

APPENDIX E – TRAVEL DEMAND MODEL TECHNICAL MEMORANDUM

February 2019

**McCracken County – Paducah Small Urban Area (SUA) Study
Item No. N/A**Project Description

The Division of Planning conducts SUA transportation studies in Kentucky for metropolitan areas with populations between 5,000 to 50,000 people. A SUA study provides a thorough examination of an area's transportation network, including an analysis of existing and future traffic conditions, with the goal of identifying needs and potential solutions to provide a more efficient transportation network. As part of this examination, preliminary traffic forecasts from the McCracken County Travel Demand Model have been developed to assist in the evaluation of improvement concepts for a SUA study for the city of Paducah, Kentucky in McCracken County. This document summarizes Stantec's minor update of the model and the preliminary model results used for the traffic forecasts.

The Paducah SUA study area includes the city limits of Paducah and adjacent portions of unincorporated McCracken County that comprise the area's existing and future suburban growth. The project study area and KYTC's most recent average daily traffic (ADT) volumes in and around this study area are shown on **Figure 1**.

McCracken County Travel Demand Model Updates

The McCracken County Travel Demand Model ("the model"), which is maintained by KYTC, was used to develop Average Daily Traffic (ADT) volume forecasts for the SUA. The last update of the model reflected a 2013 base year and 2030 forecast horizon year. As a part of the development of the Paducah SUA Study, the model's base year was updated to 2015 and the horizon year extended to 2045. The specific revisions include updates of the model's socioeconomic data, the model's roadway network databases, and traffic counts. The model structure, script, and estimation parameters were not changed.

Socioeconomic Data

Traffic Analysis Zones (TAZs) form the geographical basis for delineating and organizing the socioeconomic data used by the model to generate the vehicular trips that are assigned to the roadway network. Household and population data, as well as employment and school enrollment, are stored in each of the model's 513 internal TAZs which are depicted in **Figure 2**. This socioeconomic data is used to generate the vehicular trips that are eventually distributed and assigned to McCracken County's road network. Traffic count data is stored in the model's 23 external TAZs to represent external trips traveling to, from, and through McCracken County. The McCracken model uses separate TAZ map files for each model scenario, including the 2015 base year and the 2045 future year. For the purposes of presentation, TAZs with similar employment and population characteristics were grouped geographically into larger display Districts, as shown in Figure 2.

