Appendix B

Travel Demand Forecasting

Monroe 2040 MTP Update

TECHNICAL MEMORANDUM NO. 1

September 2015

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Monroe MPO
Metropolitan Transportation Plan 2040

TECHNICAL MEMORANDUM
Travel Demand Model Development
Travel Forecasts and Deficiency Analysis

Prepared For:

LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

OCOG

Prepared by:

ALLIANCE TRANSPORTATION GROUP

In association with:

NEEL-SCHAFFER
Solutions you can build upon

September 2015

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GLOSSARY

ADT	– Average Daily Traffic
CBD	– Central Business District
Demo	– Federal Demonstration Fund
FHWA	– Federal Highway Administration
FTA	– Federal Transit Administration
GIS	– Geographic Information System
HCM	– Highway Capacity Manual
ITS	– Intelligent Transportation System
LADOTD	– Louisiana Department of Transportation and Development
MTS	– Monroe Transit System
NHS	– National Highway System
NSI	– Neel-Schaffer, Inc.
SIC	– Standard Industrial Classification
STP	– Surface Transportation Program
TAC	– Technical Advisory Committee
TIP	– Transportation Improvement Program
TPC	– Transportation Policy Committee
TRANPLAN	– Transportation Planning Computer Modeling Software
TransCAD	– Transportation Planning Computer Modeling Software
VOC	– Volume/Capacity

CHAPTER 1: INTRODUCTION

1.0 PURPOSE AND SCOPE OF WORK

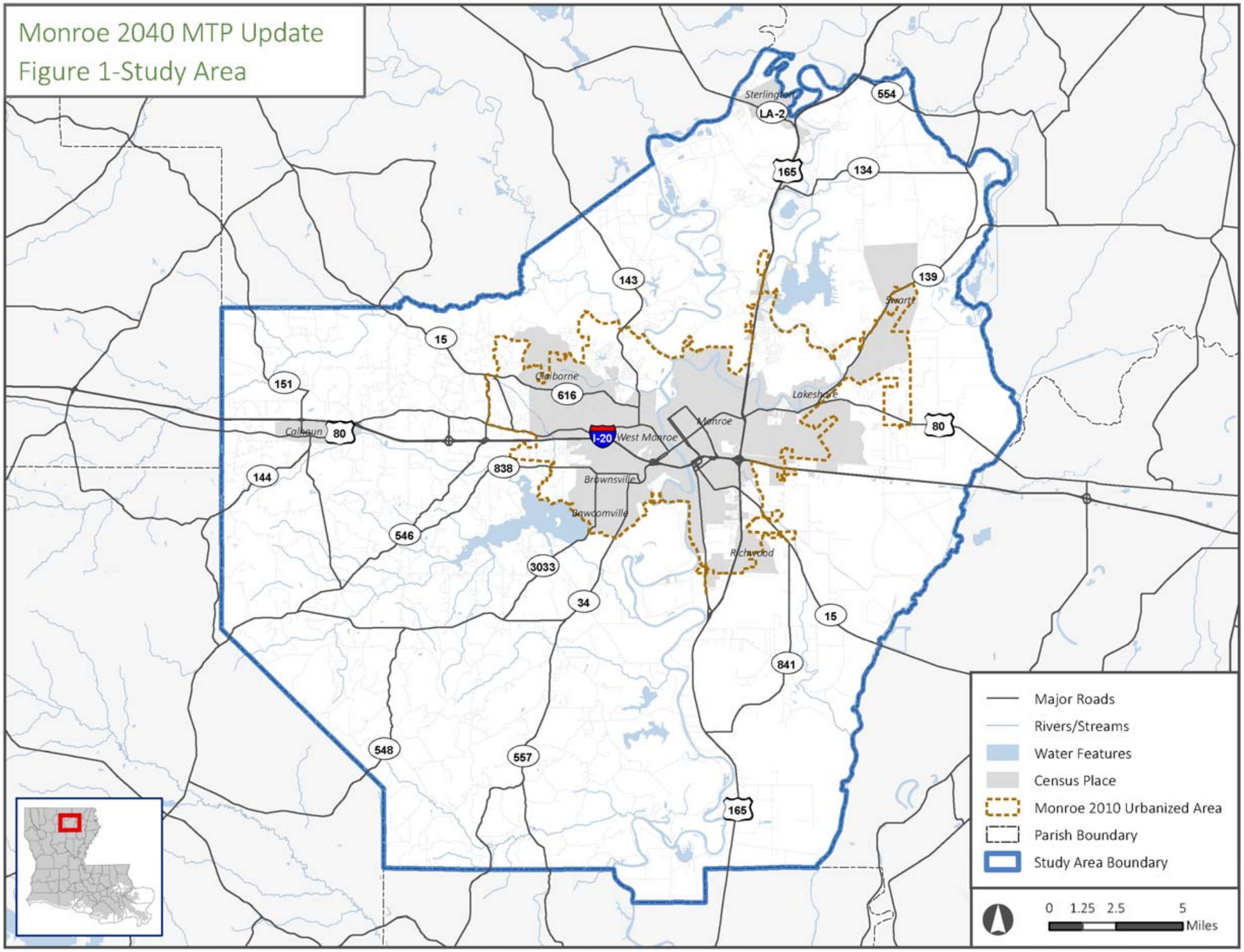
This technical memorandum summarizes the results of the travel demand modeling and forecasting elements of the Monroe 2040 Metropolitan Thoroughfare Plan (MTP) Update. The memo provides an update of area travel characteristics, conducts an inventory and evaluation of the existing transportation system, and details the results of an analysis of existing and future deficiencies in the transportation system within the MTP study area. The planning area for this study is the entirety of Ouachita Parish, which includes the Cities of Monroe and West Monroe, the towns of Richwood and Sterlington, the census-designated places of Bawcomville, Claiborne, and Swartz, and the unincorporated community of Calhoun. The study area is located in northern Louisiana approximately 150 miles northwest of the state capital, Baton Rouge. The City of Monroe is the site of the University of Louisiana at Monroe. The study area is shown in Figure 1.

1.1 HISTORICAL BACKGROUND

In response to the Federal Highway Act of 1962, most communities throughout the United States commenced comprehensive transportation planning efforts to both address their existing transportation concerns and to plan for future growth needs. Transportation planning efforts often competed with other priorities for funding and scheduling. The sophistication and vision of the individual transportation plans varied substantially in response to the availability of funding resources. Such plans were frequently formulated as part of community plans developed by the local planning offices. Others were prepared by various State Departments of Transportation.

Travel forecasting has assumed a prominent analytical role in transportation planning thanks to the development and advancement of travel demand modeling software. The Monroe Travel Demand Model used in the Monroe 2040 MTP Update is modeled in TransCAD version 6.0 and was developed by Neel-Schaffer, Inc. in conjunction with the Louisiana Department of Transportation and Development (LADOTD). Explanations of the demographic data and the transportation modeling process used in the preparation of this plan are provided in later chapters.

Figure 1: Monroe Study Area



CHAPTER 2: EXISTING TRANSPORTATION NETWORK

2.0 FEDERAL AND STATE HIGHWAYS

Several federal and state highways serve the study area. These facilities constitute the main network of roadways in the area. The most significant of these facilities are:

I-20 This interstate highway is the major east/west transportation route in the study area. I-20 is a continuous passage through the study area through the Cities of West Monroe and Monroe.

US 80 This U.S. highway is another major east/west transportation route in the study area. This route parallels 1-20. A portion of this highway overlaps with US 165 Business on a portion of Louisville Ave.

US 165 This U.S. highway is the major north/south transportation route in the study area. This highway extends from just east of the Ouachita River on the south side of the study area through Monroe to the north study area boundary at Sterlington.

LA 15 This state highway serves the study area diagonally from southeast to northwest. The highway extends through Monroe, across the Ouachita River, and through West Monroe.

State Highways There are several other state highways which serve the study area. Among these state highways are: LA 34, LA 134, LA 139, LA 143, and LA 557

2.1 EXISTING STREET AND HIGHWAY FUNCTIONAL CLASSIFICATIONS

The street and highway network developed for the project was based on the functional classification system (Figure 2) prepared by LADOTD. The system was updated by the most recent functional classification maps available from LADOTD to reflect the expanded urbanized area as defined by the 2010 Census. The components of this network are interstates, principal arterials, minor arterials, collectors, and significant local streets. The distribution of mileage in these categories is shown in Table 2.1.

Table 2.1: Study Area Network Mileage by Functional Class

Classification	Total Miles	%
Interstate	53.25	9.40%
Principal Arterial	55.82	9.85%
Minor Arterial	114.3	20.17%
Collector	273.06	48.19%
Local	70.2	12.39%
Total	***566.63***	***100.00%***

Source: LADOTD, 2015; NSI, 2015

Each type of facility provides separate and distinct traffic service functions and is best suited for accommodating particular demands. Each design varies in accordance with the characteristics of traffic to be served by the facility.

Freeways: These facilities are divided highways with full control of access and grade separations at all intersections. The controlled access character of freeways results in high-lane capacities, which are three times greater than the individual lane capacities of urban arterial streets. The only freeway that serves the study area is I-20.

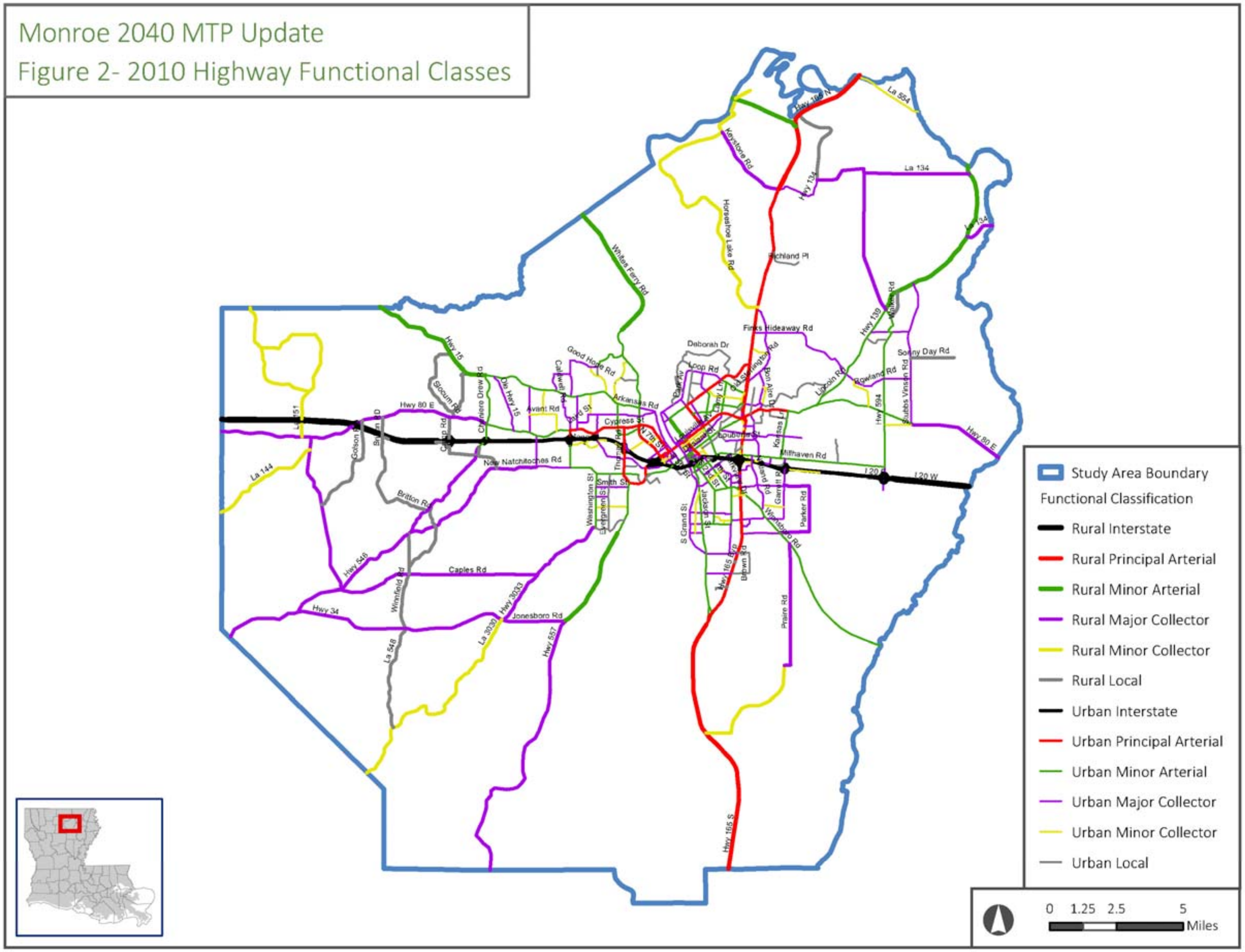
Expressways: These facilities are roads which are controlled access, but not designed as part of the interstate system. There are no expressways in Ouachita Parish.

Arterials: These facilities are important components of the total transportation system. They serve both as feeders to freeways and expressways, and as principal travel ways between major land use concentrations within the study area. Arterials are typically divided facilities (undivided where right-of-way limitations exist) with relatively high traffic volumes and traffic signals at major intersections. The primary function of arterials is moving traffic, and they are the main means of local travel. A secondary function of arterials is land access.

Collectors: These facilities provide both land service and traffic movement functions. Collectors serve as intermediate feeders between arterials and local streets and primarily accommodate short distance trips. Since collector streets are not intended to accommodate long through trips, they are generally not continuous for any great length.

Local Streets: The sole function of these facilities is to provide access to immediately adjacent land. Within the local street classification, three subclasses are established to indicate the type of area served: residential, industrial, and commercial. Some of the local streets have been included in the model network for the purpose of connectivity.

Figure 2: Existing Functional Classification



2.2 EXISTING TRAFFIC VOLUME

Traffic volumes, as indicated by traffic counts at various locations on the street system, are indicative of current travel patterns and how well the system is accommodating travel demand. LADOTD regularly conducts traffic counts in parishes and cities throughout Louisiana. This traffic count data, along with special counts at certain locations (e.g., external stations), provides a basis for determining the overall travel patterns in the study area. Existing Average Daily Traffic (ADT) counts used in model development on selected routes are shown in Figure 3. Traffic counts for locations not indicated in Figure 3 may be obtained from LADOTD at http://wwwapps.dotd.la.gov/engineering/tatv/.

The highest traffic volumes are on I-20, which exhibits ADT counts of 51,200 to 83,200 in the urbanized area. Other areas of significant traffic volumes within the urbanized area are:

- US 165 (7,000 to 46,600)
- US 80 (9,000 to 34,600)
- Jonesboro Rd/Thomas Rd (10,800 to 32,500)
- Hwy 139 (14,200 to 18,100)
- N 7th St (12,800 to 16,500)
- Arkansas Rd (6,400 to 13,100)

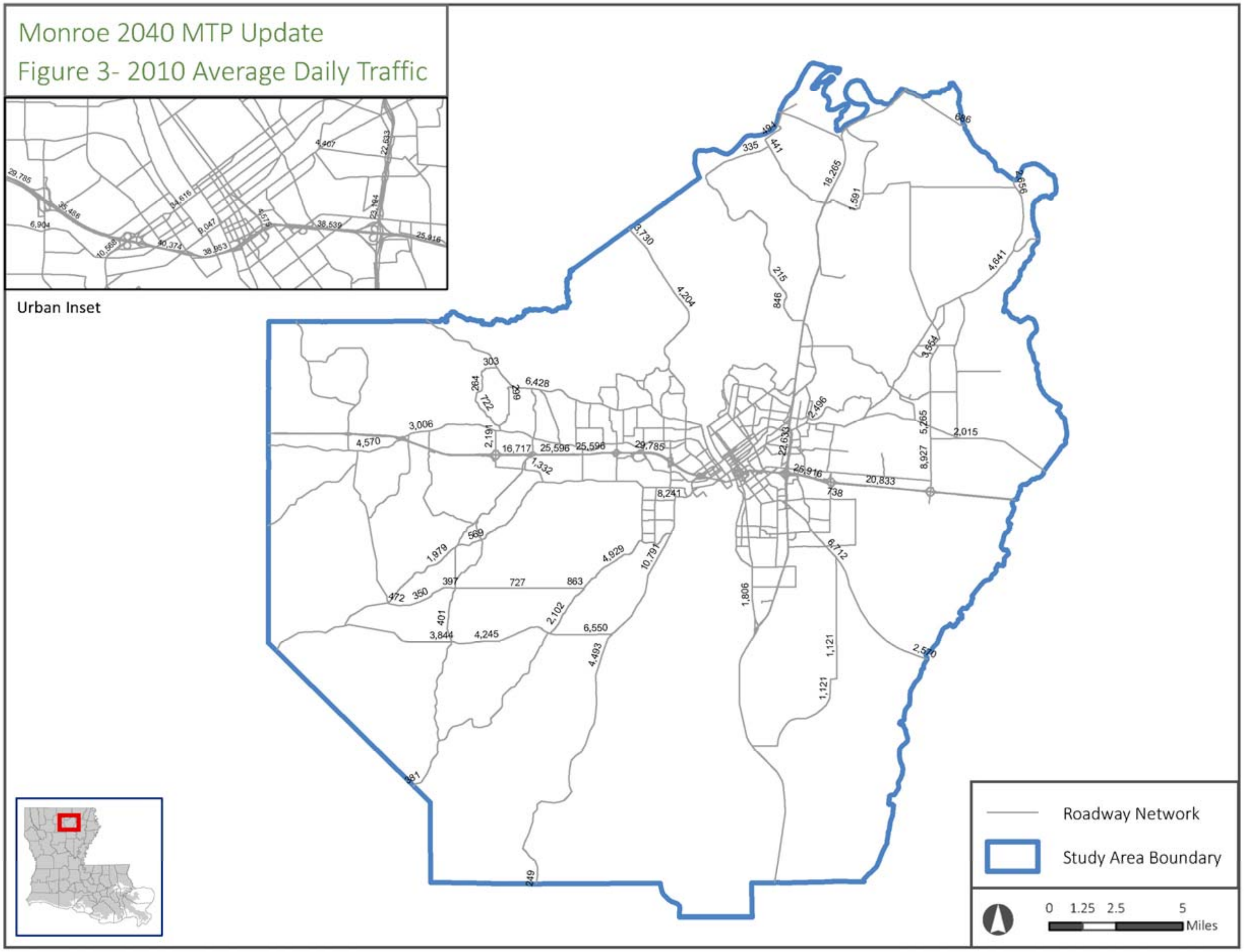
Current traffic volumes on the major Ouachita River crossings are shown in Table 2.2 below.

Table 2.2: ADTs on Ouachita River Crossings

Highway	ADT
I-20	77,900 ADT
US 80	34,600 ADT
Coleman Ave	9,000 ADT

Source: LADOTD, 2015

Figure 3: Existing Average Daily Traffic



2.3 ROADWAY CAPACITY

The primary factor used in evaluating transportation plan alternatives is the adequacy of the network in accommodating future travel demand and addressing projected facility deficiencies. Year 2040 traffic forecasts, derived from the travel demand model developed as part of this study, are assigned to the model network. Future travel demand is then compared to the capacity of the roadways and associated levels of service to identify areas with deficiencies.

