

**APPENDIX E: Traffic
Forecasting Technical
Memorandum**

To:	Connor Schurman	From:	Graham Winchester, PE
	KYTC Division of Planning		Stantec Consulting Services
File:	Smiths Grove Traffic Forecasting Technical Memorandum	Date:	November 14, 2022

Reference: Smiths Grove Traffic Forecasting Technical Memorandum

PROJECT DESCRIPTION

As part of the Smiths Grove Traffic Operations Study, Stantec was tasked with developing traffic forecasts to assist in the evaluation of improvement concepts. Historical traffic data, population trends, the Buc-ee's Traffic Impact Study, and the Bowling Green/Warren County Travel Demand Model were used to develop the forecasts. **Figure 1** presents the study area, which includes KY 101 from just south of the I-65 interchange (Exit 38) at MP 7.6 to north of the interchange near Brown Street at MP 8.2.

This memorandum presents the methodology and assumptions used in the development of the traffic forecasts for the corridor.

STUDY AREA

These mileposts (MP 7.6 to MP 8.2) generally correspond to the proposed Access Drive at the Buc-ee's Travel Center on the southern end to Brown Street on the northern end. This study will focus on identifying locations for potential crash countermeasure treatments and will assess future traffic demand along the corridor. Short- and long-term improvement concepts will be considered along the KY 101 corridor and at the I-65 interchange.

HISTORICAL TRAFFIC VOLUMES AND GROWTH

Eight KYTC count stations were used to analyze historical traffic trends for the KY 101 corridor and surrounding roadways, as shown in **Figure 2**. These count stations are located on KY 101 and I-65 in the immediate project vicinity. Average daily traffic (ADT) volumes and annual growth rates for I-65, KY 101 South, and KY 101 North are summarized in **Table 1**, **Figure 3**, and **Figure 4**. While counts can fluctuate significantly from year to year for many reasons, they still provide an opportunity to identify different growth trend lines. Table 1 presents the calculated compound annual growth rate (CAGR) for both long- (around 20 years) and short-term (around 10 years) trend lines. The red text in **Table 1** represents traffic counts from 2020 which are not an accurate representation of recent traffic patterns due to COVID shutdowns in 2020 and were not used to calculate the compound annual growth rates. Additionally, the 2015 count at station 114073 was likely high due to construction on I-65 and was not used to calculate growth rates.

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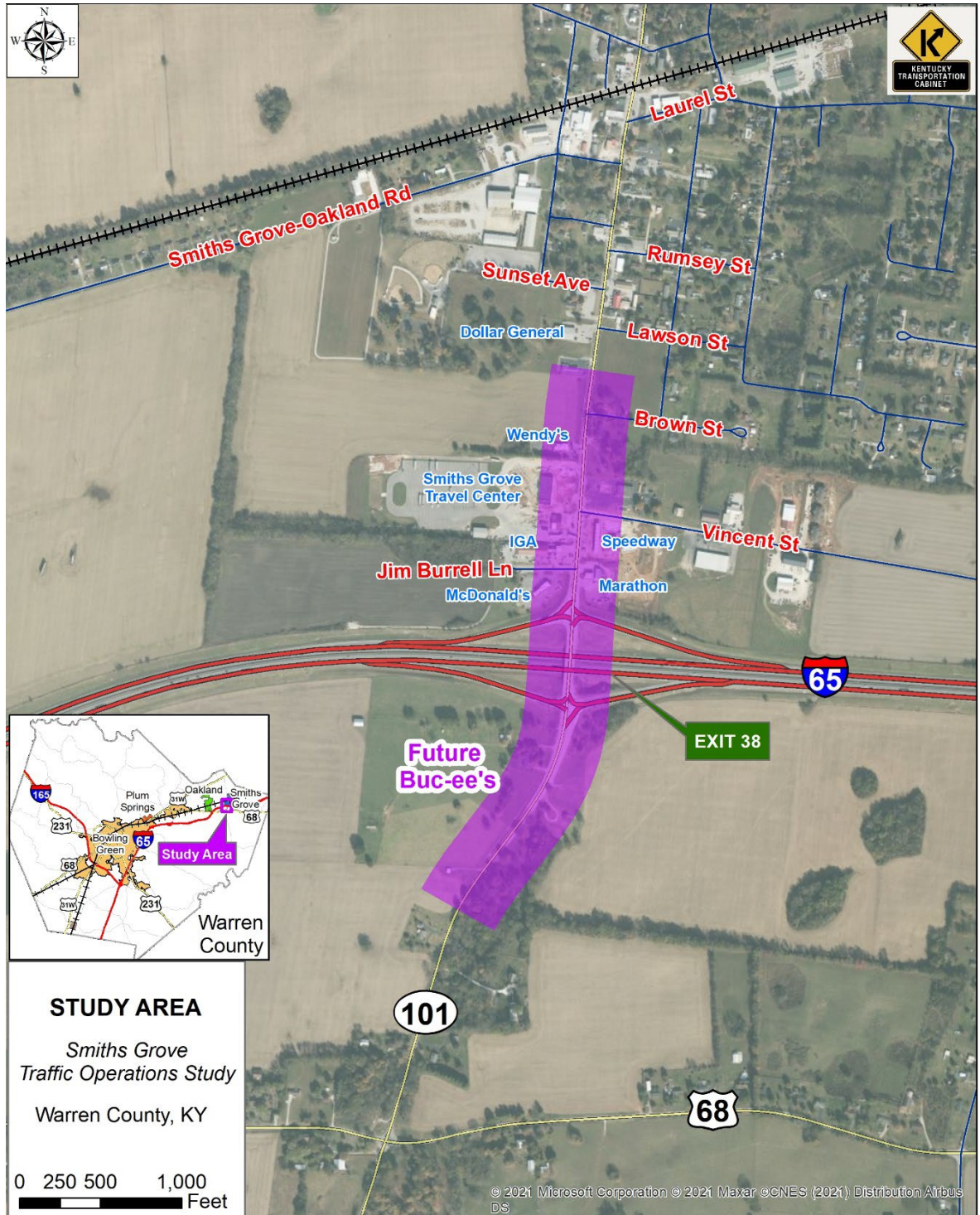