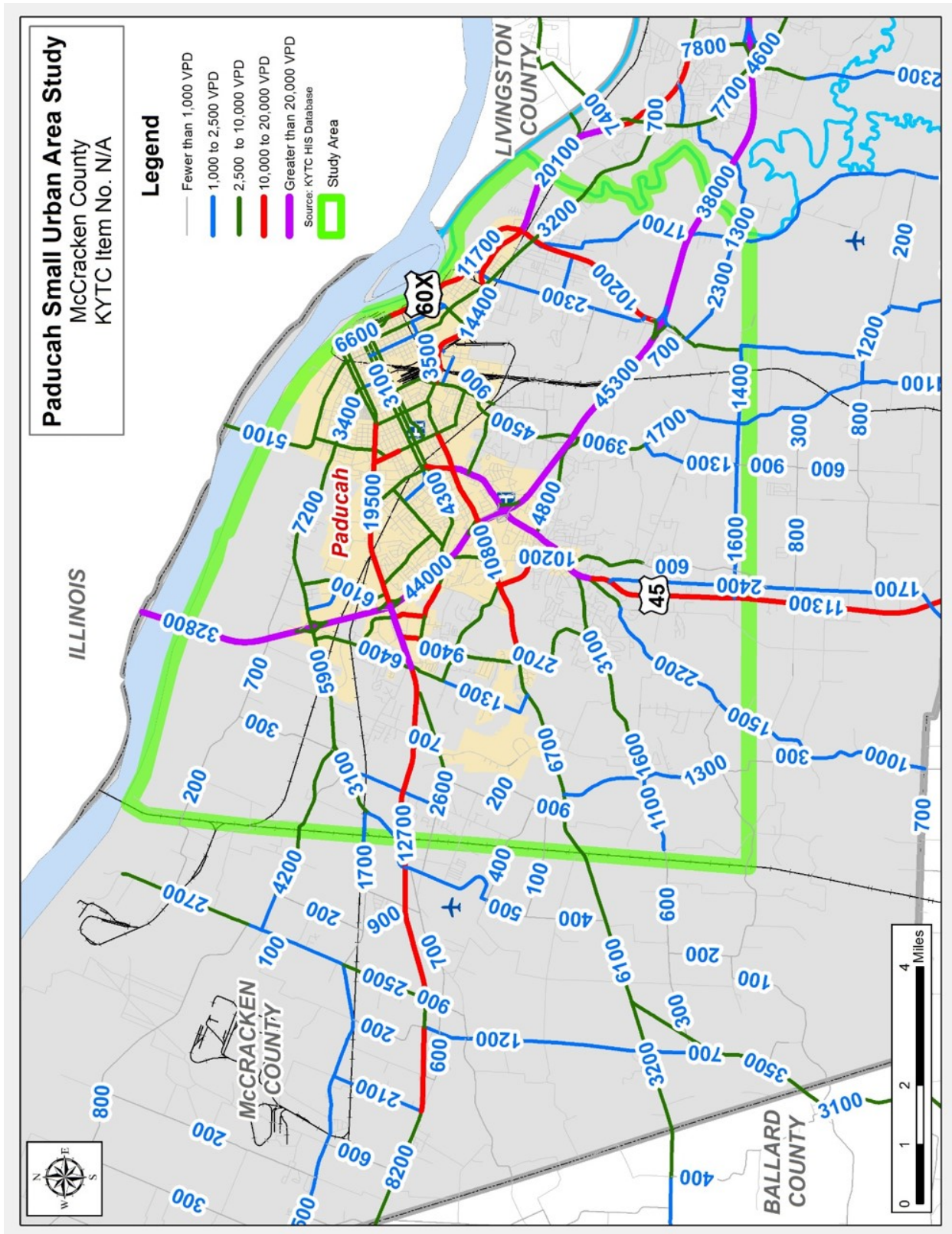


Figure 1: Study Area and Current Average Daily Traffic (ADT) Volumes

Population

Population estimates and projections from the Kentucky State Data Center (KSDC) were used as the county control total for the model's household distribution across TAZs. KSDC estimates McCracken County's population in 2015 to be 65,000 and forecasts it to drop slightly to 64,300 in 2040. Paducah's 2015 Census population estimate is 25,000, which is substantially unchanged from its 2010 Census estimate, but down slightly from 26,300 in the 2000 Census. Discussions with local officials concluded that the slight population declines within the older core and rural periphery of Paducah will continue to be balanced out by growth in suburban areas and some urban districts. A Local Advisory Committee, comprised of local officials, identified Lone Oak, US 60, and the area near Bob Noble Park as areas of potential residential growth. The overall population of McCracken County will remain stable. For the model update, the total population benchmark was extrapolated to the 2045 horizon year, to 64,100. **Figure 2** presents the distribution of residential growth patterns reflected in the model.

