Appendix G - TRAFFIC FORECAST REPORT

TRAFFIC FORECAST REPORT

US 68 Scoping Study
Green and Metcalfe County
KYTC Item No. 3-203.00

Prepared for:

Kentucky Transportation Cabinet
District 3 – Bowling Green
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1.1.1   Travel Demand Model

The traffic forecasts used to analyze current and future conditions and project alternatives were developed from the Kentucky Statewide Travel Model (KYSTM). The KYSTM underwent a major update in 2012 and has the capability to provide Average Daily Traffic (ADT) forecasts on all state-maintained and many local roads for all years through 2040. **Figure 1** illustrates the breadth of the network in and around Kentucky. **Figure 2** presents the network and study corridors within the study area while also showing the green boundaries of the model's Traffic Analysis Zones (TAZ), which act as the basic geographic blocks for generating and distributing the vehicular trips that travel across the network.
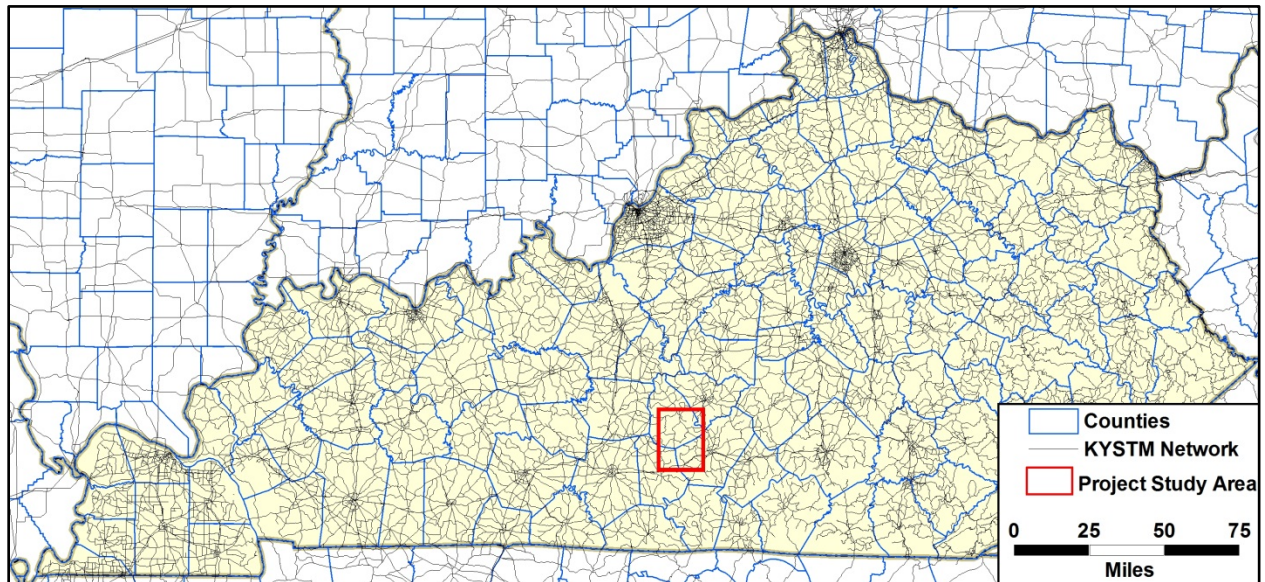
Figure 1: Kentucky Statewide Travel Model (KYSTM) Network

