

Mountain Parkway Traffic Forecasts

Item No. 10-168.00

Final Report

May 2013



Stantec



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1 PROJECT DESCRIPTION

This study involves the development of design traffic forecasts for a total of nine improvement projects located along the Bert T. Combs Mountain Parkway (KY 9009) in Magoffin, Morgan and Wolfe counties. The information presented in this report documents the development of traffic forecasts for Project 10-168.00. The project involves the widening of the Mountain Parkway to four lanes from the KY 191 overpass bridge at Milepoint 46.2 to just west of the KY 205 interchange at Milepoint 57.2. A location map showing the project limits is shown in **Figure 1**.

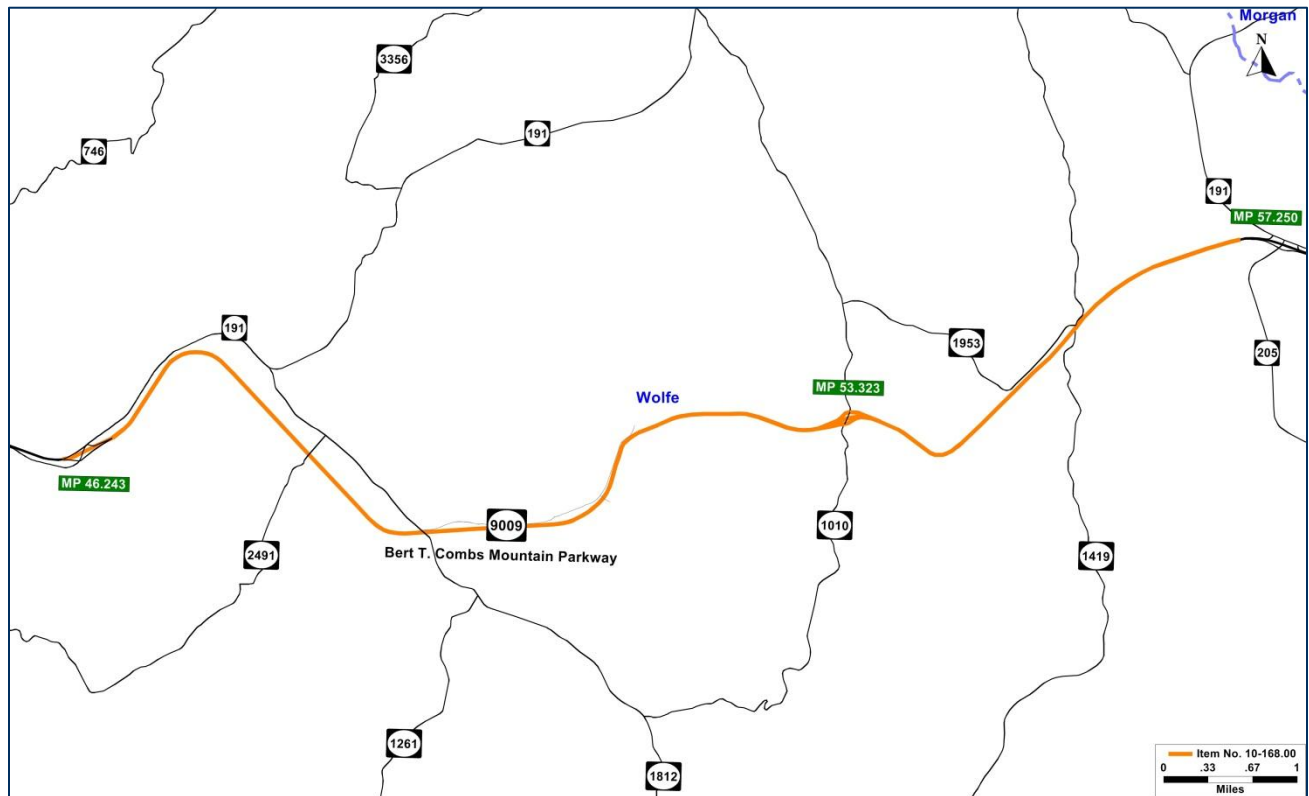


Figure 1. Item 168.00 Project Location

2 TRAFFIC COUNTS

Traffic counts were collected as part of this study. Traffic counts included 24-hour segment volumes and peak hour intersection turning movement counts at the three interchanges located within the study area. A summary of the 24-hour segment volumes is provided in **Table 1**.

Historic traffic volumes along the study section of the Mountain Parkway are limited; although traffic counts have been collected nearly every year, there are only a few KYTC traffic count stations. These counts are summarized in **Table 2**.

The peak hour intersection turning movement counts are located in **Appendix A**.

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Table 1. 24-Hour Count Summary

Traffic Count Location #130 (East of MP 46.2)

Date	Day	24-Hr. Count
11/14/2012	Wed	3,599
11/15/2012	Thu	3,742
1/29/2013	Tue	3,466
1/30/2013	Wed	2,938

Traffic Count Location #131 (West of MP 53.3)

Date	Day	24-Hr. Count
1/16/2013	Wed	3,074
1/17/2013	Thu	3,663
2/6/2013	Wed	3,063
2/7/2013	Thu	3,075

Traffic Count Location #137 (East of MP 53.3)

Date	Day	24-Hr. Count
1/16/2013	Wed	2,976
1/17/2013	Thu	3,603
2/6/2013	Wed	3,834
2/7/2013	Thu	4,032

Traffic Count Location #101 (West of MP 57.2)

Date	Day	24-Hr. Count
12/5/2012	Wed	3,562
12/6/2012	Thu	4,133

Table 2. KYTC Historic Traffic Counts

County	Wolfe	Wolfe	Magoffin	Magoffin	Magoffin	
Route	KY 9009	KY 9009	KY 9009	KY 9009	US 460	
MP	53.284 - 57.188	57.188 - 57.681	63.084 - 71.740	71.740 - 74.763	12.967 - 14.041	
Station	029	028	514	288	283	
Year	2010	4,740	4,730	5,210	6,450	12,800
	2009	4,970	4,780	4,850	5,900	
	2008	4,180	4,550	5,520	6,240	
	2007	4,090	4,250		6,670	13,500
	2006	4,220	4,250	5,390	6,670	
	2005	4,620	4,500	5,270	6,450	
	2004	4,040	4,360	5,000	6,340	13,100
	2003	4,180	4,120	5,140	6,160	
	2002					
	2001	4,090	4,120	5,170	5,600	13,100
	2000	4,280	4,400	5,750	6,340	

Source: KYTC CTS Database

3 POPULATION AND EMPLOYMENT

The Mountain Parkway extends from its beginning at Interstate 64 in Clark County to its terminus at US 460 in Magoffin County. It provides mobility and connectivity not just for these four counties but for an entire region, similar to the way a river drains a watershed. For the purpose of traffic forecasting, that region is assumed to consist of the 20 counties highlighted in **Figure 2**.