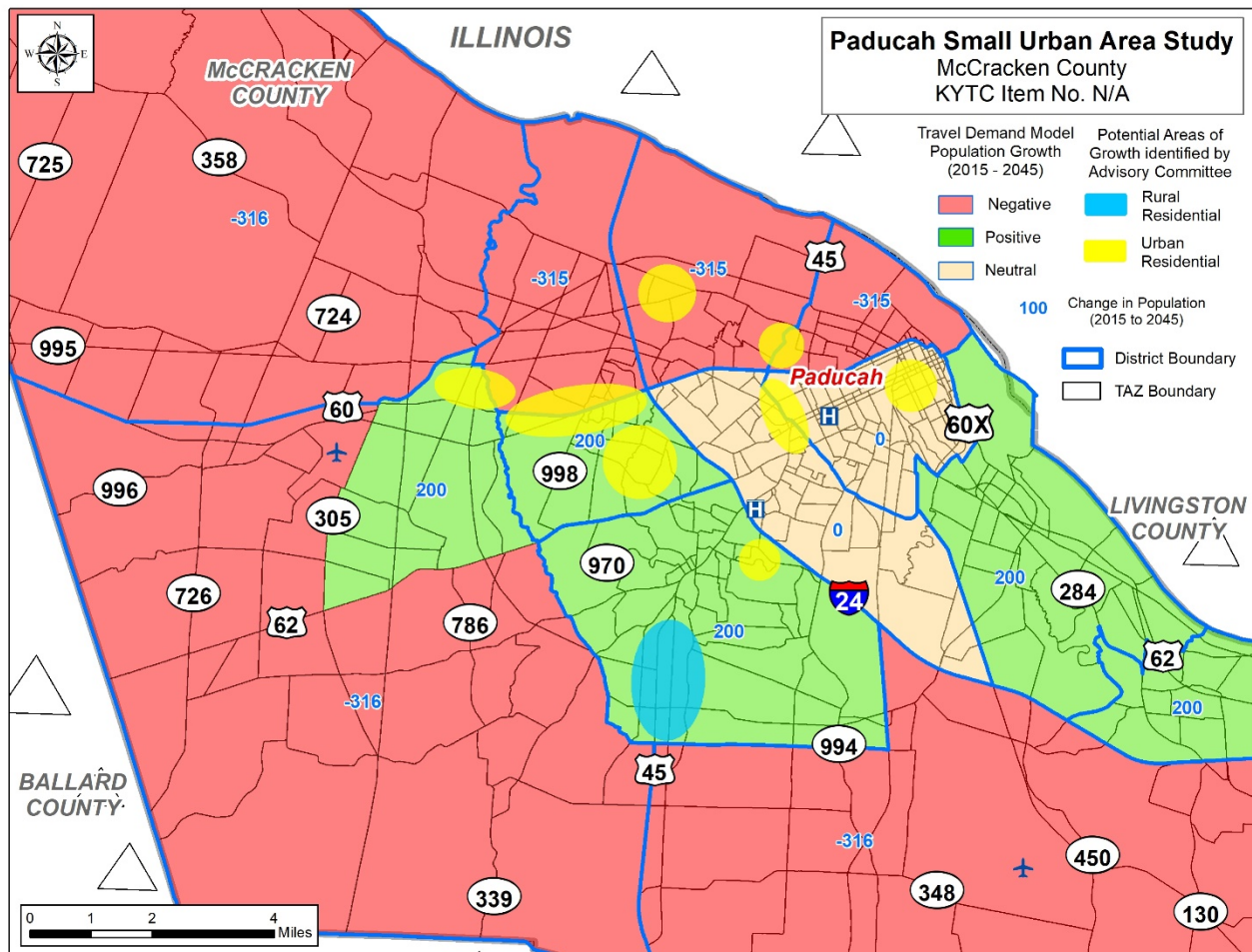


Figure 2: Projected Residential Growth: 2015 - 2045

Employment

Current employment estimates for each of the model's internal TAZs were provided by the KYTC planning staff, using employer-reported data to the U.S. Bureau of Labor Statistics. Employment was categorized as basic, retail, and service jobs. The total estimate of McCracken employment used in the 2015 base model is 37,600. Future estimates of employment growth in the model was originally informed by third party economic forecasts which extrapolate historic employment growth into the future. For the model update to 2045, employment growth was coordinated with the forecast population, but still reflects growth in regional industries that draw workers from the counties surrounding Paducah, as well as strong workforce participation. Discussions with the Advisory Committee concluded that downtown Paducah and the Lone Oak area are expected to see commercial growth while industrial growth is likely adjacent to I-24 and the Ohio River MegaPark to the north. The 2045 estimate of total employment is 42,400. Growth is expected to occur within the established areas for commercial and industrial activity, with new growth in the Ohio River MegaPark light industrial park development offsetting the decline in employment at the old Gaseous Diffusion Plant site. **Figure 3** presents the projected distribution of employment changes.