Within each TAZ, the KYSTM incorporates socioeconomic information such as population and household data from the 2010 Census, and employment data maintained by the Kentucky Department of Workforce Investment. The KYSTM uses this data to generate the number of trips produced and attracted within each TAZ for various trip purposes including work commutes; other home-based trips such as shopping, school, and recreational trips; and non-home-based trips, such as commercial traffic. These trips are then distributed between the different TAZs on the highway network, with trip ends matched together based on observed traffic patterns derived from trip survey data and traffic counts. There are 21 TAZs within Green County and Metcalfe County. **Figure 3** presents these 21 TAZs and provides the 2010 base year population, households, and total employment data for each TAZ.
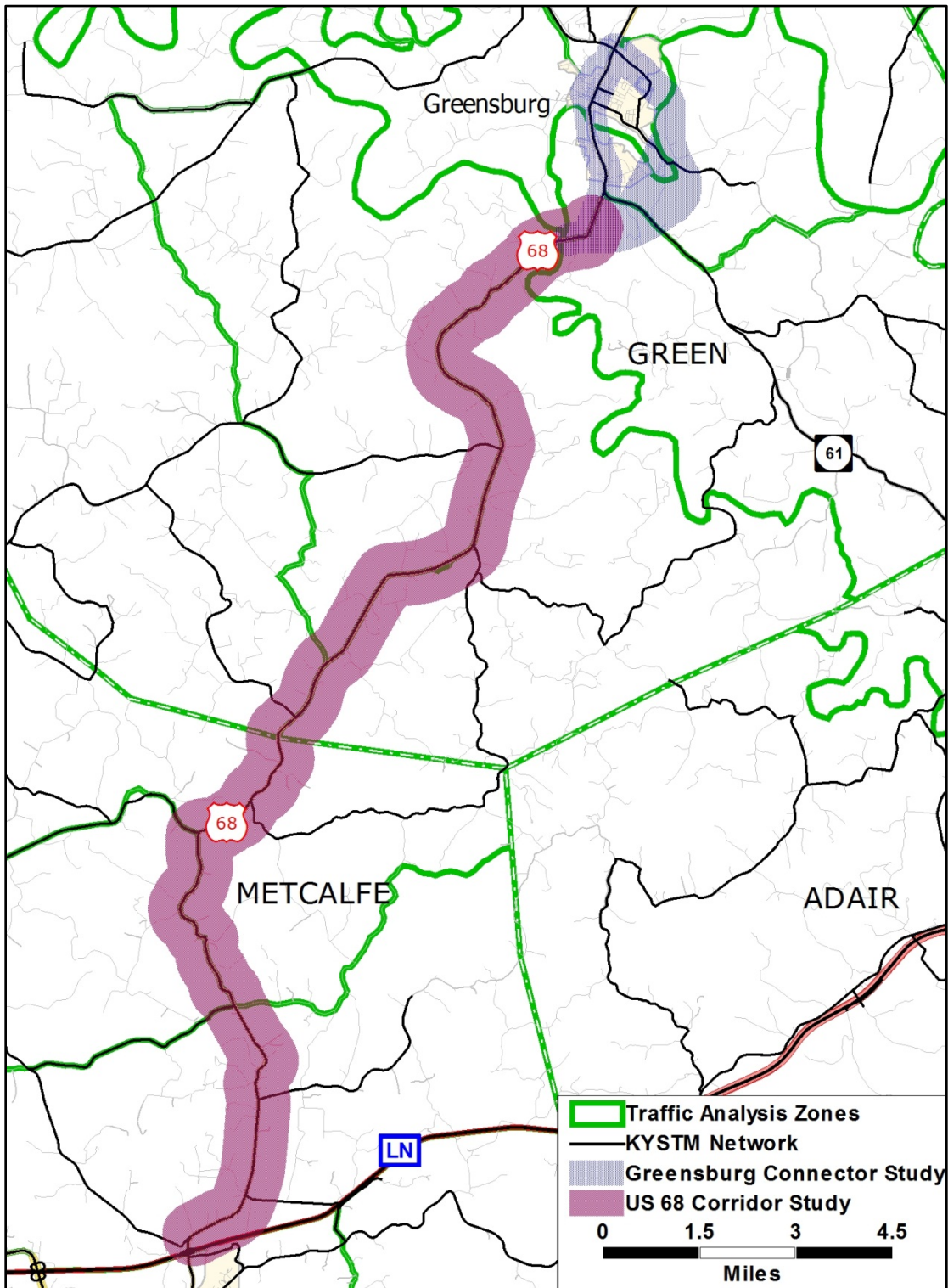
Figure 2 : KYSTM Network and Study Corridors

	TAZ ID	Pop.	Hhlds.	Emp.
Green County	3044011	725	356	2
	3044021	871	417	3
	3044031	1,246	558	19
	3044041	1,182	561	34
	3044051	1,141	487	228
	3044061	685	281	515
	3044071	837	454	287
	3044081	943	453	60
	3044091	817	386	16
	3044101	1,414	648	8
	3044111	1,397	723	490
	Total	**11,258**	**5,324**	**1,662**
Metcalfe County	3085011	1,169	551	5
	3085021	1,517	753	566
	3085031	1,144	505	88
	3085041	723	355	17
	3085051	1,219	539	44
	3085061	757	329	31
	3085071	695	313	157
	3085081	904	409	17
	3085091	1,157	539	888
	3085101	814	388	30
	Total	**10,099**	**4,681**	**1,843**

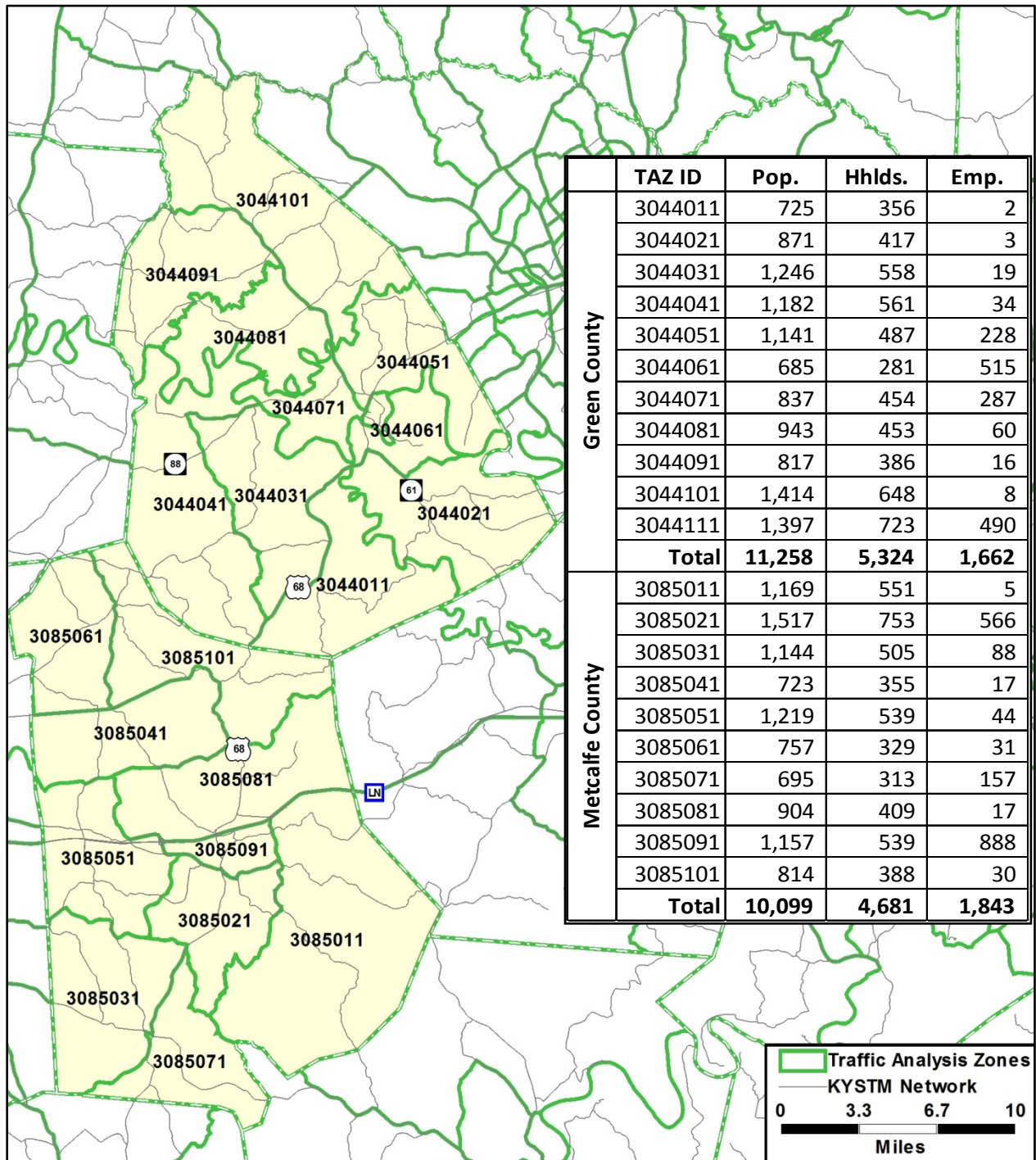**Figure 3: Local TAZs with Socioeconomic Data**