Figure 1. Smiths Grove Study Area

Reference: Smiths Grove Traffic Forecasting Technical Memorandum

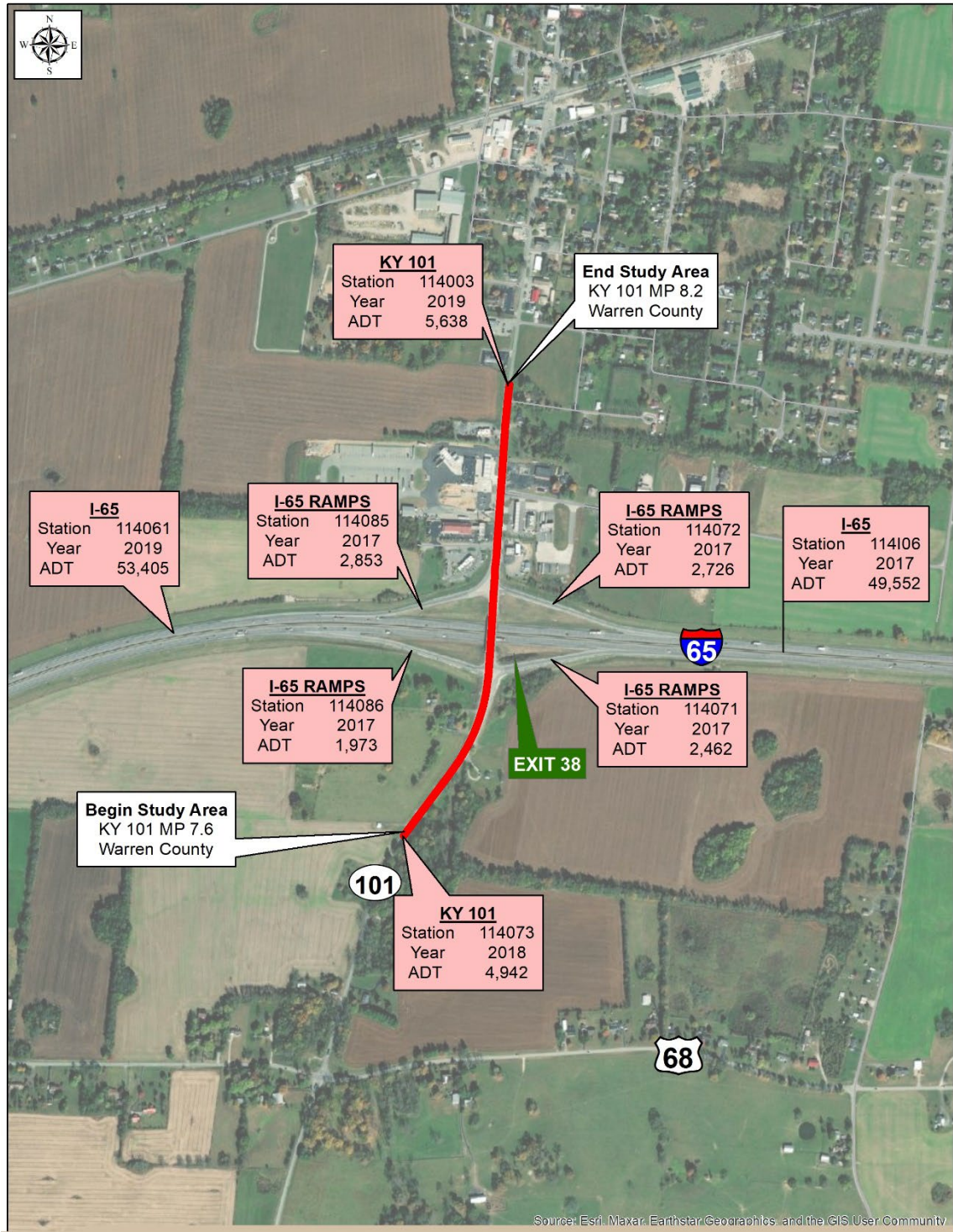


Figure 2. KY 101 Project Area and KYTC Count Station ADTs

Reference: Smiths Grove Traffic Forecasting Technical Memorandum

Table 1. Current KYTC Average Daily Traffic (ADT) Estimates

Year	KY 101 S	KY 101 N	I-65 N	I-65 S	I-65 SB On Ramp	I-65 NB Off Ramp	I-65 NB On Ramp	I-65 SB Off-Ramp
	Sta. 114073	Sta. 114003	Sta. 114106	Sta. 114061	Sta. 114085	Sta. 114086	Sta. 114071	Sta. 114072
2000	3,160							
2001		3,690	37,000	47,600				
2002				49,600				
2003	3,600		42,300					
2004		4,840	43,200					
2005			42,000	45,800	2,128	2,147	1,885	1,758
2006	3,840		45,200					
2007		4,860	41,300	42,800				
2008				45,300				
2009	3,990		43,300					
2010		4,740						
2011								
2012	4,725		43,450					
2013		4,859	46,367		2,181	1,868	1,782	1,992
2014			41,830					
2015	6,047*		42,978					
2016		4,894						
2017			49,552		2,853	1,973	2,462	2,726
2018	4,942							
2019		5,638		53,405				
2020					2,247*	1,280*	1,424*	1,589*
Long Term % CAGR	2.52%	2.38%	1.84%	0.64%	2.47%	-3.39%	2.25%	3.72%
Medium term % CAGR	2.41%	1.95%	1.70%	1.51%	6.95%	1.38%	8.42%	8.16%

Source: Kentucky Transportation Cabinet (KYTC)

*Not used in growth rate calculations

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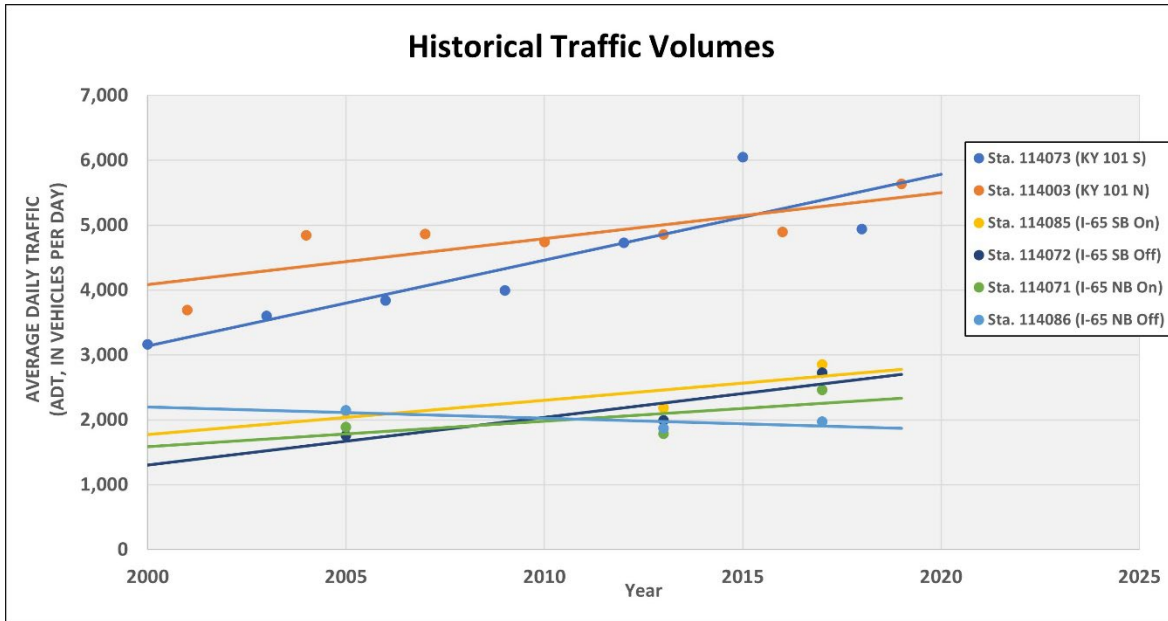


