spaulding Avenue

NOTE: K-Factors, Directional Distributions, and Peak Hour Factors were determined from a 2021 Turning Movement Count. AM and PM DHVs represent 30th highest hour estimates for each turn maneuver.

TURN MOVEMENT (2021)

****DHV TURN MOVEMENT FORECASTS SHOULD NOT BE USED FOR SIGNAL TIMING OR WARRANT ANALYSIS**



Appendix C

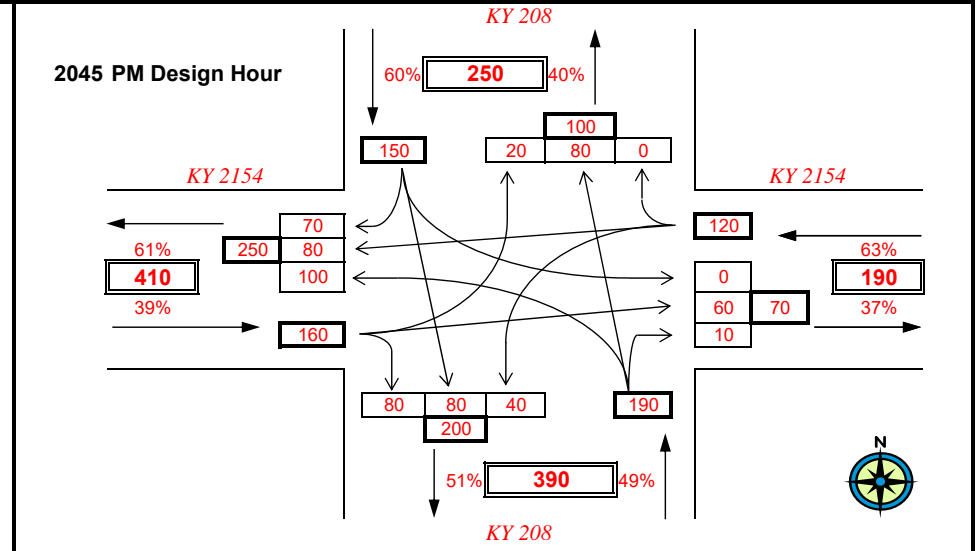
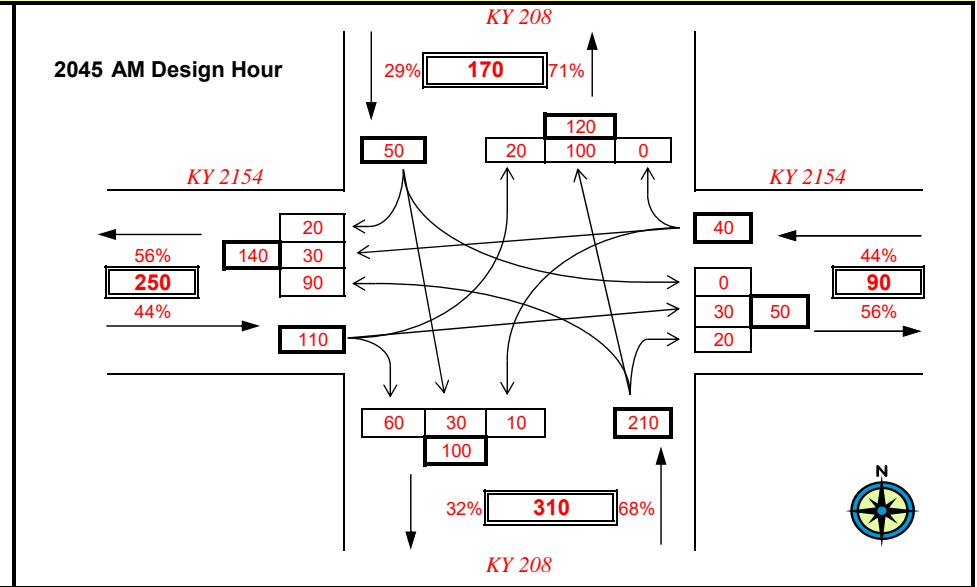
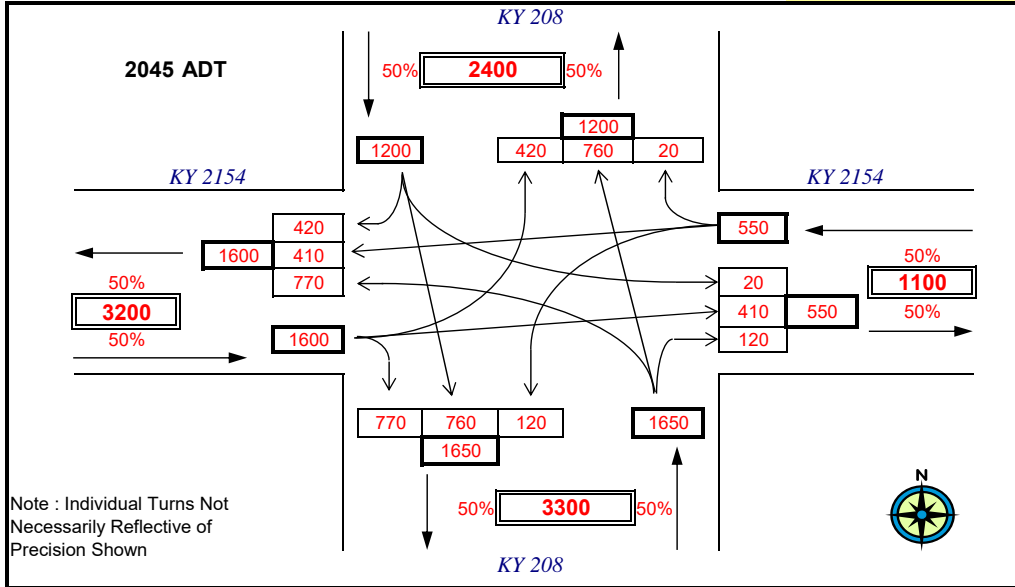
2045 No-Build Forecasts

PROJECT: Lebanon Bypass
 ITEM NUMBER: 0
 MARS NUMBER: 0
 REQUEST DATE: Tuesday, January 11, 2022
 ANALYST: ST
 YEAR: 2045 ADT and Design Hour Volumes
 INTERSECTION: KY 2154 & KY 208

NOTE: K-Factors, Directional Distributions, and Peak Hour Factors were determined from a 2045 Turning Movement Count. AM and PM DHVs represent 30th highest hour estimates for each turn maneuver.

