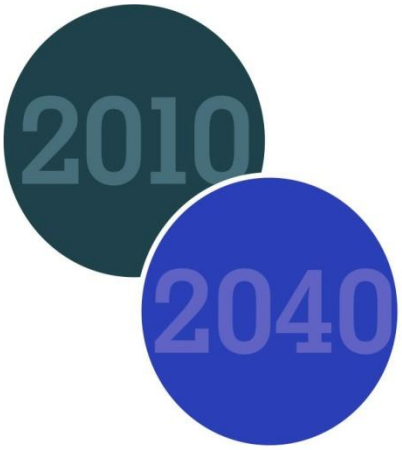
CHAPTER 6 –TRANSPORTATION DEMAND MODEL DEVELOPMENT

6.1 Introduction

Transportation demand modeling is the technical process of determining how much demand for transportation services (i.e. traffic or trips) the region should expect in the future, based on changing conditions. This includes the socioeconomic trends described in *Chapter 5 – Regional Growth Forecasts*, and proposed changes to the transportation system in the future. The Morgantown Monongalia Metropolitan Planning Organization's (MMMPO's) tool for developing such traffic forecasts is a transportation demand model created using *TransCAD* software.



The first step in the modeling process for the Long Range Transportation Plan (LRTP) update is to develop a base year model (year 2010) that replicates travel data in the region for that year. The second step is to develop a future year model (year 2040) that reflects anticipated changes in socioeconomic conditions and committed major changes to the transportation system (i.e. the widening of Mileground Road).

This chapter provides a technical summary of the update and refinement of the MPO model for the purposes of the LRTP update.

6.2 Model Application Flow

Background

The original MMMPO model was created in 2006 using the *QRS II* software package and had a base year of 2000. At that time, a 2030 future year model was used in the development of *the Greater Morgantown Regional Transportation Plan* (2007).

In 2010, the model was translated to its current *TransCAD* software package. Trip generation rates, trip distribution rates, auto occupancy rates, park and ride rates, transit, etc., remained unchanged.

Furthermore, it was determined early in this LRTP update process that the model structure was considered sound and should not be changed. In order to create the 2010 model from the 2000 model, several updates, aside from the model structure, had to be incorporated. These updates include: socioeconomic data, zone structure, network, and miscellaneous input files. A discussion of the socioeconomic data changes and forecasts is included in *Chapter 5 – Regional Growth Forecasts*.

MMMPO includes Monongalia County in its entirety for its planning area. The model for the region has 326 internal and 14 external traffic analysis zones (TAZs). Figure 6-1 represents the zone and network structure.

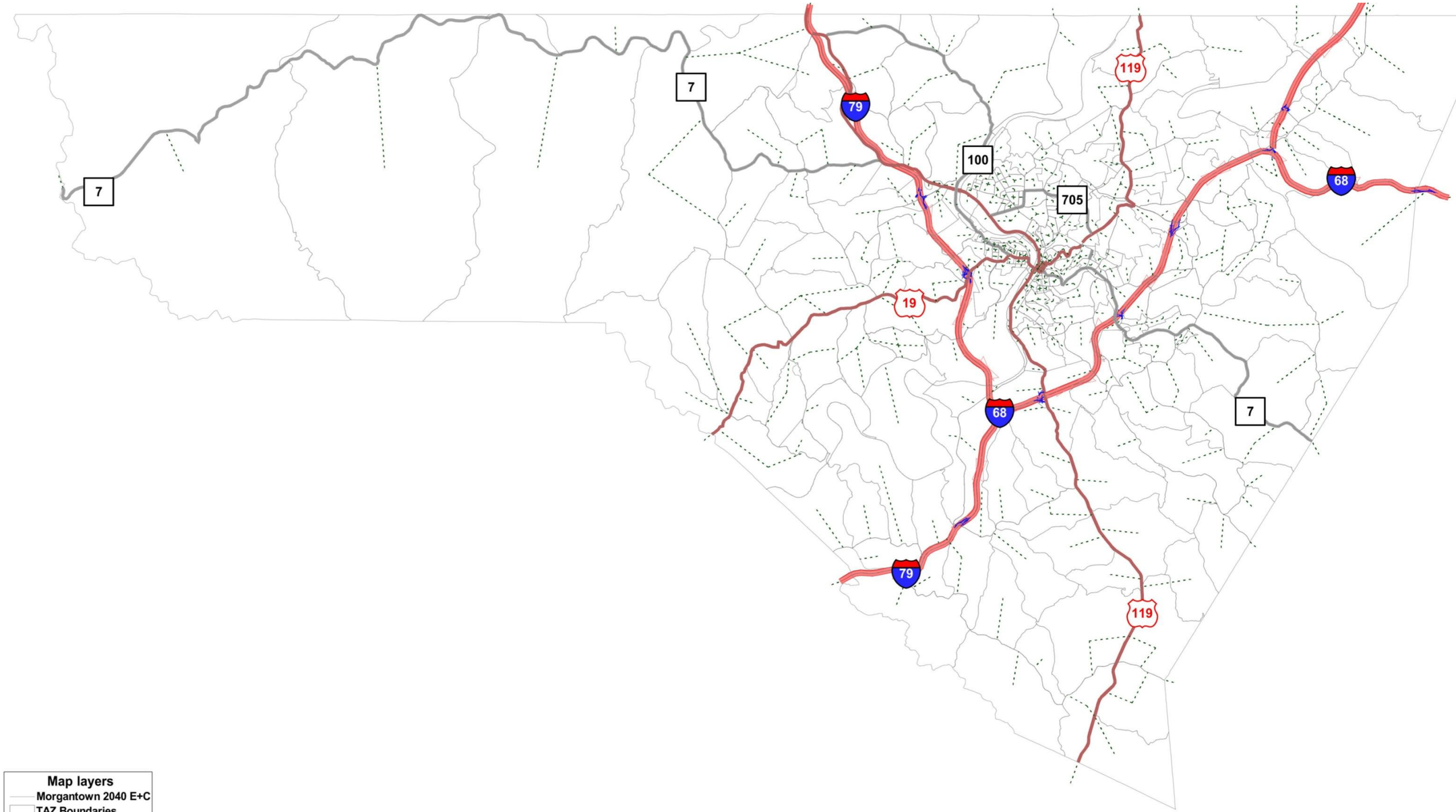
The model is a traditional three step model that includes Trip Generation, Trip Distribution, and Highway Assignment with a feedback loop. Mode Choice is not a formal step included in the modeling process of the MMMPO model.