1.1.2   Base Year Calibration

The KYSTM is calibrated to produce base year traffic assignments on state and local highways that are within an acceptable target range of accuracy for the overall statewide area encompassing a variety of larger, medium and small urban areas as well as rural communities. Further, the KYSTM is intended as a starting point for the analysis of local projects where no other model has been developed. When the KYSTM is used for a specific project in a specific location, it must be further refined within that area to better match observed conditions. For this project analysis, the KYSTM was adjusted in two primary areas, the network editing and speed adjustments.

Network edits represent changes in the geographic position of network links to better reflect the physical network. As a statewide model in a rural area, the network is generally confined to highways and local streets with significant traffic, and to centroid connectors. Centroid connectors are the theoretical driveways that aggregate many local roads, side streets, and driveways into one or more centralized connections that then load the traffic generated in a particular TAZ onto the network. At the statewide level, these connectors are set in a relatively uniform pattern to distribute traffic according to the general location of development, local roads, and geographic features. However, at a local level, they may require small location adjustments to properly reflect local traffic patterns that might not be significant at the regional or statewide level. For this analysis, six connectors were moved to better reflect local traffic, three in Edmonton, one in Campbellsville, one in Greensburg, and one southwest of Greensburg between KY 88 and US 68. **Figure 4** shows the location of these adjustments.

The KYSTM uses roadway attributes such as posted speeds, area types, lanes, and roadway widths in equations from 2010 Highway Capacity Manual (HCM) to estimate the speeds and capacities of individual network links. KYTC has also developed observed speed data for much of the statewide highway network, which has been input into the model network. To further enhance the accuracy of the model's network speeds, travel time and speed studies were conducted on primary corridors in and around the area to provide actual data. **Table 1** presents the findings of the speed study and **Figure 5** presents the locations of 13 routes where speed data were collected and applied to the KYSTM network.