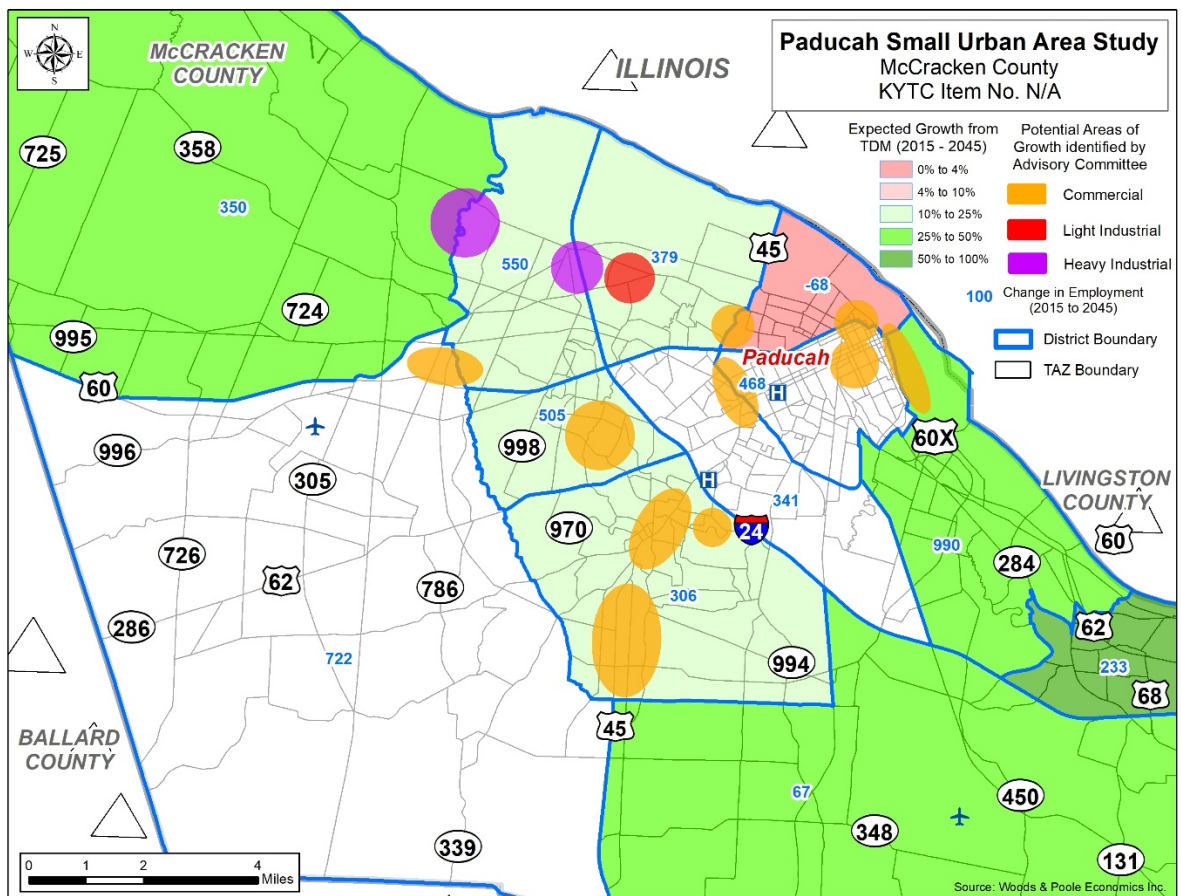


Figure 3: Projected Employment Growth: 2015 - 2045

Network Updates

The model's 2015 base year network was reviewed to ensure it includes all "Existing and Committed" (E+C) road construction projects open by 2015. A review of aerial photography from 2015 was used to verify the status of E+C projects. The review confirmed that the 2015 network was an accurate representation of the network in 2015.

The 2045 network includes E+C projects that either create a new route or increase the number of directional lanes of an existing facility. Further, a project had to have been constructed since 2015 or have utility or construction funds committed in the current Kentucky Six Year Highway Plan. Four new projects were included in the 2045 network and these projects are presented in **Figure 4**.