Figure 3. Historical KYTC Traffic Volumes

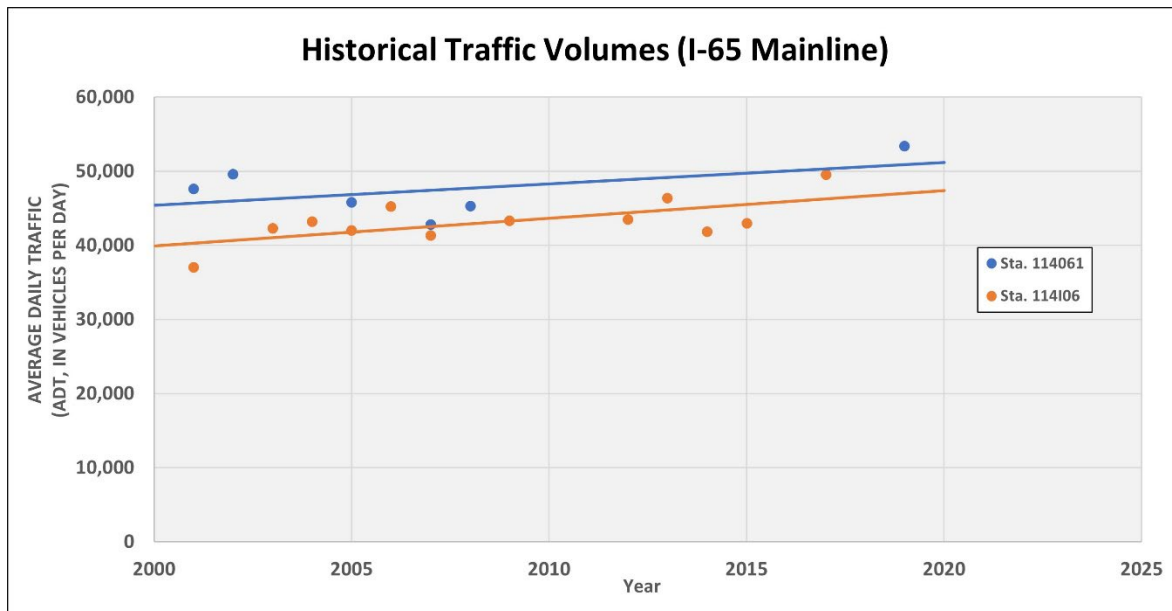


Figure 4. Historical KYTC Traffic Volumes (I-65 Mainline)

Reference: Smiths Grove Traffic Forecasting Technical Memorandum

POPULATION

Population data were obtained from the Kentucky State Data Center (KSDC) at the University of Louisville which is Kentucky’s official clearinghouse for Census data. Population projections for the state of Kentucky, Warren County, and Bowling Green are summarized in **Table 2**. Population projections for the year 2040 are used to estimate the annual growth rate for the years within 2020 and 2040. Over the past 20 years, Warren County and the City of Bowling Green have grown faster than the state average, at just under 2 percent per year. Warren County is expected to continue to grow at a rate of 1.6 percent per year over the next 20 years.

Table 2: Kentucky, Warren County, and Bowling Green Population Projections

Area	Census Estimates			Annual Growth	2040 Projection	Annual Growth
	2000	2010	2020	2000 - 2020		2020 - 2040
Kentucky	4,041,769	4,339,367	4,505,836	0.54%	4,886,381	0.41%
Warren County	92,522	113,792	133,207	1.84%	183,705	1.62%
Bowling Green	49,296	58,067	72,294	1.93%	N/A	

BUC-CEE'S TRAFFIC IMPACT STUDY

Based on a review of the Traffic Impact Study (TIS) for the Smiths Grove Travel Center, a 10-year post-development design year traffic analysis scenario was created. During the period between opening day of the proposed development and the 10-year design period, traffic conditions along KY 101 were assumed to grow at a rate of 1 percent per year. During this same period, traffic conditions on the I-65 ramps were assumed to grow at a rate of 3.5 percent per year. The TIS states that these growth rates were developed using historical traffic data from KYTC.

BOWLING GREEN/WARREN COUNTY REGIONAL TRAVEL DEMAND MODEL

The Bowling Green/Warren County Travel Demand Model ("the model") version 8 was updated and used as a tool to develop growth rates. The first step in updating the model was updating the socioeconomic data to account for Buc-ee's traffic. The project team decided to add 200 retail employees to TAZ 410 (shown in **Figure 5**) for both the base and future years. Additionally, after an iterative process that included testing several scenarios, 1,750 Non-Home Based (NHB) and 1,750 Home-Based Other (HBO) special generator trips were added to TAZ 410 for the future year 2045.