1.1.3   Validation Statistics

The accuracy of the model within the project area itself is considered more relevant than the accuracy of the model as a whole. To measure the accuracy of the KYSTM within the project area, 62 traffic counts with volumes greater than 500 vehicles per day were identified within the project area to compare to the model's assignment. **Figure 6** presents the location and observed base year volume of these 62 locations.
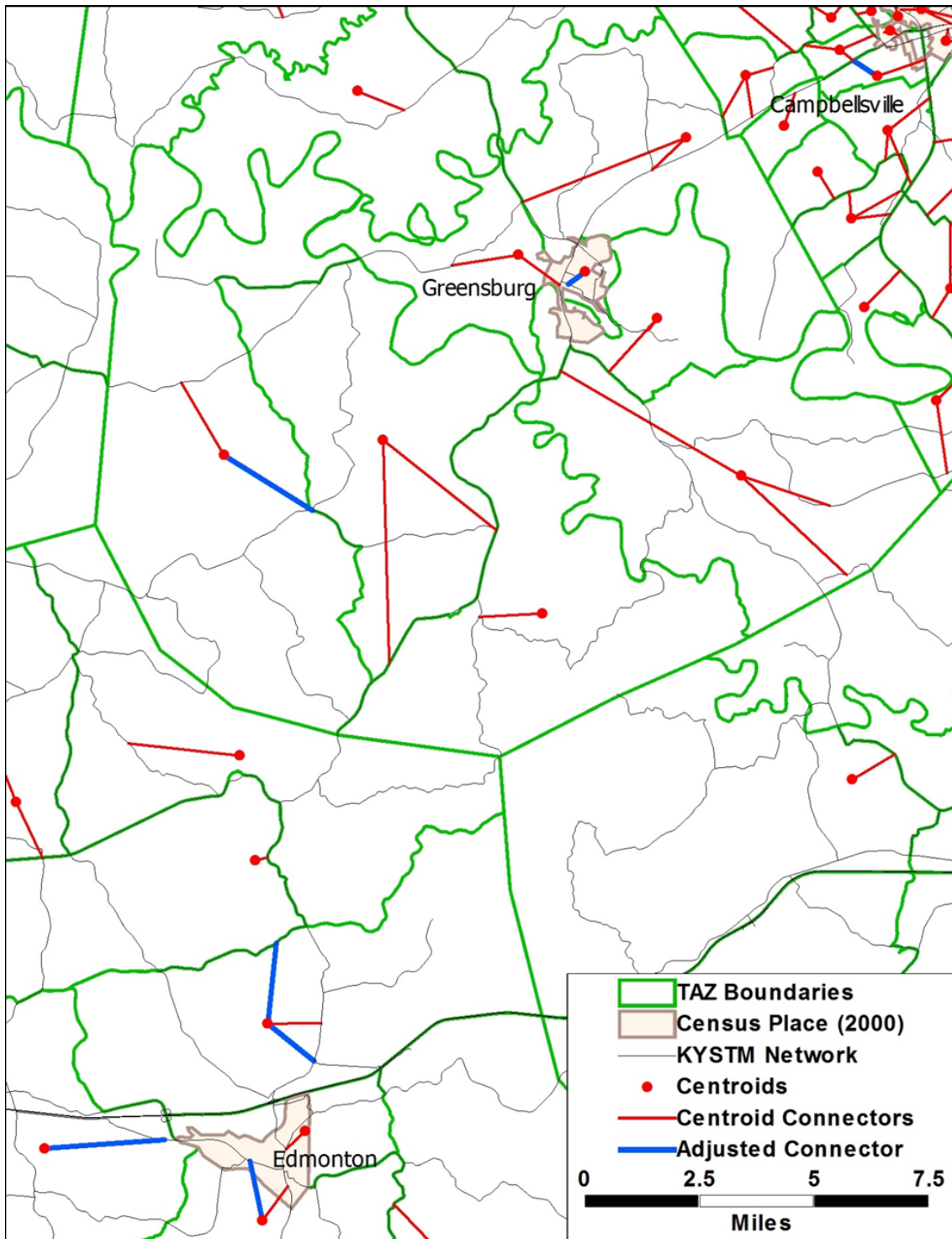
Figure 4 : Centroid Connector Adjustments

	Roadway	County	Begin MP	Begin Description	End MP	End Description	Route Length (Miles)	Travel Speed		Avg. Speed
								AM	PM	
1	I-65	Hart	54.0	Barren - Hart Co Line	64.1	US 31W Overpass	10.2	67.3	59.5	63
2	LN-9008	Metcalfe	22.4	Barren - Metcalfe Co Lin	36.2	Metcalfe - Adair Co Line	13.8	73.5	72.6	73
3	US 68	Metcalfe	0.0	Barren - Metcalfe Co Lin	5.5	Louie B Nunn Pkwy Overp	5.5	50.9	50.9	51
			5.5	Louie B Nunn Pkwy Over	10.4	KY 1243	4.8	41.3	38	40
			10.4	KY 1243	17.8	KY 70	7.5	47.4	48.2	48
			17.8	KY 70	20.0	Metcalfe - Green Co Line	2.2	48.7	48.4	49
		Green	0.0	Metcalfe - Green Co Lin	6.1	KY 218	6.1	53.2	55.9	55
			6.1	KY 218	12.0	KY 61	5.9	51.4	52.4	52
			12.0	KY 61	18.4	Green - Taylor Co Line	6.5	42.7	46.5	45
4	US 31E	Hart	1.5	KY 218	8.4	KY 88	6.8	59.2	48	54
5	US 31W	Hart	0.0	Barren - Hart Co Line	8.2	KY 335/Rowletts Heights Ln	8.2	53.8	44.4	49
			8.2	KY 335/Rowletts Heights	12.1	I-65 Underpass	4.0	44.6	37.8	41
6	KY 61	Metcalfe	0.0	Adair - Metcalfe Co Line	1.1	Metcalfe - Adair Co Line	1.1	53.1	59.3	56
7	KY 70	Metcalfe	0.0	Barren - Metcalfe Co Lin	8.9	US 68	8.9	49.6	50.8	50
8	KY 80	Metcalfe	0.0	US 68	7.9	Metcalfe - Adair Co Line	7.9	45.5	49.8	48
9	KY 90	Metcalfe	0.0	Barren - Metcalfe Co Lin	4.8	KY 163	4.8	55.1	49.7	52
			4.8	KY 163	11.7	Metcalfe - Cumberland Co	6.9	58.2	56.9	58
10	KY 61	Green	0.0	Adair - Green Co Line	8.2	US 68	8.2	50.1	51.7	51
11	KY 88	Green	0.0	Hart - Green Co Line	6.4	KY 1464	6.4	52.7		53
			6.4	KY 1464	11.2	KY 61	4.8	50.1		50
		Hart	17.8	US 31W	23.9	US 31E	6.1	46.8	42.2	45
			23.9	US 31E	30.5	Hart - Green Co Line	6.6	45.4	46.4	46
12	KY 218	Hart	5.2	I-65 Overpass	11.5	US 31E	6.3	44.9	41.9	43
			11.5	US 31E	15.0	KY 436/KY 570	3.5	51.2	49	50
13	KY 436	Hart	0.0	KY 218	5.6	KY 88	5.6	51.7	53	52