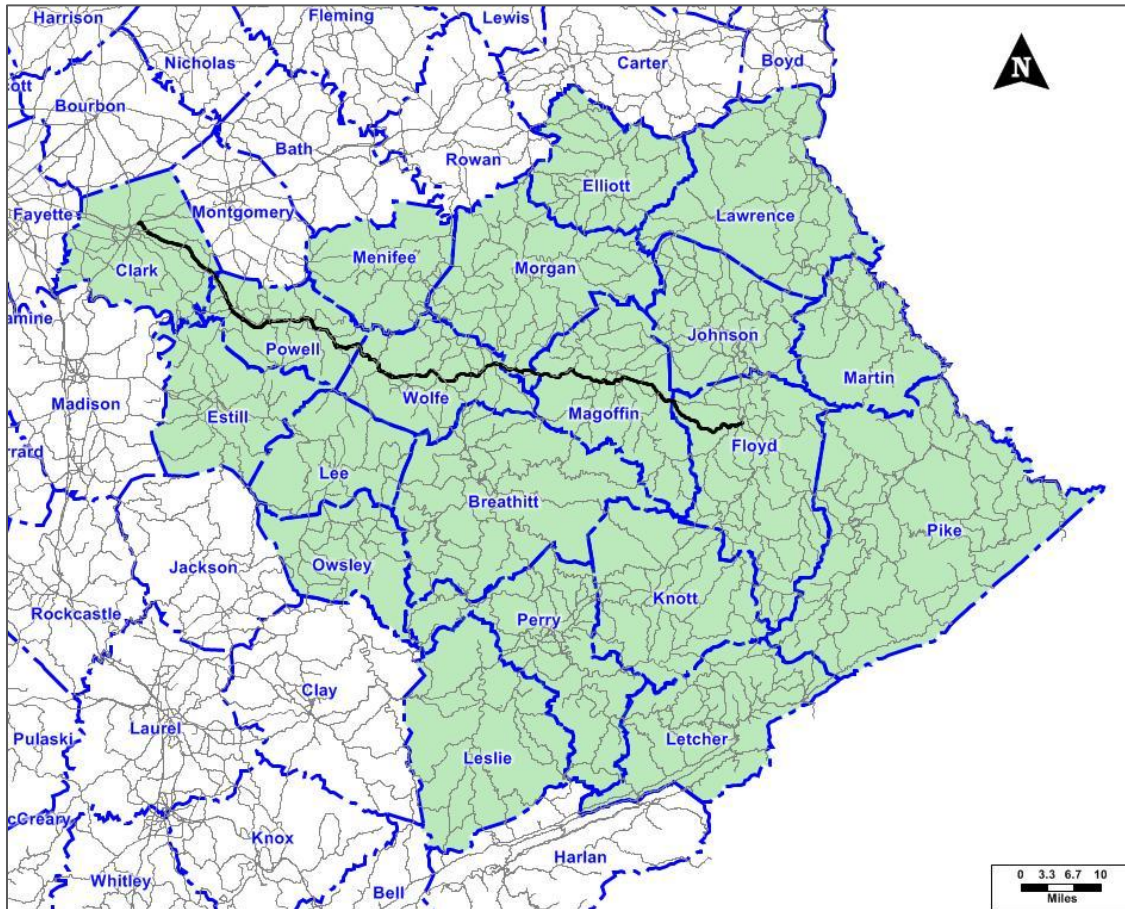


Figure 2. Counties Served by the Mountain Parkway

Population data for the region obtained from the Kentucky State Data Center shows a slight decline in population from 2000 to 2010 for about half the counties and an overall decline of about 2.5 percent. This decline is projected to continue through the year 2050, by a total of 18 percent, as listed in **Table 3**.

The 2010 version Kentucky Statewide Traffic Model (“KYSTMv10”) was consulted for deriving growth factors to be employed in the development of the traffic forecasts. The KYSTMv10 uses county-level estimates of population and employment in the creation of traffic projections. As noted previously, population estimates were compiled from the 2010 US Census and Kentucky State Data Center. Employment projections were derived from data purchased by the KYTC from Woods & Poole Economics, Inc. A comparison of year 2010 and 2040 total employment data as provided by Woods & Poole is shown in **Table 4**.

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Table 3. County-by-County Population Projections through 2050

County	Census 2000	Census 2010	Population Projections							
			2015	2020	2025	2030	2035	2040	2045	2050
Breathitt	16,100	13,878	13,216	12,495	11,750	11,000	10,275	9,600	8,979	8,410
Clark	33,144	35,613	36,892	37,985	38,836	39,423	39,756	39,933	39,988	39,977
Elliott	6,748	7,852	7,992	8,078	8,126	8,127	8,094	8,013	7,903	7,789
Estill	15,307	14,672	14,560	14,359	14,057	13,666	13,206	12,709	12,212	11,717
Floyd	42,441	39,451	38,438	37,153	35,628	34,001	32,309	30,618	28,961	27,400
Johnson	23,445	23,356	23,376	23,265	22,999	22,605	22,091	21,533	20,978	20,438
Knott	17,649	16,346	16,036	15,635	15,139	14,562	13,943	13,322	12,723	12,159
Lawrence	15,569	15,860	16,086	16,192	16,134	15,984	15,775	15,499	15,187	14,870
Lee	7,916	7,887	7,872	7,820	7,739	7,607	7,430	7,224	7,012	6,788
Leslie	12,401	11,310	10,981	10,603	10,181	9,730	9,265	8,809	8,375	7,973
Letcher	25,277	24,519	24,464	24,237	23,829	23,300	22,716	22,126	21,551	20,994
Magoffin	13,332	13,333	13,496	13,587	13,580	13,469	13,259	12,967	12,646	12,321
Martin	12,578	12,929	12,504	12,055	11,551	10,991	10,399	9,801	9,219	8,665
Menifee	6,556	6,306	6,194	6,038	5,847	5,613	5,355	5,089	4,821	4,567
Morgan	13,948	13,923	14,020	14,023	13,913	13,707	13,423	13,082	12,708	12,337
Owsley	4,858	4,755	4,738	4,704	4,633	4,529	4,405	4,265	4,122	3,975
Perry	29,390	28,712	28,520	28,137	27,516	26,682	25,693	24,610	23,489	22,386
Pike	68,736	65,024	63,666	61,991	59,983	57,679	55,198	52,681	50,230	47,928
Powell	13,237	12,613	12,504	12,319	12,063	11,732	11,358	10,967	10,587	10,226
Wolfe	7,065	7,355	7,516	7,636	7,714	7,740	7,731	7,692	7,638	7,578
Regional Totals	385,697	375,694	373,071	368,312	361,218	352,147	341,681	330,540	319,329	308,498
Statewide	4,041,769	4,339,367	4,509,429	4,672,754	4,820,390	4,951,178	5,063,331	5,162,292	5,254,876	5,349,720

Table 4. Total Employment Estimates

County	2010	2040
Breathitt	4,965	6,907
Clark	21,298	30,723
Elliott	1,795	2,380
Estill	4,014	4,807
Floyd	16,298	22,907
Johnson	8,811	11,586
Knott	5,181	8,190
Lawrence	5,013	6,021
Lee	2,781	3,576
Leslie	2,808	3,534
Letcher	7,525	8,894
Magoffin	3,610	4,193
Martin	3,917	4,789
Menifee	1,801	1,924
Morgan	5,026	6,353
Owsley	1,393	1,682
Perry	16,351	22,035
Pike	31,400	40,284
Powell	4,367	5,718
Wolfe	2,159	2,751
Totals	150,513	199,254

Obviously there is a contrast between population and employment projections – population within these counties is projected to decline, while employment is projected to increase. It must be pointed out that the data come from two different sources. While the trends imply a conflict, these are official data that are used in the KSTMv10 and the objective of this study was not to question the input data of the KYSTMv10 but rather use it as a tool in developing growth factor estimates that were applied to current traffic volumes along the Mountain Parkway.