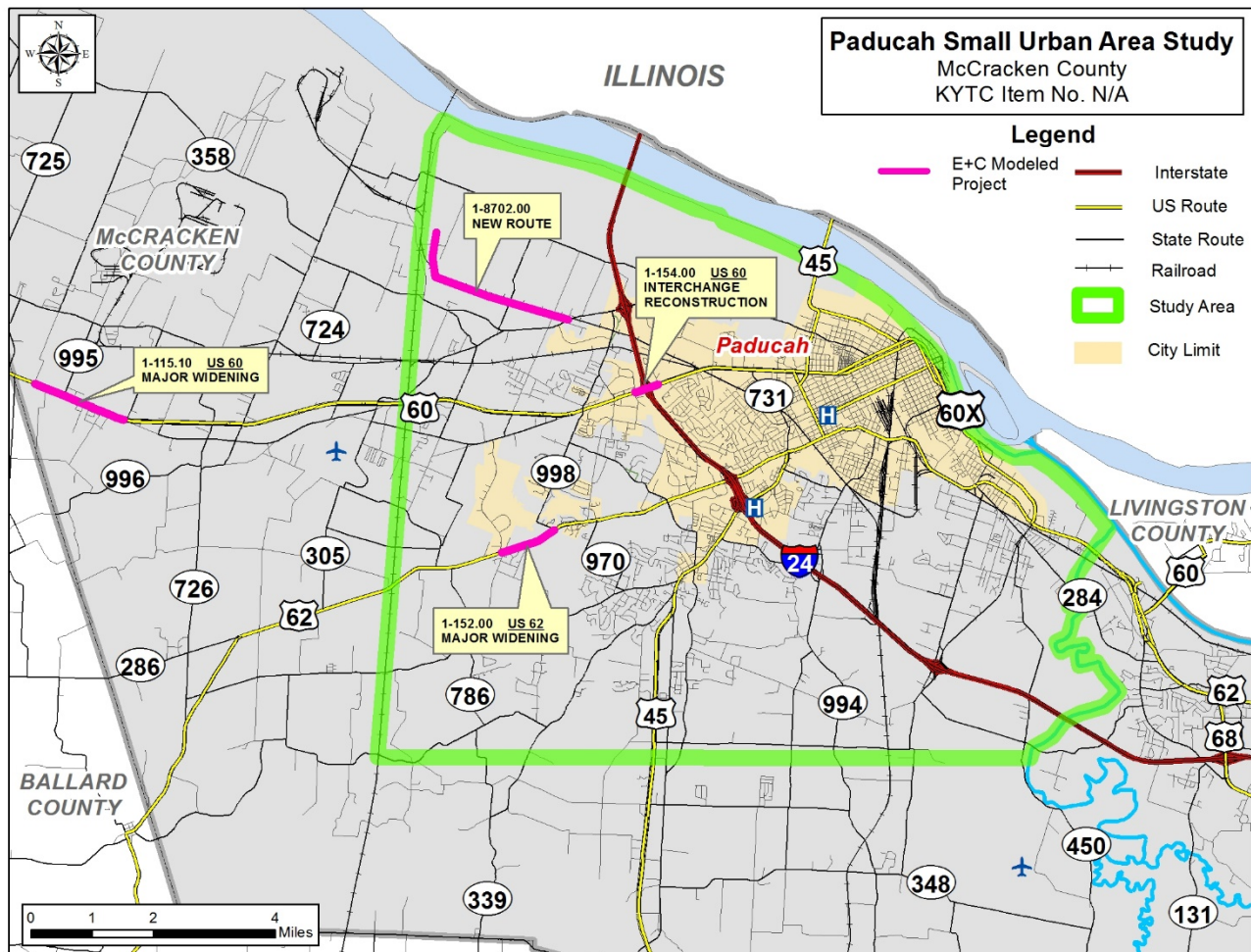


Figure 4: 2045 Network Modeled Existing and Committed Projects

Validation Statistics

The model's traffic assignments for the updated 2015 base year were compared to updated 2015-2017 counts from KYTC's traffic count database. Overall, 250 links in the model had counts, including 87 links with counts greater than 5,000 vehicles per day. The percent Root Mean Square Error (%RMSE), which describes the relative match of the model's assignments to counts, are well within all target thresholds, with the exception of links with fewer than 1,000 vehicles per day, which is relatively inconsequential in that capacity issues are not relevant when daily volumes are that low. The overall %RMSE was 33.2%, which is below the industry-recognized threshold of 35%. The total Volume to Count ratio for all links is 0.99, and the rate of assigned Vehicle Miles Traveled (VMT) to observed VMT is 1.03. **Table 1** presents the %RMSE by volume group for the 2015 base year model assignment.

Table 1: Percent Root Mean Square Error by Volume Class

Volume Group	Links with Counts	%RMSE Target	%RMSE
(< 1,000)	61	< 55	134
(1,000 to 5,000)	102	< 45	40
(5,000 to 10,000)	51	< 35	29
(10,000 to 20,000)	26	< 27	14
(20,000 to 30,000)	10	< 24	12
All Links	250	< 35	29

Future Year Forecasts

The 2045 total daily traffic volumes as assigned by the updated McCracken County travel demand model are shown on **Figure 5**. To evaluate the adequacy of individual roadway segments, the 2045 assigned volumes are compared to each segment's daily capacity to create a Volume to Capacity (V/C) ratio. For the purposes of the Paducah SUA study, a V/C ratio greater than 1.0 indicates that mitigation measures (including adding additional lanes) may be warranted. Figure 5 identifies each roadway segment with a 2045 V/C ratio greater than 1.0, and also presents the segments with V/C ratios approaching 1.0.