Table 1: Speed Study Results
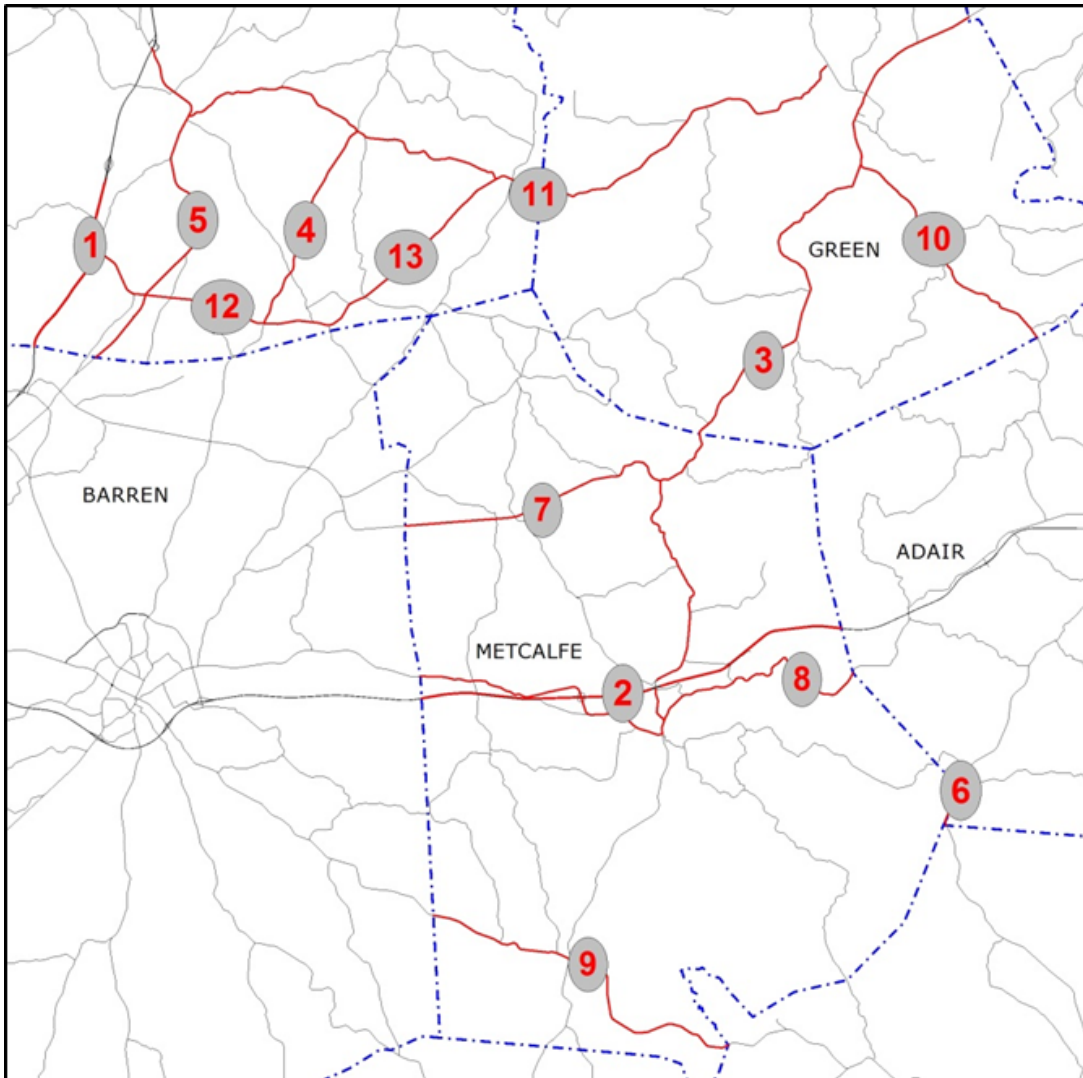
Figure 5 : Speed Study Corridors
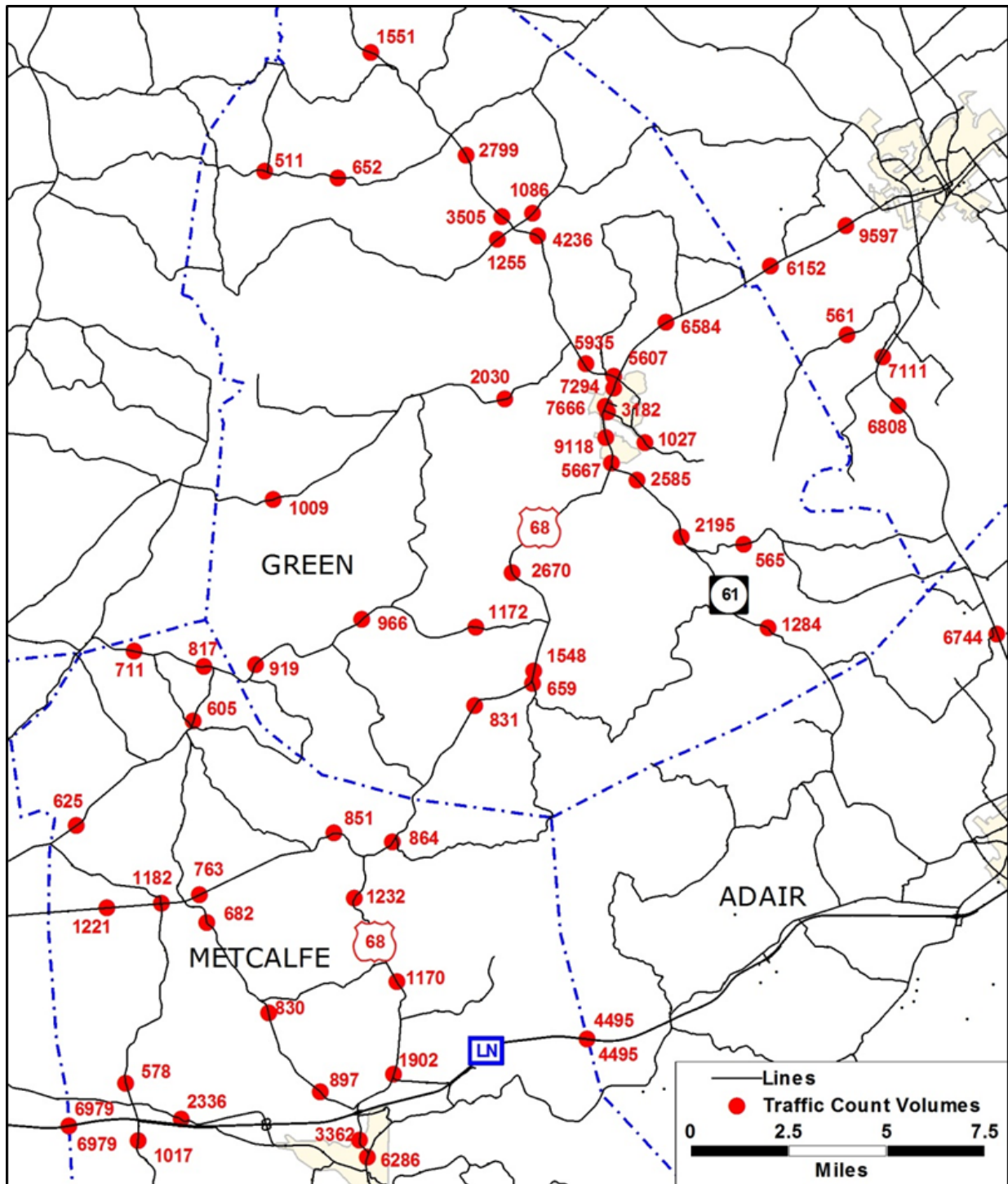
Figure 6 : Traffic Count Volumes and Locations