4 TRAFFIC GROWTH

The KSTMv10 was examined for the purpose of developing traffic growth factors that would be applied to existing traffic counts. The model showed negligible traffic growth along the Mountain Parkway from 2012 to 2040. The lack of increase in the traffic projections was a result of negative population forecasts that served to offset the modest employment growth contained in the model.

Trend lines of the historic traffic counts were constructed for the two KYTC count stations closest to the project – Stations 028 (between MP 57.2 and MP 57.7) and 029 (between MP 53.3 and MP 57.2). These trends are illustrated in **Figure 3**.

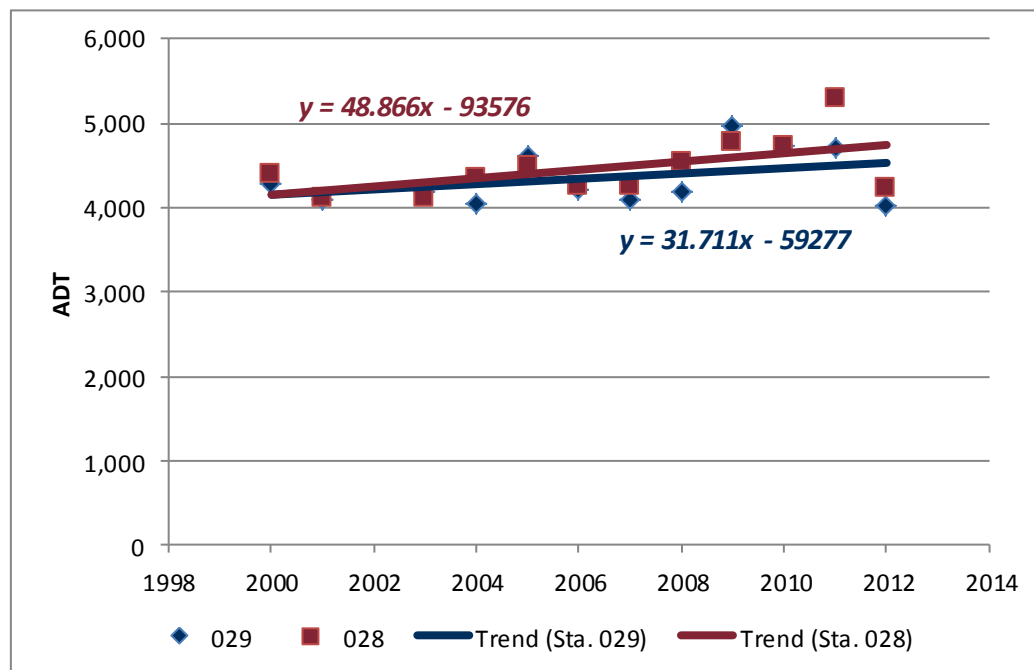


Figure 3. Historic Traffic Counts and Trends

Based on the continuation of historic trends, traffic volumes would be expected to increase about 49 vehicles per day per year for Station 028 and about 32 vehicles per day per year for Station 029. Comparing the two methods, the trend line method conservatively would yield more traffic growth than using the KSTMv10 for the subject section Mountain Parkway.

5 DESIGN HOUR FACTOR (K-FACTOR)

A summary of peak hour traffic count data collected for mainline sections of the Mountain Parkway is shown in **Table 5**.

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Table 5. K-Factor and D-Factor Summary for Mountain Parkway Mainline Count Locations

Milepoint	Date	Count ID	24-Hour	AM Peak Hour					PM Peak Hour					
			Total	Eastbound	Westbound	Total	D-Factor	K-Factor	Eastbound	Westbound	Total	D-Factor	K-Factor	
46.2	11/14/2012	127	3,576	148	116	264	0.56	0.07	149	168	317	0.53	0.09	
46.2	11/15/2012	127	3,872	151	156	307	0.51	0.08	174	179	353	0.51	0.09	
46.2	12/12/2012	130	5,194	222	178	400	0.56	0.08	209	272	481	0.57	0.09	
46.2	12/13/2012	130	5,483	206	188	394	0.52	0.07	217	290	507	0.57	0.09	
53.3	2/6/2013	131	3,063	162	95	257	0.63	0.08	183	106	289	0.63	0.09	
53.3	2/7/2013	131	3,075	149	108	257	0.58	0.08	158	107	265	0.60	0.09	
53.3	1/16/2013	137	2,976	104	120	224	0.54	0.08	143	129	272	0.53	0.09	
53.3	1/17/2013	137	3,603	141	151	292	0.52	0.08	167	168	335	0.50	0.09	
53.3	2/6/2013	137	3,834	161	167	328	0.51	0.09	170	183	353	0.52	0.09	
53.3	2/7/2013	137	4,032	146	174	320	0.54	0.08	165	194	359	0.54	0.09	
57.2	12/5/2012	101	3,562	131	155	286	0.54	0.08	179	155	334	0.54	0.09	
57.2	12/6/2012	101	4,133	143	162	305	0.53	0.07	181	193	374	0.52	0.09	
57.2	1/29/2013	105	3,601	153	151	304	0.50	0.08	157	158	315	0.50	0.09	
57.2	1/30/2013	105	3,119	102	124	226	0.55	0.07	138	135	273	0.51	0.09	
59.8	12/3/2012	106	4,002	141	177	318	0.56	0.08	167	149	316	0.53	0.08	
59.8	12/4/2012	106	4,002	140	191	331	0.58	0.08	185	204	389	0.52	0.10	
59.8	12/3/2012	110	4,021	146	179	325	0.55	0.08	170	152	322	0.53	0.08	
59.8	12/4/2012	110	3,853	126	179	305	0.59	0.08	185	203	388	0.52	0.10	
71.8	12/12/2012	112	4,120	142	173	315	0.55	0.08	158	196	354	0.55	0.09	
71.8	12/13/2012	112	4,428	148	183	331	0.55	0.07	180	229	409	0.56	0.09	
71.8	12/12/2012	118	5,194	222	178	400	0.56	0.08	209	272	481	0.57	0.09	
71.8	12/13/2012	118	5,483	206	188	394	0.52	0.07	217	290	507	0.57	0.09	
74.7	12/10/2012	120	5,064	210	185	395	0.53	0.08	230	242	472	0.51	0.09	
74.7	12/11/2012	120	5,062	195	175	370	0.53	0.07	198	233	431	0.54	0.09	
74.7	12/10/2012	126	6,414	279	232	511	0.55	0.08	283	312	595	0.52	0.09	
74.7	12/11/2012	126	6,634	267	253	520	0.51	0.08	305	329	634	0.52	0.10	
				Average						Average				
				0.54						0.08				
				0.54						0.09				

The average Design Hour Factor (K-Factor) was 0.08 for the A.M. peak and 0.09 for the P.M. peak. These values were quite consistent across dates and count locations.