Roadway capacity is generally defined as the ability of a street or highway to accommodate traffic for a specific period of time; typically during a peak hour of travel. Generalized values or 24-hour traffic volumes also are utilized to measure the anticipated congestion and delay of motorists. The main determinant of street capacity is the number and width of travel lanes. Other possible major influences on roadway capacity include on-street parking, area type [e.g., Central Business District (CBD), commercial, industrial], vehicle mix, traffic signal operation, and speed.

For this study, generalized capacity ranges were developed for various roadway types based on travel lanes and functional classification as defined by the standards identified in the *Highway Capacity Manual* (HCM).[1]

The general estimates per hour per lane capacities of various roadway facilities included in the study area network are shown in Table 2.3. In addition, factors used to calculate the roadway capacities by four time periods (AM, mid-day, PM, and night) are also shown in Table 2.3. These factors are developed using the information provided in NCHRP 365[2] and the traffic data collected by various Automatic Traffic Recording Stations in Louisiana.

1 Highway Capacity Manual 2010 (US Customary Version), Washington, DC: National Academy Sciences and Transportation Research Board. (ISBN#: 978-0-309-16077-3) 2010

2NCHRP 365, Washington, DC: Transportation Research Board. (ISBN#: 0-309-05365-X) 1998

Table 2.3: Generalized Roadway Capacities: Existing and Future Facilities

FC CODE	FUNCTIONAL CLASS	VPHPL	TIME PERIOD FACTORS			
			AM	**MD**	**PM**	NT
1	RURAL INTERSTATE	1,564	1.92	3.14	2.29	**2.65**
2	RURAL PRINCIPAL ARTERIAL DIVIDED	944	1.92	3.14	2.29	**2.65**
21	RURAL PRINCIPAL ARTERIAL UNDIVIDED	899	1.92	3.14	2.29	**2.65**
3	RURAL MINOR ARTERIAL DIVIDED	637	1.92	3.14	2.29	**2.65**
31	RURAL MINOR ARTERIAL UNDIVIDED	637	1.92	3.14	2.29	**2.65**
4	RURAL MAJOR COLLECTOR	414	1.92	3.14	2.29	**2.65**
41	RURAL MAJOR COLLECTOR UNDIVIDED	414	1.92	3.14	2.29	**2.65**
5	RURAL MINOR COLLECTOR	414	1.92	3.14	2.29	**2.65**
51	RURAL MINOR COLLECTOR UNDIVIDED	414	1.92	3.14	2.29	**2.65**
6	RURAL LOCAL	414	1.92	3.14	2.29	**2.65**
61	RURAL LOCAL UNDIVIDED	414	1.92	3.14	2.29	**2.65**
10	RURAL ON/OFF RAMP	1,000	1.92	3.14	2.29	**2.65**
11	URBAN INTERSTATE	1,772	1.92	3.14	2.29	**2.65**
12	URBAN EXPRESSWAY	1,772	1.92	3.14	2.29	**2.65**
14	URBAN PRINCIPAL ARTERIAL DIVIDED	998	1.92	3.14	2.29	**2.65**
141	URBAN PRINCIPAL ARTERIAL UNDIVIDED	917	1.92	3.14	2.29	**2.65**
16	URBAN MINOR ARTERIAL DIVIDED	866	1.92	3.14	2.29	**2.65**
161	URBAN MINOR ARTERIAL UNDIVIDED	866	1.92	3.14	2.29	**2.65**
17	URBAN COLLECTOR	458	1.92	3.14	2.29	**2.65**
171	URBAN COLLECTOR UNDIVIDED	458	1.92	3.14	2.29	**2.65**
18	URBAN LOCAL	458	1.92	3.14	2.29	**2.65**
181	URBAN LOCAL UNDIVIDED	458	1.92	3.14	2.29	**2.65**
19	URBAN OTHER	458	1.92	3.14	2.29	**2.65**
191	URBAN OTHER UNDIVIDED	458	1.92	3.14	2.29	**2.65**
20	URBAN ON/OFF RAMP	1,333	1.92	3.14	2.29	**2.65**
99	CENTROID CONNECTOR	10,000	1.92	3.14	2.29	**2.65**
25	Non DOTD Rural Other	414	1.92	3.14	2.29	**2.65**
251	Non DOTD Rural Other Undivided	414	1.92	3.14	2.29	**2.65**
35	Non DOTD Urban Other	458	1.92	3.14	2.29	**2.65**
351	Non DOTD Urban Other Undivided	458	1.92	3.14	2.29	**2.65**

Note:
VPHPL: Vehicles per hour per lane
AM: AM Period (6:00 AM – 9:00 AM)
MD: Mid-day Period (9:00 AM – 3:00 PM)
PM: PM Period (3:00 PM – 6:00 PM)
NT: Night Period (6:00 PM - 6:00 AM)
Link Capacity Formula of Each Time Period: (Number of Lanes * VPHPL * Time Period Factor)

Source: Highway Capacity Manual 2010, NSI 2015, NCHRP 365

2.4 LEVEL OF SERVICE

As defined in the HCM, "level of service" is a qualitative measure describing operational conditions within a traffic stream for a specific time period. These conditions are generally described by factors such as speed and travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety.

Six levels of service were defined for each type of facility for which analysis procedures were available. They were given letter designations from A to F, with level of service A representing the best operating conditions and level of service F representing the worst operating conditions.

The various levels of service for uninterrupted flow facilities were defined as follows:

- "**A**" represents free flowing traffic. Individual users are virtually unaffected by the presence of others in the traffic stream.
- "**B**" is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable.
- "**C**" is in the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by interactions with others in the traffic stream.
- "**D**" represents high-density, but still stable, flow. Speed and freedom to maneuver are severely restricted, and the driver experiences a generally poor level of comfort and convenience.
- "**E**" represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform value. Freedom to maneuver within the traffic stream is extremely difficult.
- "**F**" is used to define forced or breakdown flows. This condition exists wherever the amount of traffic approaching a point exceeds the amount which can traverse the point. Queues form behind such locations. Operations within the queue are characterized by stop-and-go waves, and they are extremely unstable.

For urban areas, the goal of LADOTD and local governments is to reach an overall level of service C. However, a level of service D is acceptable during peak periods in urban conditions on certain facilities.

2.5 NETWORK DEFINITION

The simulation of travel patterns in a computer model requires a representation of the street and highway system in digital format. The TransCAD model creates such a network from a geographic line layer in GIS.

The line layer data view records contain descriptive information including length, posted speed, number of travel lanes, functional classification, and capacity. Turn prohibitions were coded into the network at locations where certain movements are not allowed or physically cannot be made. A listing of the standardized codes used for number of lanes and functional classification as well as other network attributes is included in Appendix A.

Following verification of the attribute information for all model network links, the resulting file contained the 2010 base year network for use as the initial input for model calibration and validation.

CHAPTER 3: PLANNING DATA

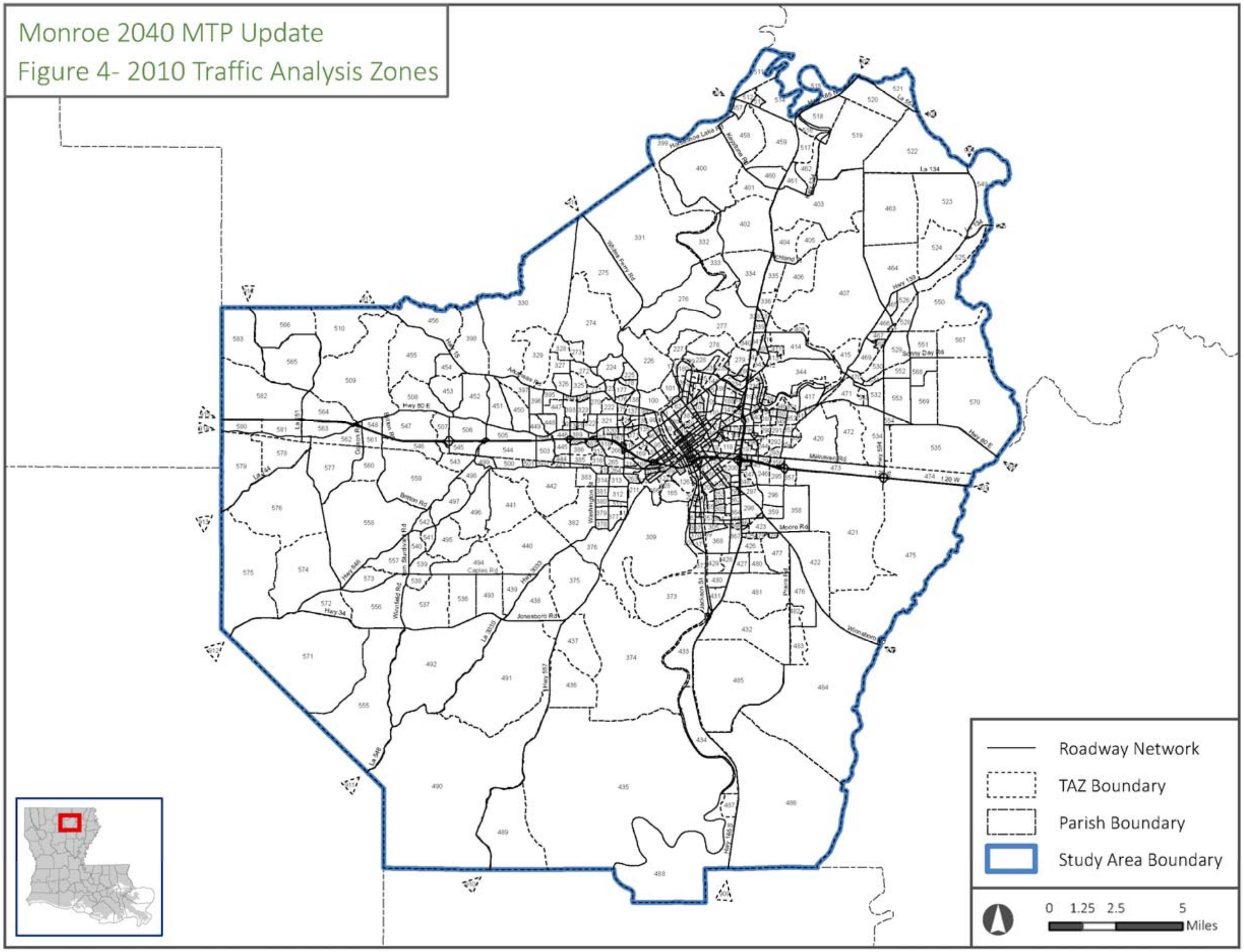
3.0 INTRODUCTION

Travel demand is greatly influenced by the pattern of development or land use in the study area. Changes in land use and/or intensity will create new travel demand or modify existing patterns. A definite relationship exists between trip making, land use, and demographic data such as population, number of housing units, employment, and school attendance. This data was compiled from several sources: population and housing from the 2010 Census, employment from a database of employers in the study area purchased from InfoUSA, and school attendance from the Department of Education and individual private schools.

The accuracy necessary for generating trips from planning data requires that the data be aggregated by small geographic areas called Traffic Analysis Zones (TAZs). These TAZs are generally homogeneous areas and were delineated based on factors such as population, land use, census tracts, physical landmarks, and governmental jurisdictions. The Monroe Travel Demand Model study area was divided into 583 TAZs with 18 external stations. A map of the TAZs is shown in Figure 4.

Throughout this report, there may be slight differences in the totals for this data. These apparent discrepancies are due to mathematical rounding, which takes place during calculations by the computer modeling software.

Figure 4: Traffic Analysis Zones



3.1 BASE YEAR (2010) PLANNING DATA

The demographic data required as input into the trip generation programs can be subdivided into five major categories: population, occupied dwelling units (households), retail employment, non-retail employment, and school attendance. These variables may be further described such as:

3.1.1 Population

Population enters the trip generation equation in terms of calculating population per occupied dwelling unit by zone, which allows the distribution of units into household size categories. Population data for the base year, 2010, was obtained from the 2010 U.S. Census. In 2010, the total population of the study area was 153,720 persons with 148,186 persons in households, and 5,534 persons in group quarters (dorms, prisons, etc.). The base year study area total population by TAZ is shown in Figure 5.

3.1.2 Dwelling Units (DU)

The largest single type of developed land use in the study area is residential land. The number of dwelling units plays a major role in trip generation since many trips have an origin and/or destination in residential areas. Both total and occupied dwelling units were calculated from the 2010 Census as well, and were aggregated by TAZ. Figure 6 shows the 2010 dwelling units by TAZ.

In 2010, there were 64,481 total dwelling units in the study area; of that total, 58,691 (91%) were occupied. Occupied dwelling units are further classified by auto ownership and household size using the American Community Survey 5-year (2008-2012) Public Use Microdata Samples (PUMS) dataset (as there was no SF3 data for the 2010 Census) and the 2010 Census data. The following classifications in Table 3.1 were developed to use in estimating the number of trips generated from each TAZ.

Table 3.1: Study Area Household Classifications: Base Year 2010		
Variable	**Description**	**Total**
POP	Total Population in Households	148,186
TOTPOP	Total Population in Study Area	153,720
OCCDU	Occupied Dwelling Units/Households	58,691
HHS1	Households with 1-person	16,395
HHS2	Households with 2-persons	18,469
HHS3	Households with 3-persons	10,282
HHS4	Households with 4-persons	7,661
HHS5P	Households with 5-or-more persons	5,884
HH_VEH0	Households with 0-cars	2,488
HH_VEH1	Households with 1-car	18,775
HH_VEH2	Households with 2-cars	24,415
HH_VEH3P	Households with 3-or-more cars	13,012
HH1VEH0	Households with 1-person and 0 cars	1,326
HH1VEH1	Households with 1-person and 1 car	10,316
HH1VEH2	Households with 1-person and 2 cars	3,728
HH1VEH3	Households with 1-person and 3-or-more cars	1,008
HH2VEH0	Households with 2-persons and 0 cars	359
HH2VEH1	Households with 2-persons and 1 car	3,722
HH2VEH2	Households with 2-persons and 2 cars	10,586
HH2VEH3	Households with 2-persons and 3-or-more cars	3,809
HH3VEH0	Households with 3-persons and 0 cars	310
HH3VEH1	Households with 3-persons and 1 car	2,048
HH3VEH2	Households with 3-persons and 2 cars	4,483
HH3VEH3	Households with 3-persons and 3-or-more cars	3,445
HH4VEH0	Households with 4-persons and 0 cars	232
HH4VEH1	Households with 4-persons and 1 car	1,321
HH4VEH2	Households with 4-persons and 2 cars	3,365
HH4VEH3	Households with 4-persons and 3-or-more cars	2,747
HH5VEH0	Households with 5-or-more persons and 0 cars	261
HH5VEH1	Households with 5-or-more persons and 1 car	1,370
HH5VEH2	Households with 5-or-more persons and 2 cars	2,253
HH5VEH3	Households with 5-or-more persons and 3-or-more cars	2,002

Source: Census 2010; NSI, 2015

3.1.3 Employment

The location of employment centers has a major impact on travel in the area, particularly home-based work trips. A database of employers from InfoUSA was used to develop the various employment types in the study area based on the Standard Industrial Classification (SIC) codes assigned to the business. Total employment in the study area in 2010 was 76,770 with 17,127 being in retail. For modeling purposes, employment variables were differentiated into the following categories:

- Agriculture, Mining and Construction (SIC 1-19)
- Manufacturing, Transportation/Communications/Utilities and Wholesale Trade (SIC 20-51)
- Retail Trade (SIC 52-59)
- Government, Office and Services (SIC 60-97)
- Other Employment (SIC 99)

Table 3.2 shows the total employment figures for each classification. The base year study area total employment and retail employment by TAZ are shown in Figure 7 and Figure 8 respectively.

Table 3.2: Study Area Employment Classifications: Base Year 2010

Variable	Description	Total
TOT_EMP	Total Employment	76,770
RET_EMP	Retail Employment	17,127
AMC_EMP	Agriculture, Mining and Construction Employment	4,106
MTCUW_EMP	Manufacturing, Transportation/Communications/Utilities and Wholesale Trade Employment	13,440
OS_EMP	Government, Office and Services Employment	41,666
OTH_EMP	Other Employment	431

Source: InfoUSA; NSI, 2015

3.1.4 School Attendance

School attendance figures include public and private elementary, middle, and high schools; colleges; universities; vocational and business schools. Total school attendance in the study area in 2010 was 44,644 students. This number includes the 8,645 students that attend the University of Louisiana at Monroe. For modeling purposes, the school attendance is measured by the number of students attending a school in a traffic zone and *not* by the number of students residing in a traffic zone. The base year study area school attendance by TAZ is shown in Figure 9.