The most commonly referenced metric for assessing the overall accuracy of a model's assignment is the Percent Root Mean Square Error (%RMSE) statistic, which describes the difference between the model's assignments and the observed counts in terms of a percentage of the average of all counts. For example, a %RMSE of 35 would indicate that on average, the assignments were 35 percent different from the observed volumes. An overall %RMSE smaller than 35 is considered acceptable. **Table 2** demonstrates that the KYSTM, with the network and speed adjustments, is within the desired target thresholds by volume class for this statistic.

Volume Group	# Counts	%RMSE		Target
		Original KYSTM	Modified KYSTM for US 68 Scoping Study	
500 - 1,000	19	65.9	45.2	<75
1,001 - 5,000	28	44.4	34.7	<45
5,000 - 10,000	15	29.9	17.9	<35
Area Wide (all)	62	42.8	28.4	<35

Table 2 Percent Root Mean Square Error

A second statistic often used to assess the relative accuracy of the model assignment is the Coefficient of Determination, represented as R^2. This statistic, which can range from 0 to 1, compares the actual relationship between the assigned volumes and observed counts to the theoretical regression function of $y = x$, where "1" represents a perfect match. An acceptable threshold for R^2 for model assignments is 0.88. The R^2 for the assignments and counts in this project area is 0.89. In **Figure 7**, the black trend line represents the $y = x$ regression line and the red points in the scatter plot illustrate the deviation of assignments to counts.

Based on these two metrics, it was determined that the KYSTM was calibrated within acceptable limits for the study area and could be used for the development of project-level traffic forecasts.
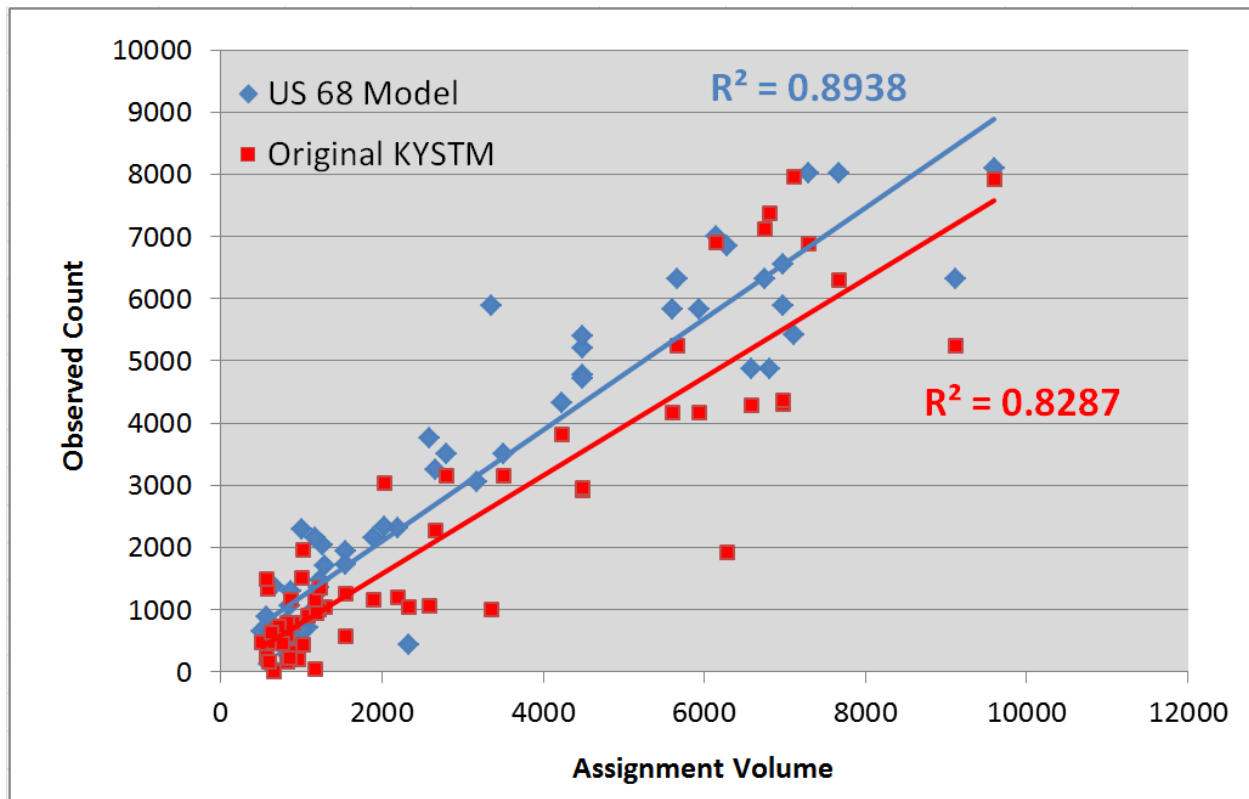
Figure 7 Scatter Plot of Assigned Volumes to Counts