Reference: Smiths Grove Traffic Forecasting Technical Memorandum

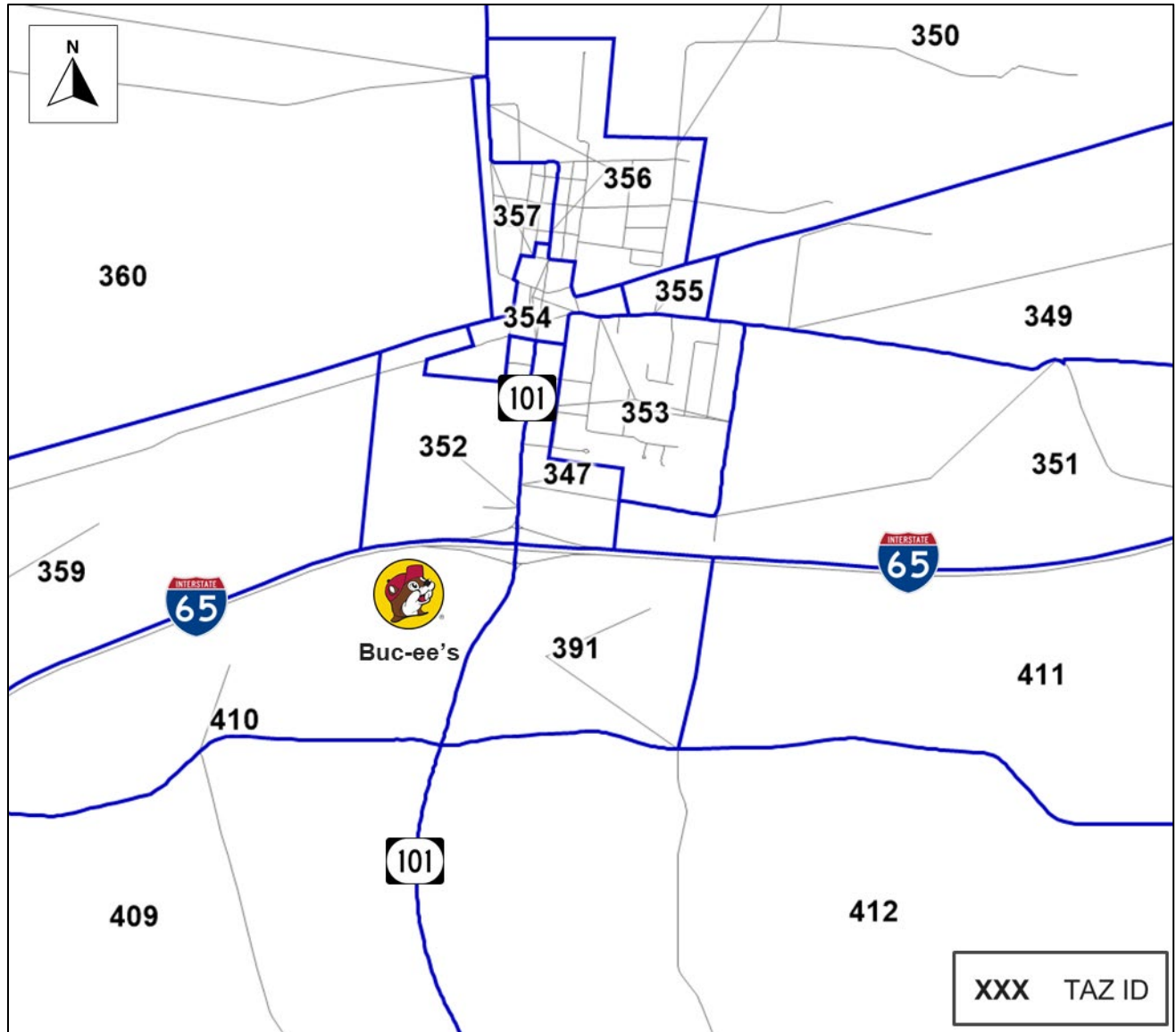


Figure 5: Bowling Green/Warren TDM Traffic Analysis Zones

Along with Buc-ee's, there are several locations near the study portion of KY 101 that could be developed in the next 20 years. The Bowling Green-Warren County MPO provided the following development assumptions, also shown in **Figure 6**:

1. The northwest corner of the I-65 interchange includes 23 acres and has one current proposed development for 400 apartment units and a hotel.