TURN MOVEMENT (2045)

****DHV TURN MOVEMENT FORECASTS SHOULD NOT BE USED FOR SIGNAL TIMING OR WARRANT ANALYSIS**

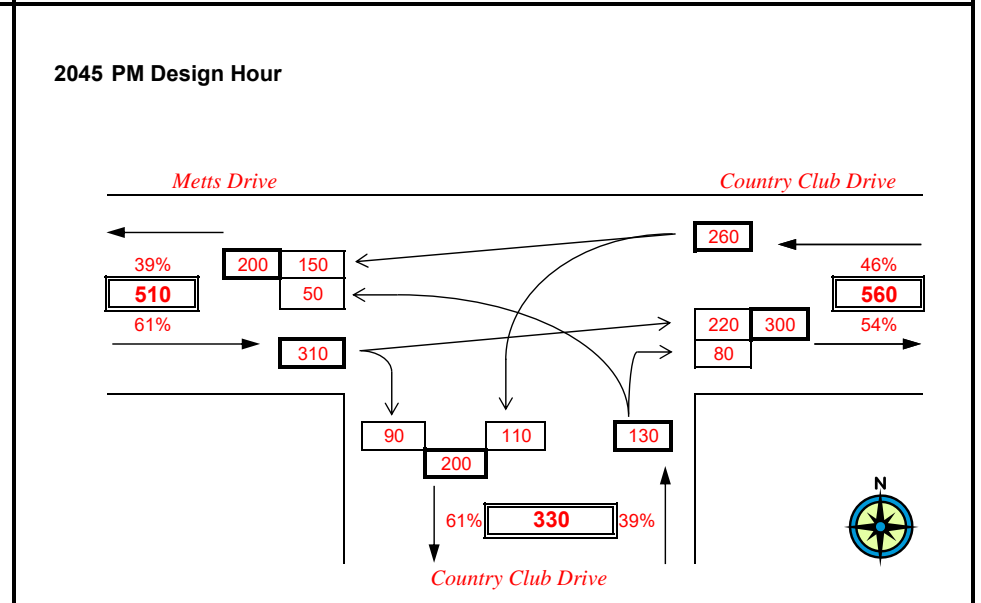
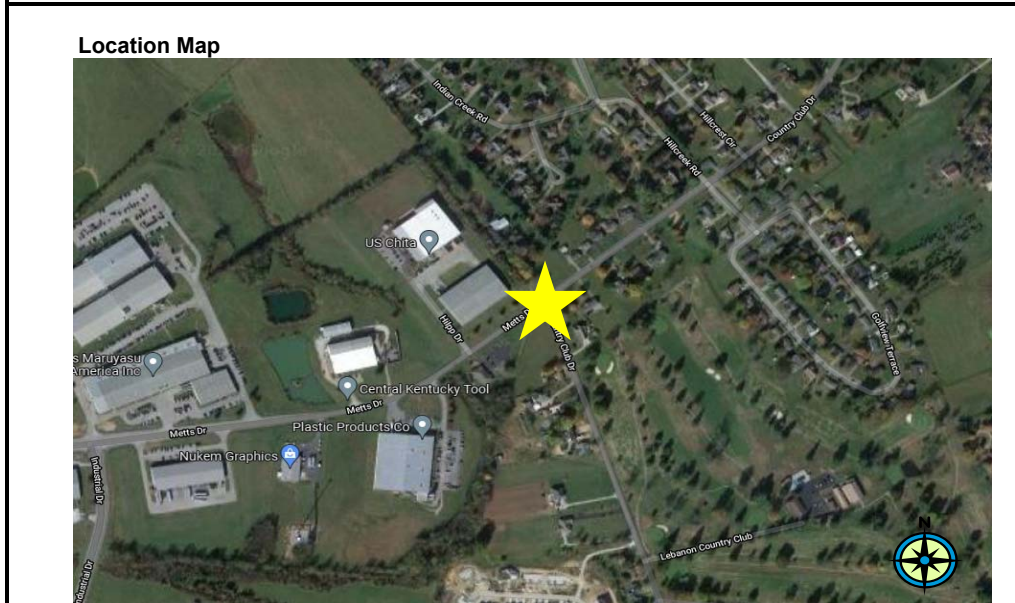
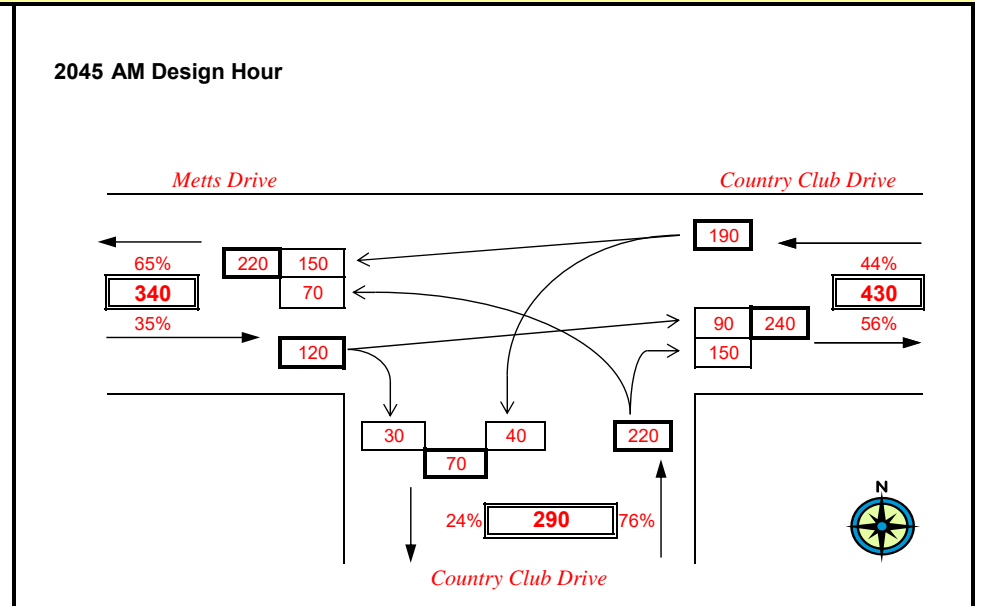
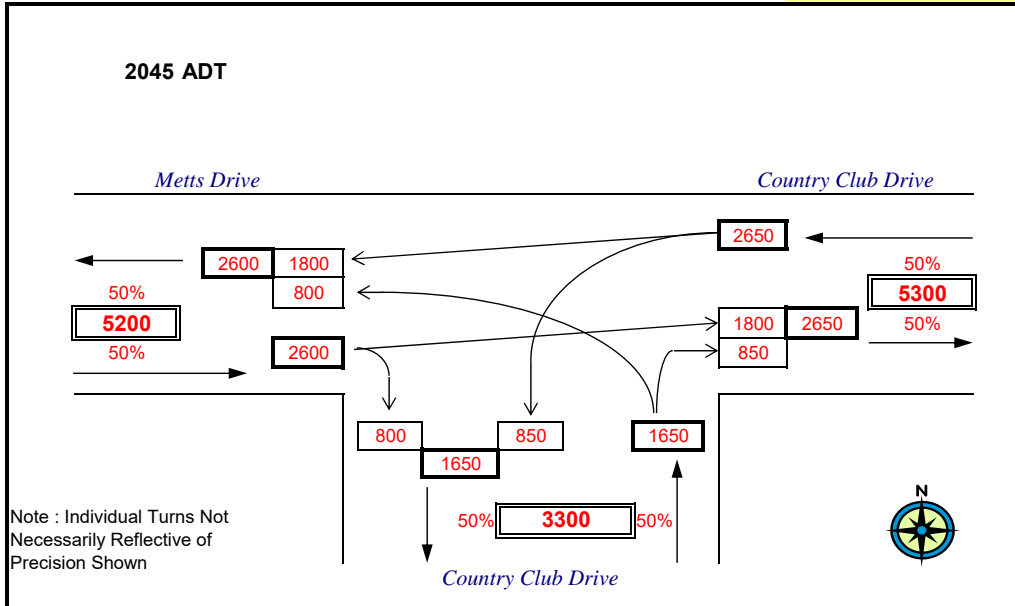