For design purposes, the Kentucky Transportation Cabinet uses the following formula in establishing the K-Factor:

$$K \text{ Factor}_{\text{Design}} = 0.02 + (\text{High Hour Count})/(\text{Total Daily Count})$$

Conservatively, using the higher value of the two peak periods, the following K-Factor will be used for developing the Mountain Parkway design traffic forecasts:

$$K \text{ Factor}_{\text{Design}} = 0.02 + 0.09 = \mathbf{0.11}$$

6 DIRECTIONAL DISTRIBUTION (D-FACTOR)

For the mainline sections of the Mountain Parkway, the average Directional Distribution (D-Factor) from the traffic counts that were collected, as summarized in Table 5, was 0.54. This value was used in the development of the traffic forecasts. At the interchanges with the Mountain Parkway, the D-Factor values for turning movements were based on the intersection counts that were collected.

7 PEAK HOUR FACTOR

For the purpose of capacity and level of service calculations, an average Peak Hour Factor (PHF) was developed from the intersection turning movement counts. The Peak Hour Factor is computed as:

$$PHF = \frac{V}{4xV_{15}}$$

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where

- PHF = Peak Hour Factor
- V = hourly volume (veh/hr)
- V₁₅ = volume during the peak 15 minutes of the analysis period (veh/15 min)

The following Peak Hour Factors are recommended:

Milepoint	Interchange	PHF
46.2	KY 191	0.88
53.3	KY 1050	0.70

8 TRUCK PERCENTAGES

Traffic count data collected for the development of the Mountain Parkway traffic forecasts included vehicle classification data, based on the FHWA 13-class scheme. A summary of the 48-hour classification counts for mainline Mountain Parkway locations is provided in **Table 6** below:

Table 6. Vehicle Classification Count Summary

Count Location	MP	FHWA Vehicle Class													48-Hour Total
		1	2	3	4	5	6	7	8	9	10	11	12	13	
127	46.2	28	4,810	1,137	88	621	147	36	79	432	21	30	13	6	7,448
130	46.2	19	2,171	531	25	329	28	1	49	10	42	0	0	1	3,206
131	53.3	710	3,352	797	69	684	89	63	61	271	16	20	5	1	6,138
137	53.3	140	3,398	2,388	133	1,034	206	55	88	361	22	25	8	8	7,866
101	57.2	23	5,086	1,175	79	641	164	75	84	384	53	30	12	4	7,810
105	57.2	192	2,627	869	71	704	84	53	64	253	59	18	4	1	4,999
106	59.8	12	5,161	1,284	91	597	156	40	101	451	73	27	3	8	8,004
110	59.8	67	4,448	1,488	112	943	164	37	99	406	66	28	9	7	7,874
112	71.8	111	4,534	1,986	114	1,083	137	24	92	361	56	30	12	8	8,548
118	71.8	42	6,309	1,885	121	1,390	102	18	167	409	186	26	12	10	10,677
120	74.7	31	6,649	1,669	106	686	141	58	133	428	186	25	8	6	10,126
126	74.7	64	7,736	2,453	176	1,490	155	58	138	403	305	25	13	32	13,048
Sum		1,439	56,281	17,662	1,185	10,202	1,573	518	1,155	4,169	1,085	284	99	92	95,744
Percentage		1.5%	58.8%	18.4%	1.2%	10.7%	1.6%	0.5%	1.2%	4.4%	1.1%	0.3%	0.1%	0.1%	100.0%

Autos (Classes 1 - 3)	78.7%
Buses (Class 4)	1.2%
Single Unit Trucks (Classes 5 - 7)	12.8%
Combination Trucks (Classes 8 - 13)	7.2%

For the purpose of developing design traffic forecasts, buses (Class 4) and single-unit trucks (Classes 5 – 7) were combined. After examination of regional socioeconomic data and discussions with the KYTC Division of Planning, it was decided that the truck percentage would be held constant through the 2040 forecast year. For Item No. 10-168.00, based on the classification count data for this section, a truck percentage of 21.0 percent was assumed for ESAL calculations.

9 TRAFFIC FORECASTS

Design year 2040 traffic forecasts by segment are shown in **Figure 4**. These include 20-year equivalent single axle load (ESAL) projections. Design hour intersection turning movements are located in **Appendix B**. Because of the low existing volumes and low projected traffic growth, only design year 2040 peak hour turning movements were developed. The ESAL worksheets are located in **Appendix C**.

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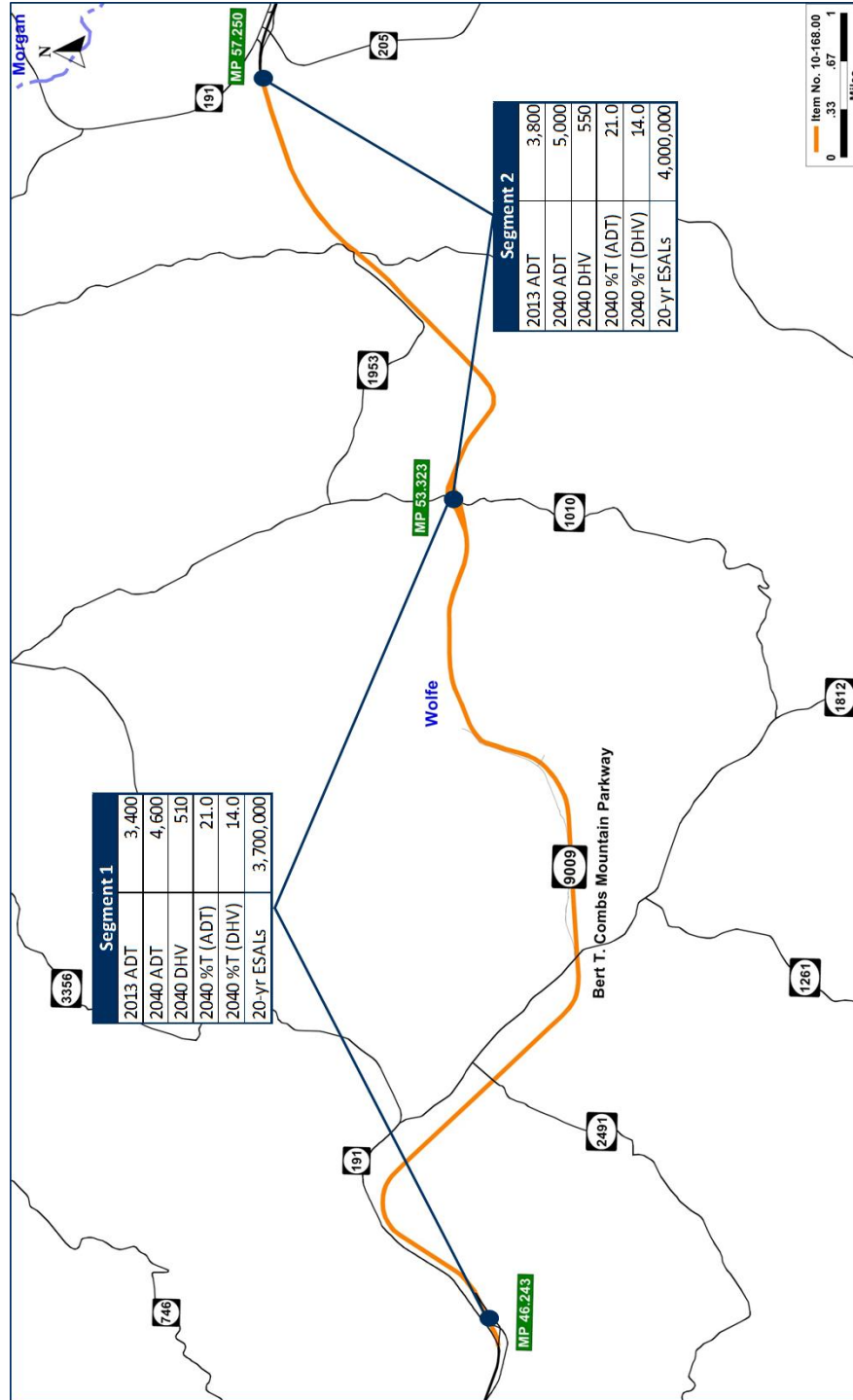