Reference: Smiths Grove Traffic Forecasting Technical Memorandum

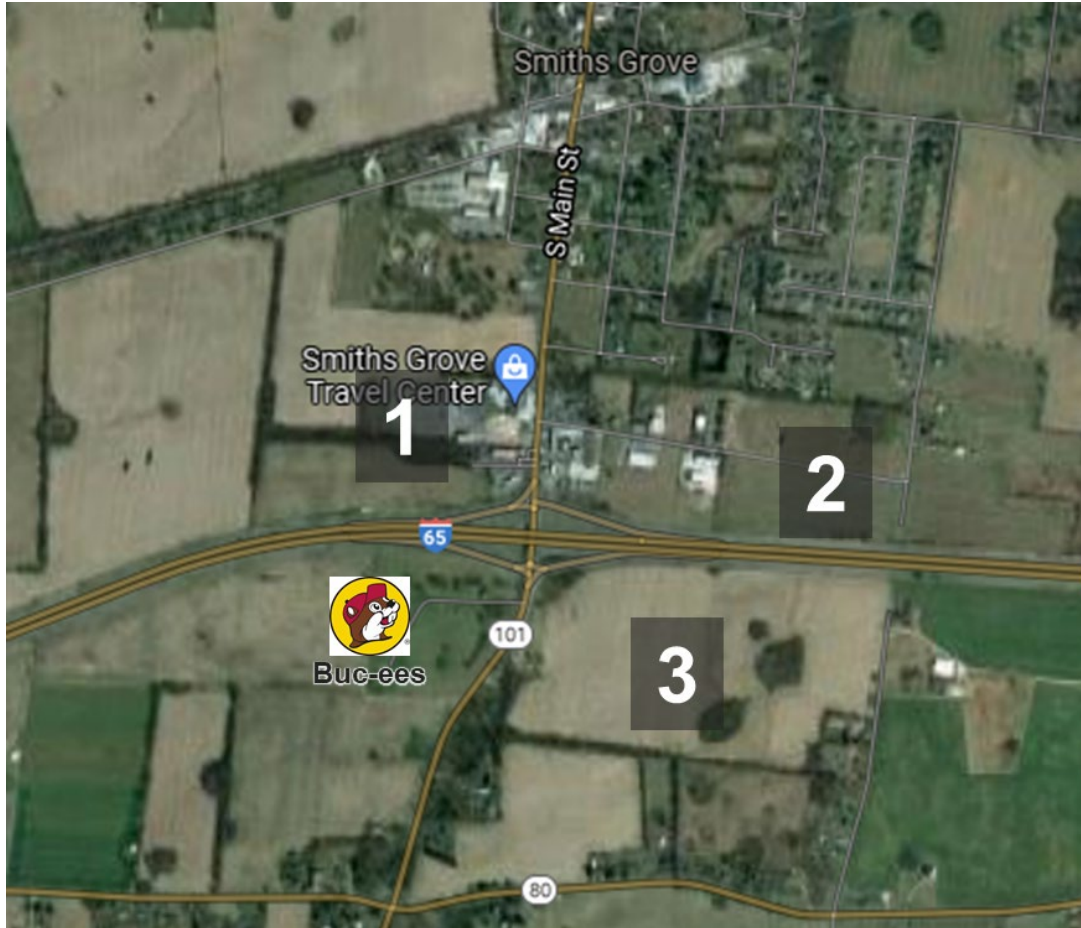


Figure 6: Potential Developments along KY 101

2. The northwest corner of Stanley Rice Road/ McKinley Road intersection includes 16.7 acres and is currently zoned for highway business. Two attempts for re-zoning (apartments) have been denied.
3. The southeast corner of the I-65 interchange is currently zoned for agriculture but could be developed after Buc-ee's.