PROJECT: Lebanon Bypass
 ITEM NUMBER: 0
 MARS NUMBER: 0
 REQUEST DATE: Tuesday, January 11, 2022
 ANALYST: ST
 YEAR: 2045 ADT and Design Hour Volumes
 INTERSECTION: Country Club Drive & Metts Drive

NOTE: K-Factors, Directional Distributions, and Peak Hour Factors were determined from a 2045 Turning Movement Count. AM and PM DHVs represent 30th highest hour estimates for each turn maneuver.

TURN MOVEMENT (2045)

****DHV TURN MOVEMENT FORECASTS SHOULD NOT BE USED FOR SIGNAL TIMING OR WARRANT ANALYSIS**

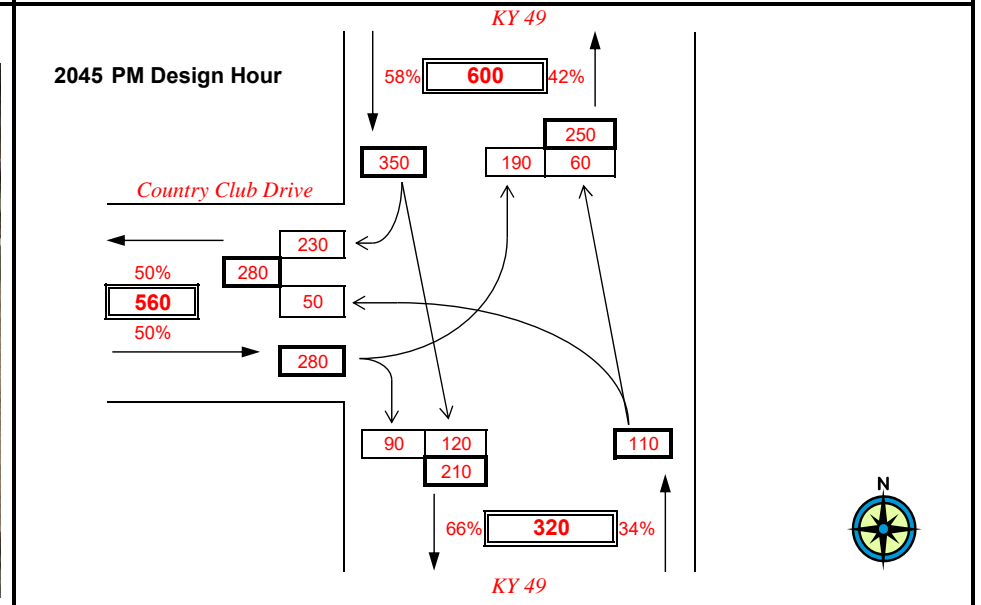
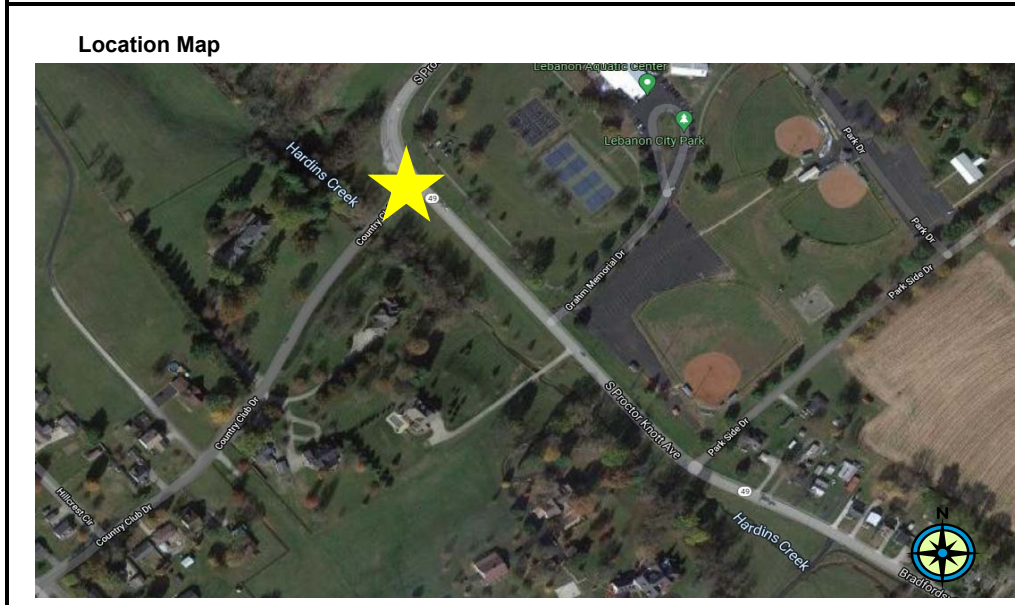
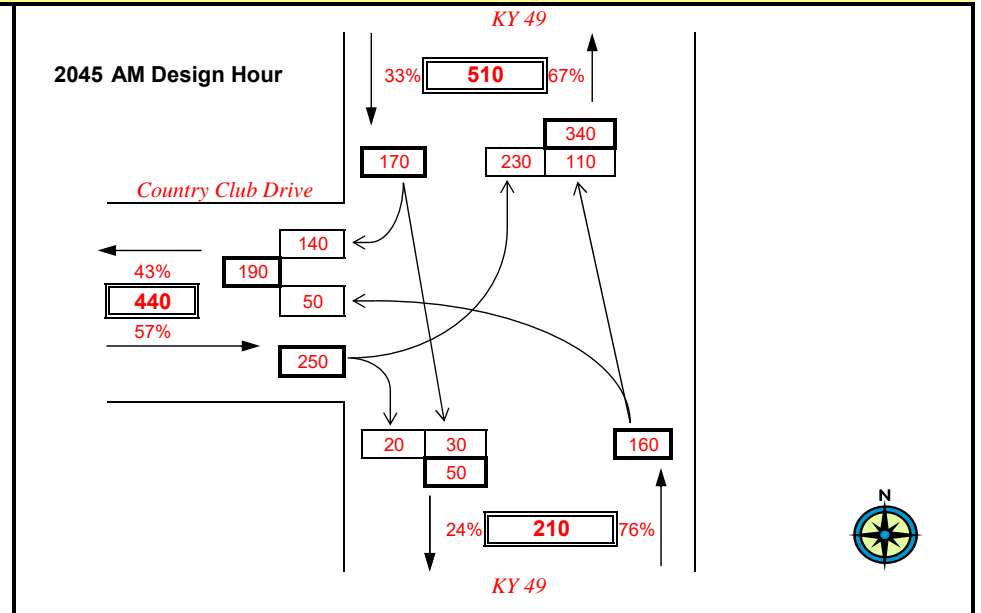
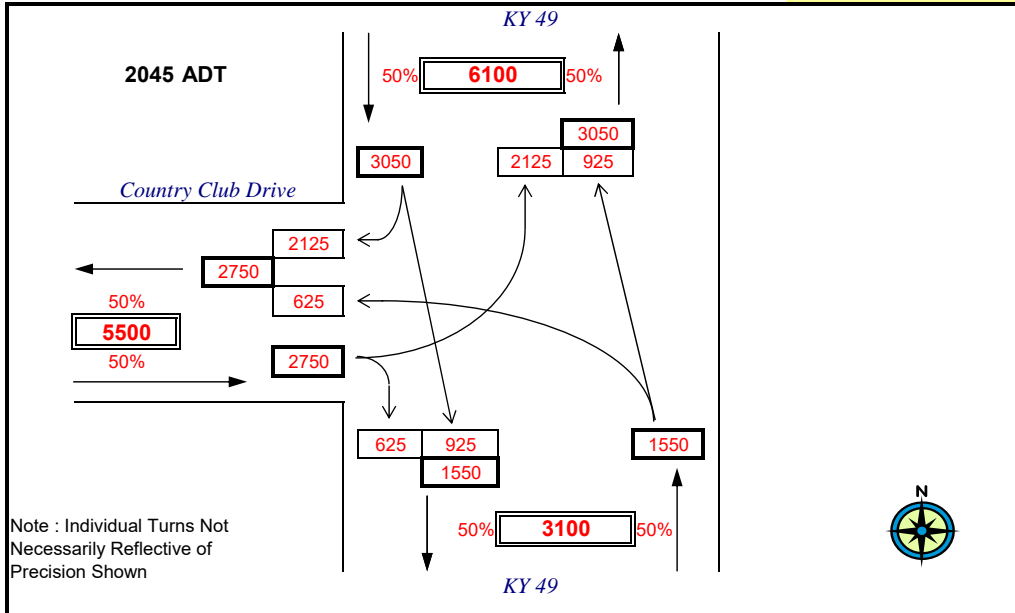