Figure 4. Design Year 2040 Traffic Forecasts



10 APPENDICES

Appendix A. Peak Hour Intersection Turning Movement Counts

Appendix B. Design Hour Intersection Turning Movements

Appendix C. ESAL Worksheets



**Appendix A.
Peak Hour Intersection Turning Movement Counts**

**MOUNTAIN PARKWAY TRAFFIC FORECAST
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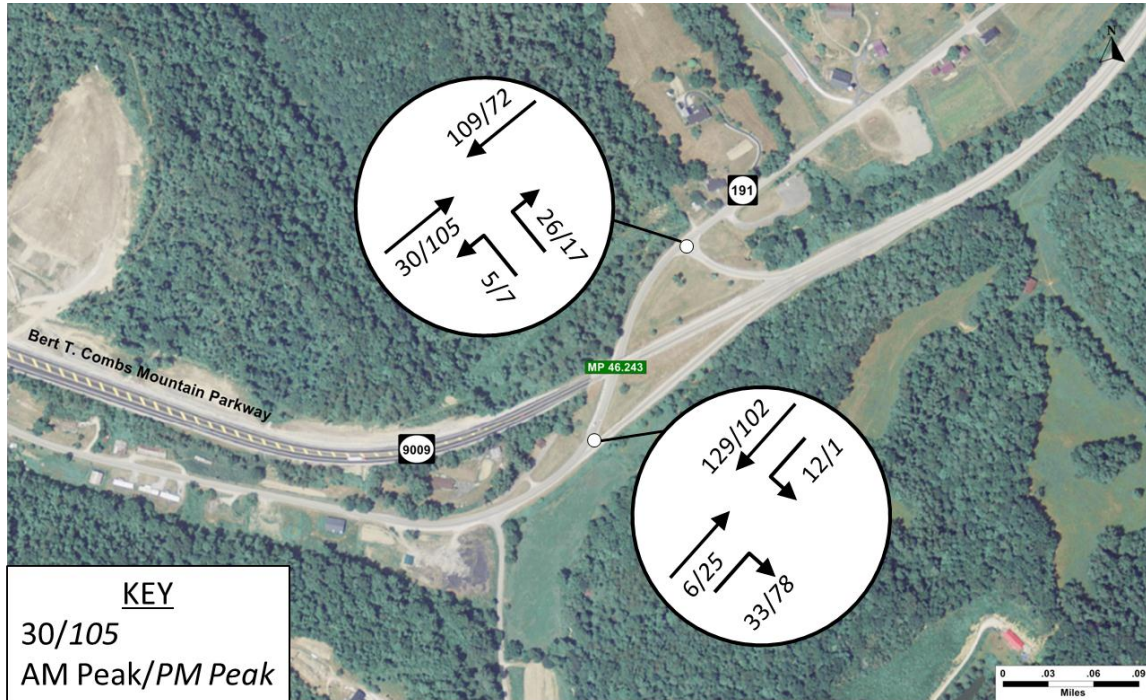