Figure 5: 2010 Population

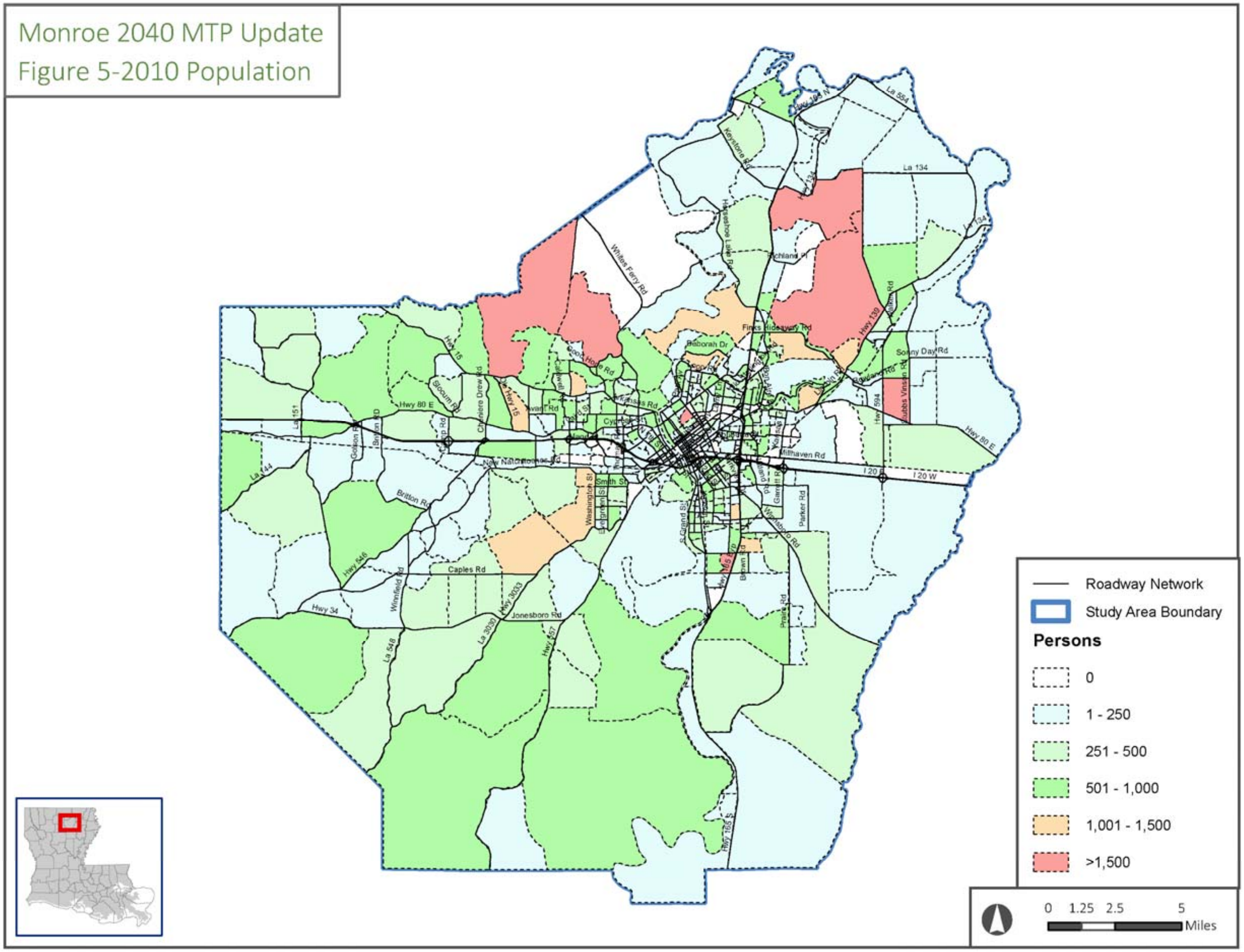


Figure 6: 2010 Dwelling Units

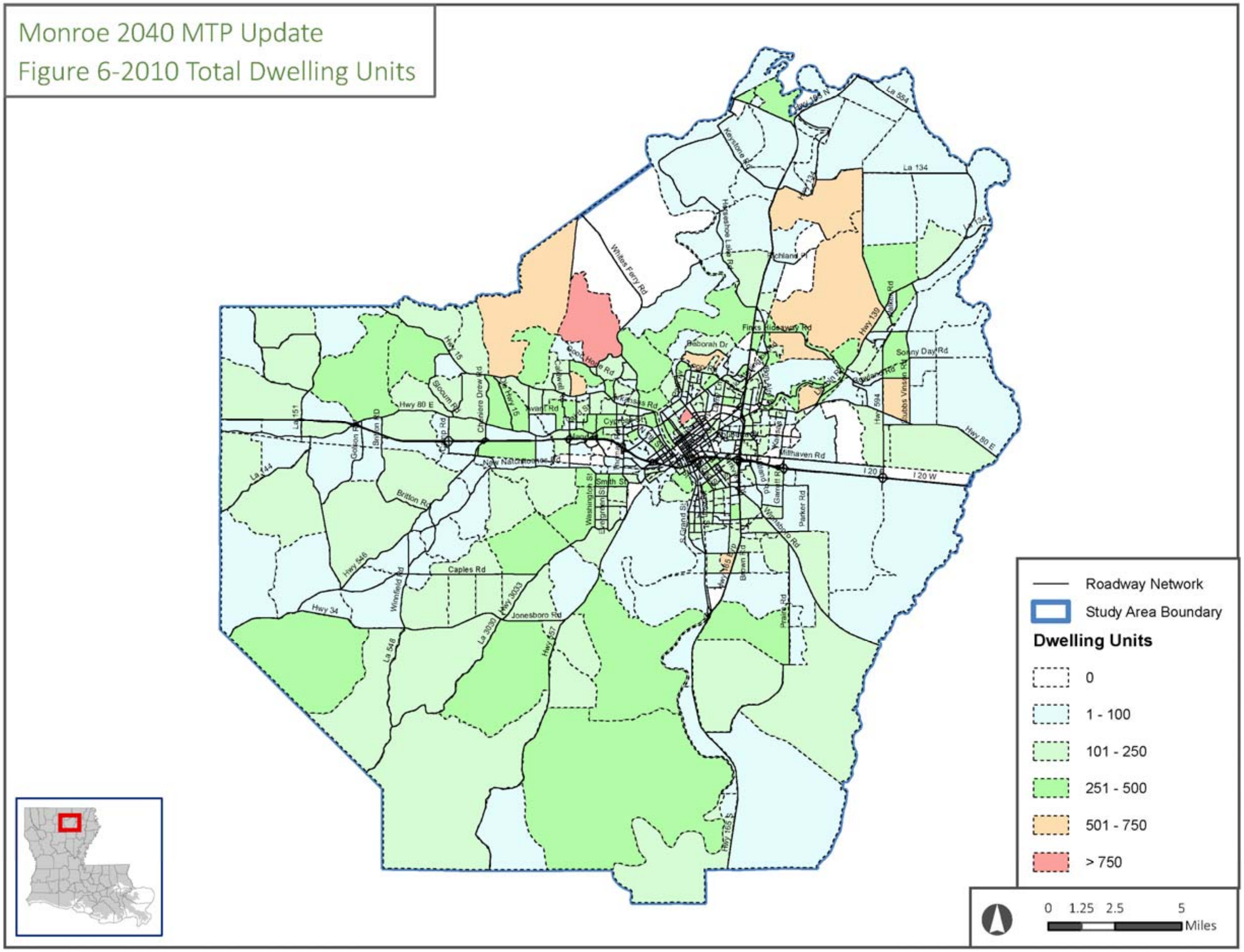


Figure 7: 2010 Total Employment

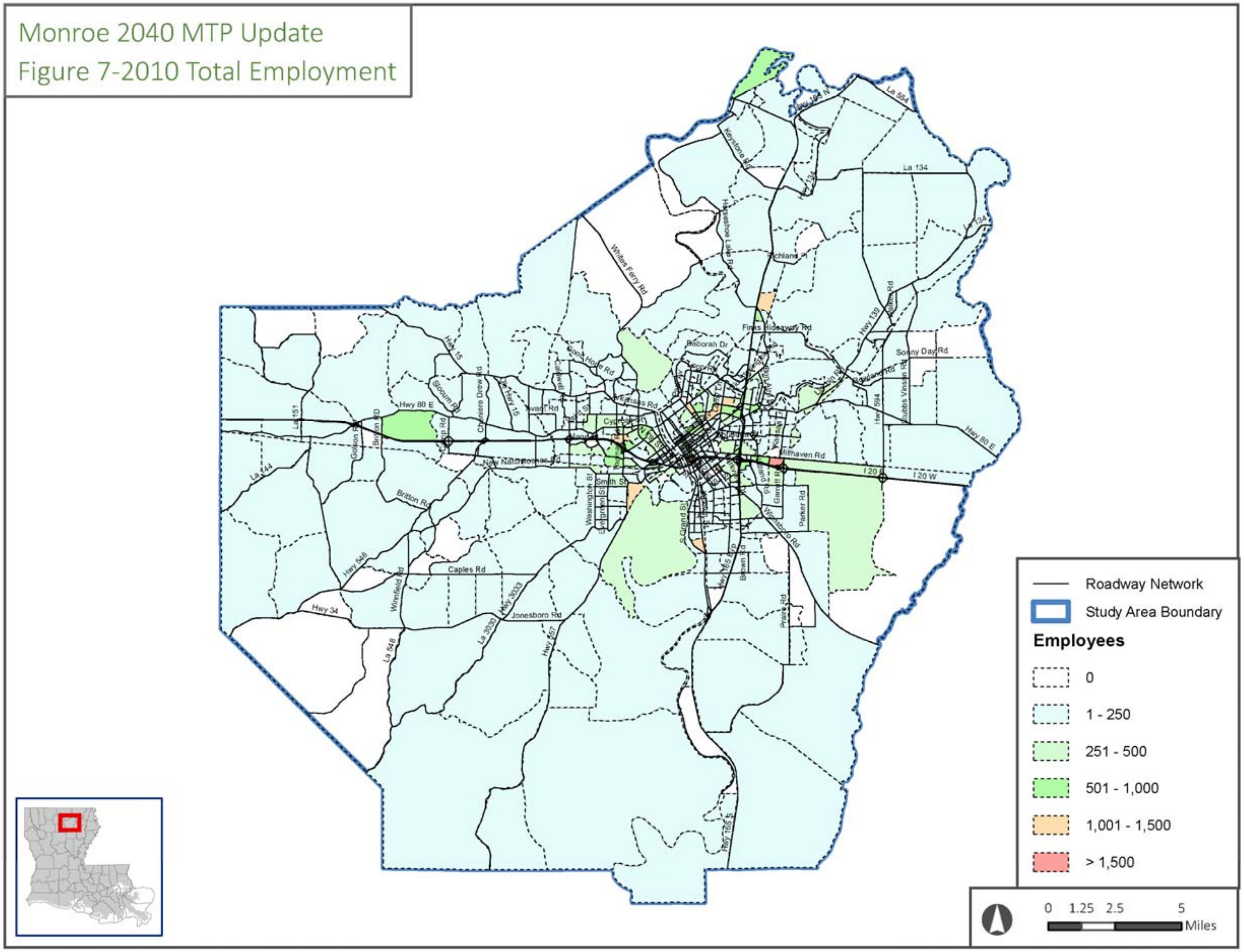


Figure 8: 2010 Retail Employment

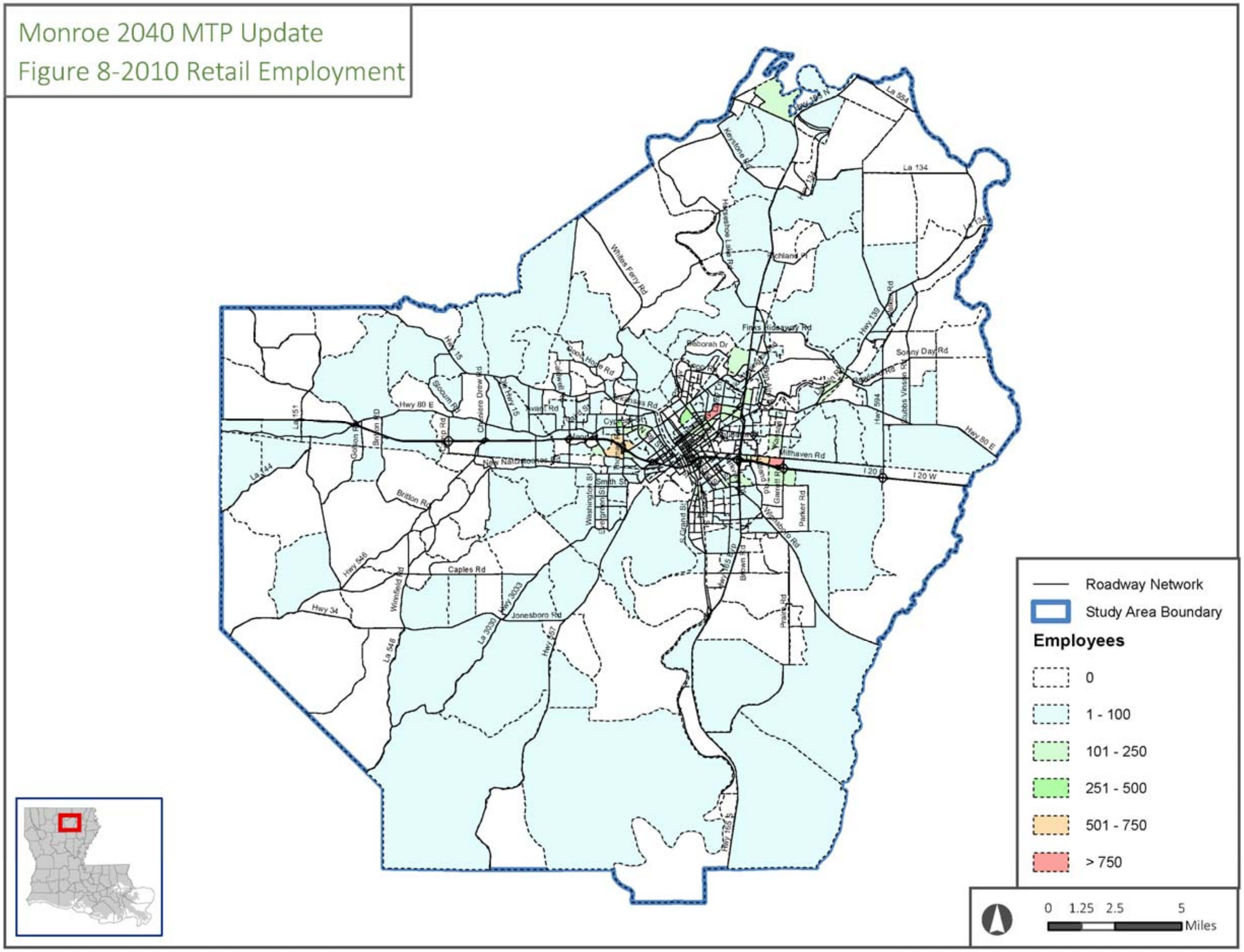
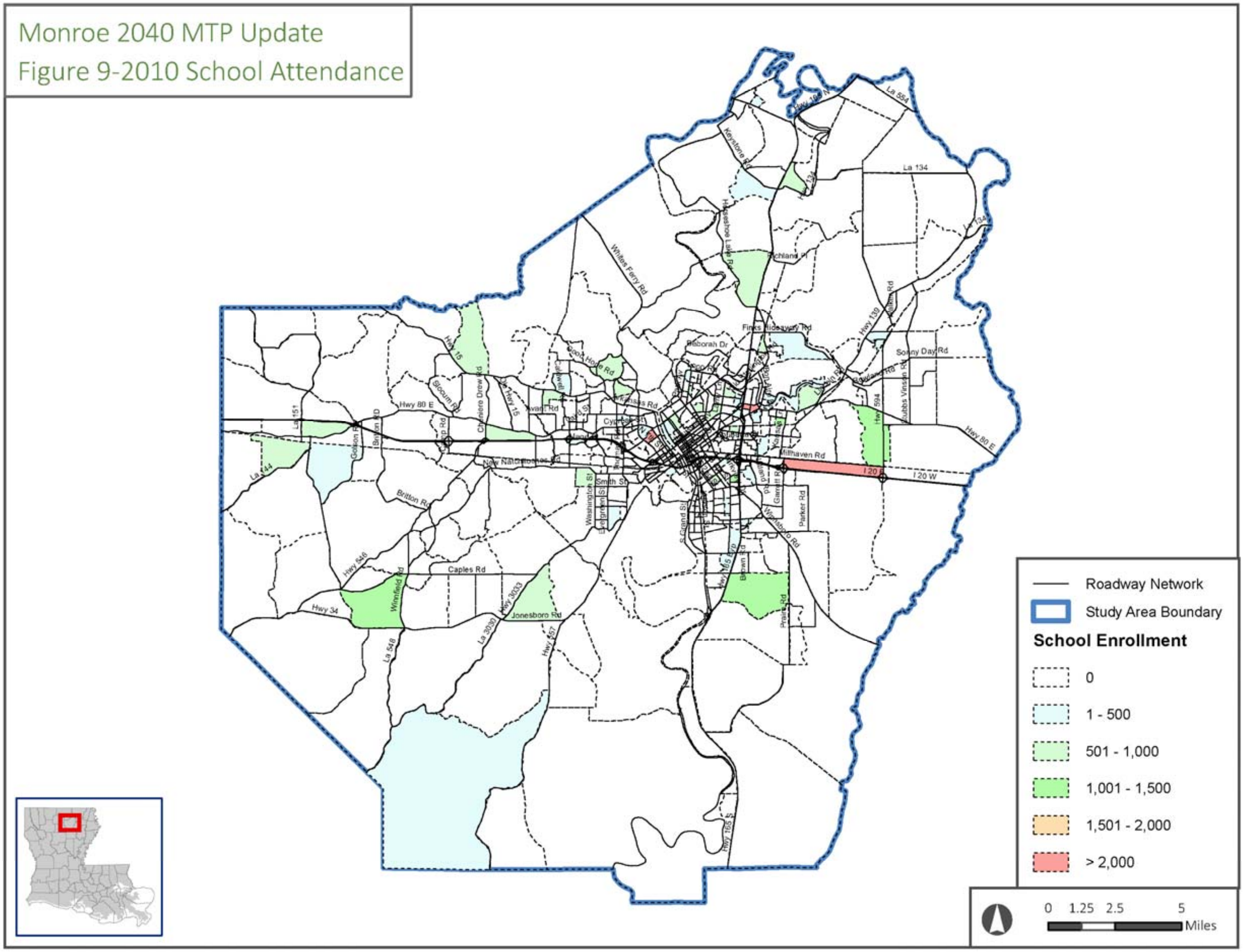


Figure 9: 2010 School Attendance



CHAPTER 4: DEVELOPMENT OF BASE YEAR MODEL

4.0 INTRODUCTION

This chapter includes a description of the procedures used in developing travel estimates, the relationship between planning data and trip making, and the calibration and validation of the models used in this study.