PROJECT: Lebanon Bypass
 ITEM NUMBER: 0
 MARS NUMBER: 0
 REQUEST DATE: Tuesday, January 11, 2022
 ANALYST: ST
 YEAR: 2045 **ADT and Design Hour Volumes**
 INTERSECTION: KY 49 & Country Club Drive

NOTE: K-Factors, Directional Distributions, and Peak Hour Factors were determined from a 2045 Turning Movement Count. AM and PM DHVs represent 30th highest hour estimates for each turn maneuver.

TURN MOVEMENT (2045)

****DHV TURN MOVEMENT FORECASTS SHOULD NOT BE USED FOR SIGNAL TIMING OR WARRANT ANALYSIS**

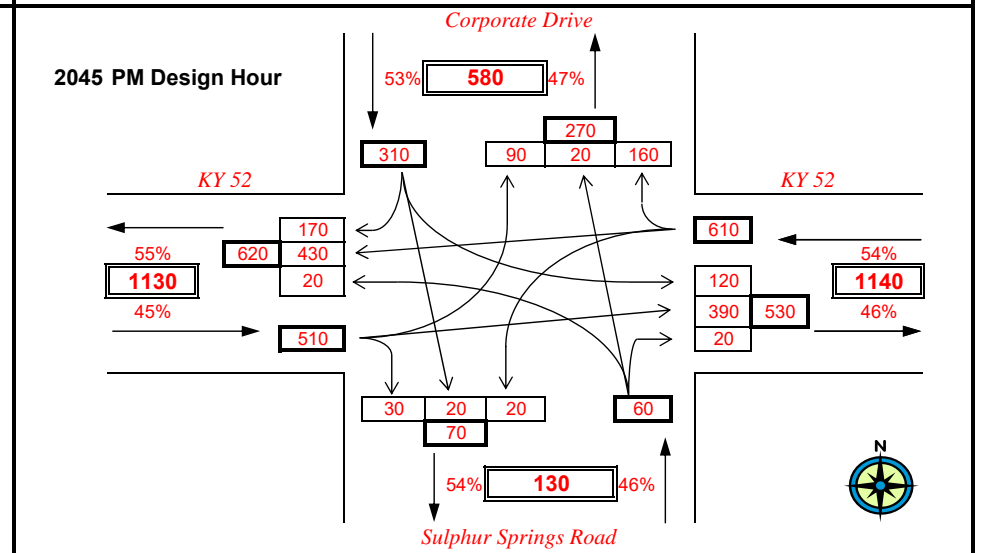
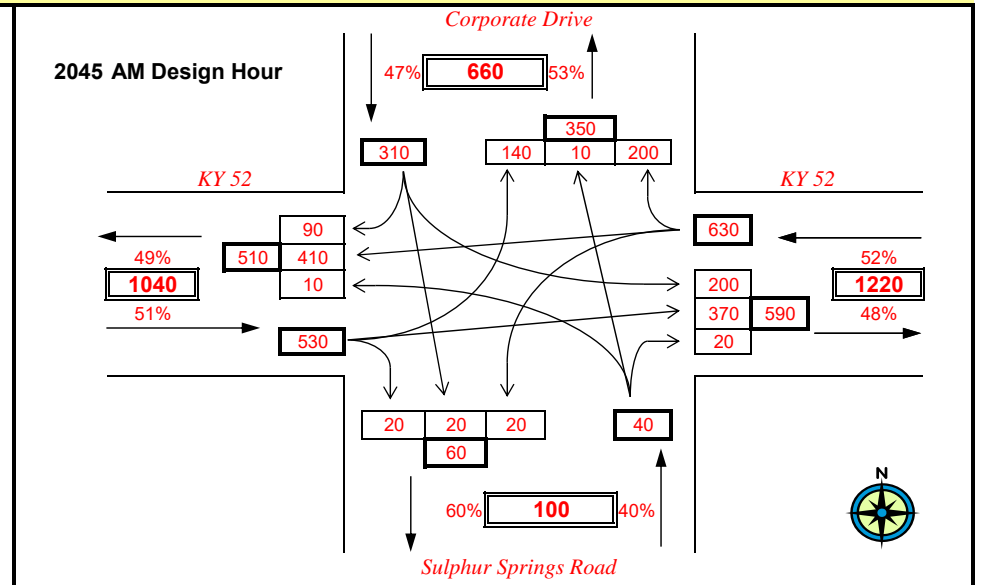
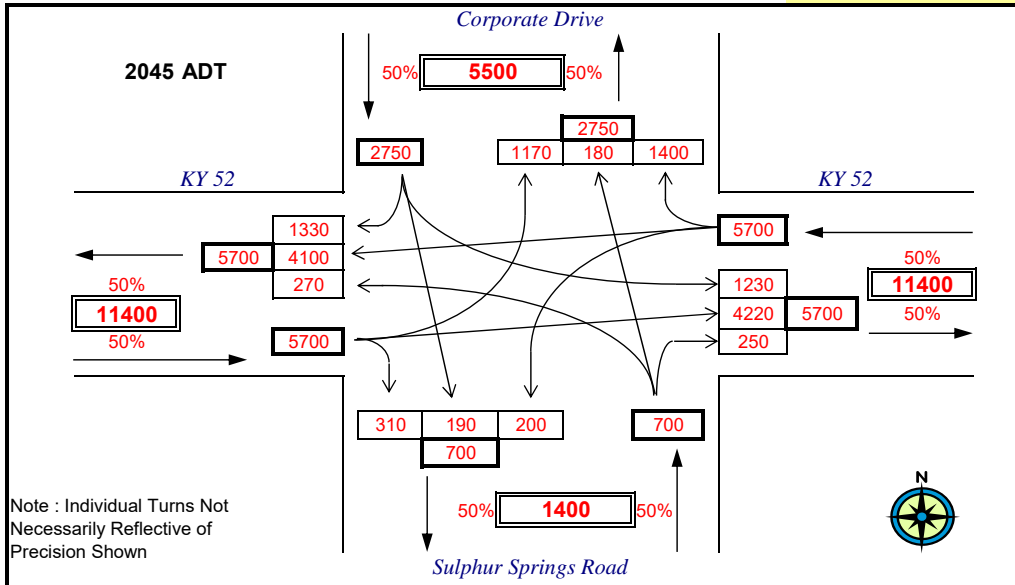