Figure A- 1. Peak Hour Intersection Turning Movement Count - KY 9009 at KY 191

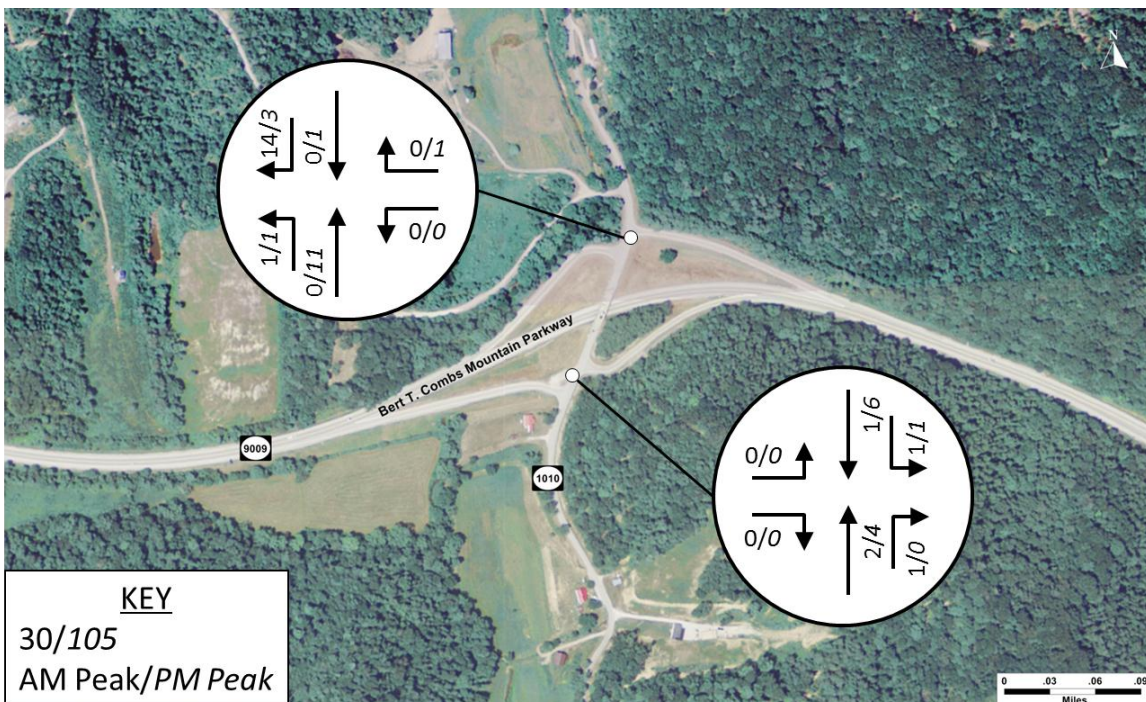


Figure A- 2. Peak Hour Intersection Turning Movement Count - KY 9009 at KY 1010



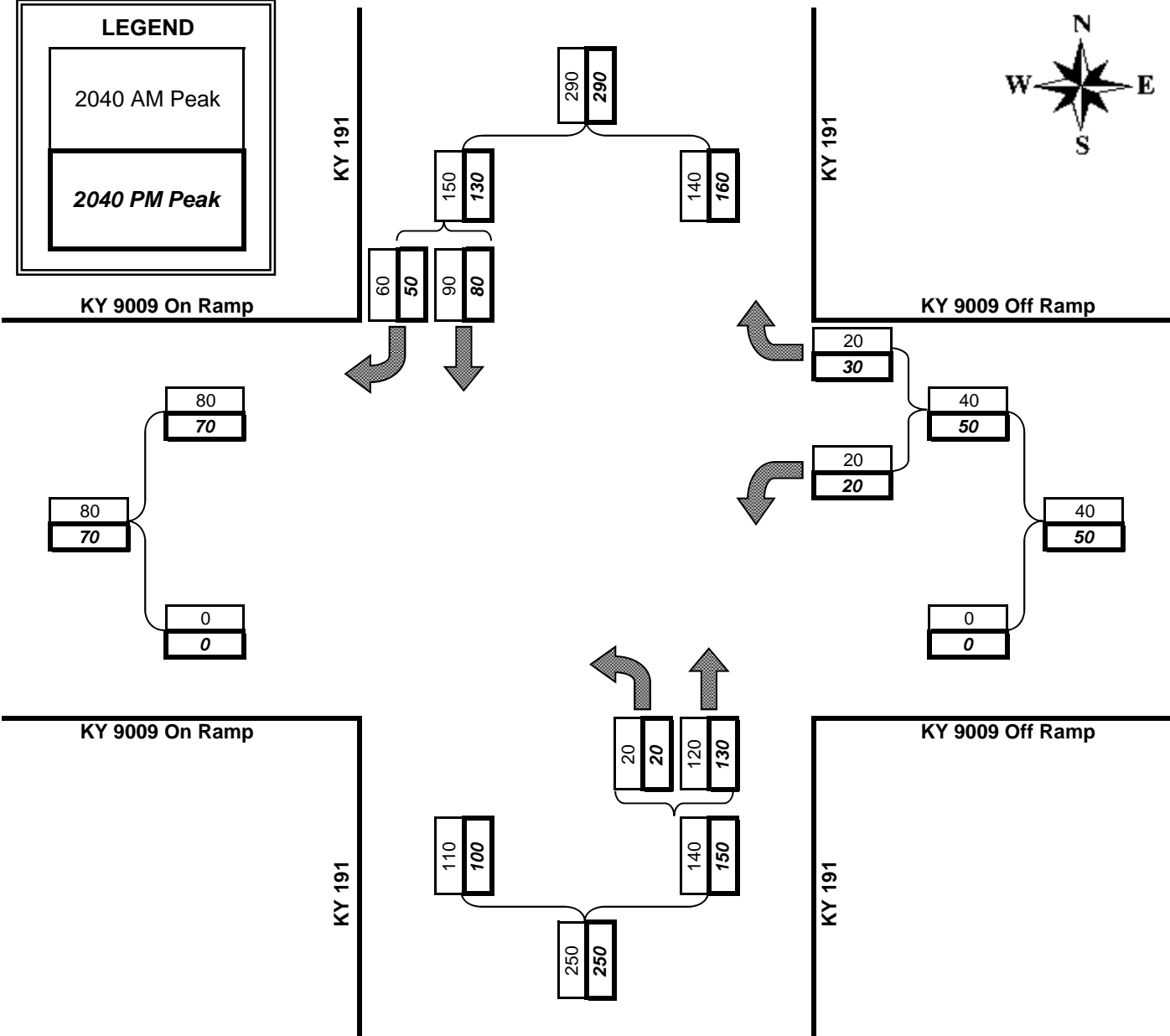
**Appendix B.
Design Hour Intersection Turning Movements**

Wolfe
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KY 9009 WB Ramps at KY 191

LEGEND

2040 AM Peak

2040 PM Peak



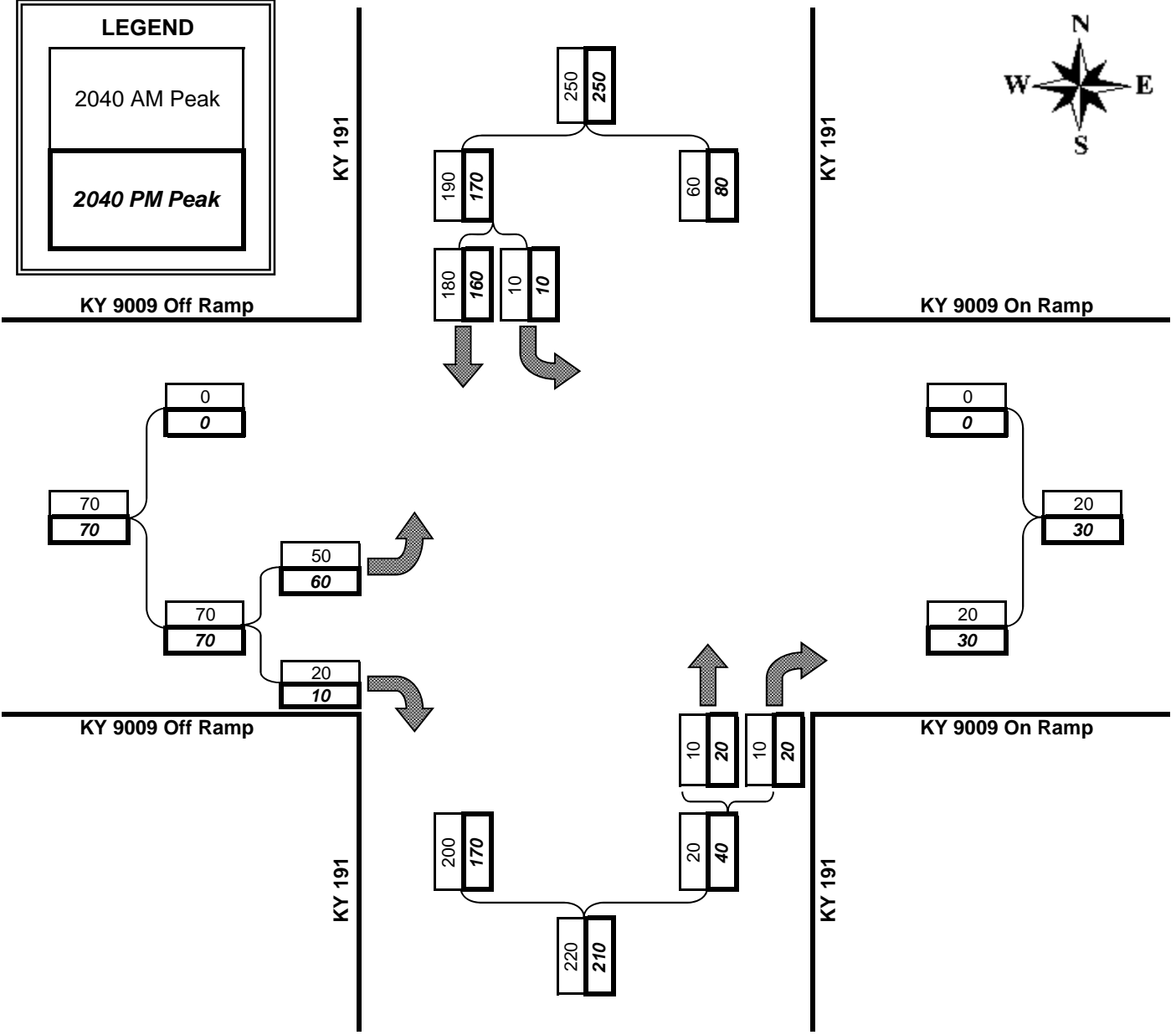
PREPARED BY: T. Creasey DATE PREPARED: 6-May-13	Notes:
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Wolfe
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KY 9009 EB Ramps at KY 191