1.1.4   2040 Forecasts

Project forecasts were developed for the year 2040, which is the horizon year for the KYSTM. The 2040 socioeconomic data developed for the model were based on demographic forecasts provided by the Kentucky State Data Center and employment forecasts developed from Woods & Poole Economics, a private economic forecasting service. **Table 3** compares the KYSTM's 2010 and 2040 socioeconomic estimates for the TAZs in Green and Metcalfe counties, and shows the stark disparities between household and employment growth. While the employment growth appears overly optimistic, it is generally in line with the growth trends forecast for the rest of the state and with historical employment trends recorded by the Federal Bureau of Labor Statistics. In contrast, the negative trend in households bears a significant negative effect on the model's local assignments, as people living in households ultimately create travel demand and generates trips. Jobs (i.e. "employment") generally can only attract the trips already generated. Therefore, while external and through traffic may increase slightly, negative household growth in the study area effectively results in negative traffic growth.

	Population			Households			Employment		
Location	2010	2040	Net Change	2010	2040	Net Change	2010	2040	Net Change
Green County	11,258	10,235	-9%	5,324	4,342	-18%	1,662	3,039	83%
Metcalfe County	10,099	10,210	1%	4,681	4,356	-7%	1,843	2,604	41%
Total	21,357	20,445	-4%	10,005	8,698	-13%	3,505	5,643	61%

Table 3 : Original KYSTM's Socioeconomic Forecast

While the negative household forecast in the KYSTM may well prove accurate, for the purposes of this analysis, it is necessary to test the project alternatives against positive local traffic growth. Further, a review of household growth in neighboring Taylor and Adair counties revealed average annual population growth rates of around 0.5%, which is modest, but in line with the region and the state as a whole. Applying a 0.5% growth rate to Green and Metcalfe counties, new population and household estimates were used for project analysis. **Table 4** summarizes the revised socioeconomic data by county.

	Population			Households			Employment		
Location	2010	Revised 2040	Net Change	2010	Revised 2040	Net Change	2010	Revised 2040	Net Change
Green County	11,258	13,075	16%	5,324	6,183	16%	1,662	3,039	83%
Metcalfe County	10,099	11,730	16%	4,681	5,438	16%	1,843	2,604	41%
Total	21,357	24,805	16%	10,005	11,621	16%	3,505	5,643	61%

Table 4: Revised KYSTM Socioeconomic Forecast

The only roadway project in the larger study area that would significantly affect the model's assignment of traffic, either as a new route or through substantially increased capacity such as additional lanes, is the Campbellsville Bypass. Therefore, the project was added to all future

model networks. The bypass adds a new route around the southeast periphery of Campbellsville, from KY 55 on the south to US 68 on the northeast.

1.1.5   2040 Traffic Forecasts

Future model runs were developed for a No-Build scenario, US 68 corridor improvements only (Scenario 1), and for US 68 corridor improvements and the development of the Greensburg Connector around the eastern periphery of Greensburg (Scenario 2). **Figure 8** displays the preliminary traffic forecasts of the scenarios. Future traffic volumes along US 68 throughout the US 68 Corridor Project area are not anticipated to exceed 5,000 vpd. Therefore, capacity should not be an issue in the future and two lanes will be able to accommodate the demand.

Traffic along the proposed US 68 Greensburg Connector varies from 1,500 vpd at the south end (Phase 3, between US 68 and KY 61) to about 4,400 vpd in the middle (Phase 1, from KY 61 to KY 417).