PROJECT: Lebanon Bypass
 ITEM NUMBER: 0
 MARS NUMBER: 0
 REQUEST DATE: Tuesday, January 11, 2022
 ANALYST: ST
 YEAR: 2045 ADT and Design Hour Volumes
 INTERSECTION: KY 52 & Corporate Drive

NOTE: K-Factors, Directional Distributions, and Peak Hour Factors were determined from a 2045 Turning Movement Count. AM and PM DHVs represent 30th highest hour estimates for each turn maneuver.

TURN MOVEMENT (2045)

****DHV TURN MOVEMENT FORECASTS SHOULD NOT BE USED FOR SIGNAL TIMING OR WARRANT ANALYSIS**

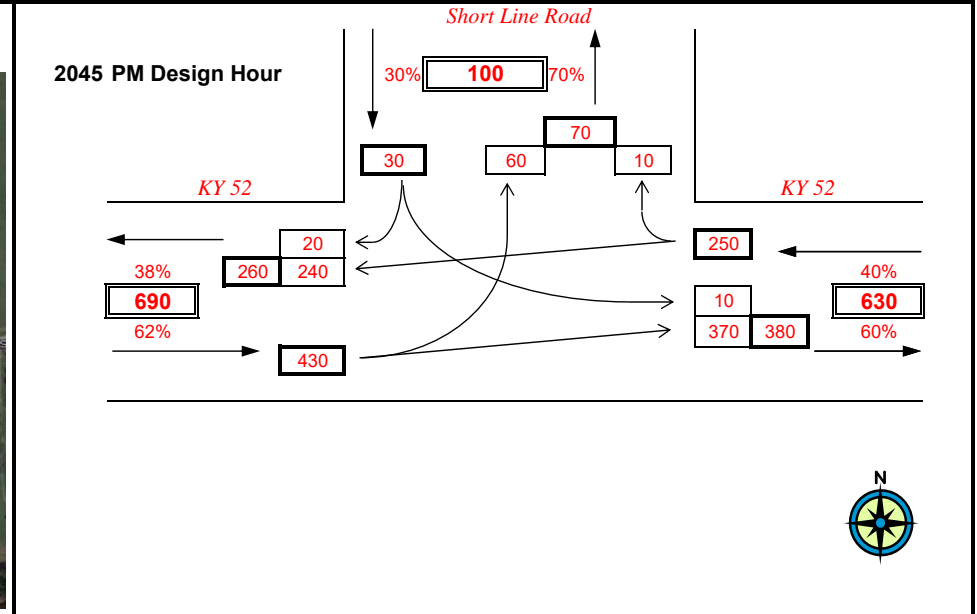
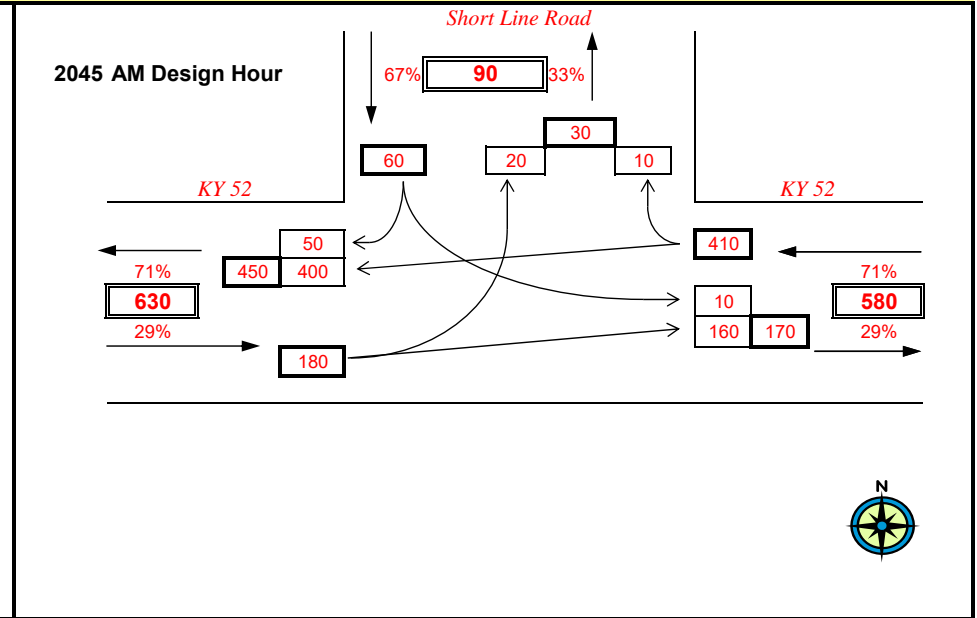
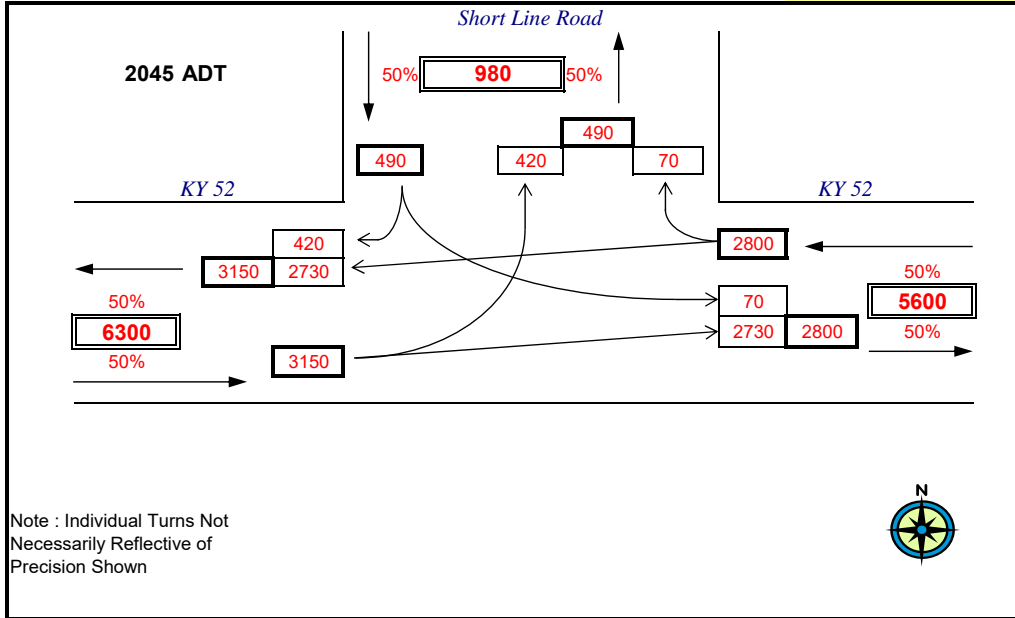