4.1 MODEL OVERVIEW

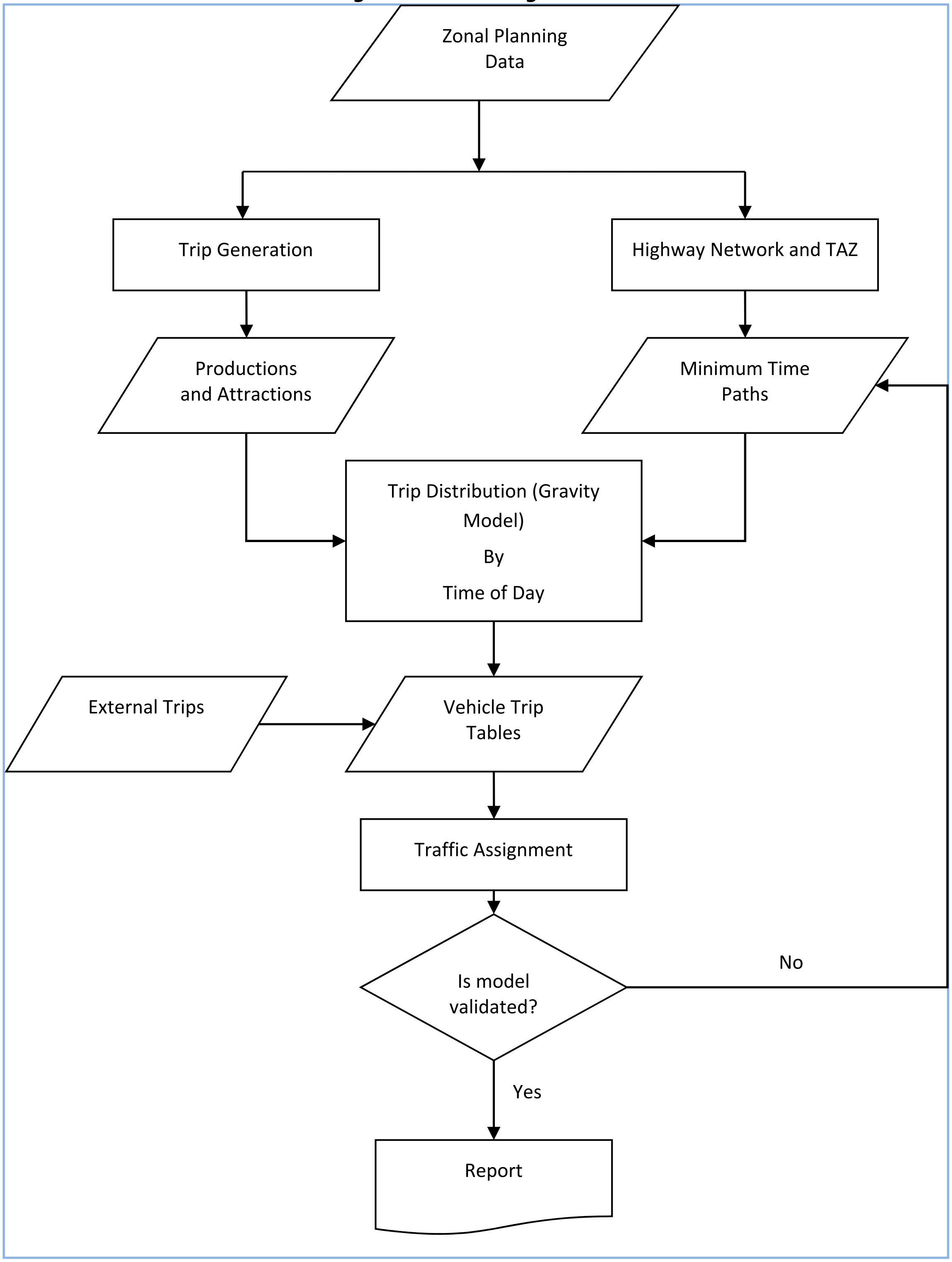
The Monroe Travel Demand Model is based upon the conventional trip-based four-step modeling approach.

Broadly, the main model components fall within the following four categories:

- ***Trip Generation*** - The process of estimating trip productions and attractions at each TAZ.
- ***Trip Distribution*** - The process of linking trip productions to trip attractions for each TAZ pair.
- ***Modal Choice*** - The process of estimating the number of trips using a particular mode for each TAZ pair. Because of the low frequency of transit trips, pedestrian, and bicycle trips in the modeling area, this step was not performed.
- ***Trip Assignment*** - The process of assigning auto and truck trips onto specific highway facilities in the region.

The general relationships between the different model steps and their inputs and outputs are presented in a schematic drawing in Figure 10. When calibrating a model, the process contains several review and adjustment loops, which are not shown for the sake of clarity.

Figure 10: Modeling Process



4.2 TRIP GENERATION

This section describes the procedures used to determine the number of trips by travel purpose that begin or end in a given traffic zone. The identification of the other end of the trips occurs in the trip distribution model to be discussed in the next section.

The model was developed using the following trip purposes:

Internal Trip Purposes

- Home-Based Work (HBW)
- Home-Based Other (HBO)
- Non Home-Based (NHB)
- Commercial Vehicle Trips (CMVEH)

External Trip Purposes

- External-Internal Trips (EI)
- External-External Trips (EE)

4.2.1 Internal Travel Model

For home-based trips, the productions refer to the home end, and the attractions refer to the non-home end of the trip. For non-home based and commercial vehicle trips, productions and attractions refer to the origin and destination respectively.

The model uses cross-classification trip production models for the home-based and non-home based trip purposes, that is, trip rates that vary by household type are applied at the zonal level. For the commercial vehicle purposes the model applies a linear regression equation that relates zonal employment and households to trip productions and attractions. The trip attraction models are linear regression equations that relate zonal employment, households and student enrollment to trip attractions. Productions and attractions are balanced at the study area level for all trip purposes by holding trip productions constant.

The HBW, HBO, and NHB trip models were modified from the trip models used by the Lake Charles, LA area travel demand model, which relies on the methodology given in NCHRP 365 for urban areas with a population of 50,000 to 199,999. These trip models were refined as needed during the calibration process. The commercial vehicle trip model was derived using the Quick Response Freight Manual, September 1996, and accounted for both commercial vehicles and trucks. Commercial vehicle trips represent four-tire commercial vehicles, including delivery and service vehicles, while truck trips represent single-unit with six or more tires and multi-unit with three-plus axle combination trucks. Final trip generation models are shown in Table 4.1, Table 4.2, Table 4.3, Table 4.4 and Table 4.5.

Table 4.1: Home-Based Work Trip Productions

	HHS1	HHS2	HHS3	HHS4	HHS5P
HH_VEH0	0.6115	1.2422	1.6538	2.0551	2.2388
HH_VEH1	0.9408	1.7331	2.0551	2.5696	2.7386
HH_VEH2	0.9408	2.0962	2.3682	2.9723	3.3384
HH_VEH3P	0.9408	2.1727	2.6592	3.3737	3.5986

Source: NCHRP 365; NSI, 2015

Table 4.2: Home-Based Other Trip Productions

	HHS1	HHS2	HHS3	HHS4	HHS5P
HH_VEH0	1.3880	2.5635	3.9515	4.9119	5.9798
HH_VEH1	2.1358	3.5770	4.9119	6.1404	7.3146
HH_VEH2	2.1358	4.3248	5.6596	7.1021	8.9165
HH_VEH3P	2.1358	4.4854	6.3543	8.0624	9.6111

Source: NCHRP 365; NSI, 2015

Table 4.3: Non-Home Based Trip Productions

	HHS1	HHS2	HHS3	HHS4	HHS5P
HH_VEH0	0.7441	1.2682	2.0357	2.3287	2.5887
HH_VEH1	1.1444	1.7689	2.5309	2.9106	3.1664
HH_VEH2	1.1444	2.1389	2.9161	3.3658	3.8597
HH_VEH3P	1.1444	2.2187	3.2737	3.8211	4.1595

Source: NCHRP 365; NSI, 2015

Table 4.4: Commercial Vehicle Trip Productions

	OCCDU	RET_EMP	RET_EMP2	OS_EMP	OTH_EMP	AMC_EMP	MTCUW_EMP
CMVEH	0.1632	0.5772	0.5772	0.2841	0.2841	0.7215	0.6097

Source: Quick Response Freight Manual, 1996; NSI, 2015

Table 4.5: Trip Attraction Equations by Trip Purpose

	OCCDU	RET_EMP	RET_EMP2	OS_EMP	OTH_EMP	AMC_EMP	MTCUW_EMP	SCHATT
HBWA	0.0000	1.5770	1.5770	1.5770	1.5770	1.5770	1.5770	0.0000
HBOA	0.7913	7.9129	7.9129	1.4947	0.4396	0.4396	0.4396	0.5782
NHBA	0.3969	3.2546	3.2546	0.9526	0.3969	0.3969	0.3969	0.2038
CMVEHA	0.1631	0.5772	0.5772	0.2841	0.2841	0.7215	0.6097	0.0000

Source: NCHRP 365; Quick Response Freight Manual, 1996; NSI, 2015

Description of the variables used in Tables 4.1, 4.2, 4.3, 4.4 and 4.5 were included in Table 3.1 and Table 3.2.

A special generator is a land use with unusually low or high trip generation characteristics. For the Monroe model, the University of Louisiana at Monroe was identified as a special generator.

Application of the trip generation models to the base-year planning data yielded estimates of trip productions and attractions by travel purpose for each traffic analysis zone. These were then balanced by holding productions constant to ensure that every trip generated by the model has both a beginning and an end. Table 4.6 lists the daily person trips by trip purpose.

Table 4.6: Daily Study Area Person Trips by Trip Purpose

Trip Purpose	Trips
HBW	123,037
HBO	275,847
NHB	138,957
CMVEH	42,576
TRK	8,512
Total	**588,929**

Note: CMVEH and TRK shown above are vehicle trips.

Source: NSI, 2015

4.2.2 External Travel Model

External travel consists of two types of trips: external-internal (EI) trips and external-external (EE) trips. EI trips have one end of the trip inside the study area and the other outside. EE trips pass through the study area, having no origin or destination within the study area.

In order to build the EI and EE trip tables, the external matrix of the previous model (conducted in 2009) was used as the starting point for the new external matrix due to the expansion of the study area and subsequent external stations. Based on the distribution of the old stations to one another and their correspondence to the new stations, where applicable, the external matrix was expanded to reflect the new external stations. The matrix was then adjusted to spread the trips to the added stations as necessary. The matrix was then updated to the current traffic counts using TransCAD's Fratar procedure to estimate trips crossing the study area boundary.

External-External (EE) Trips

Tables 4.7 through 4.9 list the balanced EE trips used in the model.

Table 4.7: Expanded 24-Hour EE All Trips Table

TAZ	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	Total
901	0	175	0	0	0	0	45	26	30	0	0	0	0	0	0	0	0	0	**277**
902	175	0	0	0	0	52	65	9	135	0	2	26	10	39	1,185	0	0	17	**1,715**
903	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
904	0	0	0	0	0	0	25	0	0	0	0	0	0	0	108	0	0	0	**133**
905	0	0	0	0	0	0	0	0	1	0	0	0	0	0	30	0	0	0	**31**
906	0	52	0	0	0	0	142	0	36	0	0	0	0	0	50	0	0	0	**280**
907	45	65	0	25	0	142	0	35	181	1	8	64	53	167	8,106	79	77	176	**9,225**
908	26	9	0	0	0	0	35	0	17	0	0	0	0	0	98	1	7	0	**193**
909	30	135	0	0	1	36	181	17	0	0	0	42	0	21	878	11	0	0	**1,351**
910	0	0	0	0	0	0	1	0	0	0	0	0	0	0	5	0	0	0	**6**
911	0	2	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	**10**
912	0	26	0	0	0	0	64	0	42	0	0	0	0	0	0	0	0	0	**132**
913	0	10	0	0	0	0	53	0	0	0	0	0	0	0	0	0	0	0	**63**
914	0	39	0	0	0	0	167	0	21	0	0	0	0	0	0	0	0	0	**227**
915	0	1,185	0	108	30	50	8,106	98	878	5	0	0	0	0	0	0	174	0	**10,634**
916	0	0	0	0	0	0	79	1	11	0	0	0	0	0	0	0	0	0	**90**
917	0	0	0	0	0	0	77	7	0	0	0	0	0	0	174	0	0	0	**259**
918	0	17	0	0	0	0	176	0	0	0	0	0	0	0	0	0	0	0	**193**
Total	**277**	**1,715**	**0**	**133**	**31**	**280**	**9,225**	**193**	**1,351**	**6**	**10**	**132**	**63**	**227**	**10,634**	**90**	**259**	**193**	**24,820**

Source: LADOTD, 2015; NSI, 2015

Table 4.8: Expanded 24-Hour EE Auto Trips Table

TAZ	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	Total
901	0	166	0	0	0	0	42	26	30	0	0	0	0	0	0	0	0	0	264
902	166	0	0	0	0	52	65	9	135	0	2	24	10	37	937	0	0	16	1,454
903	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
904	0	0	0	0	0	0	25	0	0	0	0	0	0	0	101	0	0	0	126
905	0	0	0	0	0	0	0	0	1	0	0	0	0	0	28	0	0	0	30
906	0	52	0	0	0	0	142	0	36	0	0	0	0	0	36	0	0	0	266
907	42	65	0	25	0	142	0	35	181	1	7	59	51	158	5,800	75	77	167	6,885
908	26	9	0	0	0	0	35	0	17	0	0	0	0	0	89	1	7	0	183
909	30	135	0	0	1	36	181	17	0	0	0	41	0	21	858	11	0	0	1,331
910	0	0	0	0	0	0	1	0	0	0	0	0	0	0	4	0	0	0	6
911	0	2	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	9
912	0	24	0	0	0	0	59	0	41	0	0	0	0	0	0	0	0	0	125
913	0	10	0	0	0	0	51	0	0	0	0	0	0	0	0	0	0	0	60
914	0	37	0	0	0	0	158	0	21	0	0	0	0	0	0	0	0	0	216
915	0	937	0	101	28	36	5,800	89	858	4	0	0	0	0	0	0	161	0	8,014
916	0	0	0	0	0	0	75	1	11	0	0	0	0	0	0	0	0	0	86
917	0	0	0	0	0	0	77	7	0	0	0	0	0	0	161	0	0	0	246
918	0	16	0	0	0	0	167	0	0	0	0	0	0	0	0	0	0	0	183
Total	**264**	**1,454**	**0**	**126**	**30**	**266**	**6,885**	**183**	**1,331**	**6**	**9**	**125**	**60**	**216**	**8,014**	**86**	**246**	**183**	**19,482**

Source: LADOTD, 2015; NSI, 2015

Table 4.9: Expanded 24-Hour EE Truck Trips Table																			
TAZ	**901**	**902**	**903**	**904**	**905**	**906**	**907**	**908**	**909**	**910**	**911**	**912**	**913**	**914**	**915**	**916**	**917**	**918**	**Total**
901	0	9	0	0	0	0	4	1	0	0	0	0	0	0	0	0	0	0	**14**
902	9	0	0	0	0	0	0	0	0	0	0	1	0	2	248	0	0	1	**262**
903	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
904	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	**7**
905	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	**2**
906	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	**14**
907	4	0	0	0	0	0	0	0	0	0	0	5	3	10	2,306	4	0	9	**2,341**
908	1	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	**10**
909	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	**21**
910	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
911	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
912	0	1	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	**6**
913	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	**3**
914	0	2	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	**11**
915	0	248	0	7	2	14	2,306	9	20	0	0	0	0	0	0	0	13	0	**2,620**
916	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	**4**
917	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	**13**
918	0	1	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	**9**
Total	**14**	**262**	**0**	**7**	**2**	**14**	**2,341**	**10**	**21**	**0**	**0**	**6**	**3**	**11**	**2,620**	**4**	**13**	**9**	**5,338**

Source: LADOTD, 2015; NSI, 2015

External-Internal (EI) Trips

The following EI attraction equations were used in the travel demand model to estimate EI attractions at the TAZ level:

$$EI\ AUTO\ Attractions = 0.5030 * (OCCDU) + 0.0366 * (RET\_EMP + OS\_EMP + OTH\_EMP + AMC\_EMP + MTCUW\_EMP)$$

$$EI\ TRK\ Attractions = 0.1160 * (RET\_EMP) + 0.0930 * (AMC\_EMP + MTCUW\_EMP)$$

Table 4.10: Daily Study Area External Vehicle Trips by Type

Trip Purpose	Trips
EI AUTO	49,838
EI TRK	7,675
EE AUTO	19,482
EE TRK	5,338
Total	**82,333**

Source: LADOTD, 2015; NSI, 2015

4.3 TRIP DISTRIBUTION

The next step in travel demand modeling is the trip distribution process. This function determines the destinations of trips produced in the trip generation model and conversely, where the attracted trips originated. Many models are available for this process. The one used for this effort was the doubly constrained gravity model.

This model employs two relationships, the first of which is indirect:

The shorter the travel time to the destination zone, the greater the number of trips will be distributed to it from the origin zone.

The second relationship is a direct one:

The more attractions there are in a destination zone, the more trips will be distributed to it from the origin zone.

The generalized equation for this model is:

$$T_{ij} = \frac{(P_i)(A_j)(F_{ij})}{\sum_{j=1}^{n}(A_j)(F_{ij})}$$

Where: T_{ij} = Trips distributed between zones i and j

P_i = Trips produced at zone i

A_j = Trips attracted to zone j

F_{ij} = Relative distribution rate (friction factors or impedance function) reflecting impedance between zone i and zone j

n = Total number of zones in study area

In a model of this type, friction factors determine the effect that spatial separation has on trip distribution between zones. These factors measure the probability of trip-making at one-minute increments of travel time. Gamma function was used to derive the friction factors. Calibration of a gamma impedance function involves estimating the three parameters of the gamma function; a, b, and c, as shown in the following equation:

$$f(t_{ij}) = a * t_{ij}^{-b} * e^{-c(t_{ij})}$$

Where: t_{ij} = Travel time between zones i and j

a,b,c = Parameters of the gamma function

e = 2.71828183… (Base of the natural logarithm)

The a,b,c parameter values used for each trip purpose are shown in Table4.9.

Table 4.11: Gamma Function Parameter Values by Trip Purpose

Trip Purpose	a	b	c
HBO	5,757,246.6014	1.2469	0.1743
HBW	186.9551	-3.5137	0.3270
NHB	2,188,886.4252	1.0691	0.1704
CMVEH	1.0000	0.0000	0.0800
EIAUTO	5.8171	-2.1712	0.1281
TRK	1.0000	0.0000	0.1000
EITRK	1.0000	0.0000	0.0307

Source: NCHRP 365; NSI, 2015; Quick Response Freight Manual, 1996

The initial outcome of the Trip Distribution step was a daily production-attraction matrix. It is necessary to convert this production-attraction (P-A) matrix to an origin-destination (O-D) matrix to use in the Trip Assignment step. TransCAD's "P-A to O-D" procedure with diurnal distribution of trips by purpose was used to create the final O-D matrix of each time period used in this model.

Diurnal distribution is the process of allocating daily trips (by purpose and mode) into the time periods used for highway assignment. The allocation is achieved via use of time of day or diurnal factors. A time of day factor gives the proportion of total trips (by purpose) that are in-motion during a certain period of the day. These factors are typically developed separately for the production to attraction direction of travel (P-to-A) and the attraction to production direction of travel (A-to-P). This consideration is necessary to ensure that the trips loaded to the networks are in Origin-Destination format, and not in the Production-Attraction format used in all previous modeling steps.

This time of day split is based on diurnal factors derived from various sources and are shown in Table 4.12. The four assignment time periods are:

- AM Peak Period: 6:00 AM to 9:00 AM
- Mid-Day: 9:00 AM to 3:00 PM
- PM Peak Period: 3:00 PM to 6:00 PM
- Night: 6:00 PM to 6:00 AM

Table 4.12: Diurnal Factors Used in Model Development

TIME_PERIOD	ACTUAL_HOUR	HOUR	DEP_HBW	RET_HBW	DEP_HBO	RET_HBO	DEP_NHB	RET_NHB	DEP_CMVEH	RET_CMVEH	DEP_TRK	RET_TRK	DEP_EI_AUTO	RET_EI_AUTO	DEP_EI_TRK	RET_EI_TRK	DEP_EE_AUTO	RET_EE_AUTO	DEP_EE_TRK	RET_EE_TRK
AM PEAK	6	0	10.30	0.25	1.26	0.02	1.35	1.35	3.50	3.50	2.50	2.50	2.82	3.71	2.36	3.80	2.82	3.71	2.36	3.80
AM PEAK	7	1	12.53	0.62	3.24	0.05	2.68	2.68	3.30	3.30	3.65	3.65	3.31	3.56	2.71	3.13	3.31	3.56	2.71	3.13
AM PEAK	8	2	5.30	0.31	3.13	0.09	2.36	2.36	3.20	3.20	3.60	3.60	3.10	2.87	3.01	3.06	3.10	2.87	3.01	3.06
MID-DAY	9	3	2.57	0.29	4.32	1.37	3.81	3.81	2.60	2.60	3.90	3.90	2.78	2.77	3.44	3.10	2.78	2.77	3.44	3.10
MID-DAY	10	4	1.30	0.42	3.63	1.73	3.52	3.52	2.85	2.85	3.50	3.50	2.56	2.59	3.27	3.19	2.56	2.59	3.27	3.19
MID-DAY	11	5	2.08	1.41	3.39	3.07	8.07	8.07	2.70	2.70	3.75	3.75	2.42	2.55	2.95	3.22	2.42	2.55	2.95	3.22
MID-DAY	12	6	1.62	2.16	2.44	2.95	7.40	7.40	2.75	2.75	3.40	3.40	2.59	2.82	2.82	3.18	2.59	2.82	2.82	3.18
MID-DAY	13	7	1.54	1.74	2.72	2.77	5.05	5.05	2.90	2.90	3.55	3.55	2.46	2.81	3.05	3.29	2.46	2.81	3.05	3.29
MID-DAY	14	8	1.33	2.26	2.71	5.13	4.26	4.26	3.20	3.20	3.85	3.85	2.79	2.85	3.33	3.24	2.79	2.85	3.33	3.24
PM PEAK	15	9	1.36	7.95	1.72	3.43	2.50	2.50	3.90	3.90	3.80	3.80	3.20	3.30	3.65	3.21	3.20	3.30	3.65	3.21
PM PEAK	16	10	1.21	11.38	2.33	2.99	2.57	2.57	4.35	4.35	3.30	3.30	4.30	3.92	3.91	2.77	4.30	3.92	3.91	2.77
PM PEAK	17	11	0.75	10.67	3.28	3.41	1.87	1.87	3.55	3.55	2.55	2.55	5.24	3.75	3.83	2.56	5.24	3.75	3.83	2.56
NIGHT	0	12	0.00	0.51	0.00	0.79	0.14	0.14	0.35	0.35	0.35	0.35	0.38	0.21	0.45	0.34	0.38	0.21	0.45	0.34
NIGHT	1	13	0.00	0.43	0.00	0.31	0.09	0.09	0.20	0.20	0.30	0.30	0.28	0.22	0.37	0.30	0.28	0.22	0.37	0.30
NIGHT	2	14	0.00	0.29	0.00	0.03	0.05	0.05	0.20	0.20	0.30	0.30	0.31	0.21	0.50	0.33	0.31	0.21	0.50	0.33
NIGHT	3	15	0.32	0.36	0.00	0.13	0.00	0.00	0.20	0.20	0.25	0.25	0.49	0.35	0.72	0.57	0.49	0.35	0.72	0.57
NIGHT	4	16	1.56	0.20	0.21	0.00	0.46	0.46	0.30	0.30	0.55	0.55	0.85	1.14	0.86	1.16	0.85	1.14	0.86	1.16
NIGHT	5	17	4.73	0.17	0.79	0.00	1.09	1.09	1.00	1.00	1.50	1.50	1.60	2.64	1.54	3.18	1.60	2.64	1.54	3.18
NIGHT	18	18	0.38	3.05	6.87	5.74	1.14	1.14	2.90	2.90	1.75	1.75	3.17	2.68	2.75	2.11	3.17	2.68	2.75	2.11
NIGHT	19	19	0.22	1.06	4.52	4.54	0.59	0.59	1.65	1.65	1.20	1.20	1.78	1.75	1.58	1.45	1.78	1.75	1.58	1.45
NIGHT	20	20	0.31	1.47	1.87	4.62	0.55	0.55	1.45	1.45	0.80	0.80	1.27	1.25	0.91	1.06	1.27	1.25	0.91	1.06
NIGHT	21	21	0.24	1.61	1.01	3.80	0.23	0.23	1.30	1.30	0.65	0.65	1.08	0.98	0.86	0.78	1.08	0.98	0.86	0.78
NIGHT	22	22	0.29	0.98	0.44	2.18	0.14	0.14	1.00	1.00	0.50	0.50	0.75	0.67	0.73	0.56	0.75	0.67	0.73	0.56
NIGHT	23	23	0.07	0.42	0.12	0.85	0.09	0.09	0.65	0.65	0.50	0.50	0.48	0.39	0.39	0.41	0.48	0.39	0.39	0.41

Source: NCHRP 365; NSI, 2015

4.4 TRIP ASSIGNMENT

Traffic assignment models are used to estimate the traffic flows on a network. The main input to these models is a matrix of flows that indicate the volume of traffic between origin and destination (O-D) pairs. The other inputs to these models are network topology, link characteristics, and link performance functions. The trips between each O-D pair are loaded onto the network based on the travel time or impedance of the alternative paths that could carry this traffic.

TransCAD's Multi-Modal Multi-Class Assignment (MMA) with User Equilibrium (UE) as assignment type and Bureau of Public Roads (BPR) Volume-Delay function was used for the Monroe model. The MMA model is a generalized cost assignment that allows the modeler to assign trips by individual modes or user classes to the network simultaneously. Each mode or class can have different network exclusions, congestion impacts (passenger car equivalent values), values of time, and toll costs.

4.5 MODEL VALIDATION

The validation process is intended to ensure that the model is performing within the limits that define acceptable ranges of deviation from observed "real-world" values. In practice this means making link assignment volumes approximate traffic estimates, based on actual counts, within acceptable limits of deviation. Generally speaking, the lower the volume the greater the relative deviation that is acceptable. Conversely, the greater the amount of traffic, the greater the degree of accuracy required. This is because the ultimate purpose of the model is to determine whether additional vehicular capacity will be needed on any given roadway at a designated future date. Where existing volumes are low, the model assignment may deviate from actual conditions by 40 or 50 percent without affecting the projected need for additional capacity. On the other hand, in the case of a heavily traveled interstate route, a deviation of 20 percent may be significant (i.e., alter the projection of required capacity).

Validation of the Monroe Travel Demand Model proceeded from consideration of its area-wide performance to the relative distribution of traffic by roadway functional classification and Average Daily Traffic (ADT) range. In the final stage of the validation process, the accuracy of the model with respect to specific routes and roadway groups was analyzed. At each level an appropriate degree of accuracy was defined in terms of the maximum tolerable deviation from base-year vehicular volumes, i.e., estimated annual average daily traffic and Root Mean Square Error (RMSE).

RMSE was chosen because when comparing model flows versus counts, sometimes an aggregate sum by link group can be misleading. The sum of all traffic counts for a particular link group may be close to the sum of the corresponding traffic flows, but individual link flows may still be very different than their corresponding link count. However, the RMSE statistic does not convey information about the magnitude of the error relative to that of the counts. Therefore the Percent Root Mean Square Error (Percent RMSE or % RMSE) is often computed. This measure expresses the RMSE as a percentage of the average count value. The Percent RMSE is defined as below:

$$\%RMSE = \frac{\sqrt{\sum_j (Model_j - Count_j)^2 / (Numberofcounts)}}{\left(\sum_j Count_j \Big/ Numberofcounts\right)} * 100$$

Overall, the cumulative model volume for all network links associated with LADOTD traffic count locations (2,173,663vehicles) differed from total model estimated ADT (2,180,775 vehicles) by only -0.33 percent compared to an allowable error limit of five percent.

Validation results by ADT group and by functional classification are shown in Table 4.13 and Table 4.14 respectively.

Table 4.13: Validation of Base-Year Model by ADT Group						
ADT Range	Total Count[1]	Total Model Volume[2]	% Dev Limit[3]	% Dev	% RMSE Limit[4]	% RMSE
ADT < 5,000	214,215	231,578	+/- 50.0	8.1	115.8	49.8
5,000<= ADT < 10,000	259,218	269,195	+/- 25.0	3.9	43.1	32.7
10,000<= ADT < 20,000	622,910	647,709	+/- 20.0	4.0	28.3	17.9
20,000<= ADT < 40,000	920,482	870,101	+/- 15.0	-5.5	25.4	16.7
ADT >= 40,000	163,950	155,030	+/- 12.0	-5.4	30.3	13.6
Total	**2,180,775**	**2,173,614**	**+/- 5.0**	**-0.3**	**40.0**	**25.3**

Source: Minimum Travel Demand Model Calibration and Validation Guidelines for State of Tennessee; NSI, 2015

Table 4.14: Validation of Base-Year Model by Roadway Functional Classification				
Functional Classification	Total Count[1]	Total Model Volume[2]	% Dev Limit[3]	% Dev
Interstate	688,601	691,056	+/- 7.0	0.4
Principal Arterial	856,297	817,544	+/- 10.0	-4.5
Minor Arterial	409,720	430,892	+/- 15.0	5.2
Collector/Local	219,293	227,725	+/- 25.0	3.9
All Features	**2,180,775**	**2,173,614**	**+/- 5.0**	**-0.3**

Source: Minimum Travel Demand Model Calibration and Validation Guidelines for State of Tennessee; NSI, 2015

(1) Total Count represents the sum of average daily traffic estimates for all LADOTD count locations (area wide), all count locations on principal arterials, all locations on minor arterials, all on major/minor collectors.

(2) Total Model Volume is the sum of model-generated traffic volumes for all network links associated with LADOTD count locations (area wide), all links associated with count locations on principal arterials, all links associated with locations on minor arterials, and all links associated with count locations on collectors.

(3) % Dev Limit is the maximum acceptable plus/minus percentage deviation from estimated base-year (2010) average daily traffic (ADT) based on counts conducted by LADOTD.

(4) % RMSE Limit is the maximum acceptable magnitude of the error relative to that of the counts conducted by the LADOTD.

The validation effort concluded that the Monroe study area travel demand forecasting model performs well within the established limits of acceptable deviation from base-year estimated volumes.

CHAPTER 5: EXISTING PLUS COMMITTED (E+C) NETWORK

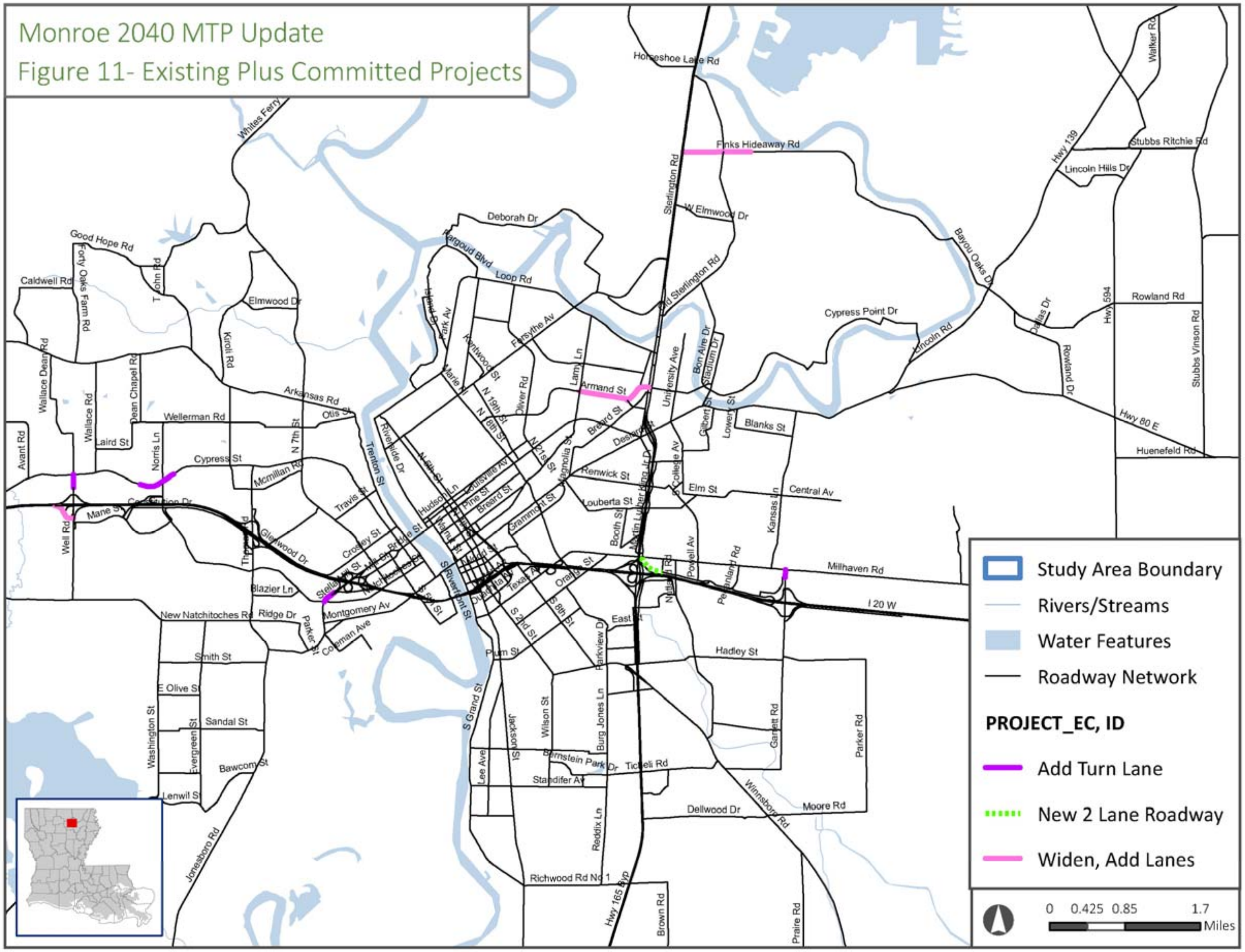
The base year network was defined as the street and highway system in the year 2010. Once the base year network was calibrated, the E+C network was developed. Committed projects are those improvements for which construction has been completed or initiated since 2010, a contract for construction has been awarded, or for which funding has been dedicated such as through legislative approval of the proposed construction program. The committed projects are listed in Table 5.1 and shown in Figure 11.

Table 5.1: Existing Plus Committed (E+C) Projects

Map No.	Name	Location	Improvement
1	US 80	@ Downing Pines	Add Left Turn Lanes
2	LA 594	@ Garret Rd	Add Right Turn Lane
3	I-20 EB Off Ramp	@ Well Rd	Widen to 2 Lanes
4	Well Rd	@ US 80	Add Right Turn Lane
5	LA 34	@ Old Natchitoches Rd	Add Left Turn Lane
6	Finks Hideaway Rd	US 165 to Holland Dr	Widen to 5 Lanes
7	Pecanland Mall Dr Extension	Auto Mall Dr to Millhaven Rd	New 2 Lane Roadway
8	Armand St	Lamy Ln to Sterlington Rd	Widen to 5 Lanes

Source: LADOTD

Figure 11: Existing Plus Committed (E+C) Projects



CHAPTER 6: PLANNING AREA FORECAST

To adequately forecast future transportation needs, future projections of demographic variables are needed. In order to accomplish this effort, it is first necessary to forecast the population and employment of the entire Parish for the future years of 2020, 2030, and 2040. For this purpose, preliminary population forecast numbers were developed using a cohort-component approach. Then, preliminary employment forecasts were developed with the assumption that employment will grow slightly faster than population, based on historical trends in metropolitan areas. These preliminary forecasts were confirmed through discussions with the public, key stakeholders, and the MPO Director.

The allocation of future population growth to the TAZs relied upon information provided by the public, key stakeholders, MPO staff, and local planning officials, along with additional information from existing studies, plans, documents, and news articles. A complete review of existing plans used for MTP development can be found in Appendix B. Planners responsible for residential development at the municipal and parish level were interviewed during the preparation of the forecasts. Specifically, they were asked to identify the locations of residential developments that were either planned, under development, or recently completed and then to approximate the number of new dwelling units associated with each development. These developments could be either single-family or multifamily developments.

In order to forecast future populations of each TAZ, this local knowledge of residential development was considered alongside GIS data such as historical population change, environmental constraints such as flood zones and wetland areas, existing land use patterns, future land use regulations, and regional accessibility.

Information necessary to allocate new employment growth was gathered according to a similar process. Local planners were asked about anticipated major employers, retail developments, or other new employment centers planning to locate within their jurisdiction. The most prominent projects identified were the IBM application development innovation center and expansion of the CenturyLink campus.

Planners were also asked if the area is anticipated to lose any major employers, but none were identified. Other questions concentrated on sensitive environmental features and properties protected from development, along with new or planned parks, recreational facilities, schools, and other public buildings. To supplement the interviews, information was gathered from a review of recent local news articles concerning economic development.

As with the population forecasts, the development of employment forecasts also incorporated GIS data such as historical population change, flood zones and wetland areas, existing land use patterns, future land use regulations, regional accessibility, and proximity to major roadways and other transportation infrastructure.

Table 6.1 and Table 6.2 present the forecast demographic data for the study area. Figures 12 through 16 show the population, dwelling units, employment, and school enrollment data by TAZ for the year 2040.

Table 6.1: Study Area Demographic Forecast Data by Year					
Variable	**Description**	**2010**	**2020**	**2030**	**2040**
DU	Total Dwelling Units	64,481	68,565	71,619	74,433
OCCDU	Occupied Dwelling Units	58,691	62,322	65,158	67,709
POP	Total Population in Households	148,186	157,242	164,426	170,972
SCHATT	School Enrollment	44,644	46,138	48,483	51,269
HHS1	Households with 1-person	16,395	17,421	18,081	18,747
HHS2	Households with 2-persons	18,469	19,562	20,507	21,317
HHS3	Households with 3-persons	10,282	10,906	11,418	11,867
HHS4	Households with 4-persons	7,661	8,175	8,617	8,989
HHS5P	Households with 5-or-more persons	5,884	6,258	6,535	6,789
HH_VEH0	Households with 0-cars	2,488	2,716	2,810	2,929
HH_VEH1	Households with 1-car	18,775	19,980	20,817	21,577
HH_VEH2	Households with 2-cars	24,415	25,838	27,071	28,156
HH_VEH3P	Households with 3-or-more cars	13,012	13,788	14,460	15,047
HH1VEH0	Households with 1-person and 0 cars	1,326	1,447	1,491	1,553
HH1VEH1	Households with 1-person and 1 car	10,316	10,949	11,365	11,768
HH1VEH2	Households with 1-person and 2 cars	3,728	3,941	4,099	4,257
HH1VEH3	Households with 1-person and	1,008	1,065	1,107	1,150
HH2VEH0	Households with 2-persons and 0 cars	359	390	410	430
HH2VEH1	Households with 2-persons and 1 car	3,722	3,966	4,169	4,335
HH2VEH2	Households with 2-persons and 2 cars	10,586	11,185	11,716	12,172
HH2VEH3	Households with 2-persons and	3,809	4,029	4,221	4,388
HH3VEH0	Households with 3-persons and 0 cars	310	338	349	362
HH3VEH1	Households with 3-persons and 1 car	2,048	2,182	2,273	2,354
HH3VEH2	Households with 3-persons and 2 cars	4,483	4,745	4,978	5,180
HH3VEH3	Households with 3-persons and	3,445	3,647	3,824	3,976
HH4VEH0	Households with 4-persons and 0 cars	232	254	265	277
HH4VEH1	Households with 4-persons and 1 car	1,321	1,419	1,492	1,550
HH4VEH2	Households with 4-persons and 2 cars	3,365	3,582	3,781	3,948
HH4VEH3	Households with 4-persons and	2,747	2,923	3,083	3,217
HH5VEH0	Households with 5-or-more persons	261	287	296	307
HH5VEH1	Households with 5-or-more persons	1,370	1,464	1,518	1,570
HH5VEH2	Households with 5-or-more persons	2,253	2,386	2,498	2,598
HH5VEH3	Households with 5-or-more persons	2,002	2,124	2,226	2,316

Source: NSI

Table 6.2: Study Area Employment Forecast Data by Year					
Variable	**Description**	**2010**	**2020**	**2030**	**2040**
TOT_EMP	Total Employment	76,770	83,152	87,091	90,439
AMC_EMP	Agriculture, Mining and Construction Employment	4,106	4,458	4,474	4,474
MTCUW_EMP	Manufacturing, Transportation/Communications/Utilities and Wholesale Trade Employment	13,440	12,763	12,709	12,635
RET_EMP	Retail Employment	17,127	18,086	19,002	19,735
OS_EMP	Government, Office and Services Employment	41,666	47,414	50,475	53,164
OTH_EMP	Other Employment	431	431	431	431

Source: NSI, InfoUSA

Figure 12: 2040 Total Population

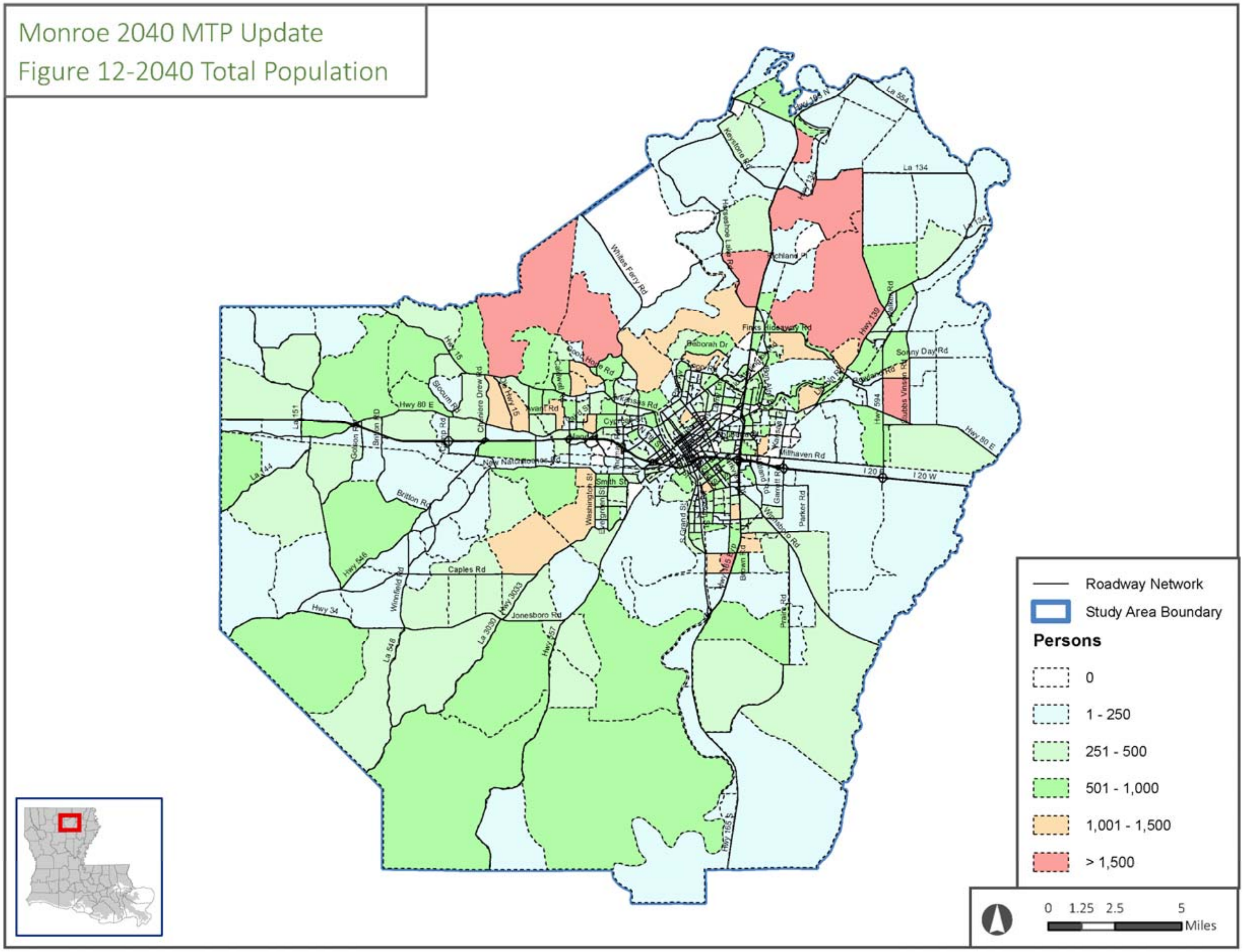


Figure 13: 2040 Total Dwelling Units

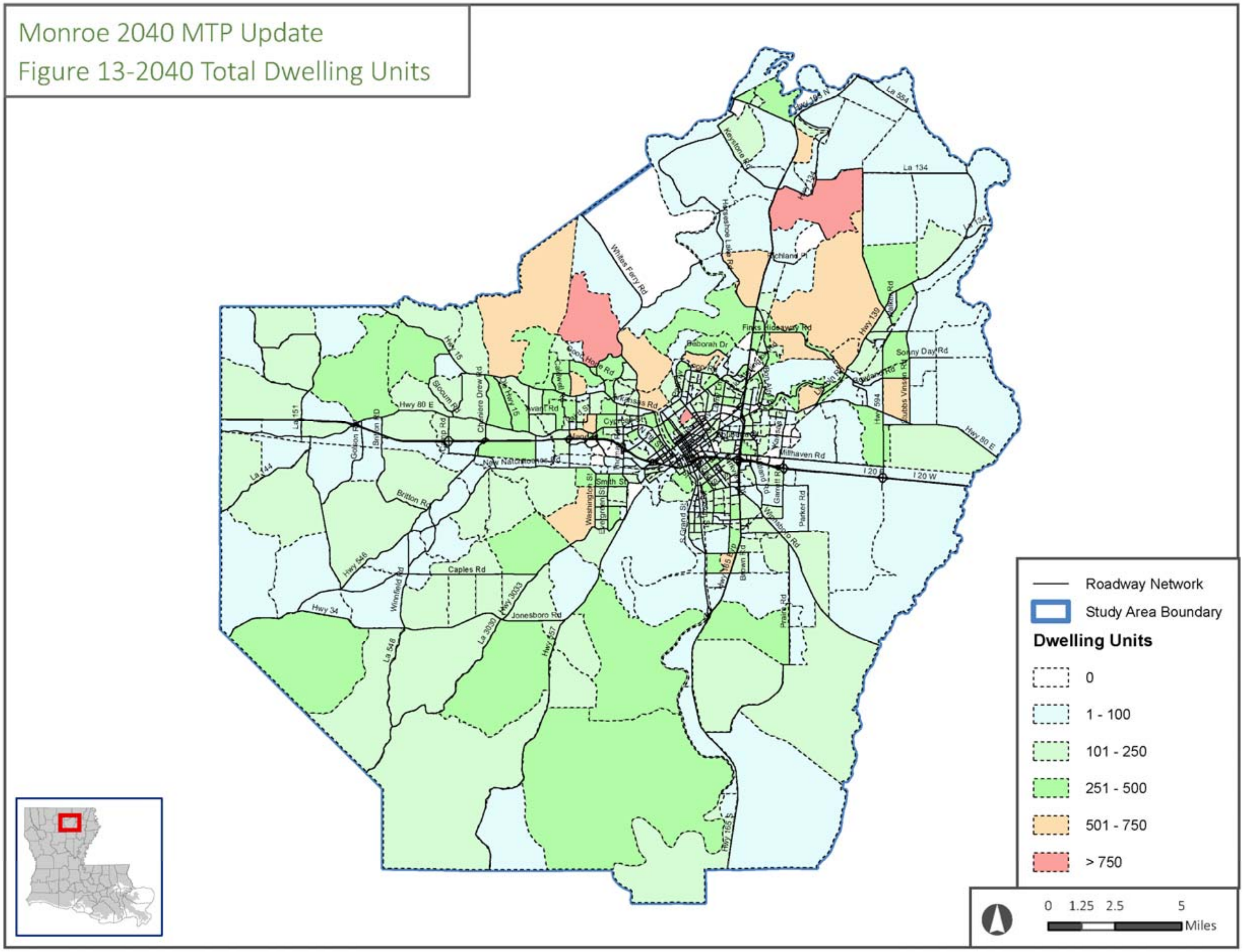


Figure 14: 2040 Total Employment

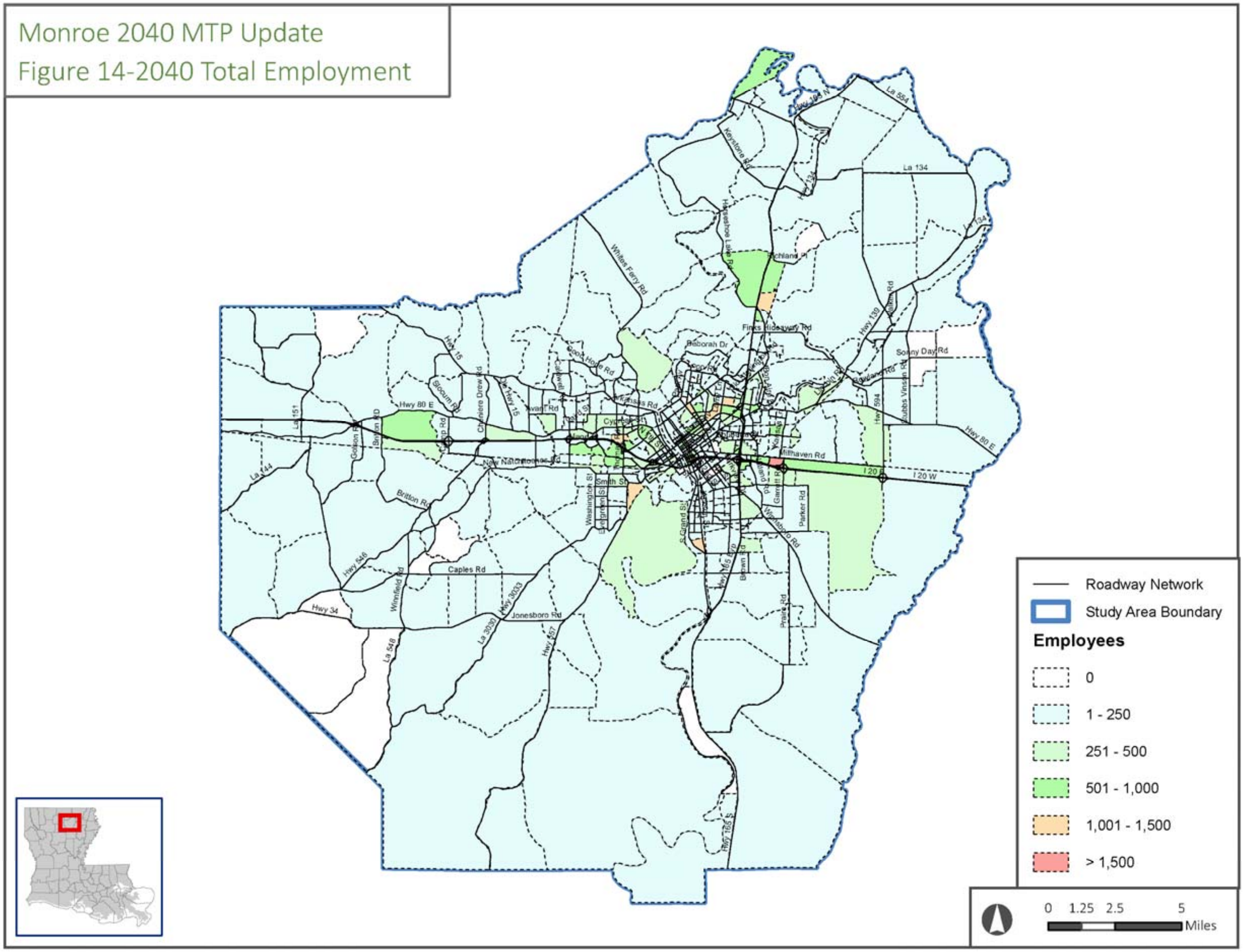


Figure 15: 2040 Retail Employment

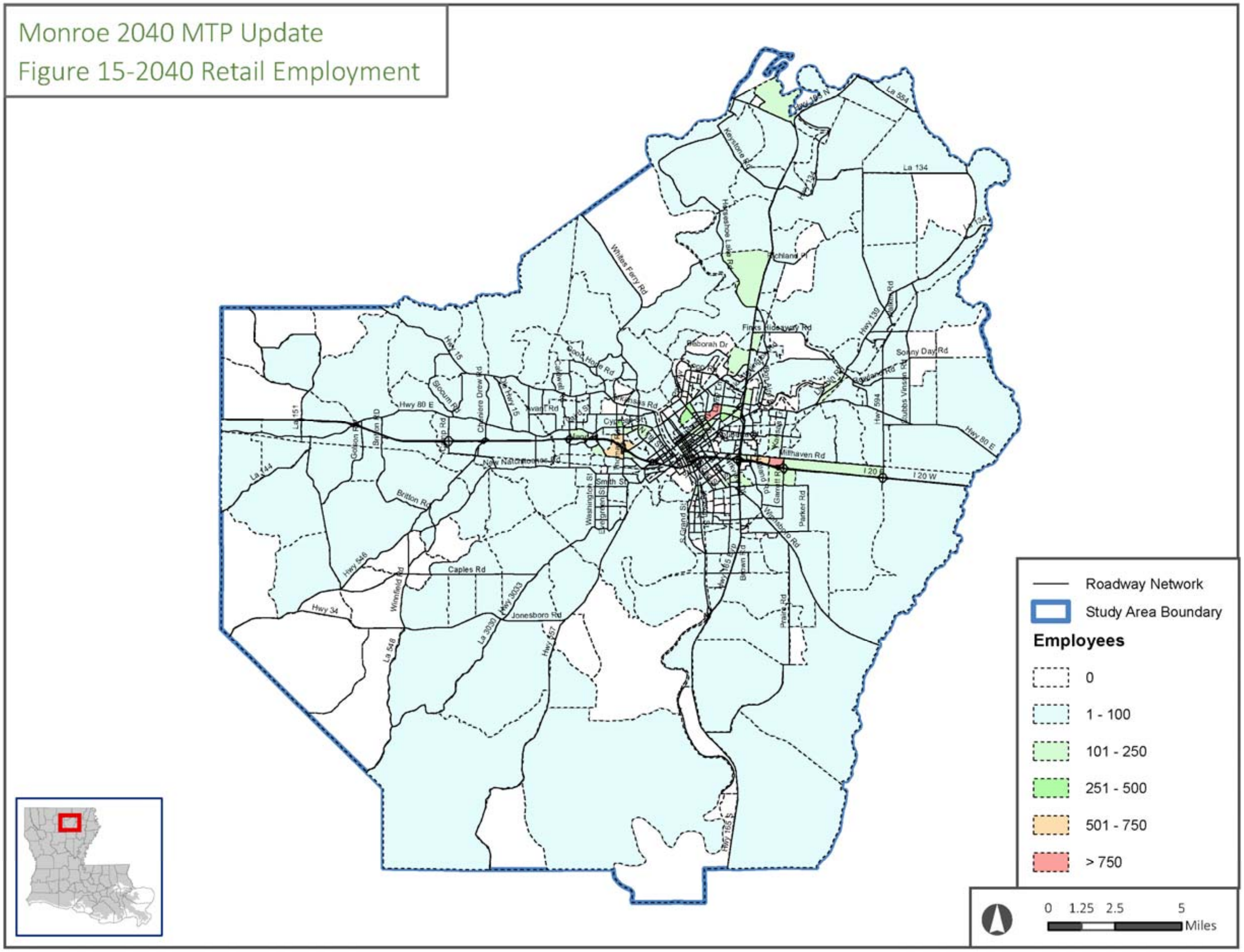
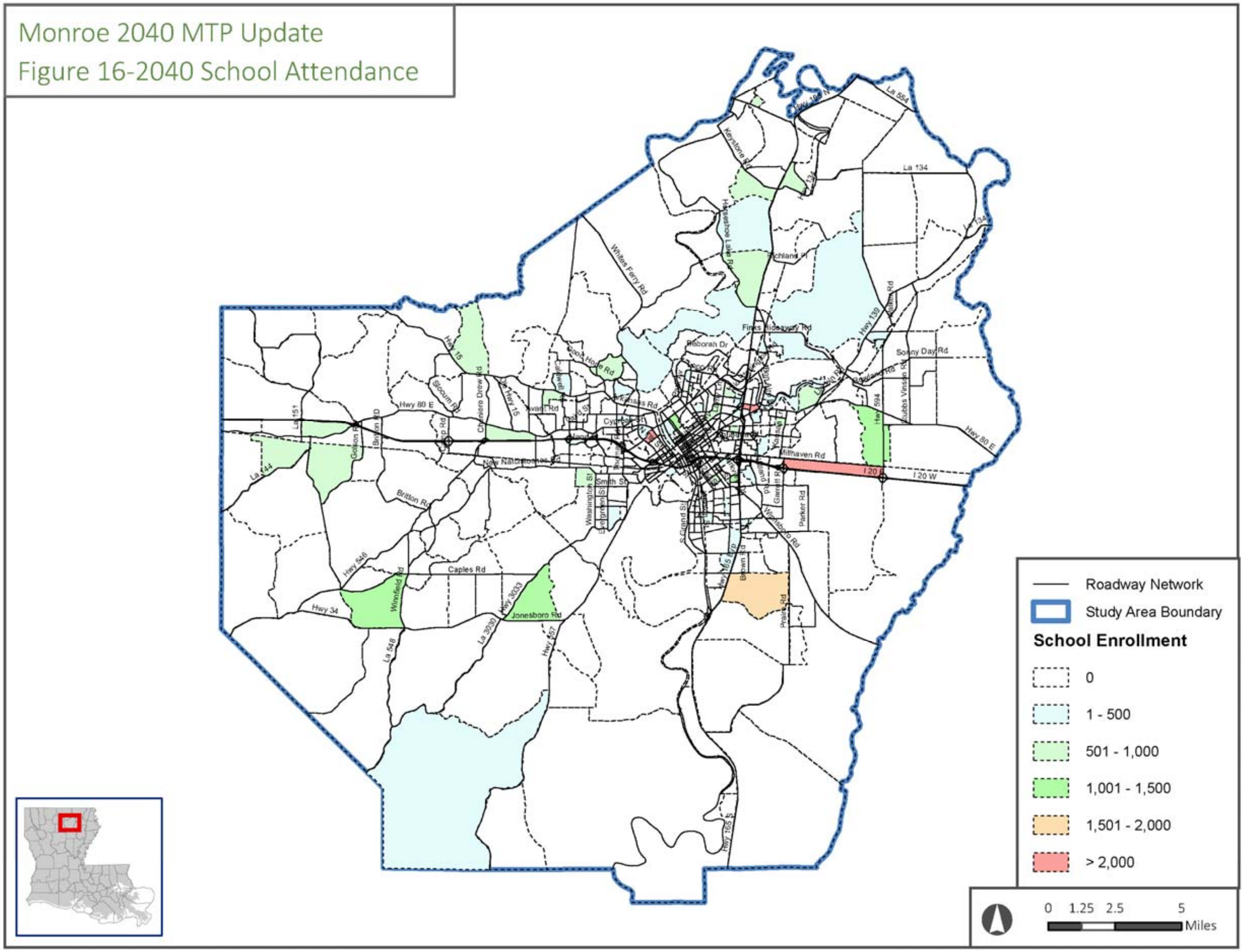


Figure 16: 2040 School Attendance



CHAPTER 7: DEFICIENCY ANALYSIS

7.0 FUTURE TRAVEL DEMAND

Link traffic volumes for the year 2040 were estimated using the travel demand estimation models developed during the base year calibration process, the forecast planning data, external trip forecasts and the E+C network..

7.1 EXTERNAL TRIP FORECAST

As described in Section 4.2.1, there are two types of external trips; External-Internal and External-External. The base year traffic counts at each external station were forecast to the interim years and horizon year by developing growth factors based on historical traffic counts at the external stations. The total traffic at each station was then divided into EI and EE trips with the assumption that there would not be a significant change in the distribution from the base year. The comparison of external travel forecast for the base year and target years is shown in Table 7.1.

Table 7.1: Daily Study Area External Vehicle Trips by Type and Year

Trip Purpose	2010	2020	2030	2040
EI AUTO	49,838	58,085	67,951	79,800
EI TRK	7,675	9,132	10,889	13,011
EE AUTO	19,482	23,449	28,262	34,108
EE TRK	5,338	6,469	7,844	9,517
Total	**82,333**	**97,135**	**114,946**	**136,436**

Source: NSI

7.2 INTERNAL TRIP FORECAST

The trip generation programs were operated using the demographic forecast data files. These programs calculated the productions and attractions by traffic zone. The comparison of trip productions by purpose for the base year and future years is shown in Table 7.2.

Table 7.2: Daily Study Area Person Trips by Trip Purpose and Year

Trip Purpose / Year	2010	2020	2030	2040
HBW	123,037	126,365	132,353	137,618
HBO	275,847	292,870	306,742	318,951
NHB	138,957	145,170	152,656	159,153
CMVEH	42,576	45,195	47,035	48,593
TRK	8,512	8,941	9,271	9,551
Total	**588,928**	**618,541**	**648,057**	**673,866**
Note: CMVEH and TRK shown above are vehicle trips.				

Source: NSI

The doubly constrained gravity model then distributed the trips between zonal pairs. The equilibrium traffic assignment model loaded the trips on the network based on minimum time paths. The assigned volumes on each link were compared to the capacity of the links and volume/capacity (VOC) ratios were calculated. The resulting link VOC ratios were then used to determine areas of future capacity deficiency.

7.3 PROJECTED DEFICIENCIES

It is recommended that those facilities which show a projected volume/capacity ratio of greater than 1.00 – or in terms of Level of Service (LOS), any facilities which have a LOS of E and higher – should be considered deficient. The facilities estimated to be deficient by each year are listed below and are also shown in Figures 17 through 20. In addition, base year (2010) deficient facilities are shown in Figure 18.

Major corridors forecast to be deficient by the year 2010 are:

- I-20 from Thomas Rd east ramps to LA 34 west ramps, 0.78 miles
- US 80 from I-20 EB ramps to I-20 WB ramps, 0.22 miles
- US 80 from Trenton St to Riverside Dr, 0.26 miles
- US 165 from LA 3275 to Old Sterlington Rd, 0.89 miles
- LA 34 from E Bawcom St to Delaughter St, 0.03 miles
- Riverside Dr from US 80 to Bres Ave, 0.07 miles
- S 5th St from I-20 WB Off-Ramp to Coleman Ave, 0.02 miles
- LA 616 from Kiroll Ave to LA 617, 0.10 miles

Major corridors forecast to be deficient by the year 2020 are:

- I-20 from Well Rd east ramps to LA 34 east ramps, 3.57 miles
- I-20 from Ouachita River Bridge ramps to Jackson St ramps, 0.23 miles
- US 80 from I-20 EB ramps to I-20 WB ramps, 0.22 miles
- US 80 from Avant Rd to Wallace Dean Rd, 0.51 miles

- US 80 from Trenton St to Riverside Dr, 0.26 miles
- US 165 from I-20 north ramps to Louberta Dr, 0.57 miles
- US 165 from LA 3275 to Old Sterlington Rd, 0.89 miles
- US 165 from LA 840 to Finks Hideaway Rd, 1.22 miles
- LA 34 from E Bawcom St to Delaughter St, 0.03 miles
- Riverside Dr from US 80 to Hudson Ave, 0.11 miles
- S 5th St from I-20 WB Off-Ramp to Coleman Ave, 0.02 miles
- LA 616 from Kiroll Ave to LA 617, 0.10 miles
- Finks Hideaway Rd from Savoy Rd to Leon Patrick Dr, 1.01 miles
- Garret Rd from I-20 EB ramps to I-20 WB ramps, 0.31 miles
- LA 546 from Phillips Rd to Cheniere Station Rd, 0.74 miles

Major corridors forecast to be deficient by the year 2030 are:

- I-20 from LA 546 east ramps to LA 34 east ramps, 6.73 miles
- I-20 from Ouachita River Bridge ramps to LA 594 west ramps, 0.87 miles
- US 80 from Research Ln to I-20 WB ramps, 1.10 miles
- US 80 from Shows Ln to 0.27 miles west of Camp Rd, 1.11 miles
- US 80 from Avant Rd to Wallace Dean Rd, 0.51 miles
- US 80 from LA 15 to Riverside Dr, 0.36 miles
- US 80 from Kansas St to Chatham Dr, 0.42 miles
- US 165 from I-20 north ramps to Louberta Dr, 0.57 miles
- US 165 from Renwick Dr to Martin Luther King Jr Dr, 0.36 miles
- US 165 from LA 3275 to Teakwood Dr, 3.02 miles
- US 165 from Old Sterlington Rd to Veteran Dr, 0.42 miles
- LA 34 from Philpot Rd to Winks Ln, 2.48 miles
- LA 34 from E Bawcom St to Delaughter St, 0.03 miles
- Riverside Dr from US 80 to Hudson Ave, 0.11 miles
- S 5th St from I-20 WB Off-Ramp to Coleman Ave, 0.02 miles
- LA 616 from Kiroll Ave to LA 617, 0.10 miles
- Finks Hideaway Rd from Savoy Rd to Leon Patrick Dr, 1.01 miles
- Garret Rd from I-20 EB ramps to I-20 WB ramps, 0.31 miles
- LA 546 from Phillips Rd to Cheniere Station Rd, 0.74 miles
- Natchitoches Rd from Blazier St to LA 34, 0.33 miles
- LA 3275 from US 80 to US 165, 0.62 miles
- Old Sterlington Rd from Bon Aire Dr to Karren Ln, 0.65 miles

Major corridors forecast to be deficient by the year 2040 are:

- I-20 from LA 151 east ramps to LA 594 west ramps, 15.51 miles
- US 80 from Research Ln to Golson Rd, 1.30 miles
- US 80 from Shows Ln to LA 15, 2.84 miles
- US 80 from 0.13 miles west of Avant Rd to Wallace Dean Rd, 0.64 miles
- US 80 from LA 15 to Walnut St, 0.43 miles
- US 80 from Kansas St to LA 139, 1.12 miles
- US 165 from Century Blvd to I-20 On-Ramps, 0.12 miles

- US 165 from I-20 north ramps to Louberta Dr, 0.57 miles
- US 165 from Renwick Dr to Martin Luther King Jr Dr, 0.36 miles
- US 165 from LA 3275 to Dew Ln, 5.11 miles
- LA 34 from Philpot Rd to Winks Ln, 2.48 miles
- LA 34 from E Bawcom St to Delaughter St, 0.03 miles
- Riverside Dr from US 80 to Hudson Ave, 0.11 miles
- S 5th St from I-20 WB Off-Ramp to Coleman Ave, 0.02 miles
- LA 616 from Good Hope Rd to LA 617, 0.60 miles
- Finks Hideaway Rd from Savoy Rd to Leon Patrick Dr, 1.01 miles
- Garret Rd from Frontage Rd to I-20 WB ramps, 0.37 miles
- LA 546 from Phillips Rd to Cheniere Station Rd, 0.74 miles
- Natchitoches Rd from Blazier St to LA 34, 0.33 miles
- LA 3275 from US 80 to US 165, 0.62 miles
- Old Sterlington Rd from Bon Aire Dr to Karren Ln, 0.65 miles
- Bon Air Dr from Northeast Dr to Warhawk Way, 0.08 miles
- Elm St from Louberta St to 0.13 miles east of Sherouse St, 0.28 miles
- LA 838 from Vancil Rd to Well Rd, 1.27 miles
- Downing Pines Rd from I-20 WB Ramps to US 80, 0.18 miles