US 68 Scoping Study
Metcalfe and Green County
KYTC Item No. 3-203.00

TRAFFIC FORECASTS

South of Green River
Existing: 7,800
2040 No-Build: 8,500
Scenario 1: 8,700
Scenario 2: 4,500

US 68 Connector
Existing: --
2040 No-Build: --
Scenario 1: --
Scenario 2: 4,000

South of Russell Creek Hill
Existing: 2,400
2040 No-Build: 3,300
Scenario 1: 3,400
Scenario 2: 3,400

US 68 Connector
Existing: --
2040 No-Build: --
Scenario 1: --
Scenario 2: 4,400

US 68 Connector
Existing: --
2040 No-Build: --
Scenario 1: --
Scenario 2: 1,500

GREEN COUNTY

South of Exie
Existing: 990
2040 No-Build: 1,100
Scenario 1: 1,300
Scenario 2: 1,300

ADAIR COUNTY

North of KY 70
Existing: 900
2040 No-Build: 1,100
Scenario 1: 1,300
Scenario 2: 1,300

METCALFE COUNTY

South of KY 70
Existing: 900
2040 No-Build: 2,300
Scenario 1: 2,600
Scenario 2: 2,600

Traffic Forecast Scenarios

Existing: Latest daily traffic count available from KYTC.

2040 No-Build: 2040 daily forecasts assuming no improvements to US 68.

Scenario 1: 2040 Forecast assuming the US 68 Corridor Project is implemented.

Scenario 2: 2040 Forecast assuming the US 68 Corridor Project and the US 68 Connector Project are implemented.

All traffic volumes are in vehicles per day (VPD).

Source: KY Statewide Travel Demand Model and Stantec

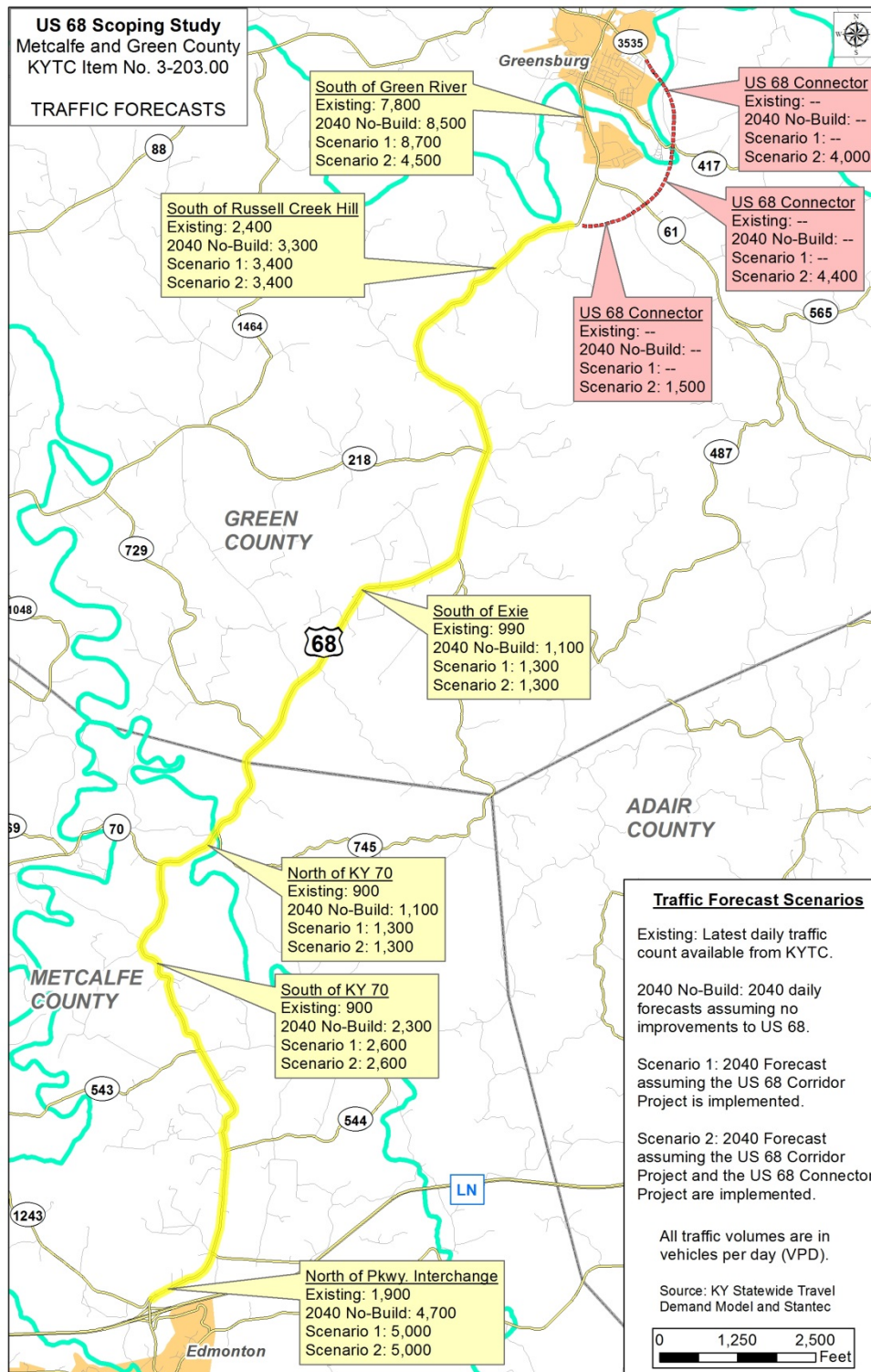North of Pkwy. Interchange
Existing: 1,900
2040 No-Build: 4,700
Scenario 1: 5,000
Scenario 2: 5,000

Figure 8 2040 Traffic Forecasts