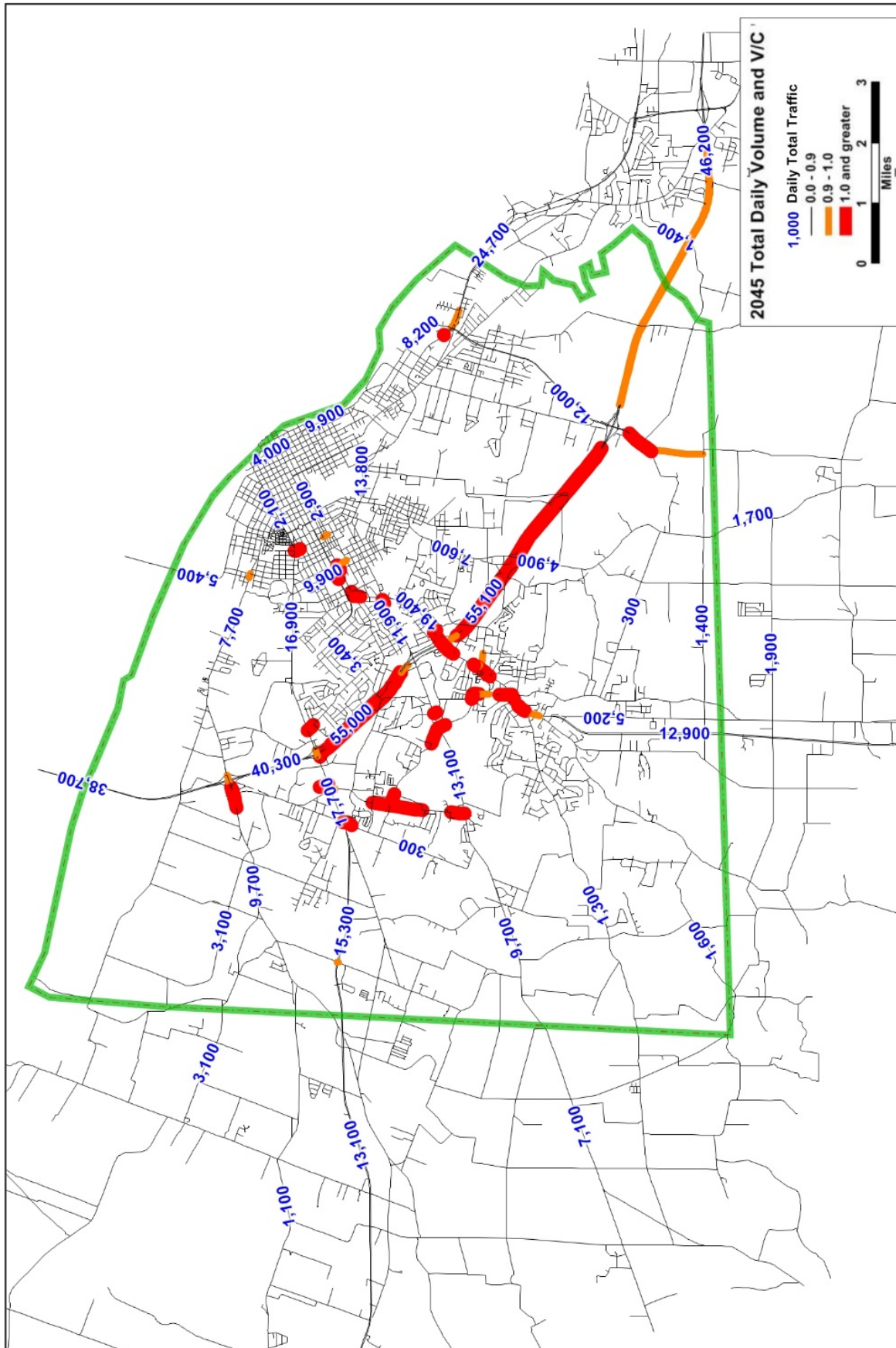


Figure 5: 2045 Total Daily Traffic Volume and Volume over Capacity