PROJECT: Lebanon Bypass
 ITEM NUMBER: 0
 MARS NUMBER: 0
 REQUEST DATE: Tuesday, January 11, 2022
 ANALYST: ST
 YEAR: 2045
 INTERSECTION: KY 52 & Short Line Road

NOTE: K-Factors, Directional Distributions, and Peak Hour Factors were determined from a 2045 Turning Movement Count. AM and PM DHVs represent 30th highest hour estimates for each turn maneuver.

TURN MOVEMENT (2045)

****DHV TURN MOVEMENT FORECASTS SHOULD NOT BE USED FOR SIGNAL TIMING OR WARRANT ANALYSIS**

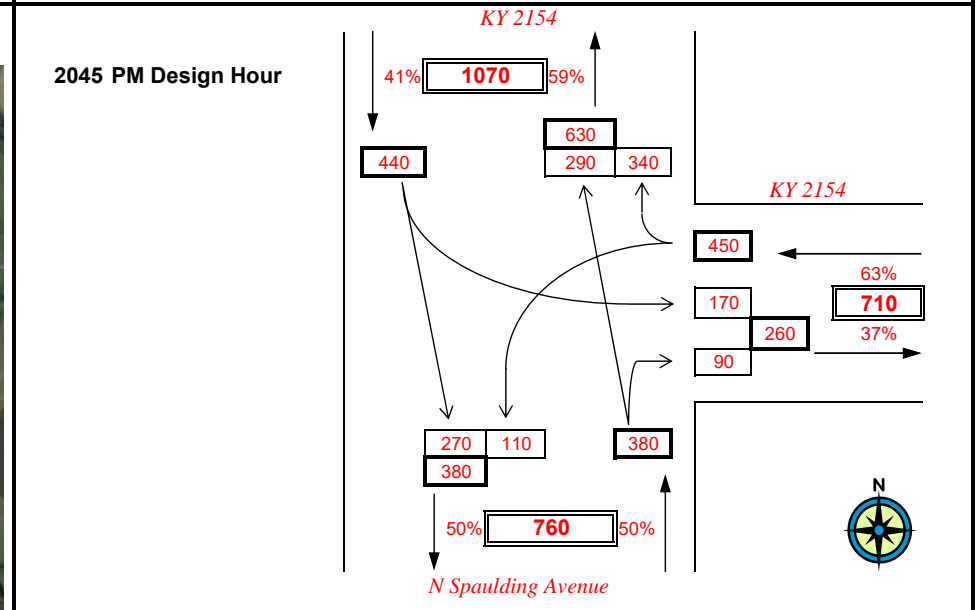
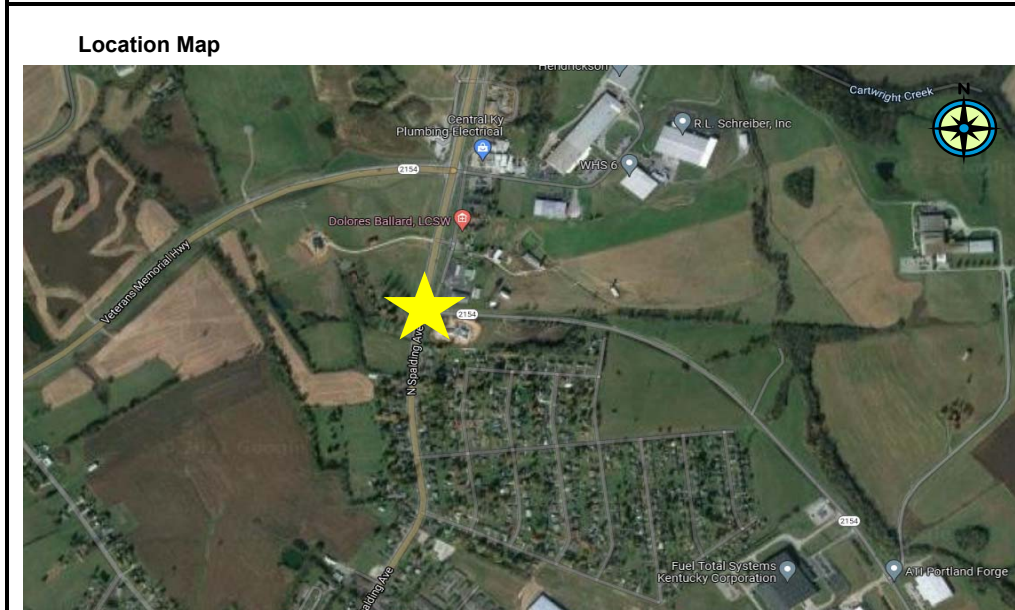
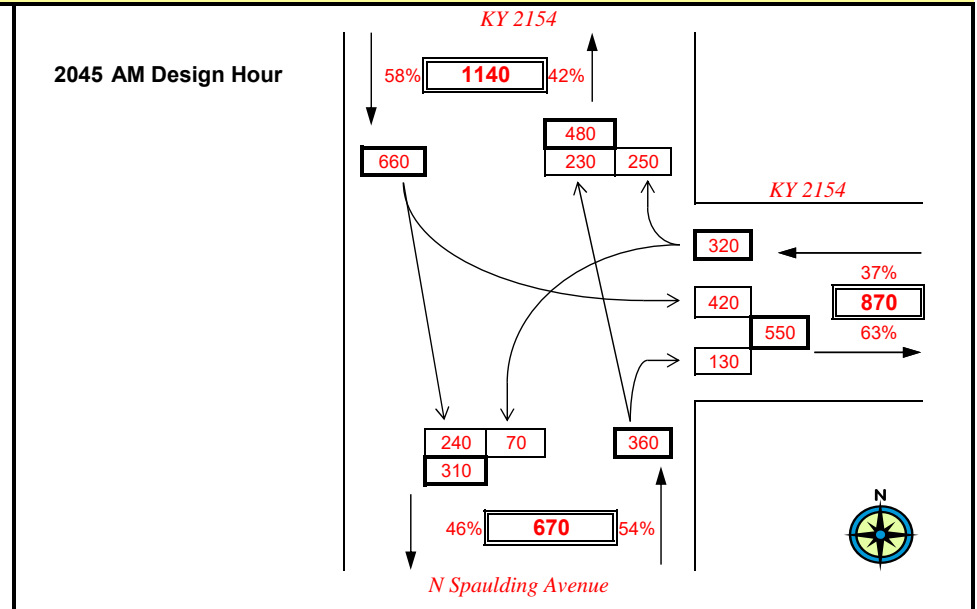
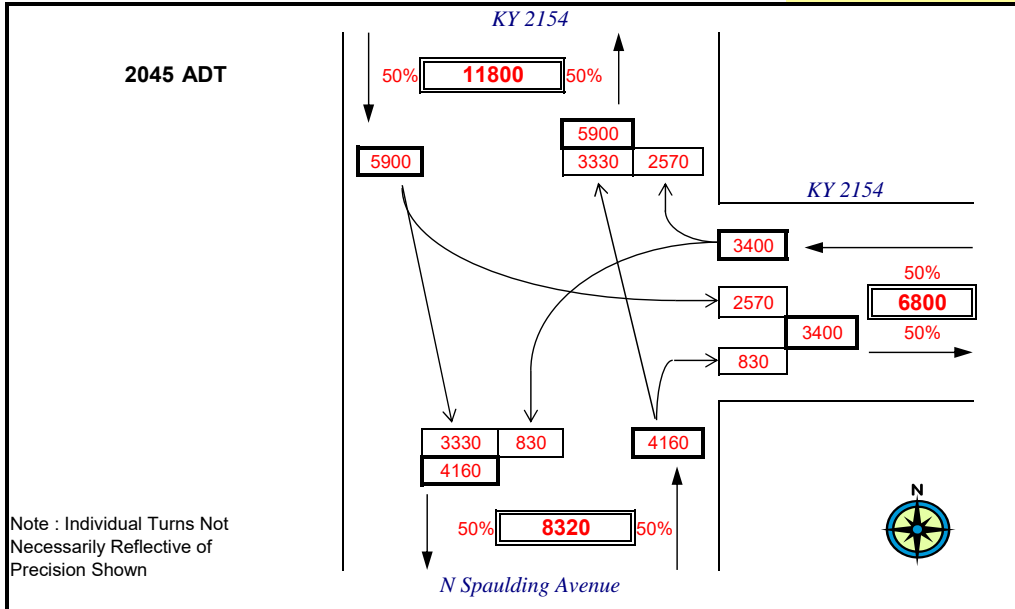