LEGEND

2040 AM Peak

2040 PM Peak



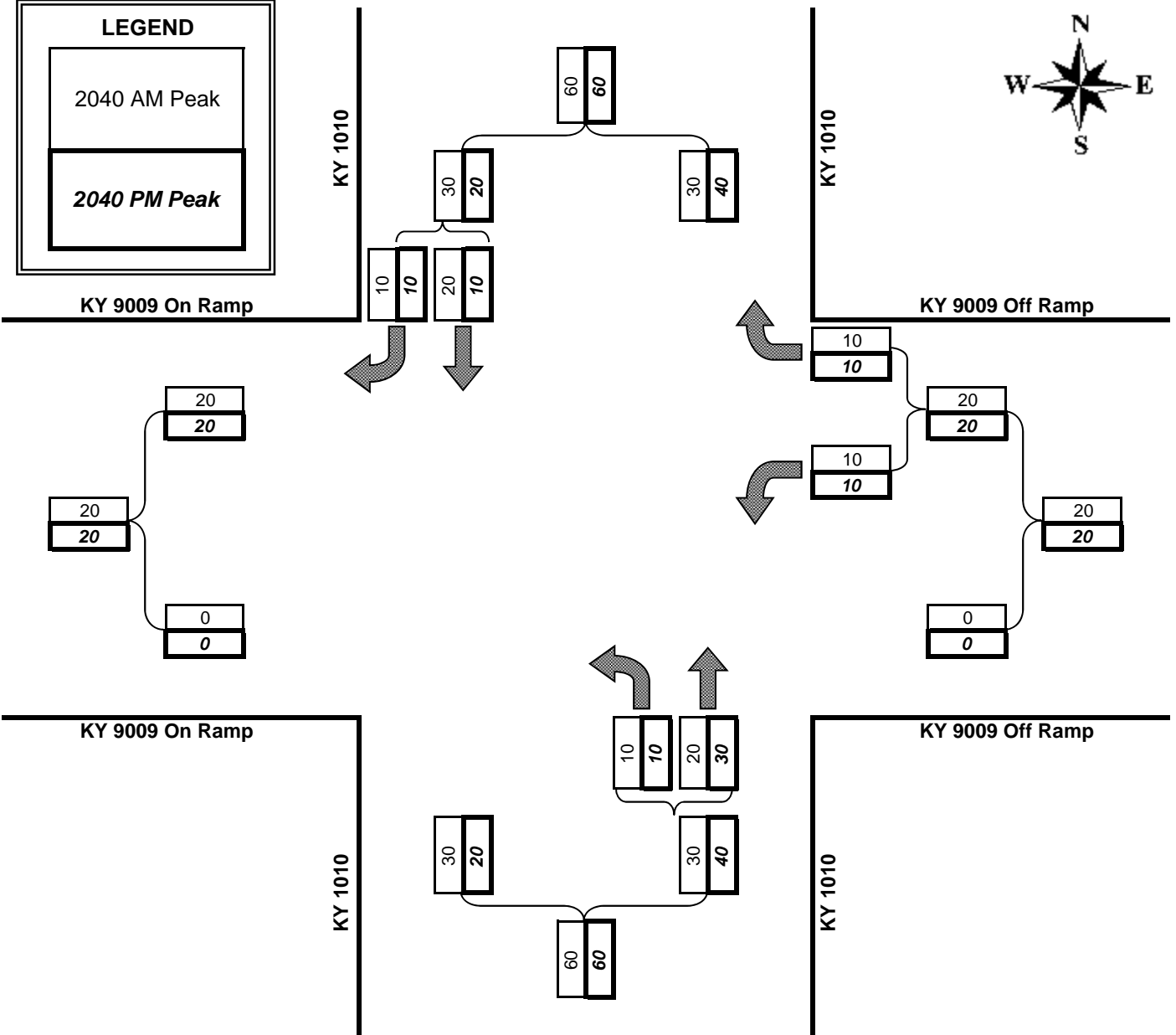
PREPARED BY: T. Creasey DATE PREPARED:	Notes:
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Wolfe
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KY 9009 WB Ramps at KY 1010