The model's socioeconomic data was reallocated to ensure that the county employment and household totals remained constant. **Table 3** presents a summary of the updates.

Reference: Smiths Grove Traffic Forecasting Technical Memorandum

Table 3: Bowling Green/Warren TDM Socioeconomic Updates

TAZ	2018		2045					
	RetEmp	Updated RetEmp	HH	Updated HH	RetEmp	Updated RetEmp	NonRetEmp	Updated NonRetEmp
410	0	200	--	--	0	200	--	--
391	--	--	--	--	0	4	0	46
347	--	--	--	--	0	46	--	--
352	--	--	46	146	200	308	--	--
353	--	--	--	--	70	12	--	--
351	--	--	--	--	100	50	10	5
360	--	--	--	--	--	--	42	1
318	--	--	529	429	--	--	--	--

The updated model was then run and network assignments were reviewed to determine annual growth rates on each of the links. **Figure 7** presents the annual growth rates in the study area.

KENTUCKY STATEWIDE TRAVEL DEMAND MODEL (KYSTM)

As an additional data source, study area growth rates from the KYSTM, as shown in **Figure 8**, were also reviewed. Model growth rates on KY 101 range from -0.2 to 3.7 percent per year while growth rates on I-65 are expected to be between 1.5 and 2.1 percent per year.

ENVISION AESC ELECTRIC BATTERY PLANT

An electric vehicle (EV) battery plant is planned to be built at the Kentucky TransPark in northeastern Warren County. The plant is expected to bring 2,000 jobs to the area. The KY 101 corridor is not expected to be used to access the plant. However, the plant will contribute to the continued growth of background traffic.

CONCLUSIONS

Based on historical traffic data, regional population trends, the Buc-ee's TIS, and the Bowling Green/Warren County Travel Demand Model, an annual growth rate of 1.5 percent was used for the Smiths Grove Traffic Operations Study.

Reference: Smiths Grove Traffic Forecasting Technical Memorandum



Figure 7: Bowling Green/Warren County TDM Annual Growth Rates (2018 - 2045)

Reference: Smiths Grove Traffic Forecasting Technical Memorandum



Figure 8: KYSTM Annual Growth Rates (2019 - 2045)

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EXISTING TRAFFIC

The annual growth rate was applied to the latest KYTC daily traffic counts (excluding 2020) to develop 2022 daily traffic estimates, as shown in **Figure 9**.

2032 TRAFFIC FORECASTS

To develop the 2032 daily traffic forecasts, the expected Buc-ee's traffic was added to the 2022 traffic estimates and then the annual growth rate was applied. The daily Buc-ee's traffic was estimated using the peak hour generated trips for the Smiths Grove location along with the hourly percentages of the daily traffic generated by Buc-ee's in Baytown and Terrell, Texas as provided in the Buc-ee's TIS. Based on these estimates, the Buc-ee's in Smiths Grove is expected to generate 7,600 trips in and 7,600 trips out each day. The 2032 daily traffic forecasts are shown in **Figure 10**.

2045 TRAFFIC FORECASTS

The annual growth rate was then used to develop 2045 daily traffic forecasts, shown in **Figure 11**.