PROJECT: Lebanon Bypass
 ITEM NUMBER: 0
 MARS NUMBER: 0
 REQUEST DATE: Tuesday, January 11, 2022
 ANALYST: ST
 YEAR: 2045 **ADT and Design Hour Volumes**
 INTERSECTION: KY 2154 & N Spaulding Avenue

NOTE: K-Factors, Directional Distributions, and Peak Hour Factors were determined from a 2045 Turning Movement Count. AM and PM DHVs represent 30th highest hour estimates for each turn maneuver.

TURN MOVEMENT (2045)

****DHV TURN MOVEMENT FORECASTS SHOULD NOT BE USED FOR SIGNAL TIMING OR WARRANT ANALYSIS**



Appendix D

2045 Build Forecasts

KY 208 & KY 2154 (Adam Hughes Memorial)

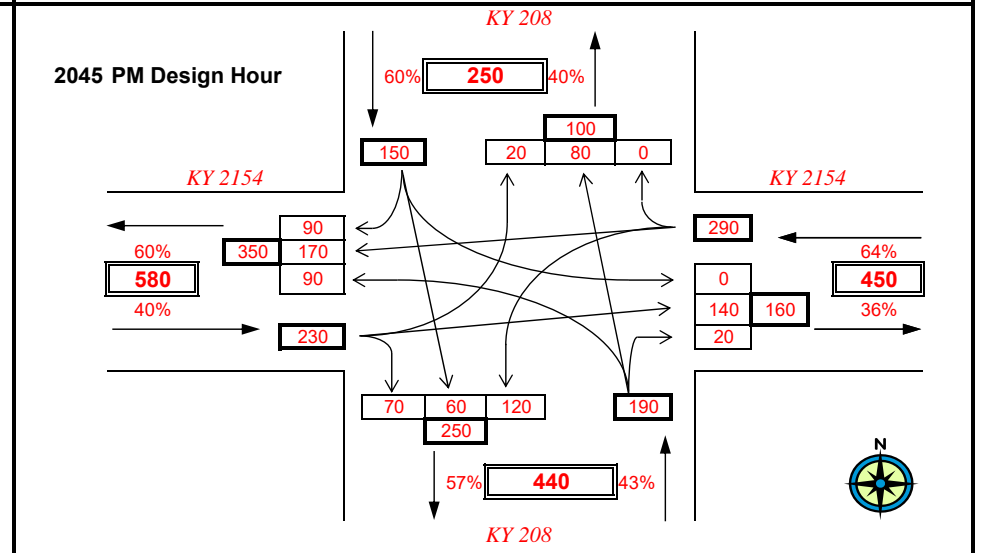
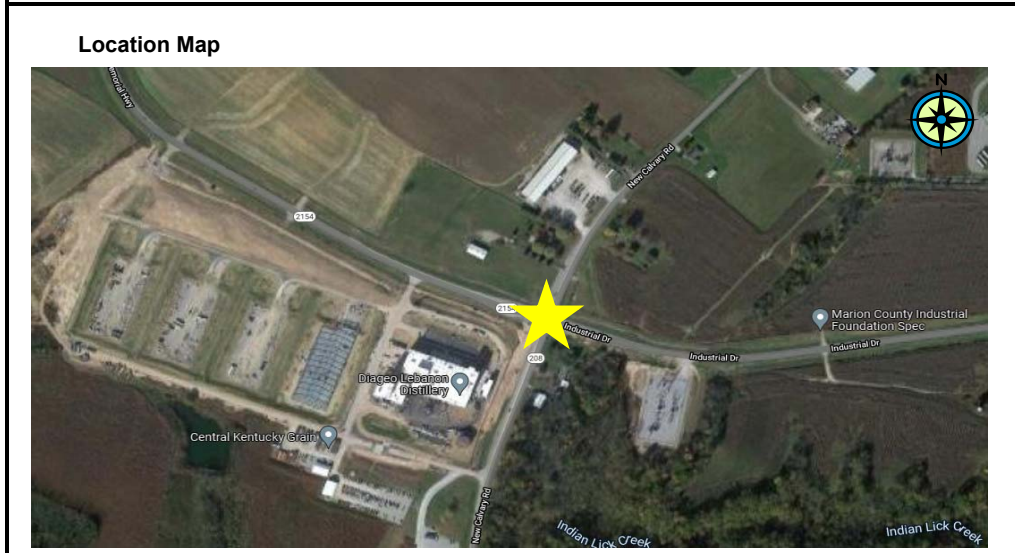
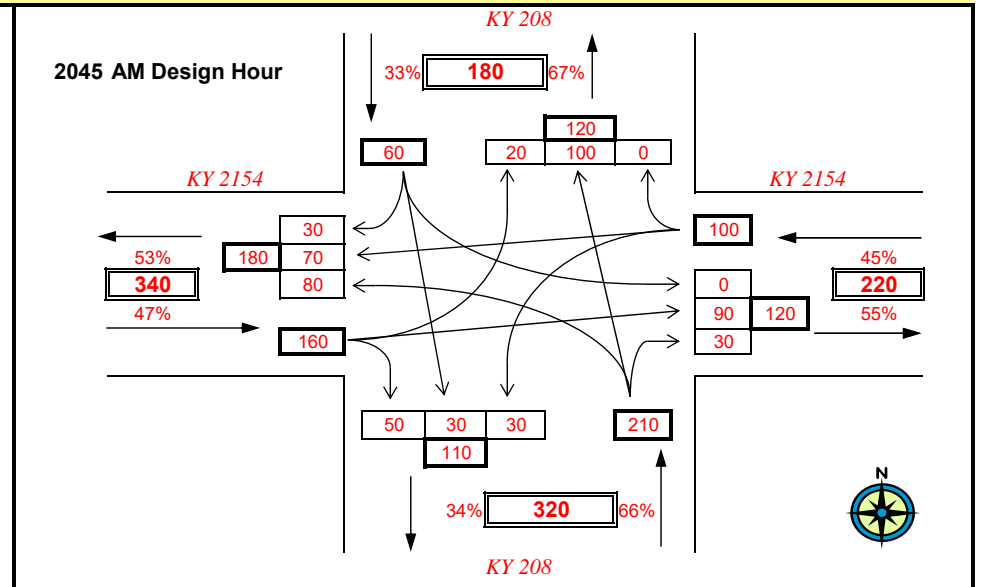
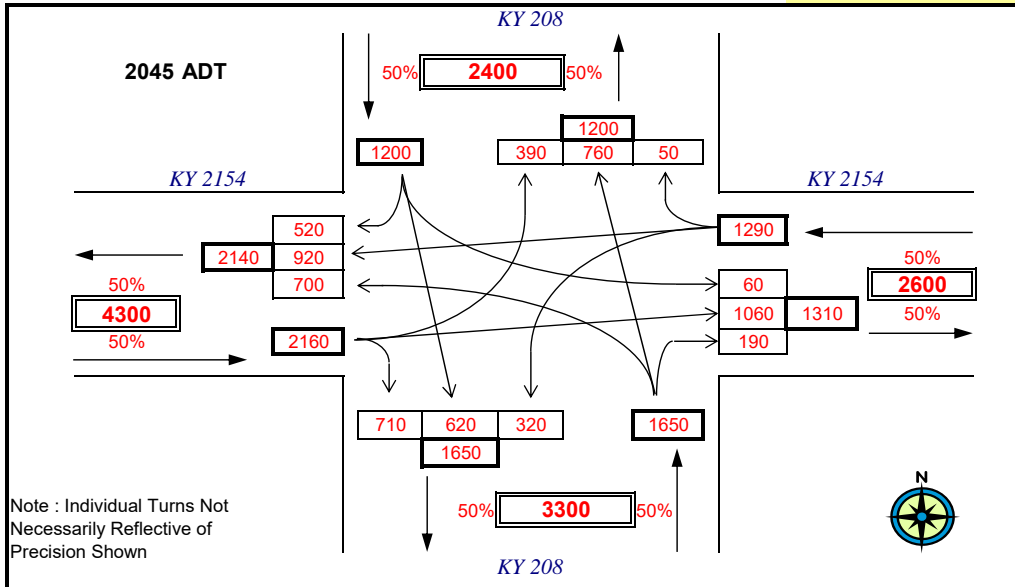
US 68 (KY 55) & KY 2154 (Corporate Dr / Sulphur Springs Rd)

PROJECT: Lebanon Bypass
 ITEM NUMBER: 0
 MARS NUMBER: 0
 REQUEST DATE: Tuesday, January 11, 2022
 ANALYST: ST
 YEAR: 2045 ADT and Design Hour Volumes
 INTERSECTION: KY 2154 & KY 208

NOTE: K-Factors, Directional Distributions, and Peak Hour Factors were determined from a 2045 Turning Movement Count. AM and PM DHVs represent 30th highest hour estimates for each turn maneuver.

TURN MOVEMENT (2045)

****DHV TURN MOVEMENT FORECASTS SHOULD NOT BE USED FOR SIGNAL TIMING OR WARRANT ANALYSIS**



PROJECT: Lebanon Bypass
 ITEM NUMBER: 0
 MARS NUMBER: 0
 REQUEST DATE: Tuesday, January 11, 2022
 ANALYST: ST
 YEAR: 2045 ADT and Design Hour Volumes
 INTERSECTION: KY 52 & Corporate Drive

NOTE: K-Factors, Directional Distributions, and Peak Hour Factors were determined from a 2045 Turning Movement Count. AM and PM DHVs represent 30th highest hour estimates for each turn maneuver.

TURN MOVEMENT (2045)

****DHV TURN MOVEMENT FORECASTS SHOULD NOT BE USED FOR SIGNAL TIMING OR WARRANT ANALYSIS**