LEGEND

2040 AM Peak

2040 PM Peak



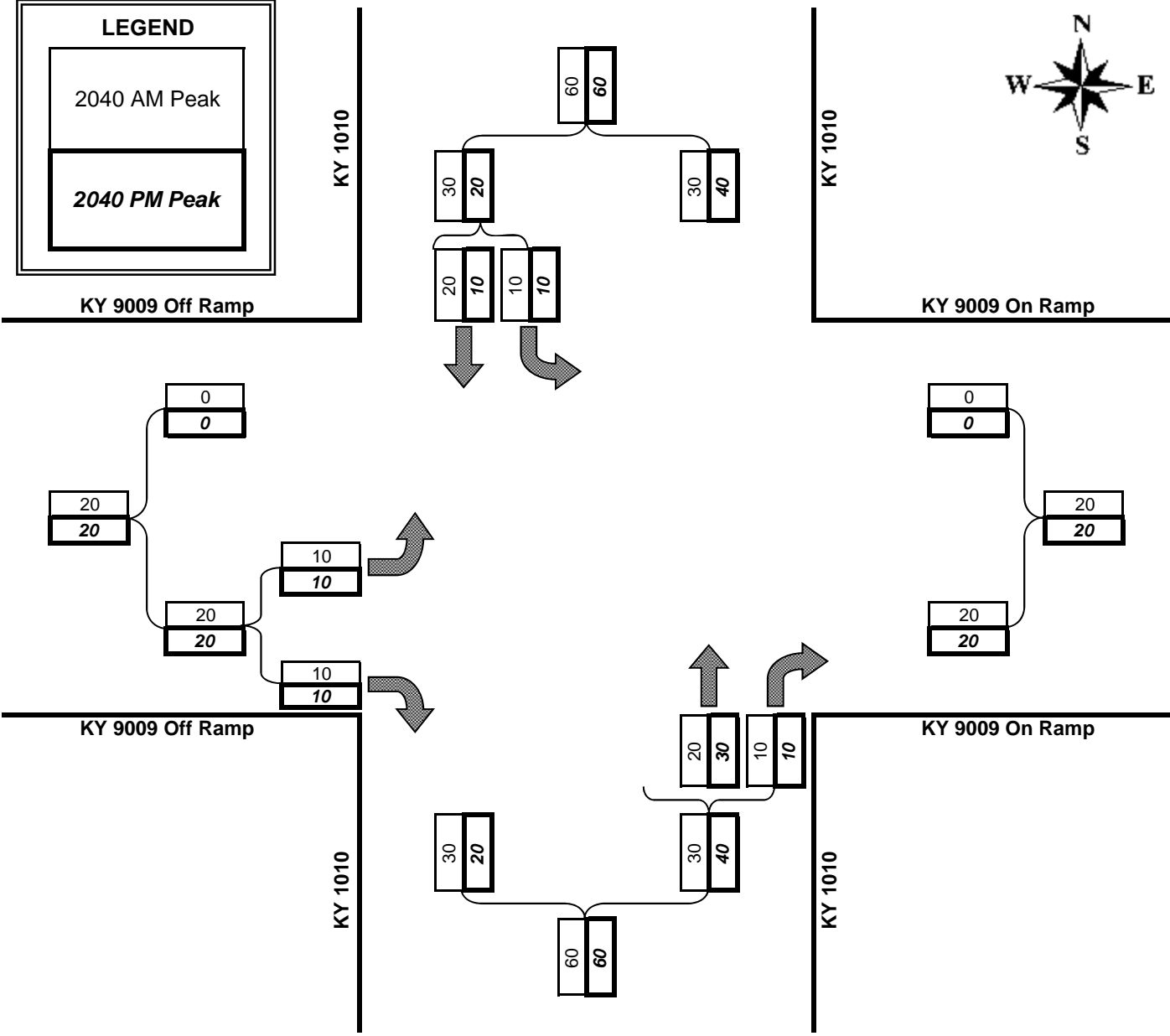
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Wolfe
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KY 9009 EB Ramps at KY 1010

LEGEND

2040 AM Peak

2040 PM Peak



PREPARED BY: T. Creasey DATE PREPARED:	Notes:
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**Appendix C.
ESAL Worksheets**

FORECAST OF EQUIVALENT SINGLE AXLE LOAD ACCUMULATIONS (20-year)

ROUTE ID:

County	Wolfe	Date	04/30/13
Road Name	9009	Forecaster	Tom Creasey
Functional Class	2 - Rural Principal Arterial	MARS No.	0
Project Description	Widen the Mountain Parkway to 4 lanes from KY 191 (MP 46.2) to KY 205 (MP 57.2)	Item No.	10-168.00
Scenario		Route No.	KY
Segment Description		Beg. MP	46.2
		End MP	53.3
		T.F. No.	0.000
		No. of Lanes	4
		1 or 2 way	2

REFERENCES:

Previous Forecasts	None	K- Factor Value	11.0%
Traffic Volume Milepoint	2009/2010 Traffic Counts, TDM Forecast Year, Growth Rate	K-Factor Source	2010 Counts
Truck Percent Milepoint	2009 VCC, Sta. A14 2.6	PHF	0.9
ESAL Information	2007 Aggregated ESALS		
Growth Rate	1.1%		

TRAFFIC PARAMETERS:

		Present Year	Growth Rate	Construction Year	Median Year	Design Year
		2013		2016	2028	2040
Volume	(AADT)	3400	1.1%	3500	4000	4600
Percent Trucks	(%T)	21.0%	0.0%	21%	21%	21%
Number of Trucks		710	1.1%	740	840	970
Percent Trucks Hauling Coal	(%CT)	0%	-1.1%	0%	0%	0%
<i>Non-Coal Trucks:</i>						
Axles/Truck	(A/T)	3.600	0.00%	3.600	3.600	3.600
ESALs/Axle	(ESAL/A)	0.260	1.60%	0.273	0.330	0.399
<i>Coal Trucks:</i>						
Axles/Truck	(A/CT)	5.123	0.00%	5.123	5.123	5.123
ESALs/Axle	(ESAL/CA)	3.3	0.00%	3.300	3.300	3.300

ESAL CALCULATIONS: SEE ATTACHED ESAL CALCULATION SHEET

Design ESALs in Critical Lane 3,700,000

General Comments:

FORECAST OF EQUIVALENT SINGLE AXLE LOAD ACCUMULATIONS (20-year)

ROUTE ID:

County	Wolfe	Date	04/30/13
Road Name	9009	Forecaster	Tom Creasey
Functional Class	2 - Rural Principal Arterial	MARS No.	0
Project Description	Widen the Mountain Parkway to 4 lanes from KY 191 (MP 46.2) to KY 205 (MP 57.2)	Item No.	10-168.00
Scenario		Route No.	KY
Segment Description		Beg. MP	53.3
		End MP	57.2
		T.F. No.	0.000
		No. of Lanes	4
		1 or 2 way	2

REFERENCES:

Previous Forecasts	None	K- Factor Value	11.0%
Traffic Volume Milepoint	2009/2010 Traffic Counts, TDM Forecast Year, Growth Rate	K-Factor Source	2010 Counts
Truck Percent Milepoint		PHF	0.9
ESAL Information	2009 VCC, Sta. A14 2.6		
Growth Rate	2007 Aggregated ESALS 1.0%		

TRAFFIC PARAMETERS:

		Present Year	Growth Rate	Construction Year	Median Year	Design Year
		2013		2016	2028	2040
Volume	(AADT)	3800	1.0%	3900	4400	5000
Percent Trucks	(%T)	21.0%	0.0%	21%	21%	21%
Number of Trucks		800	1.0%	820	920	1100
Percent Trucks Hauling Coal	(%CT)	0%	-1.0%	0%	0%	0%
<i>Non-Coal Trucks:</i>						
Axles/Truck	(A/T)	3.600	0.00%	3.600	3.600	3.600
ESALs/Axle	(ESAL/A)	0.260	1.60%	0.273	0.330	0.399
<i>Coal Trucks:</i>						
Axles/Truck	(A/CT)	5.123	0.00%	5.123	5.123	5.123
ESALs/Axle	(ESAL/CA)	3.3	0.00%	3.300	3.300	3.300

ESAL CALCULATIONS: SEE ATTACHED ESAL CALCULATION SHEET

Design ESALs in Critical Lane 4,000,000

General Comments: