2045
Metropolitan Transportation Plan

Technical Report #1
Transportation Modeling and Forecasting

Hattiesburg-Petal-Forrest-Lamar
Metropolitan Planning Organization

DRAFT
April 2020

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1.0 Introduction and Model Overview

1.1 Introduction

This report includes a description of the procedures used in developing the updated demographics and travel estimates used in the 2045 Metropolitan Transportation Plan (MTP) for the Hattiesburg-Petal-Forrest-Lamar (HPFL) Metropolitan Planning Organization (MPO). It also describes the relationship between planning data and trip making, and the calibration and testing of the model. This report does not include how to operate the model.

1.2 Model Overview

The HPFL MPO Travel Demand Model (TDM) is being updated for use in the MPO's new 2045 MTP. The new TDM is an update of the model used in the previous MTP. The updated model was calibrated and validated to meet the requirements established by the Federal Highway Administration (FHWA) and uses the calibration and validation parameters described in the latest *Minimum Travel Demand Model Calibration and Validation Guidelines for State of Tennessee*[1].

The updated TDM continues to use the 2013 base year. Additional updates to the TDM include:

- updated master roadway network;
- updated socioeconomic data and trip rates; and
- updated turn penalties, time penalties, capacity factors, and external trip data.

[1] http://tnmug.utk.edu/wp-content/uploads/sites/47/2017/06/MinimumTravelDemandModel2016.pdf

The HPFL MPO TDM 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.

Mode Choice

- The process of estimating the number of trips by mode for each TAZ pair.
- This process allows the model to calculate transit trips.

Trip Assignment

- The process of assigning auto and truck trips onto specific highway facilities in the region.

The TDM's focus is on the region's highway network due to a limited number of transit trips. As a result, a transit element has not been included, eliminating the Mode Choice step. The TDM was developed in TransCAD 8.0 travel demand forecasting software and the model interface was developed using GISDK macros.

2.0 Traffic Analysis Zones and Socioeconomic Data

2.1 Study Area and Traffic Analysis Zones

The accuracy necessary for generating trips from planning data requires it to be aggregated by small geographic areas. These areas are called Traffic Analysis Zones (TAZs).

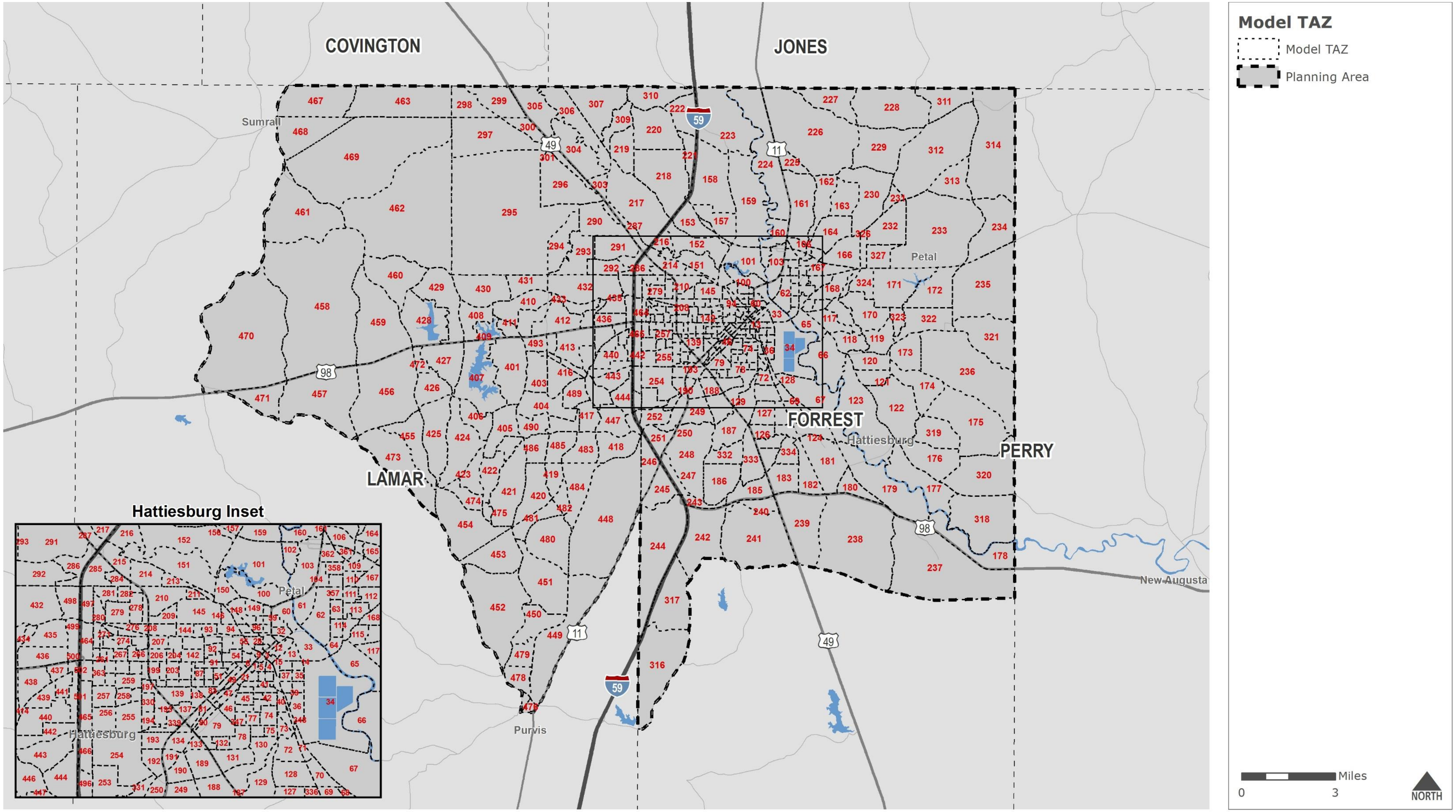
TAZs are generally homogeneous areas and were delineated based on:

- *population,*
- *land use,*
- *census geography,*
- *physical landmarks, and*
- *governmental jurisdictions.*

The MTP 2045 study area and TAZ structure are the same as those established in the MTP 2040. The HPFL MTP 2045 study area was divided into 464 TAZs. There are 362 TAZs in Forrest County and 102 TAZs in Lamar County. Additionally, there are 12 external stations. A map of the TAZ's is shown in Figure 1.

The study area is comprised of the City of Hattiesburg, the City of Petal, portions of the cities of Purvis and Sumrall, and portions of Forrest and Lamar Counties as shown in Figure 2.1.

Figure 2.1: MPO Study Area



Data Sources: Census Bureau; MPO Staff

Disclaimer: This map is for planning purposes only.

2.2 Base Year (2013) Model Socioeconomic Data Update

The previous TDM had a 2013 base year that used housing, income, employment, and school attendance data as model inputs. The MTP 2045 uses the same base year as the previous model, but included an in-depth review of the study area's socioeconomic data. This section describes the procedures used to update the model files to create the updated base year socioeconomic data.

Household Data Update

Household data for the MPO TAZs was updated from the previous model's 2013 data using aerial imagery analysis to account for major areas of growth from the 2010 Census. Google Earth's "historical imagery" feature was used to find areas of growth and redevelopment and a household count corresponding to the growth was estimated and assigned for each TAZ. A corresponding population change was then developed for these locations using the ratio of population to household from the 2010 Census. Finally, the estimated changes were added to the 2010 household and population data to obtain the updated 2013 data.

Table 2.1 displays the updated household data within the study area by the portion of each county within the study area.

Table 2.1: Study Area Households and Population, Base Year 2013

Variable	Forrest County	Lamar County	Total
Total Population	69,487	39,235	108,722
Household Population	65,317	39,152	104,469
Households	26,484	15,480	41,964

Source: Census 2010; NSI, 2019

Employment Data Update

Employment data for the MPO TAZs was updated from the previous model's 2013 data using an updated geocoding process and a review of aerial imagery and third-party employment data. First, all establishments were re-geocoded using an updated geocoding process that improved overall accuracy. Then, Google Earth's "historical imagery" feature was used to find major employment areas not included in the 2013 dataset. Then, the Census Bureau's Longitudinal Employer-Household Dynamics (LEHD) 2013 dataset was compared and major discrepancies were adddressed. For new establishments added, the number of employees and NAICS industry classification was estimated based on local news articles, LEHD data, and similar developments across the state.

Table 2.2 displays the study area employment by type. For modeling purposes, employment variables were differentiated into the following categories:

- Agriculture, Mining and Construction (NAICS 11, 21, 23)
- Manufacturing, Transportation/Communications/Utilities, and Wholesale Trade (NAICS 31-33, 48-49, 22, 42)
- Retail Trade (NAICS 44-45, NAICS 722)
- Government, Office, and Services (NAICS 51-56, 61, 62, 71, 721, 81, 92)
- Other Employment (NAICS 99)

Table 2.2: Study Area Households and Population, Base Year 2013

Variable	Description	Forrest County	Lamar County	Total
TOT_EMP	Total Employment	46,324	21,811	68,135
AMC_EMP	Agriculture, Mining and Construction Employment	2,337	801	3,138
MTCUW_EMP	Manufacturing, Transportation/Communications/ Utilities and Wholesale Trade Employment	7,433	1,655	9,088
RET_EMP	Retail Employment	7,697	7,954	15,651
OS_EMP	Government, Office and Services Employment	28,176	10,991	39,167
OTH_EMP	Other Employment	681	410	1,091

Source: InfoUSA; NSI, 2019

<u>School Enrollment Data Update</u>

The MTP 2045 school enrollment uses the same data as the previous TDM. 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 2013 was 39,837 students with 32,595 in Forrest County and 7,242 in Lamar County. 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.

3.0 Roadway Network

3.1 Network Line Layer

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 dataview records contain descriptive information for each link and its properties. Turn prohibitions are also coded into the network at locations where certain movements are not allowed or physically cannot be made.

Adjustments were made to the model network to update the base year for accuracy.