Reference: Smiths Grove Traffic Forecasting Technical Memorandum

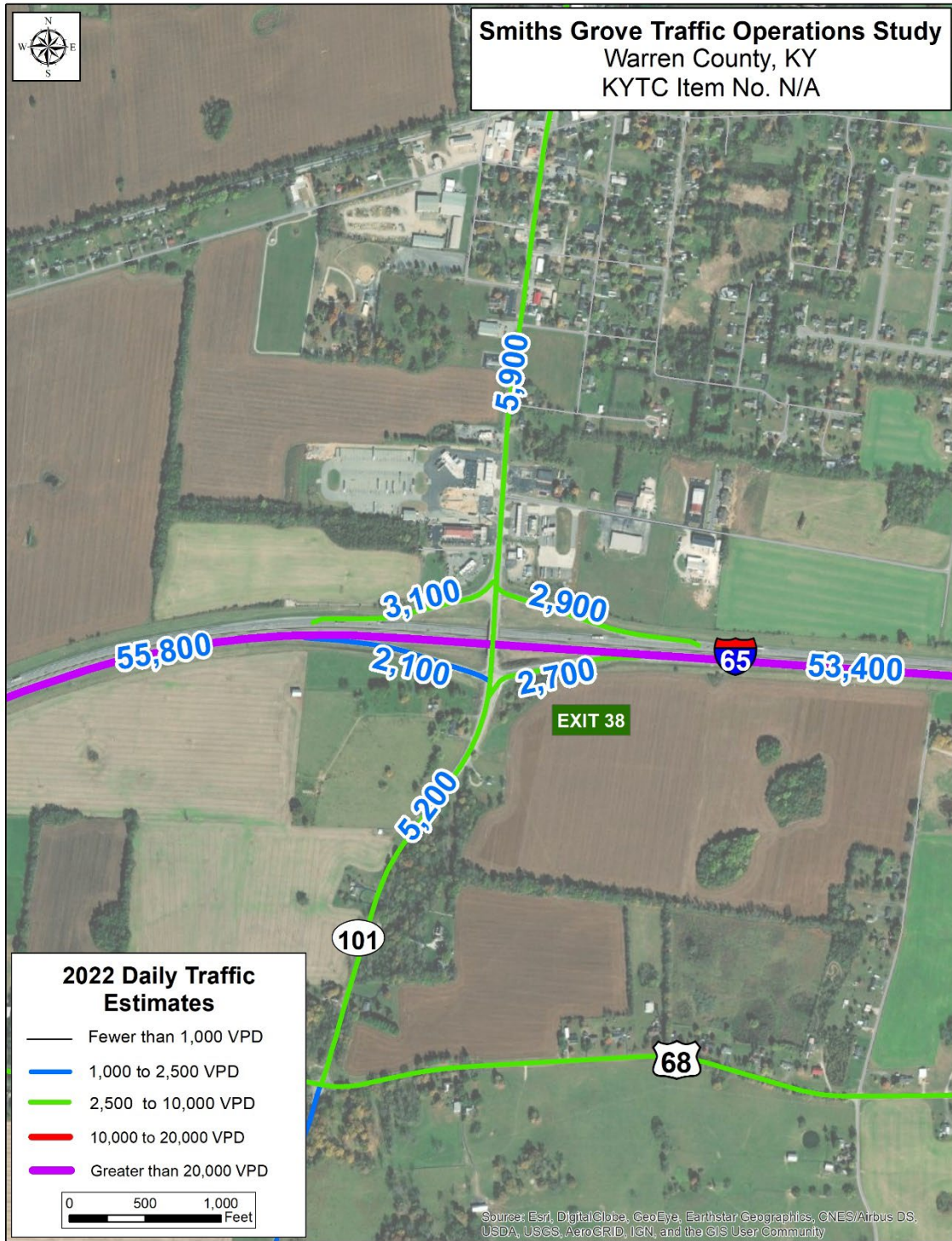


Figure 9: 2022 Daily Traffic Estimates

Reference: Smiths Grove Traffic Forecasting Technical Memorandum

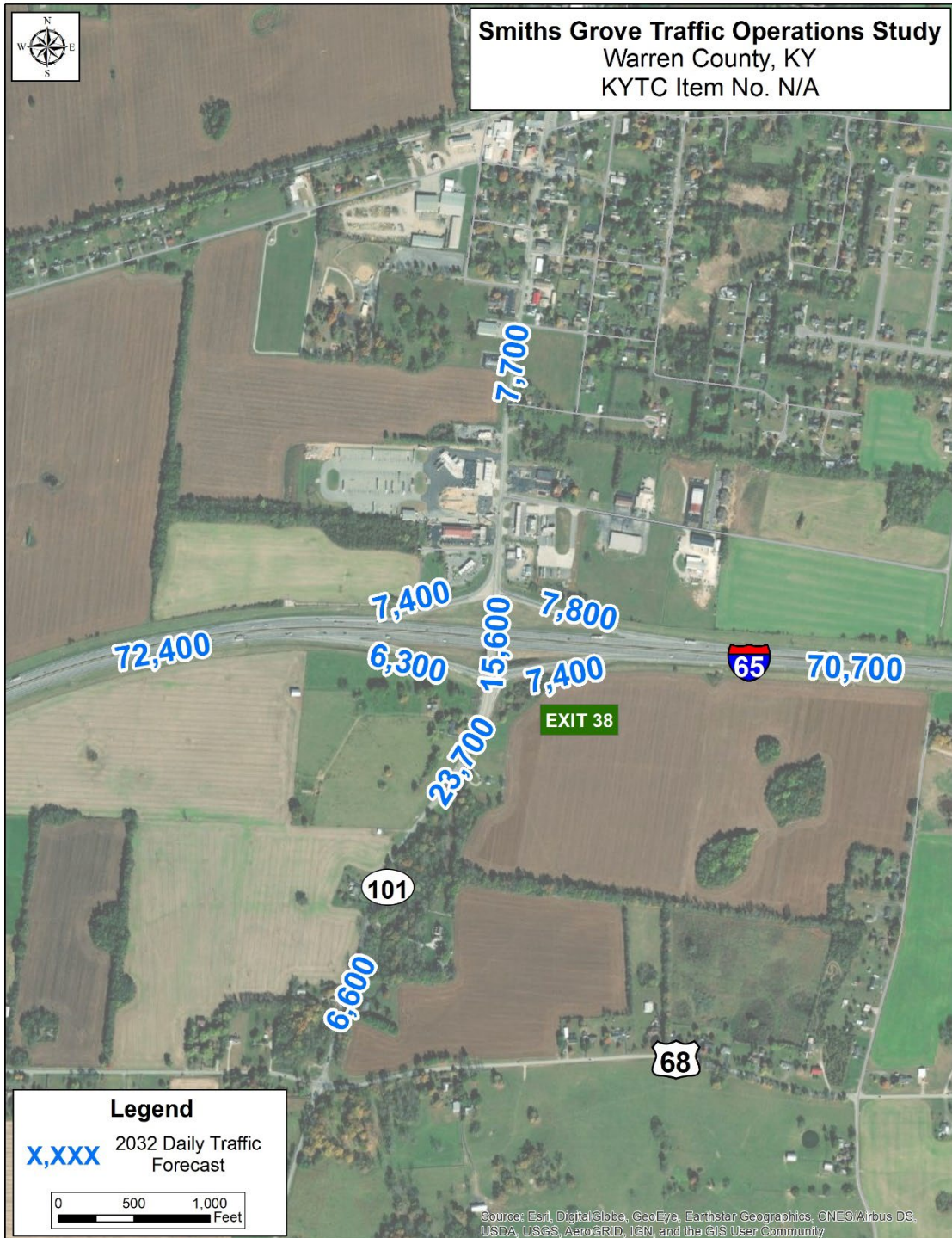


Figure 10: 2032 Daily Traffic Forecasts

Reference: Smiths Grove Traffic Forecasting Technical Memorandum

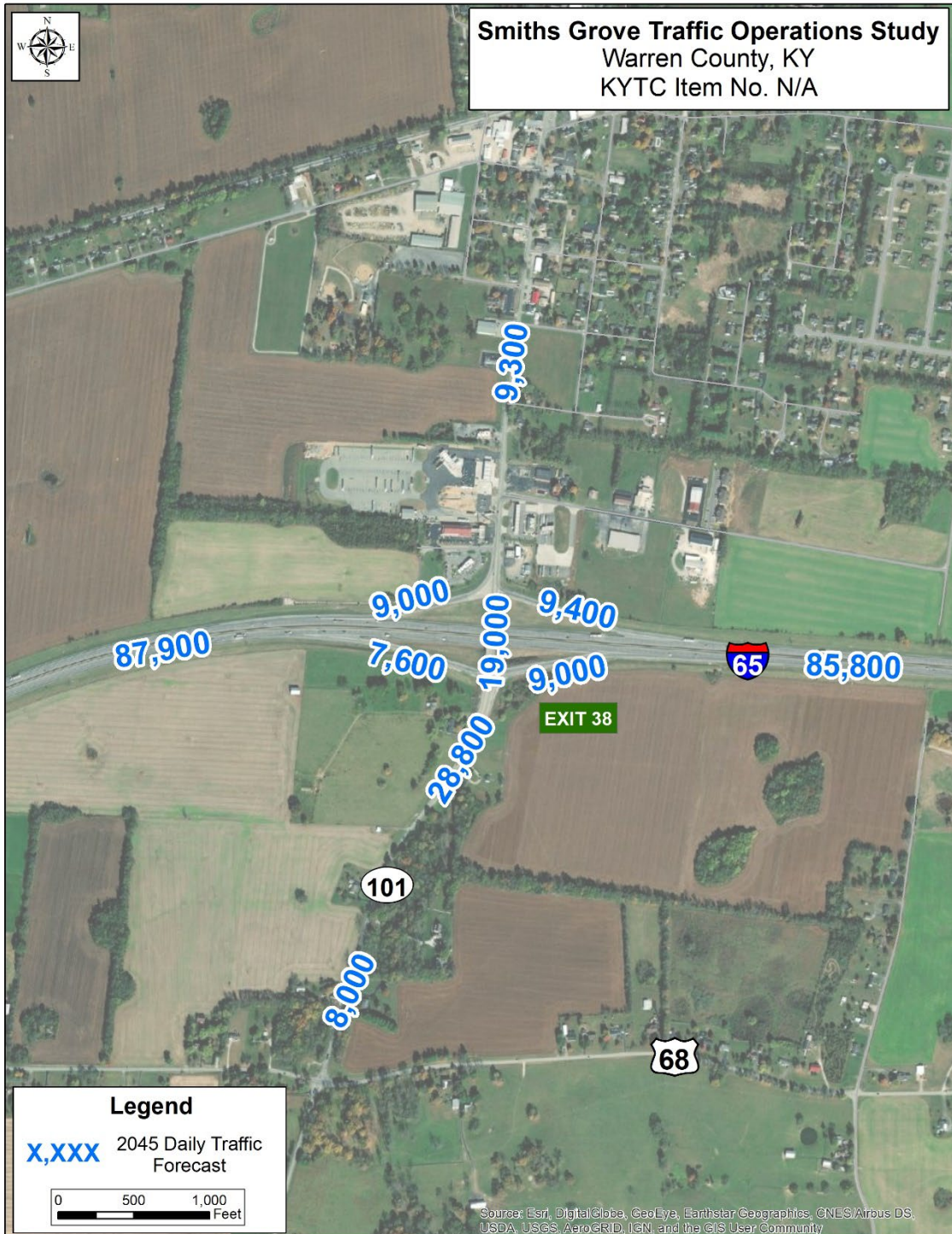


Figure 11: 2045 Daily Traffic Forecasts

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Reference: Smiths Grove Traffic Forecasting Technical Memorandum

NEXT STEPS

The next step is to use the annual growth rate to develop 2032 AM and PM peak hour traffic simulation model scenarios after KYTC has approved the Buc-ee's TIS trip generation and trip distribution numbers.

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A handwritten signature in black ink, appearing to read "Graham Winchester".

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