Figure 17: 2010 Volume/Capacity

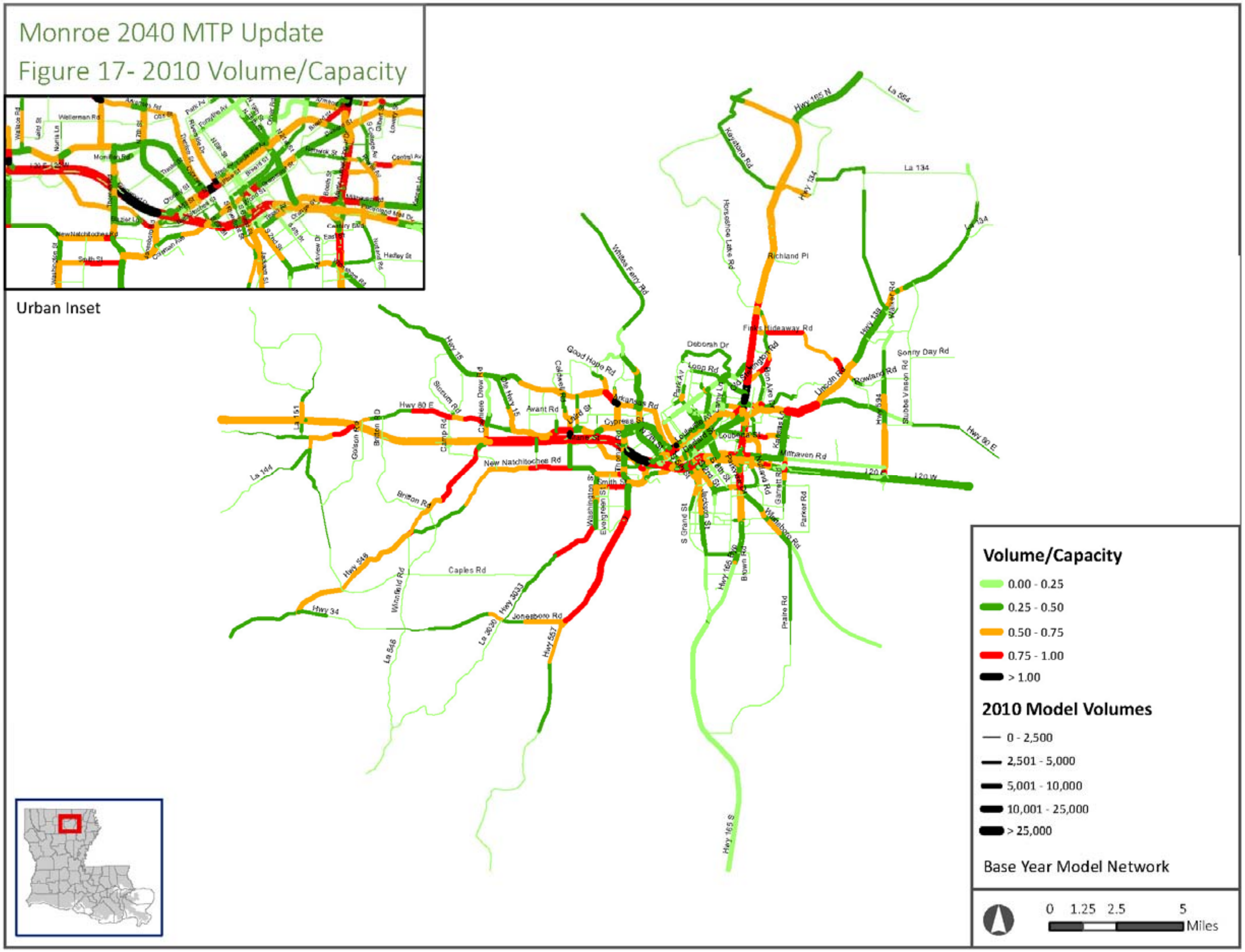


Figure 18: 2020 Volume/Capacity

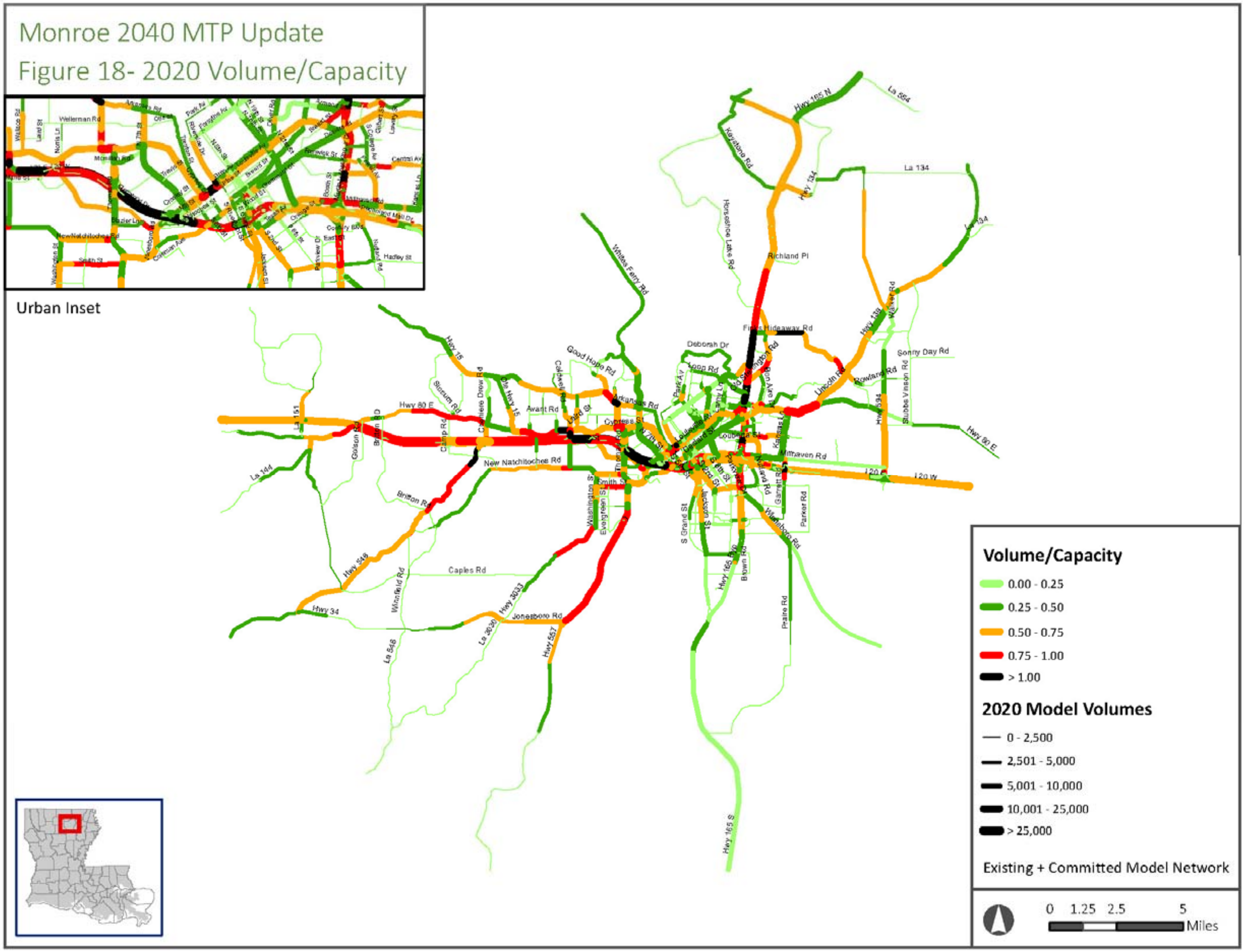


Figure 19: 2030 Volume/Capacity

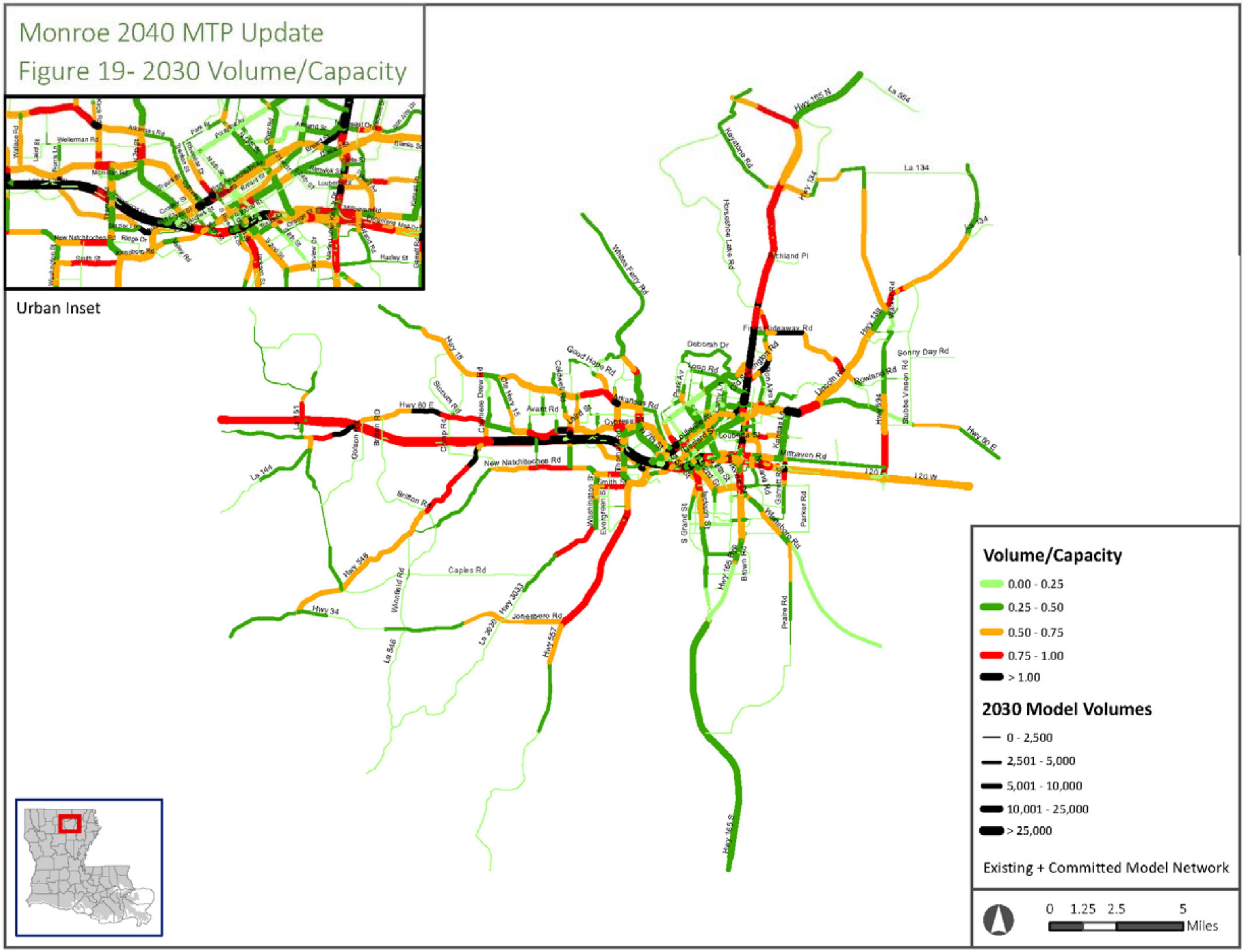
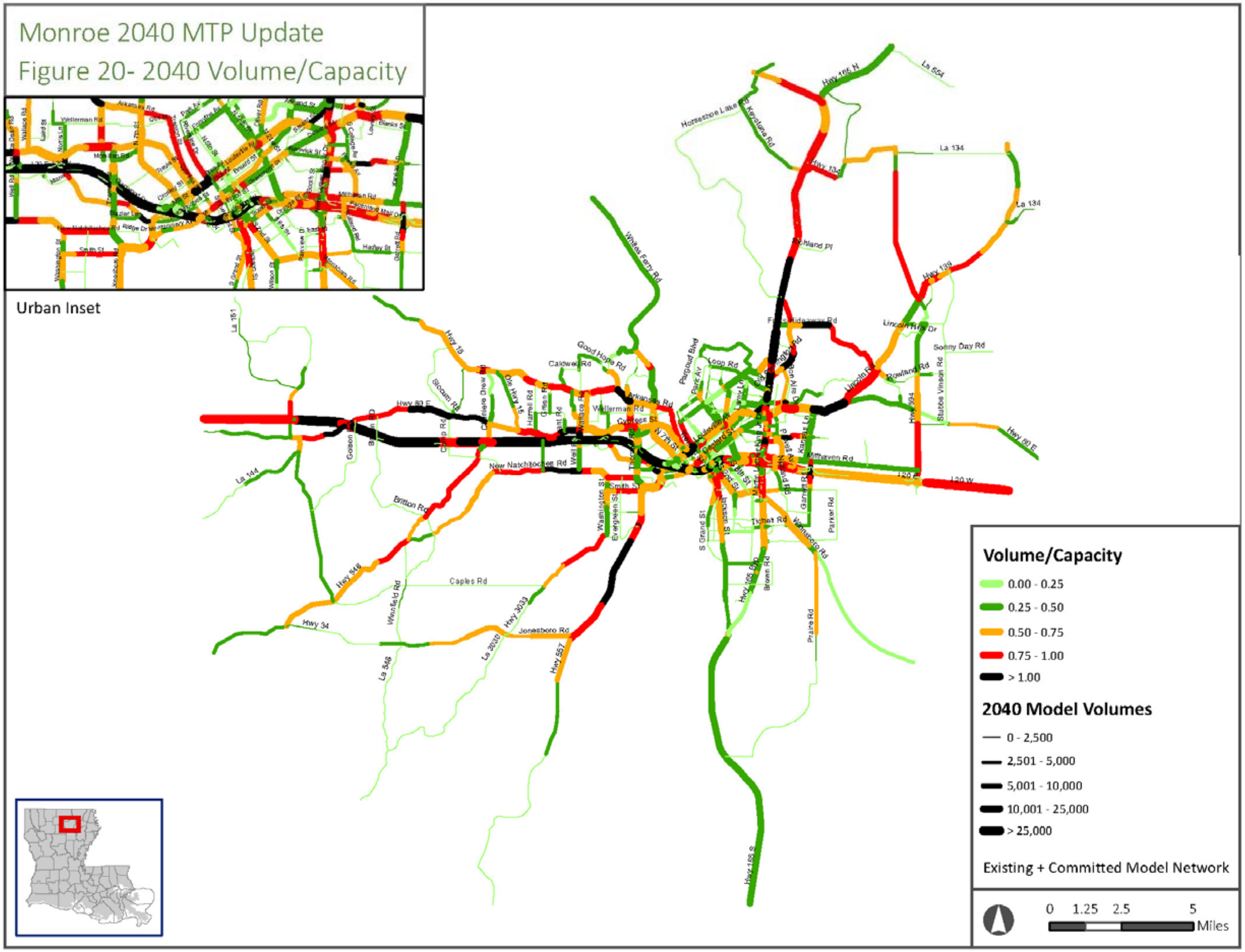


Figure 20: 2040 Volume/Capacity



APPENDIX A: CODING GUIDE

A.1 SOCIO-ECONOMIC VARIABLES

The following table lists various variables used in the Socio-Economic Database File.

ATTRIBUTE NAME	TYPE	DESCRIPTION	INPUT TYPE
ID	Integer (4 bytes)	TAZ ID	User
Area	Real (4 bytes)	TAZ Area in Square Miles	Model
TAZ	Integer (4 bytes)	TAZ ID	User
DU	Real (8 bytes)	All Dwelling Units	User
OCCDU	Real (8 bytes)	Occupied Dwelling Units/Households	User
POP	Real (8 bytes)	Total Population in Households	User
POP_GQ	Real (8 bytes)	Group Quarters Population in TAZ	User
TOTPOP	Real (8 bytes)	Total Population in TAZ	User
SCHATT	Real (8 bytes)	School Enrollment	User
HHS1	Real (8 bytes)	Households with 1-person	Model
HHS2	Real (8 bytes)	Households with 2-persons	Model
HHS3	Real (8 bytes)	Households with 3-persons	Model
HHS4	Real (8 bytes)	Households with 4-persons	Model
HHS5P	Real (8 bytes)	Households with 5-or-more persons	Model
HH_VEH0	Real (8 bytes)	Households with 0-cars	Model
HH_VEH1	Real (8 bytes)	Households with 1-car	Model
HH_VEH2	Real (8 bytes)	Households with 2-cars	Model
HH_VEH3P	Real (8 bytes)	Households with 3-or-more cars	Model
HH1VEH0	Real (8 bytes)	Households with 1-person and 0 cars	Model
HH1VEH1	Real (8 bytes)	Households with 1-person and 1 car	Model
HH1VEH2	Real (8 bytes)	Households with 1-person and 2 cars	Model
HH1VEH3	Real (8 bytes)	Households with 1-person and 3-or-more cars	Model
HH2VEH0	Real (8 bytes)	Households with 2-persons and 0 cars	Model
HH2VEH1	Real (8 bytes)	Households with 2-persons and 1 car	Model
HH2VEH2	Real (8 bytes)	Households with 2-persons and 2 cars	Model
HH2VEH3	Real (8 bytes)	Households with 2-persons and 3-or-more cars	Model
HH3VEH0	Real (8 bytes)	Households with 3-persons and 0 cars	Model
HH3VEH1	Real (8 bytes)	Households with 3-persons and 1 car	Model
HH3VEH2	Real (8 bytes)	Households with 3-persons and 2 cars	Model
HH3VEH3	Real (8 bytes)	Households with 3-persons and 3-or-more cars	Model
HH4VEH0	Real (8 bytes)	Households with 4-persons and 0 cars	Model

ATTRIBUTE NAME	TYPE	DESCRIPTION	INPUT TYPE
HH4VEH1	Real (8 bytes)	Households with 4-persons and 1 car	Model
HH4VEH2	Real (8 bytes)	Households with 4-persons and 2 cars	Model
HH4VEH3	Real (8 bytes)	Households with 4-persons and 3-or-more cars	Model
HH5VEH0	Real (8 bytes)	Households with 5-or-more persons and 0 cars	Model
HH5VEH1	Real (8 bytes)	Households with 5-or-more persons and 1 car	Model
HH5VEH2	Real (8 bytes)	Households with 5-or-more persons and 2 cars	Model
HH5VEH3	Real (8 bytes)	Households with 5-or-more persons and 3-or-more cars	Model
TOT_EMP	Real (8 bytes)	Total Employees	User
AMC_EMP	Real (8 bytes)	Agriculture, Mining, and Construction Employees	User
MTCUW_EMP	Real (8 bytes)	Manufacturing, Transportation/|Communications/Utilities, and Wholesale Employees	User
RET_EMP	Real (8 bytes)	CBD Retail Employees	User
RET_EMP2	Real (8 bytes)	Non-CBD Retail Employees	User
OS_EMP	Real (8 bytes)	Office and Services, Government Employees	User
OTH_EMP	Real (8 bytes)	Non-Classified Employment	User
HBWP	Real (8 bytes)	Home based work trip productions	Model
HBWA	Real (8 bytes)	Home based work trip attractions	Model
HBOP	Real (8 bytes)	Home based other trip productions	Model
HBOA	Real (8 bytes)	Home based other trip productions	Model
NHBP	Real (8 bytes)	Non home based trip productions	Model
NHBA	Real (8 bytes)	Non home based trip attractions	Model
CMVEHP	Real (8 bytes)	Commercial vehicle trip productions	Model
CMVEHA	Real (8 bytes)	Commercial vehicle trip attractions	Model
TRKP	Real (8 bytes)	Truck trip productions	Model
TRKA	Real (8 bytes)	Truck trip attractions	Model
EIAUTOP	Real (8 bytes)	External-Internal auto trip productions	User
EIAUTOA	Real (8 bytes)	External-Internal auto trip attractions	Model
EITRKP	Real (8 bytes)	External-Internal truck trip productions	User
EITRKA	Real (8 bytes)	External-Internal truck trip attractions	Model

Note:

User does not need to input values of fields whose "INPUT TYPE" is 'Model'. Model interface will calculate the values of these fields.

A.2 NETWORK SEGMENT CODING

The network-coding guide for network segment coding is included in this section of the appendix. For each segment attribute, a brief definition and a complete list of ranges of numeric codes are presented enabling a user to code network links using a replicable methodology.

ATTRIBUTE	TYPE	DESCRIPTION	INPUT TYPE
LENGTH	Real (8 bytes)	Segment length	Automatic
DIR	Integer (4 bytes)	0 = Two way link 1 = one way link, AB fields will be used -1 = one way link, BA fields will be used.	Automatic but user can override
FULL_NAME	Character	Street Name	User
COUNT_YEAR	Integer (4 bytes)	Year of ADT count	User
STA_NUMBER	Integer (4 bytes)	DOTD Station of ADT Count	User
ADT_10	Integer (4 bytes)	2010 Daily Traffic Count	User
NETWORK_10	Integer (4 bytes)	1= Network Road link 2= Centroid connector 0 or null= Link will not be included in the model run	User*
AB_DOTD_10	Integer (4 bytes)	Refer to section A.2.2	User
BA_DOTD_10	Integer (4 bytes)	Refer to section A.2.2	User
DOTD _FC_DESC_10	Character	Refer to section A.2.2	User
MODEL_FC_10	Integer (4 bytes)	Refer to section A.2.3	User*
MODEL_FC_DESC_10	Character	Refer to section A.2.3	User
AB_CLASS_10	Integer (4 bytes)	Refer to section A.2.1	User
BA_CLASS_10	Integer (4 bytes)	Refer to section A.2.1	User
POSTED_SPEED	Integer (4 bytes)	Posted Link Speed (mph)	User
AB_SPEED_10	Real (8 bytes)	Link speed (mph) in AB direction	User*
BA_SPEED_10	Real (8 bytes)	Link speed (mph) in BA direction	User*
TOTAL_LANES_10	Integer (4 bytes)	Number of lanes for the roadway	User*
AB_LANES_10	Integer (4 bytes)	Number of lanes in AB direction	User*
BA_LANES_10	Integer (4 bytes)	Number of lanes in BA direction	User*
ALPHA_10	Real (8 bytes)	BPR Function Parameter	User*
BETA_10	Real (8 bytes)	BPR Function Parameter	User*
AB_TT_ 13	Real (8 bytes)	Link travel time in AB direction	Model
BA_TT_ 13	Real (8 bytes)	Link travel time in BA direction	Model
IS_MANUAL_CAP_10	Integer (2 bytes)	0 or null= Model calculates the link capacity Any other value= Link capacity value input by User will be retained	User*
AB_CAPACITY_10	Integer (4 bytes)	Link capacity in AB direction	Model
BA_CAPACITY_10	Integer (4 bytes)	Link capacity in AB direction	Model
AB_CAP_AM_10	Integer (4 bytes)	Morning capacity in AB direction	Model

ATTRIBUTE	TYPE	DESCRIPTION	INPUT TYPE
BA_CAP_AM_10	Integer (4 bytes)	Morning capacity in BA direction	Model
AB_CAP_MD_10	Integer (4 bytes)	Mid-day capacity in AB direction	Model
BA_CAP_MD_10	Integer (4 bytes)	Mid-day capacity in BA direction	Model
AB_CAP_PM_10	Integer (4 bytes)	Afternoon capacity in AB direction	Model
BA_CAP_PM_10	Integer (4 bytes)	Afternoon capacity in BA direction	Model
AB_CAP_NT_10	Integer (4 bytes)	Night time capacity in AB direction	Model
BA_CAP_NT_10	Integer (4 bytes)	Night time capacity in BA direction	Model
DAILY_FLOW_10	Real (8 bytes)	Daily model volume	Model
AB_DAILY_FLOW_10	Real (8 bytes)	AB directional daily model volume	Model
BA_DAILY_FLOW_10	Real (8 bytes)	BA directional daily model volume	Model
DAILY_TRK_FLOW_10	Real (8 bytes)	Daily model truck volume	Model
AB_DAILY_TRK_10	Real (8 bytes)	AB directional daily model truck volume	Model
BA_DAILY_TRK_10	Real (8 bytes)	BA directional daily model truck volume	Model
AB_VMT_10	Real (8 bytes)	AB directional vehicle miles travelled	Model
BA_VMT_10	Real (8 bytes)	BA directional vehicle miles travelled	Model
TOT_VMT_10	Real (8 bytes)	Total vehicle miles travelled	Model
AB_VHT_10	Real (8 bytes)	AB directional vehicle hours travelled	Model
BA_VHT_10	Real (8 bytes)	BA directional vehicle hours travelled	Model
TOT_VHT_10	Real (8 bytes)	Total vehicle hours travelled	Model
AB_VHD_10	Real (8 bytes)	AB directional vehicle hours delay	Model
BA_VHD_10	Real (8 bytes)	BA directional vehicle hours delay	Model
TOT_VHD_10	Real (8 bytes)	Total vehicle hours delay	Model
AB_VOC_10	Real (8 bytes)	AB directional volume/capacity	Model
BA_VOC_10	Real (8 bytes)	BA directional volume/capacity	Model
MAX_VOC_10	Real (8 bytes)	Higher of AB and BA volume/capacity	Model

Note:
1. These fields should be repeated for each scenario suffix. (Ex: EC, SCE, VIS etc.)
2. Volume-delay function parameter fields Alpha_10 and Beta_10 are based on BPR function.
3. * : These values are required when adding and/or modifying a roadway link.
4. User does not need to input values of fields whose "INPUT TYPE" is 'Model'. Model interface will calculate the values of these fields.

A.2.1 Model Link Classes

Code	*Description*
11	one lane, one way
12	one lane (each. dir.), two way
14	one lane (each. dir.), two way with left turn lanes, median or boulevard
16	one lane (each. dir.), two way with center turn lane
21	two lanes, one way
22	two way (each. dir.), two way
24	two lanes (each. dir.), two way with left turn lanes, median or boulevard
26	two lanes (each. dir.), two way with center turn lane
31	three lanes, one way
34	three lanes, two way with left turn lanes, median or boulevard
36	three lanes, two way with center turn lane

A.2.2 LADOTD Functional Classes

Code	*Description*
00	Centroid Connector
01	Rural Interstate
02	Rural Principal Arterial
06	Rural Minor Arterial
07	Rural Major Collector
08	Rural Minor Collector
09	Rural Local
11	Urban Interstate
14	Urban Principal Arterial
16	Urban Minor Arterial
17	Urban Major Collector
18	Urban Minor Collector
19	Urban Local

A.2.3 Model Facility Types

Code	*Description*
1	RURAL INTERSTATE
2	RURAL PRINCIPAL ARTERIAL DIVIDED
21	RURAL PRINCIPAL ARTERIAL UNDIVIDED
3	RURAL MINOR ARTERIAL DIVIDED
31	RURAL MINOR ARTERIAL UNDIVIDED
4	RURAL MAJOR COLLECTOR
41	RURAL MAJOR COLLECTOR UNDIVIDED
5	RURAL MINOR COLLECTOR
51	RURAL MINOR COLLECTOR UNDIVIDED
6	RURAL LOCAL
61	RURAL LOCAL UNDIVIDED
10	RURAL ON/OFF RAMP
11	URBAN INTERSTATE
12	URBAN EXPRESSWAY
14	URBAN PRINCIPAL ARTERIAL DIVIDED
141	URBAN PRINCIPAL ARTERIAL UNDIVIDED
16	URBAN MINOR ARTERIAL DIVIDED
161	URBAN MINOR ARTERIAL UNDIVIDED
17	URBAN COLLECTOR
171	URBAN COLLECTOR UNDIVIDED
18	URBAN LOCAL
181	URBAN LOCAL UNDIVIDED
19	URBAN OTHER
191	URBAN OTHER UNDIVIDED
20	URBAN ON/OFF RAMP
99	CENTROID CONNECTOR
25	NON DOTD RURAL OTHER
251	NON DOTD RURAL OTHER UNDIVIDED
35	NON DOTD URBAN OTHER
351	NON DOTD URBAN OTHER UNDIVIDED