These adjustments included:

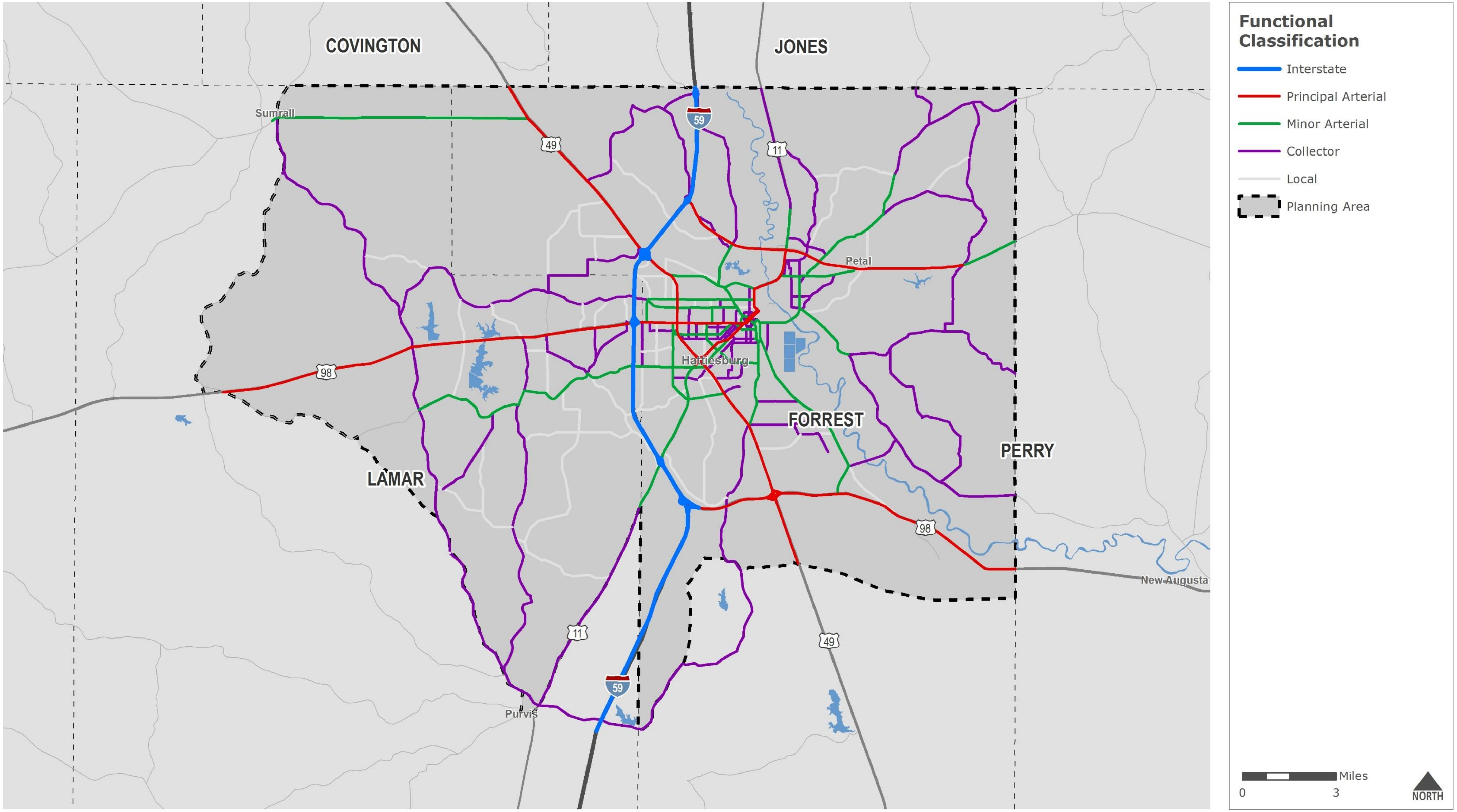
- number of lanes and/or turn lanes,
- speeds,
- functional classification to the most up-to-date data,
- volume-delay function parameters (alpha and beta values), and
- daily traffic counts and traffic stations (where necessary).

The updated TDM continues to use a master network in the model's setup folder. This line layer contains the records for all roadway links used in the TDM process. The master network contains the data for the base year, Existing Plus Committed network, and all roadway test projects. Figure 3.1 displays the base year roadway network and link functional classifications used in the TDM.

3.2 Functional Classification

Each link in the model's roadway network was assigned a functional classification based on the system maintained by the Mississippi Department of Transportation (MDOT). The functional classifications used in the TDM are shown in Table 3.1.

Figure 3.1: Roadway Network and Functional Classification, Base Year



Data Sources: MDOT

Disclaimer: This map is for planning purposes only.

Table 3.1: Functional Classification Used in MPO Model

FHWA Functional Classification		Description	MDOT Functional Classification Number
Rural	01	Interstate	1
	02	Other Principal Arterial	2
	06	Minor Arterial	3
	07	Major Collector	4
	08	Minor Collector	5
	09	Local	6
	N/A	Ramp	**
Urban	11	Interstate	11
	12	Freeway/Expressway	12
	14	Principal Arterial	14
	16	Minor Arterial	16
	17	Collector	17
	19	Local	18
	N/A	Ramp	**
Other	N/A	System Ramp	**
	N/A	Centroid Collector	0

**NOTE: Ramps follow the same functional classification as the primary roadway they connect to.

Source: FHWA, MDOT

3.3 Model Link Speeds and Capacities

Roadway speeds and capacities are important TDM inputs that affect the traffic assignment model. The posted speed, which is assumed to be the free flow speed, for each roadway link is contained In the network database. The model has been updated with new capacity factors, which are shown in Figure 3.2. The capacity inputs consider factors such as:

- Roadway functional classification
- Location of roadway in an urban or rural area
- Number of lanes
- Width of travel lanes
- Presence of a median or dividing feature
- Presence and width of shoulder on roadway

Figure 3.2: Model Capacity Factors

Link Capacity (LOS D)

Vehicles per lane per hour - vphpl

Functional Class		vphpl Directional
All Interstate		
2 Lanes		2,300
>2 Lanes		2,400
Principal Arterial		
Rural	Divided	1,700
Rural	Undivided	1,500
Urban	Divided	1,500
Urban	Undivided	1,300
Minor Arterial		
Rural	Divided	1,600
Rural	Undivided	1,350
Urban	Divided	1,400
Urban	Undivided	1,150
Collector		
Rural	Divided	1,350
Rural	Undivided	1,150
Urban	Divided	1,150
Urban	Undivided	950
Local		
Rural	2 Lane	900
Rural	>2 Lane	1,000
Urban	2 Lane	800
Urban	>2 Lane	900
Ramps		1,000
Centroid Connectors		9,999

Adjustment Factors

Acronym	Name	Facility Type	Lane	Shoulder	Factor
Fw	Lane & Shoulder Width	Interstate & Sys Ramp	<=10'	0-<2'	0.78
		Interstate & Sys Ramp	<=10'	2'-5'	0.83
		Interstate & Sys Ramp	<=10'	>5'	0.88
		Interstate & Sys Ramp	>10'	0-<2'	0.90
		Interstate & Sys Ramp	>10'	2'-5'	0.95
		Interstate & Sys Ramp	>10'	>5'	1.00
		Principal Arterial Div	<=10'	0-<2'	0.78
		Principal Arterial Div	<=10'	2'-5'	0.83
		Principal Arterial Div	<=10'	>5'	0.88
		Principal Arterial Div	>10'	0-<2'	0.92
		Principal Arterial Div	>10'	2'-5'	0.96
		Principal Arterial Div	>10'	>5'	1.00
		Principal Arterial Undiv	<=10'	0-<2'	0.78
		Principal Arterial Undiv	<=10'	2'-5'	0.82
		Principal Arterial Undiv	<=10'	>5'	0.86
		Principal Arterial Undiv	>10'	0-<2'	0.90
		Principal Arterial Undiv	>10'	2'-5'	0.95
		Principal Arterial Undiv	>10'	>5'	1.00
		Minor Arterial Div	<=9'	0-<2'	0.81
		Minor Arterial Div	<=9'	2'-5'	0.86
		Minor Arterial Div	<=9'	>5'	0.93
		Minor Arterial Div	>9'	0-<2'	0.94
		Minor Arterial Div	>9'	2'-5'	1.00
		Minor Arterial Div	>9'	>5'	1.05
		Minor Arterial Undiv	<=9'	0-<2'	0.77
		Minor Arterial Undiv	<=9'	2'-5'	0.83
		Minor Arterial Undiv	<=9'	>5'	0.88
		Minor Arterial Undiv	>9'	0-<2'	0.89
		Minor Arterial Undiv	>9'	2'-5'	0.95
		Minor Arterial Undiv	>9'	>5'	1.00
		Collector Div	<=9'	0-<2'	0.81
		Collector Div	<=9'	2'-5'	0.86
		Collector Div	<=9'	>5'	0.93
		Collector Div	>9'	0-<2'	0.96
		Collector Div	>9'	2'-5'	1.00
		Collector Div	>9'	>5'	1.05
		Collector Undiv	<=9'	0-<2'	0.81
		Collector Undiv	<=9'	2'-5'	0.85
		Collector Undiv	<=9'	>5'	0.90
		Collector Undiv	>9'	0-<2'	0.94
		Collector Undiv	>9'	2'-5'	1.00
		Collector Undiv	>9'	>5'	1.04
		Local 2 Lane	<=9'	0-<2'	0.65
		Local 2 Lane	<=9'	2'-5'	0.78
		Local 2 Lane	<=9'	>5'	0.90
		Local 2 Lane	>9'	0-<2'	0.85
		Local 2 Lane	>9'	2'-5'	1.00
		Local 2 Lane	>9'	>5'	1.04
		Local >2 Lane	<=9'	0-<2'	0.81
		Local >2 Lane	<=9'	2'-5'	0.85
		Local >2 Lane	<=9'	>5'	0.92
		Local >2 Lane	>9'	0-<2'	0.96
		Local >2 Lane	>9'	2'-5'	1.00
		Local >2 Lane	>9'	>5'	1.10
Fhv	Heavy Vehicle	Interstate			0.88
		Principal Arterial			0.90
		Minor Arterial			0.90
		Collector			0.92
		Local			0.97
Fp	Driver Population	Rural Interstate			0.90
		Urban Interstate			0.92
		System Ramp			0.92
		Principal Arterial			0.95
		Minor Arterial			0.98
		Collector			NA
		Local			NA
Fe	Driving Environment	Interstate			NA
		Rural Prin Art	Divided		1.00
		Rural Prin Art	Undivided		0.90
		Urban Prin Art	Divided		0.90
		Urban Prin Art	Undivided		0.80
		Rural Minor Art	Divided		1.00
		Rural Minor Art	Undivided		0.90
		Urban Minor Art	Divided		0.90
		Urban Minor Art	Undivided		0.80
		Rural Collector	Divided		1.00
		Rural Collector	Undivided		0.90
		Urban Collector	Divided		0.90
		Urban Collector	Undivided		0.80
		Rural Local	2 Lane		0.90
		Rural Local	>2 Lane		0.90
		Urban Local	2 Lane		0.80
		Urban Local	>2 Lane		0.80
Fd	Directional Distribution (Local only)	2 Lane	Divided		0.94
		>2 Lane	Divided		1.16
		2 Lane	Undivided		0.94
		>2 Lane	Undivided		1.10
Fctl	Center Turn Lane	Interstate			NA
		All Other			1.08
Fpark	On Street Parking	Any			0.95

SF = c x N x Fw x Fhv x Fp x Fe x Fd x Fctl x Fpark X (V/C)i

SF = Model vphpl for desired level of service
c = Ideal vphpl
N = Number of Lanes
(V/C)I = Rate of service flow for level of service D

Source: Nashville Model

3.5 Centroid Connectors

Centroid connectors are imaginary roadway network links that connect a TAZ's centroid to the adjacent roadway network at nodes. These links represent the local streets on the street and highway system that are not in the model network. Centroid connectors provide the model the ability to move trips generated from individual TAZs to the roadway network. Where centroid connectors access the model network Is based on features such as neighborhood roadway entrances, driveways, and parking lots.

During the TDM update, the centroid connectors were adjusted to match locations where traffic is most likely to access the model's roadways. This was accomplished by relocating the centroid for the TAZ to reflect the "center of mass" of developed land and/or moving the centroid connector roadway network access points to a location where trips generally enter or leave the TAZ. This changes the length of the centroid connectors and the travel times on the links to encourage modeled traffic to use certain access points to reflect the observed traffic.

3.6 Traffic Counts

The updated model contains the same traffic counts as the TDM for the MTP 2040. These counts come from MDOT and reflect the 2013 base year. The update process included the verification of count stations upon the existing TDM links and ensuring that the ADTs are assigned to the correct link, with adjustments made as necessary.

3.7 Network Attributes

Table 3.2 displays the network attributes used on the links in the TDM.

Table 3.2: Model Link Attributes

Attribute Name	Description	Input Type
LENGTH	Real (4 bytes) Segment length in miles	Automatic
DIR	Integer (2 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.
STREETNAME	Character Street Name	User
ADT_13	Integer (4 bytes) 2013 Daily Traffic Count	User

Attribute Name	Description	Input Type
DIR_13	Integer (2 Bytes) 2013 Link Direction 0 = Two way link 1 = one way link, AB fields will be used -1 = one way link, BA fields will be used.	User
NETWORK_13	Integer (2 bytes) 1= Network Road link 2= Centroid connector 0 or null= Link will not be included in the model run	User*
AB_MDOT_FC_13	Integer (4 bytes) Refer to Table 3.1	User
BA_MDOT_FC_13	Integer (4 bytes) Refer to Table 3.1	User
MDOT_FC_DESC_13	Character Refer toTable 3.1	User
MODEL_FC_13	Integer (4 bytes) Model functional classification code	User*
MODEL_FC_DESC_13	Character Model functional classification description	User
AB_CLASS_13	Integer (4 bytes) Field denoting number of lanes and configuration in AB direction	User
BA_CLASS_13	Integer (4 bytes) Field denoting number of lanes and configuration in BA direction	User
POSTED_SPEED_13	Integer (4 bytes) Posted Link Speed (mph)	User
AB_SPEED_13	Real (8 bytes) Link speed (mph) in AB direction	User*
BA_SPEED_13	Real (8 bytes) Link speed (mph) in BA direction	User*
LANES_13	Integer (4 bytes) Number of lanes for the roadway	User
AB_LANES_13	Integer (4 bytes) Number of lanes in AB direction	User*
BA_LANES_13	Integer (4 bytes) Number of lanes in BA direction	User*
ALPHA_13	Real (8 bytes) BPR Function Parameter	User*

Attribute Name	Description	Input Type
BETA_13	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
Fw_13	Real (8 bytes) Capacity factor for lane and shoulder width	User
Fhv_13	Real (8 bytes) Capacity factor for heavy vehicles	User
Fp_13	Real (8 bytes) Capacity factor for driver population	User
Fe_13	Real (8 bytes) Capacity factor for driving environment	User
Fd_13	Real (8 bytes) Capacity factor for directional distribution	User
Fctl_13	Real (8 bytes) Capacity factor for center turn lanes	User
Fpark_13	Real (8 bytes) Capacity factor for on street parking	User
Fall_13	Real (8 bytes) Overall capacity factor	User
IDEAL_VPHPL_13	Real (8 bytes) Maximum capacity in vehicles/hour/lane	User
AB_VPHPL_13	Real (8 bytes) Capacity in AB direction in vehicles/hour/lane	User
BA_VPHPL_13	Real (8 bytes) Capacity in AB direction in vehicles/hour/lane	User
IS_MANUAL_CAP_13	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_13	Integer (4 bytes) Capacity in AB direction	Model
BA_CAPACITY_13	Integer (4 bytes) Capacity in BA direction	Model
AB_CAP_AM_13	Integer (4 bytes) Morning capacity in AB direction	Model

Attribute Name	Description	Input Type
BA_CAP_AM_13	Integer (4 bytes) Morning capacity in BA direction	Model
AB_CAP_MD_13	Integer (4 bytes) Mid-day capacity in AB direction	Model
BA_CAP_MD_13	Integer (4 bytes) Mid-day capacity in BA direction	Model
AB_CAP_PM_13	Integer (4 bytes) Afternoon capacity in AB direction	Model
BA_CAP_PM_13	Integer (4 bytes) Afternoon capacity in BA direction	Model
AB_CAP_NT_13	Integer (4 bytes) Night time capacity in AB direction	Model
BA_CAP_NT_13	Integer (4 bytes) Night time capacity in BA direction	Model
DAILY_FLOW	Real (8 bytes) Total daily model volume	Model
AB_DAILY_FLOW	Real (8 bytes) AB directional daily model volume	Model
BA_DAILY_FLOW	Real (8 bytes) BA directional daily model volume	Model
DAILY_TOT_VMT	Real (8 bytes) Total daily vehicle miles travelled	Model
DAILY_AB_VMT	Real (8 bytes) AB directional daily vehicle miles travelled	Model
DAILY_BA_VMT	Real (8 bytes) BA directional daily vehicle miles travelled	Model
DAILY_TOT_VHT	Real (8 bytes) Total daily vehicle hours travelled	Model
DAILY_AB_VHT	Real (8 bytes) AB directional daily vehicle hours travelled	Model
DAILY_BA_VHT	Real (8 bytes) BA directional daily vehicle hours travelled	Model
DAILY_TOT_VHD	Real (8 bytes) Total daily vehicle hours delay	Model
DAILY_AB_VHD	Real (8 bytes) AB directional daily vehicle hours delay	Model
DAILY_BA_VHD	Real (8 bytes) BA directional daily vehicle hours delay	Model

Attribute Name	Description	Input Type
DAILY_AB_VOC	Real (8 bytes) AB directional volume/capacity	Model
DAILY_BA_VOC	Real (8 bytes) BA directional volume/capacity	Model
DAILY_MAX_VOC	Real (8 bytes) Higher of AB and BA volume/capacity	Model
DAILY_TRK_FLOW	Real (8 bytes) Total daily model truck volume	Model
AB_DAILY_TRK_FLOW	Real (8 bytes) AB directional daily model truck volume	Model
BA_DAILY_TRK_FLOW	Real (8 bytes) AB directional daily model truck volume	Model
Note: 1. Each of the suffix "13" fields should be repeated for EC, VIS, and SCE suffixes as well. 2. Volume-delay function parameter fields ALPHA_13 and BETA_13 are based on BPR function. 3. In addition to the base year fields, each planned year should have a field called "PROJECT_[suffix]" of type Integer. This field should have a unique project number for each committed or planned project.		

Source: NSI, 2019

4.0 External Travel

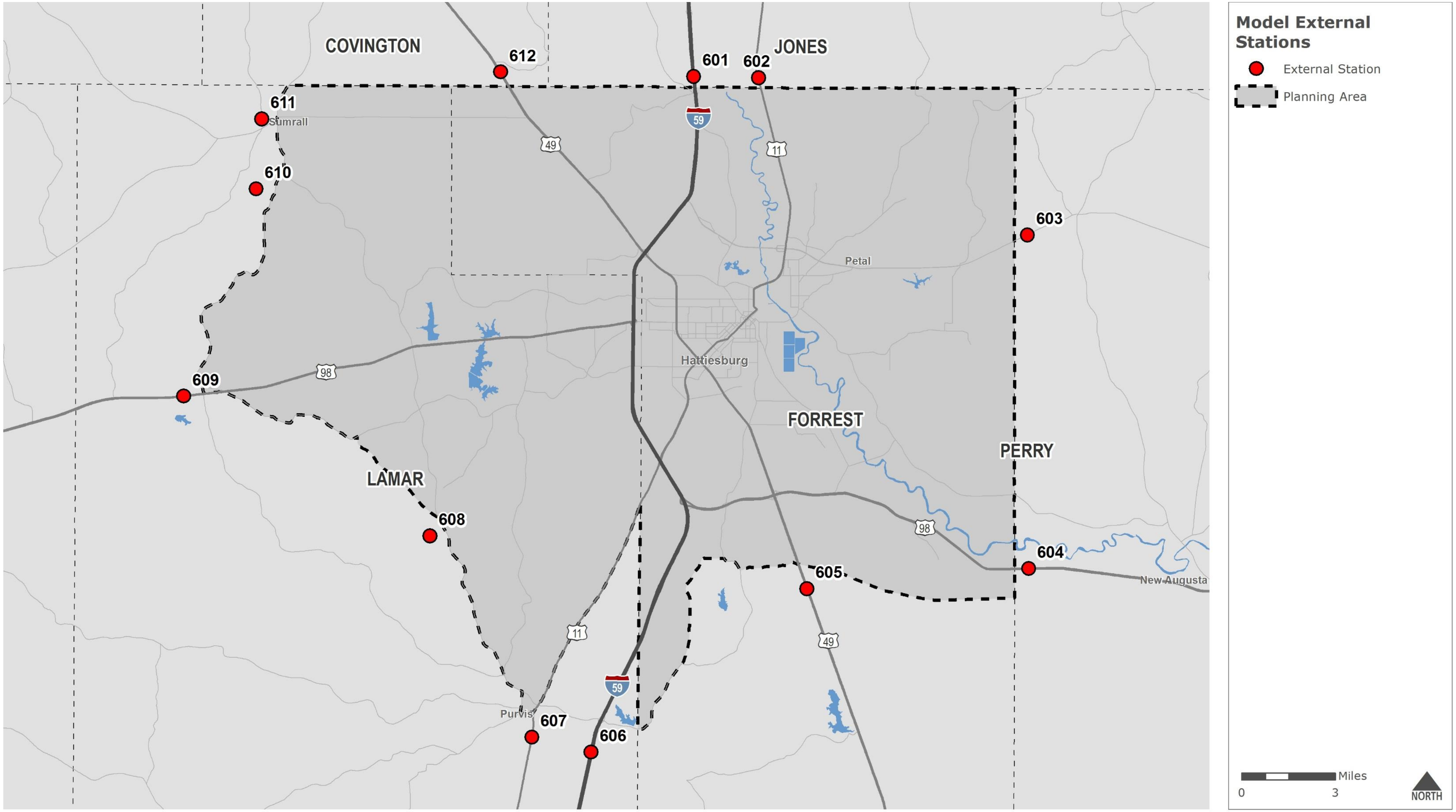
There are two types of external travel trips: external-internal (EI) trips and external-external (EE) trips. EI trips have one end of the trip inside the study area, and the other outside. EE trips pass through the study area and have no origin or destination within the study area itself. Both trip types are assigned at external stations located on significant roadways that are at the study area's periphery. These stations represent most of the trips that are crossing the study area boundary.

Since there were no changes to the study area boundary or the base year, and no additional roadways were added to the network crossing the study area boundary, the external stations are the same as the previous model.

The locations of the TDM's external stations are shown in Figure 4.1.

External trips in the model are divided into auto trips (AUTO) and truck (TRK) trips. Auto trips are those that are made in a personal vehicle. While not actually an auto trip, commercial vehicle (CMVEH) trips are included in AUTO trips for the purposes of external trips and represent four-tire commercial vehicles. Commercial vehicles include delivery and service vehicles. Truck trips represent single-unit with six or more tires and multi-unit with three-plus axle combination trucks.

Figure 4.1: Model External Stations



Data Sources: MDOT; MPO Staff

Disclaimer: This map is for planning purposes only.

4.1 External-External Trips

The MTP 2045 TDM uses the same external-external trip matrices developed as part of the MTP 2040 TDM. The matrices were developed using data provided through AirSage on the travel patterns in the metropolitan area and the methodology described in NCHRP 716, with the Fratar procedure used to obtain balanced trips crossing the study area boundary. Table 4.1 displays the expanded 24 hour EE trip table for all vehicles.

4.2 External-Internal Trips

The EI attraction equations used in this model were derived by regression analysis using the AirSage data and knowledge of the area's travel patterns. In addition, EI trips were also separated into auto and truck trips based on the vehicle classification counts at external stations.

The following EI attraction equations were used in the travel demand model for EIAUTO and EITRK trips.

EIAUTO Attractions = 0.9120 * (OCCDU) + 1.5340 * (RET_EMP + RET_EMP2) +

0.2754 * (AMC_EMP + MTCUW_EMP + OS_EMP + OTH_EMP)

EITRK Attractions = 0.1160 * (RET_EMP + RET_EMP2) + 0.0930 * (AMC_EMP + MTCUW_EMP)

Descriptions of the variables used in the equations were included in Table 2.3. Table 4.2 displays the EI trips at each external station.

Table 4.1: Expanded 24-Hour EE Trip Table for All Vehicles

TAZ	601	602	603	604	605	606	607	608	609	610	611	612	Total
601	0.0	0.0	61.6	80.9	721.9	417.0	36.0	11.7	1,352.3	9.4	18.5	1,169.0	3,878.4
602	0.0	0.0	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0
603	61.6	9.0	0.0	0.0	0.0	0.4	0.0	0.0	3.1	0.0	0.4	103.7	178.2
604	80.9	0.0	0.0	0.0	3.2	1.7	0.1	0.0	22.6	0.0	0.6	1,337.2	1,446.4
605	721.9	0.0	0.0	3.2	0.0	0.0	0.0	0.0	11.1	0.0	0.0	1,214.0	1,950.3
606	417.0	0.0	0.4	1.7	0.0	0.0	0.0	0.0	0.6	0.3	0.0	189.8	609.8
607	36.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.2	0.1	0.0	15.2	51.6
608	11.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.5	0.0	0.0	0.0	31.3
609	1,352.3	0.0	3.1	22.6	11.1	0.6	0.2	19.5	0.0	2.8	0.0	83.0	1,495.3
610	9.4	0.0	0.0	0.0	0.0	0.3	0.1	0.0	2.8	0.0	0.0	0.0	12.5
611	18.5	0.0	0.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.9	48.4
612	1,169.0	0.0	103.7	1,337.2	1,214.0	189.8	15.2	0.0	83.0	0.0	28.9	0.0	4,140.8
Total	3,878.4	9.0	178.2	1,446.4	1,950.3	609.8	51.6	31.3	1,495.3	12.5	48.4	4,140.8	13,852.0

Source: NSI, 2019

Table 4.2: External Station EI Data

Station Number	Description	EI AUTO Trips	EI TRK Trips
601	I-59 North	14,043	5,200
602	US 11 North	3,955	527
603	MS 42 East	4,879	665
604	US 98 East	4,385	1,622
605	US 49 South	6,804	1,295
606	I-59 South	9,334	3,447
607	US 11 South	3,202	395
608	MS 589 South	1,562	275
609	US 98 West	5,924	585
610	MS 589 North	1,846	229
611	MS 42 West	4,809	594
612	US 49 North	10,428	2,290

Source: NSI, 2019

5.0 Trip Generation

This section describes the procedures used to determine the number of trips that begin or end in a given traffic zone. Trip generation is the estimation of the amount of person trips that are produced and attracted to each TAZ. Trip rates for the various types of trips are based upon the land use properties and demographic characteristics of each TAZ.

The model considers the following internal trip purposes:

- Home-based Work (HBW)
- Home-based Other (HBO)
- Non-home-based (NHB)
- CMVEH
- TRK

Home-based trips are those that have one trip end located at the traveler's household. Examples of home-based trips include travel from home to work, shopping, or other personal business. Non-home-based trips include travel to and from any location that does not involve the traveler's household. Examples of these trips can include travel from work to shopping, from school to daycare, and from work to a lunch location.

5.1 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 NHB, CMVEH, and TRK 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. This means that trip rates that vary by household type are applied at the zonal level. The trip attraction models are linear regression equations that relate zonal employment, school enrollment, and households to trip attractions. For the commercial vehicle and freight vehicle trip purposes, the model applies a linear regression equation that relates zonal employment and households to trip productions and attractions. These equations are based on the Quick Response Freight Manual II.

The trip production and attraction models used in the MTP 2040 were checked for reasonableness and determined to be valid for the MTP 2045. No adjustments were made to the trip rates from the previous model. The final trip generation production and attraction models for HBW, HBO, and NHB trips are shown in Tables 5.1 and 5.2 respectively. The final trip generation production and attraction models for CMVEH and TRK trips are shown in Tables 5.3 and 5.4 respectively.

Table 5.1: HBW, HBO, and NHB Trip Production Rates

Trip Purpose	Number of Vehicles	Household Size				
		HHS1	HHS2	HHS3	HHS4	HHS5P
HBW	VEH0	0.6020	1.2226	1.6278	2.0237	2.2043
	VEH1	0.9262	1.7065	2.0237	2.5296	2.6963
	VEH2	0.9262	2.0631	2.3316	2.9256	3.2868
	VEH3P	0.9262	2.1395	2.6176	3.3215	3.5426
HBO	VEH0	1.2336	2.2774	3.6410	4.6884	6.1012
	VEH1	1.8978	3.1789	4.5267	5.8604	7.4631
	VEH2	1.8978	3.8431	5.2155	6.7777	9.0973
	VEH3P	1.8978	3.9855	5.8552	7.6950	9.8055
NHB	VEH0	0.7325	1.2483	2.0046	2.2928	2.5485
	VEH1	1.1269	1.7424	2.4922	2.8660	3.1174
	VEH2	1.1269	2.1064	2.8714	3.3146	3.8000
	VEH3P	1.1269	2.1845	3.2236	3.7632	4.0959

Source: NSI, 2019

Table 5.2: HBW, HBO, and NHB Trip Attraction Rates

	OCCDU	RET_EMP	RET_EMP2	OS_EMP	OTH_EMP	AMC_EMP	MTCUW_EMP	SCHATT
HBW	0.0000	1.2044	1.2044	1.2044	1.2044	1.2044	1.2044	0.0000
HBO	1.0006	2.2236	10.0062	1.8901	0.5559	0.5559	0.5559	0.7416
NHB	0.4488	1.2567	3.6803	1.0772	0.4488	0.4488	0.4488	0.2478

Source: NSI, 2019

Table 5.3: CMVEH and TRK Trip Production Rates

	OCCDU	RET_EMP	RET_EMP2	OS_EMP	OTH_EMP	AMC_EMP	MTCUW_EMP
CMVEH	0.1506	0.5328	0.5328	0.2622	0.2622	0.6660	0.5628
TRK	0.0719	0.1670	0.1670	0.0404	0.0404	0.2431	0.1817

Source: NSI, 2019

Table 5.4: CMVEH and TRK Trip Attraction Rates

	OCCDU	RET_EMP	RET_EMP2	OS_EMP	OTH_EMP	AMC_EMP	MTCUW_EMP
CMVEH	0.1506	0.5328	0.5328	0.2622	0.2622	0.6660	0.5628
TRK	0.0720	0.1670	0.1670	0.0400	0.0400	0.2430	0.1820

Source: NSI, 2019

5.2 Special Generators

A special generator is a land use with unusually low or high trip generation characteristics when compared to the established trip generation rates. For the HPFL TDM there was only one special generator:

- TAZs 76; William Carey University (3,000 trips) - the college experiences more trips than generic school attendance trip rates suggest it would receive.

5.3 Balancing Productions and Attractions

Productions and attractions are balanced at the study area level for all trip purposes. This means that the area-wide trip attractions match the amount of area-wide trip productions. HBW, HBO, and TRK trips are balanced by holding the productions as a constant. The NHB and CMVEH trips are balanced by holding the attractions as a constant. This reflects that the trips produced at the households or trip origins must be equal to the total number of trips attracted to the non-home ends or destinations. Table 5.5 shows the daily trips by trip purpose before and after balancing.

Table 5.5: Balanced Productions and Attractions

Trip Purpose	Before Balancing		After Balancing	
	Productions	Attractions	Productions	Attractions
HBW	86,150	83,059	86,150	86,150
HBO	186,505	187,764	186,505	186,505
NHB	96,833	97,039	97,039	97,039
CMVEH	32,419	32,419	32,419	32,419
TRK	9,672	9,662	9,672	9,672

Source: NSI, 2019

5.4 Summary

Two separate documents were used In the calibration and validation of the HPFL MPO TDM. The first is the *Minimum Travel Demand Model Calibration and Validation Guidelines for State of Tennessee*, which was last updated in 2016. The second is the *Travel Model Validation and Reasonableness Checking*

Manual, 2nd Edition.[2] Using these guidelines, several key statistics for trip generation were monitored, which are shown in Table 5.6.

Table 5.6: Modeled vs Benchmark Trip Rates

Trip Rate	Modeled	Low Benchmark	High Benchmark
Person Trips per Person	3.7	3.3	4.0
Person Trips per Household	9.1	8.0	10.0
HBW Trips	23.5%	12.0%	24.0%
HBO Trips	50.9%	45.0%	60.0%
NHB Trips	25.5%	20.0%	33.0%

Source: Minimum Travel Demand Model Calibration and Validation Guidelines for State of Tennessee; NSI, 2019

These statistics are within the reasonable limits established by the TNMUG guidance. No further adjustments were made since the model was performing well within all other benchmark ranges and persons were not directly used in the trip rates.

[2] Travel Model Validation and Reasonableness Checking Manual, 2nd Edition. Travel Model Improvement Program.

6.0 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.

6.1 Gravity Model

Many models are available for this process; however, the HPFL MPO TDM effort used the traditional 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:

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

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

K_{ij} = Calibration parameter

n = Total number of zones in study area

6.2 Shortest Path Matrix

The TDM uses a travel time impedance matrix for each zonal pairing within the study area. This matrix traced the shortest free-flow travel time path from zone i (the start of the trip) to zone j (the end of the trip). These values are used in the calculation of F_{ij} as described in Section 6.1.

6.3 Friction Factors

Friction factors are another input used to calculate F_{ij}. This is the first relationship that was mentioned for the gravity model. These factors measure the probability of trip making at one-minute increments of travel time. Friction factors in the gravity model are an inverse function of travel time and each unique trip purpose has its own friction factors. This TDM effort uses the gamma function to derive the friction factors. Calibration of a gamma impedance function involves estimating the three parameters of the gamma function; a, b, and c. The gamma function parameter values used for each trip purpose are shown in Table 6.1.

Table 6.1: Gamma Function Friction Factors

Trip Purpose	a	b	c
HBO	5757246.6014	1.2469	0.1743
HBW	186.9551	-3.5137	0.3270
NHB	2188886.4252	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: NSI, 2019

6.4 Terminal Times

Terminal times reflect additional travel that is associated with a trip. These can be events such as parking or walking to vehicles and/or facilities. This factor was added to the beginning and end of each trip and is stored in a matrix used by the model. This value was derived from the previous TDM and adjusted as needed.

6.5 Trip Length Frequency Distribution

As mentioned previously, the gravity model develops friction factors in one minute increments and accommodates various trip lengths. The average trip lengths obtained from the model are displayed in Table 6.2. The average trip lengths that were estimated from the 2013 AirSage data are also displayed in Table 6.2. Figures 6.1 through 6.3 show the modeled trip length frequency distribution for HBW, HBO, and NHB trips. These curves were compared to those used in the AirSage data and determined to be within an acceptable level of consistency.

Table 6.2: Average Trip Length by Trip Purpose

Trip Purpose	2013 Model Average Trip Length (min)	2013 AirSage Average Trip Length (min)
HBO	6.7	8.8
HBW	11.7	11.6
NHB	7.0	9.1

Source: AirSage, 2013; NSI, 2019

Figure 6.1: Modeled HBW Trip Length Frequency Distribution

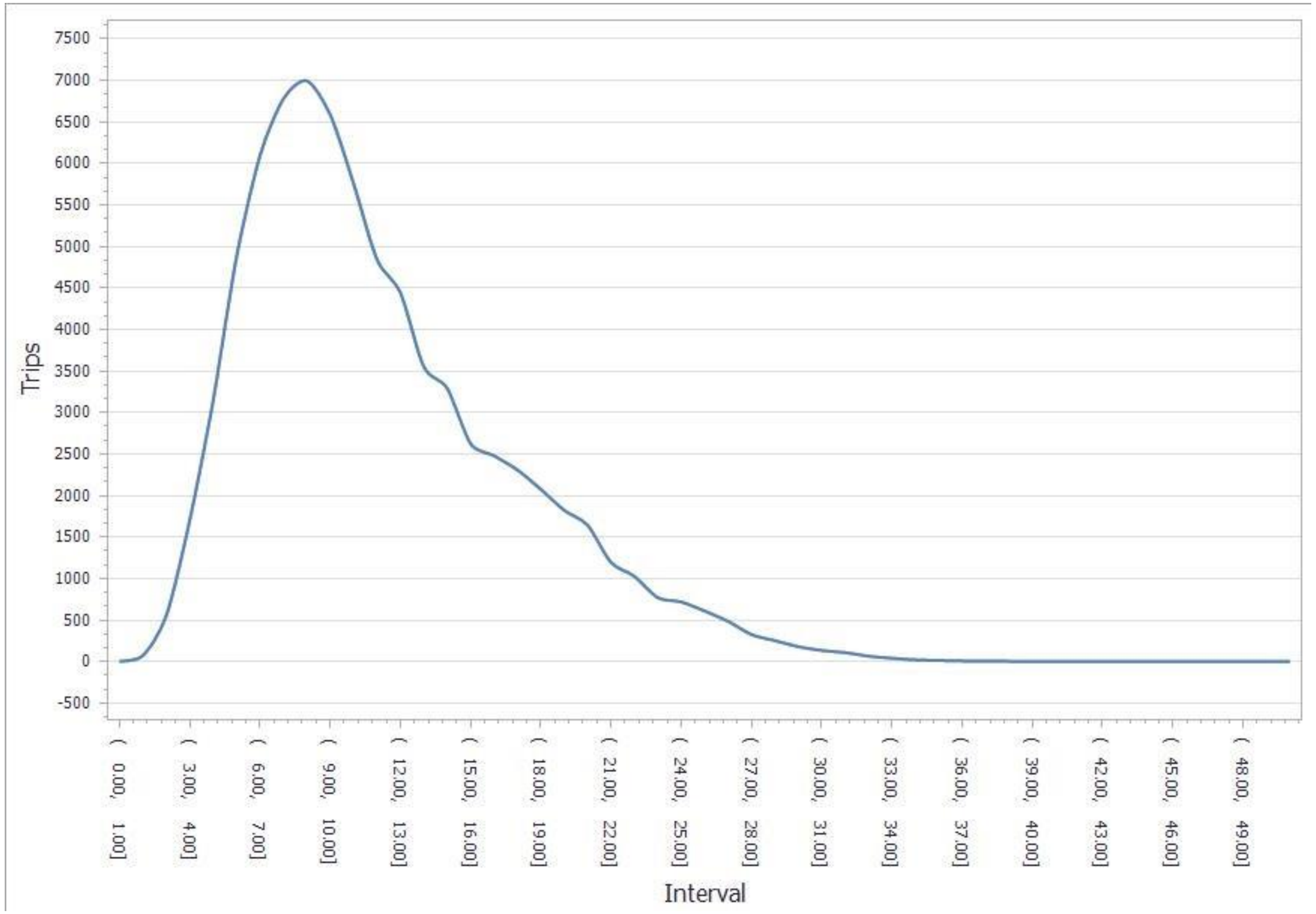


Figure 6.2: Modeled HBO Trip Length Frequency Distribution

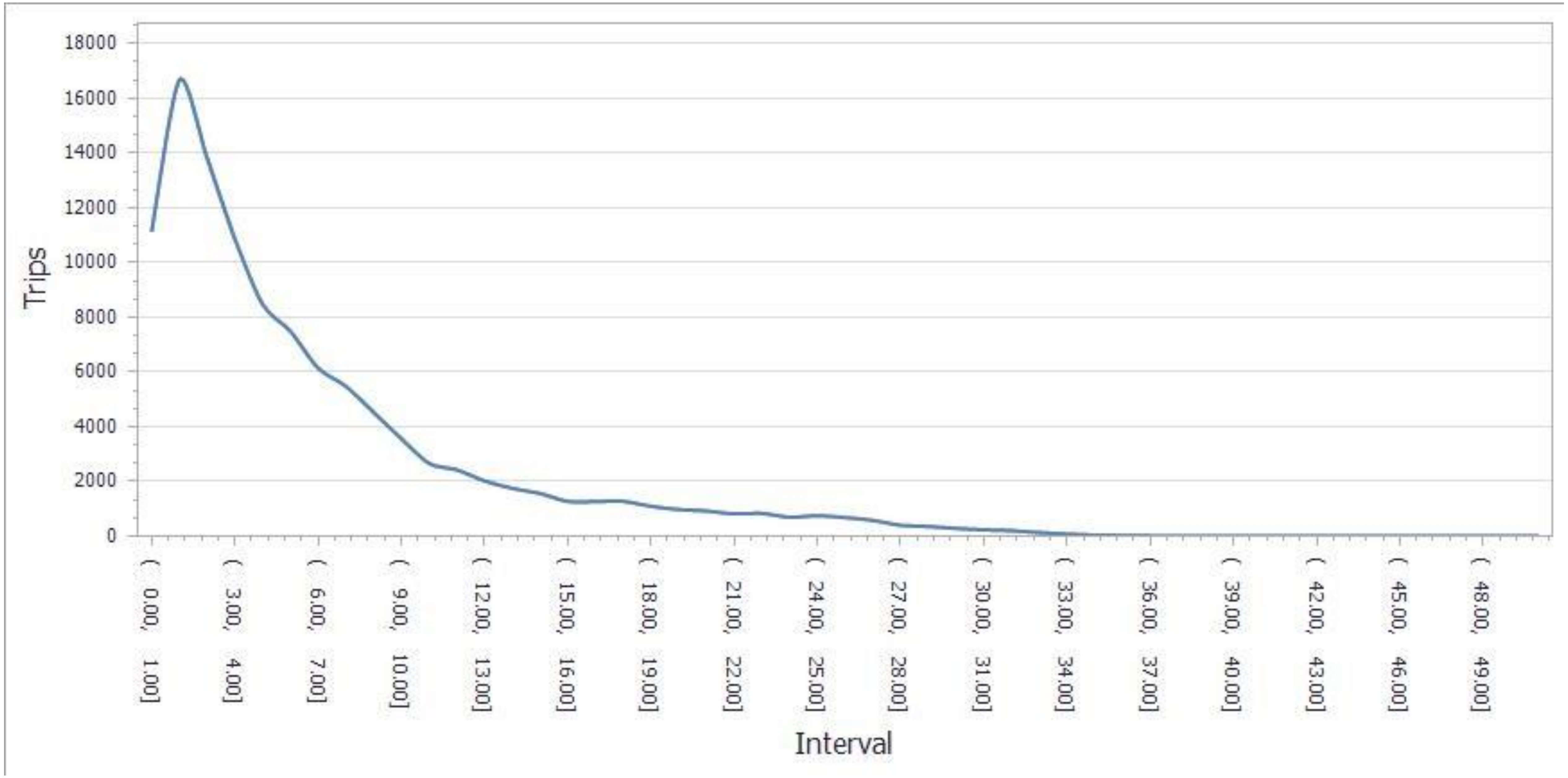
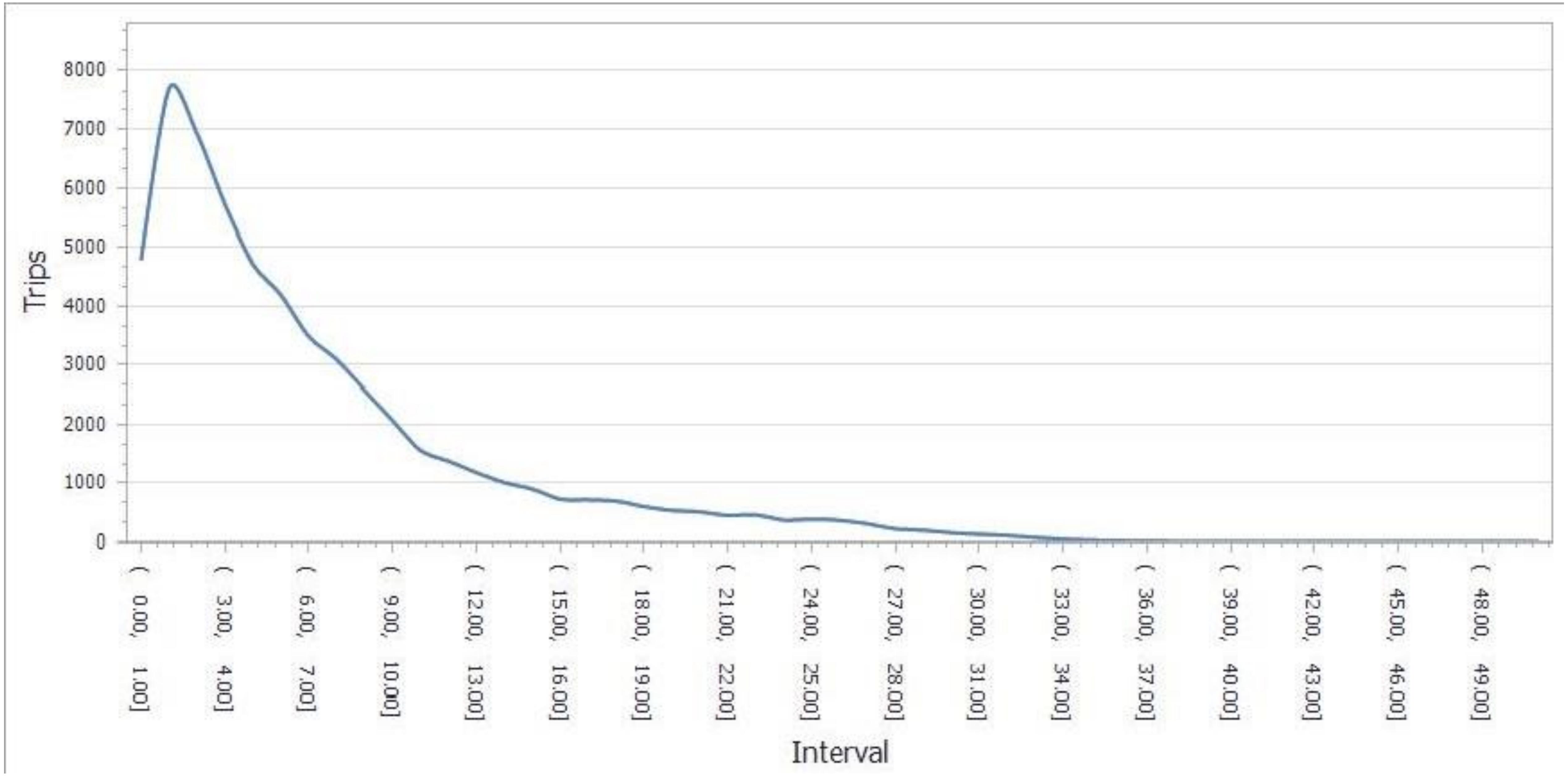


Figure 6.3: Modeled NHB Trip Length Frequency Distribution



6.6 Auto Occupancy Rates

The trip rates calculated in the Trip Generation step for HBW, HBO, and NHB trips are in person trips. In order for the TDM to assign vehicles to the roadway network, the amount of trips assigned must be in vehicle trips. This process is done using auto occupancy factors. It divides the amount of person trips by the corresponding occupancy factors shown in Table 6.3. These auto occupancy factors are the same as those used in the previous TDM effort.

Table 6.2: Model Auto Occupancy Factors

Trip Purpose	Auto Occupancy Factor
HBW	1.11
HBO	1.67
NHB	1.66
CMVEH	1.00
TRK	1.00

Source: NSI, 2019

7.0 Trip Assignment

Trip assignment is the final step in the traditional four step planning model.

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-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. The MTP 2045 model is a user equilibrium model with a generalized cost assignment that uses travel time as the cost.

7.1 BPR Volume-Delay Functions

The TDM link travel time was estimated by the Bureau of Public Roads (BPR) Volume-Delay function. The values that were used in the BPR formula are determined by facility type. The TDM uses the same alpha and beta values from the previous MTP effort, which are assigned by a roadway's functional classification. The assignment process used in the TDM analyzes link and intersection delay. As traffic volume increases on a roadway and approaches its maximum capacity, the average speed on the roadway declines. After a point, the roadway speed declines past that of the free flow speed and indicates congestion.

The generalized equation for the BPR formula is:

$$T = T_0 * (1 + \alpha * (\frac{v}{c})^{\beta})$$

Where: T = Congested travel time

T_0 = Free flow travel time

v = Assigned link volume

c = Capacity

α, β= BRP coefficients

This allows for the calculation of the roadway's peak hour travel:

$$\text{Peak Hour Travel Speed} = (\text{Free Flow Speed}) / (1 + \alpha * (\frac{v}{c})^{\beta}$$

The BPR coefficients used in the TDM are shown in Table 7.1.

Table 7.1: BPR Volume-Delay Function Parameters

Model Functional Classification	Alpha	Beta
Rural Interstate	0.71	2.10
Rural Principal Arterial	0.71	2.10
Rural Minor Arterial	0.71	2.10
Rural Major Collector	0.60	1.60
Rural Minor Collector	0.60	1.60
Rural Local	0.60	1.60
Rural Other	0.60	1.60
Rural On/Off Ramp	0.56	3.60
Urban Interstate	0.71	2.10
Urban Expressway	0.71	2.10
Urban Principal Arterial	0.71	2.10
Urban Minor Arterial	0.71	2.10
Urban Collector	0.60	1.60
Urban Local	0.60	1.60
Urban Other	0.60	1.60
Urban On/Off Ramp	0.56	3.60
System Ramp	0.71	2.10
Centroid Connector	0.15	4.00

Source: NSI, 2019

8.0 Model Validation

The purpose of model validation is to make the adjustments necessary to replicate the base-year traffic conditions as closely as possible.

In practice, this means making the link assignment volumes approximate the 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). 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.

As stated previously, this modeling effort uses the *Minimum Travel Demand Model Calibration and Validation Guidelines for State of Tennessee* and the *Travel Model Validation and Reasonableness Checking Manual, 2nd Edition,* as guidelines for the validation of TDMs.

The following criteria were used to validate the HPFL MPO TDM:

- Percent Root Mean Square Error (RMSE) by ADT Group
- Percent RMSE by Roadway Functional Classification
- Percent Error/Deviation by ADT Group
- Percent Error/Deviation by Functional Classification

8.2 Percent RMSE

The RMSE measure was chosen because when comparing model flows versus counts, sometimes a direct 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 below:

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

Validation results by ADT group and functional class are shown in Table 8.1 and Table 8.2 respectively.

Table 8.1: RMSE by ADT Group

ADT Range	Number of Observations	Total Count	Total Model Volume	% RMSE	% RMSE Limit[1]
ADT<5,000	157	326,250	301,622	41.9	45.0 - 100.0
5,000 <= ADT < 10,000	67	483,300	439,500	23.4	35.0 - 45.0
10,000 < =ADT < 15,000	25	323,000	335,693	24.2	27.0 - 35.0
15,000 < =ADT < 20,000	7	126,000	111,148	15.1	25.0 – 30.0
20,000 < =ADT < 30,000	11	279,000	285,727	9.0	15.0 – 27.0
30,000 < =ADT <50,000	13	468,000	476,771	10.9	15.0 – 25.0
ADT>=50,000	280	2,005,550	1,950,462	24.5	10.0 – 20.0
Areawide	157	326,250	301,622	41.9	35.0 – 45.0

Source: Minimum Travel Demand Model Calibration and Validation Guidelines for State of Tennessee; NSI, 2019

Table 8.2: RMSE by Functional Classification

Functional Classification	Number of Observations	Total Count	Total Model Volume	% RMSE	% RMSE Limit[1]
Interstate	8	232,000	228,059	11.6	20
Principal Arterial	47	875,200	903,418	15.5	30
Minor Arterial	74	456,940	416,615	23.6	40
Collector	105	283,920	238,707	42.5	70
Local	7	20,680	16,488	35.6	N/A
Areawide	280	2,005,550	1,950,462	24.5	35.0-45.0

Source: Minimum Travel Demand Model Calibration and Validation Guidelines for State of Tennessee; NSI, 2019

(1) % RMSE Limit is the maximum acceptable magnitude of the error relative to that of the counts conducted by MDOT

8.3 Percent Error

The next measure of model validation is the percent error, or percent deviation, of the model's assigned traffic volumes to the observed traffic counts. Tables 8.3 and 8.4 display the validation results by ADT group, ADT and lane group, and by facility category respectively.

Table 8.3: Percent Deviation by ADT Group

ADT Range	Number of Observations	Total Count	Total Model Volume	% Deviation	% Deviation Limit[1]
ADT<1,000	43	28,150	26,414	-6.2	200.0
1,000 < =ADT < 2,500	66	115,100	106,916	-7.1	100.0
2,500 <= ADT < 5,000	48	183,000	168,292	-8.0	50.0
5,000 <= ADT < 10,000	67	483,300	439,500	-9.1	25.0
10,000 < =ADT <25,000	37	560,000	565,023	0.9	20.0
25,000 < =ADT < 50,000	19	636,000	644,317	1.3	15.0
Areawide	280	2,005,550	1,950,462	-2.7	5.0

Source: Minimum Travel Demand Model Calibration and Validation Guidelines for State of Tennessee; NSI, 2019

Table 8.4: Percent Deviation by Functional Classification

Functional Classification	Number of Observations	Total Count	Total Model Volume	% Deviation	% Deviation Limit[1]
Interstate	8	232,000	228,059	-1.7	+/- 7.0
Principal Arterial	47	875,200	903,418	3.2	+/- 15.0
Minor Arterial	74	456,940	416,615	-8.8	+/- 15.0
Collector	105	283,920	238,707	-15.9	+/- 25.0
Local	7	20,680	16,488	-20.3	N/A
Areawide	280	2,005,550	1,950,462	-2.7	+/- 5.0

Source: Minimum Travel Demand Model Calibration and Validation Guidelines for State of Tennessee; NSI, 2019

(1) % Deviation Limit is the maximum acceptable magnitude of the error relative to that of the counts conducted by MDOT

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

9.0 Future Year Model Development

Future year models were developed to forecast traffic that the study area will experience based on its anticipated growth. This includes forecast socioeconomic data, external travel, and special generator data. Forecast models also require updates to the roadway network based on projects that are expected to occur or have allocated funding in the near future.

9.1 Future Year Socioeconomic Data Development

To adequately forecast future transportation system needs, future projections of demographic variables were developed for each Traffic Analysis Zone (TAZ).

Population and Employment Growth

County level population and employment control totals for the years 2025, 2035, and 2045 were derived using forecasts developed for the Mississippi 2045 Statewide Long Range Transportation Plan. These forecasts were based on historical trends, national projections, and stakeholder input and were validated against third-party projections. Areas in a county that are not included in the MPO study area were included in this analysis and then removed at the end.

After setting control totals for each county in the study area, growth was then sub-allocated to each TAZ in the travel demand model.

- First, growth that has occurred since the base year was added, based upon a review of recent news articles and satellite imagery.
- Then, a GIS-based growth model was used to allocate the remaining growth through 2045. This growth model evaluated the attractiveness of each TAZ for residential, commercial, and industrial development and estimated its capacity for such development based on existing land development patterns and future land use regulations.
- Finally, MPO staff reviewed the growth forecasts by TAZs and adjustments were made as necessary.

Figures 9.1 and 9.2 show the projected growth in population and employment by TAZ.

School Enrollment Growth

For public primary and secondary schools, enrollment growth was projected for each school based upon the projected population growth rates in its “attendance zone.” Growth rates for each “attendance zone” were developed by assigning each TAZ to a school, based on proximity and school zone boundaries, and then calculating the population growth rate for these areas from 2013 to 2045. New/planned schools were also included as necessary.

For private primary and secondary schools and all colleges/universities, except for the University of Southern Mississippi, student enrollment was assumed to grow one percent annually based on historical and recent trends. For the University of Southern Mississippi, enrollment projections were modified further to reflect long-term expectations.

Table 9.1: Population and Households by Year

Variable	2013	2025	2035	2045
Total Population	108,722	124,620	143,838	160,785
Household Population	104,468	120,132	139,658	156,929
Households	41,964	48,167	55,855	62,653

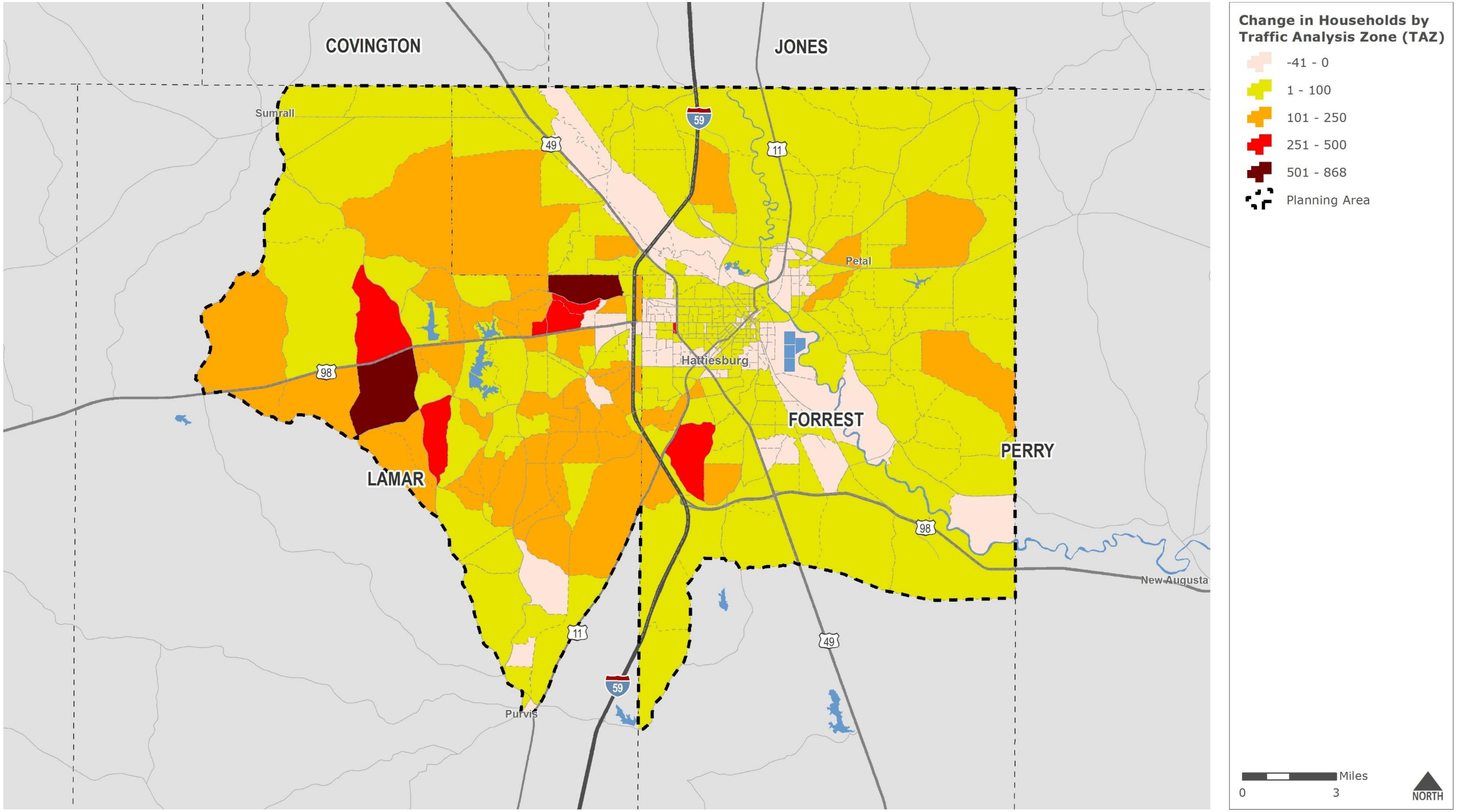
Source: NSI, 2019

Table 9.2: Employment by Year

Variable	2016	2025	2035	2045
TOT_EMP	68,135	78,814	87,333	96,024
AMC_EMP	3,138	3,254	3,330	3,437
MTCUW_EMP	9,088	10,222	11,956	12,938
RET_EMP	15,651	18,201	19,925	22,100
OS_EMP	39,167	46,045	51,029	56,455
OTH_EMP	1,091	1,092	1,093	1,094

Source: NSI, 2019

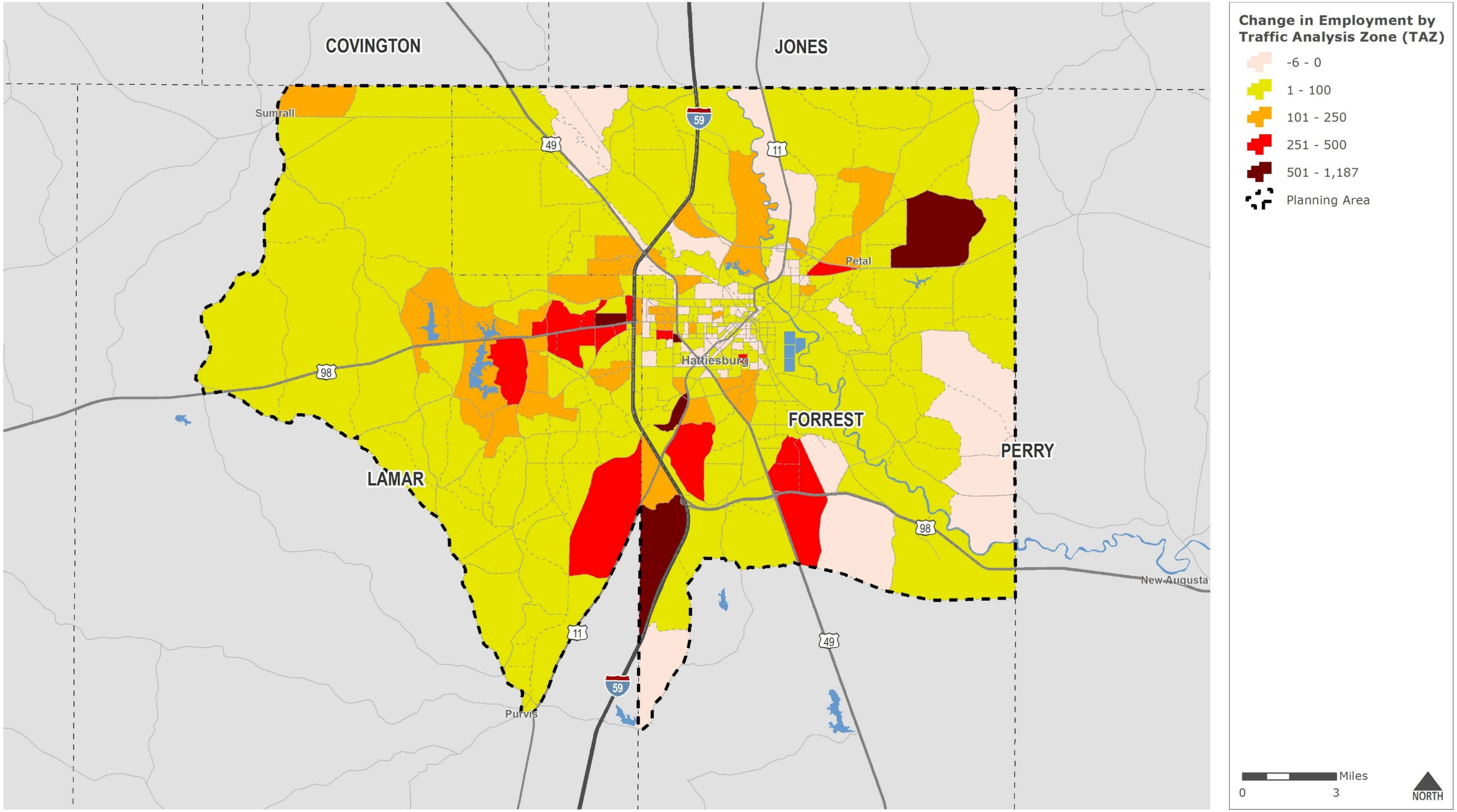
Figure 9.1: Household Growth, 2013-2045



Data Sources: Neel-Schaffer, Inc.

Disclaimer: This map is for planning purposes only.

Figure 9.2: Employment Growth, 2013-2045



Data Sources: Neel-Schaffer, Inc.

Disclaimer: This map is for planning purposes only.

9.2 Existing Plus Committed (E+C) Network

The base year network was defined as the street and highway system that existed in year 2013. Once the base year network was calibrated, the E+C network was developed which included committed projects.

Committed projects are those improvements for which:

- construction was either completed or begun since 2013,
- a contract for construction has been awarded,
- have completed the National Environmental Policy Act (NEPA) phase, or
- have funding for right-of-way and/or construction programmed in the MPO's Transportation Improvement Program.

Committed projects were added to the base network using the following procedure:

- New routes were coded with the proposed number of lanes, and with the posted speed and volume-delay function attributes that reflect the project's functional classification.
- Widened roadways change the number of lanes to the appropriate amount in each direction as well as the lane configuration field required by the network.
- All E+C projects were flagged in the 'PROJECT_VIS' field using a unique project ID.

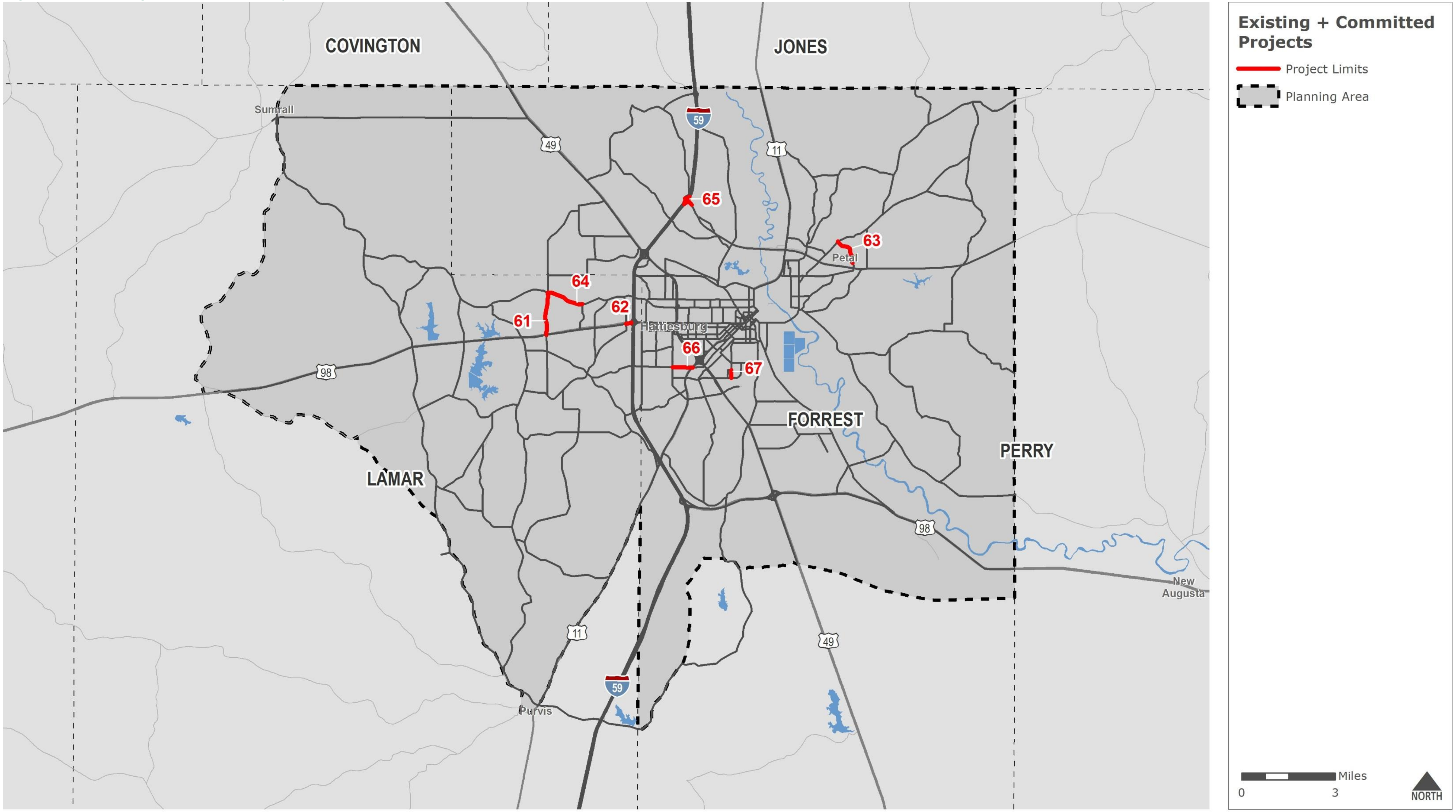
The committed projects are listed in Table 9.3 and shown in Figure 9.3.

Table 9.3: Existing + Committed Projects

Project ID	Roadway	Location	Improvement
61	Jackson Rd Extension	US 98 to W 4th St	New 2 Lane Roadway
62	US 98	Westover Dr to I-59	Interchange Improvements
63	Byrd Blvd Extension	MS 42 to Old Richton Rd	New 2 Lane Roadway
64	W 4th St	Jackson Rd to Cross Creek Pkwy	Add Center Turn Lane
65	I-59	@ MS 42 (Evelyn Gandy Pkwy)	Interchange Improvements
66	Lincoln Rd	US 11 to 28th Ave	Widen to 4 Lanes
67	Martin Luther King E	Bowling St to Helveston Rd	New 2 Lane Roadway

Source: HPFL MPO, MDOT

Figure 9.3: Existing + Committed Projects



Data Sources: Hattiesburg MPO; MDOT

Disclaimer: This map is for planning purposes only.

9.3 External Station Growth

The base year traffic counts at each external station were projected to 2025, 2035, and 2045 using growth factors developed based on historic traffic counts at the external stations. Development of the growth rates used the following methodology:

- Developed an average annual growth rate using historical traffic counts from 2007 through 2013.
- If the calculated average annual growth rate is less than one (1) percent, then the growth rate for that station was set at one (1) percent.
- If the calculated average annual growth rate is more than three (3) percent, then the growth rate for that station was set at three (3) percent.
- If the calculated average annual growth rate is between one (1) percent and three (3) percent, then the calculated average annual growth rate was used with no changes.
- If it was determined that a growth rate was not expected to be sustained for a long period of time it was adjusted to a reasonable rate.

It should be noted that the vast majority of external stations within the study area grew at less than one (1) percent and so were adjusted to meet that threshold.

The final forecast growth rates for each external station and comparison of external travel forecast for the base year and target years is shown in Table 9.4.

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. In addition, both EI and EE forecast trips were also separated into auto and truck trips.

Table 9.4: External Station Forecast Growth

External Station	Forecast Growth Rate	2016 Volume	2026 Volume	2036 Volume	2045 Volume
601	1.0%	27,000	30,424	33,607	37,123
602	3.0%	4,500	6,432	8,661	11,664
603	1.0%	5,900	6,648	7,344	8,112
604	1.0%	8,900	10,029	11,078	12,237
605	1.0%	12,000	13,522	14,937	16,499
606	1.0%	14,000	15,776	17,426	19,249
607	1.0%	3,700	4,169	4,605	5,087
608	1.0%	1,900	2,141	2,365	2,612
609	1.0%	9,500	10,705	11,825	13,062
610	1.5%	2,100	2,521	2,937	3,420
611	1.0%	5,500	6,198	6,846	7,562
612	1.3%	21,000	24,524	27,909	31,761

Source: HPFL MPO; NSI, 2019

9.4 Future Year Model Runs

The TDM was used to forecast traffic for the future years using the E+C network and forecast socioeconomic, external station, and special generator data. Interpolation was used where necessary to obtain a future year scenario that occurred between the base year (2013), interim years (2025 and 2035), or the horizon year (2045). This feature was also used to conduct a 2018 model run for the purposes of the existing conditions (Technical Report 2) analysis.