As transit plays a key role in evaluating the area-wide transportation system improvements of this LRTP, a methodology outside the model stream was developed to allow consideration of these types of projects (see Appendix D). Similarly, biking and walking improvements are also a key component of the LRTP transportation system, but the model is not capable of evaluating their impact on travel demand. The bicycle and walking projects were not evaluated in the same context as the roadway and transit improvements.

Input File Updates

The MMMPO model uses the number of households, retail employment, and non-retail employment by zone to determine number of trips and how they are allocated. The 2010 household model data was developed using data gathered from the Census Bureau at census block level and then aggregated into the traffic analysis zone (TAZ) structure of the model. Retail and non-retail job data was provided by the West Virginia Division of Highways (WVDOH) by business address and by North American Industry Classification System (NAICS) code. This information was geocoded using zip codes and street addresses and then aggregated to the TAZ level. The largest employer locations were verified manually.

Figure 6-1. Model Zone and Network Structure



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The 2040 socioeconomic data inputs were developed using the methodology outlined in *Chapter 5 – Regional Growth Forecasts* and in Appendix B.

Table 6-1 shows the population, households, and employment totals used in the 2010 and 2040 model runs and the forecasted growth over the 30-year period.

Table 6-1. Model Input Totals and Forecasted Growth

	2010	2040	Growth	Percent Growth
Population	96,189	138,069	41,880	43.5%
Retail Jobs	11,461	16,151	4,690	40.9%
Non-Retail Jobs	40,217	57,721	17,504	43.5%
Total Employment	51,678	73,872	22,194	43.0%

The socioeconomic data is used to generate trips on the transportation system. These trips represent the travel that people will make from one location to another. To facilitate the generation of these trips, this model utilizes four trip purposes: Home Based Work (HBW), Home Based Non-Work (HBNW), Home Based University (HBU), and Non-Home Based (NHB) trips. A brief description of each is provided below:

- Home Based Work (HBW) – Trips between home and work or work and home without a stop in the middle
- Home Based Non-Work (HBNW) – Trips between home and any non-work location
- Home Based University (HBU) – Trips between home and one of the WVU campuses for the purpose of either going to school or work
- Non-Home Based (NHB) – Trips that do not start or end at the driver's home

The increase in number of households, retail jobs, and non-retail jobs detailed in Table 6-1 creates an increase in the number of people who use the system. The three input socioeconomic data sets modify the internal to internal trips (people who travel completely within the system), internal to external trips (people who travel from within the system to outside), and external to internal trips (people who travel from outside the system to inside).

Additionally, the model incorporates an External to External (E-E) trip table. The previous model had a 2000 and a 2030 input file for the E-E

trip table. To create the new 2010 E-E trips, a straight line projection of the growth in trips was generated between 2000 and 2030. For 2040, the straight line growth projection was then extrapolated for an additional 10 years. A comparison of the person trip growth between the updated 2010 and 2040 is shown in Table 6-2.

Table 6-2. Person Trips Growth (Includes both internal and external trips)

Trip Purpose	2010 Person Trips	Percent of 2010 Person Trip Total	2040 Person Trips	Percent of 2040 Person Trip Total	Growth in Person Trips from 2010 to 2040	Percent Growth from 2010 to 2040
Home Based Work (HBW)	108,338	24%	188,393	27%	80,055	74%
Home Based Non-Work (HBNW)	197,504	44%	302,429	44%	104,925	53%
Home Base University (HBU)	18,053	4%	25,920	4%	7,867	44%
Non-Home Based (NHB)	120,609	27%	170,689	25%	50,080	42%
Total	444,504	100%	687,431	100%	242,927	55%

Network Changes

The original zone structure reflected the 2000 census block boundaries. Some of these block boundaries changed with the 2010 Census. As much of the input data required for 2010 was gathered from the Census Bureau's website block data as part of the LRTP process, the zones needed to be further modified to reflect the updated 2010 Census block boundaries.

During the calibration of the base year model, the attributes on the roadway network were evaluated for reasonableness. Where data were not contiguous or did not match ground observations or aerial photography, the network attributes were modified. The primary attributes that were evaluated included the network model speed, the daily capacity on the roadway, and the functional classification.

Validation Checks

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The Federal Highway Administration (FHWA), through their Travel Model Improvement Program (TMIP), has provided a set of guidelines for evaluating model performance. These guidelines are documented in the *Travel Model Validation and Reasonableness Checking Manual-Second Edition* dated September 2010 and were used where the model data set allowed.

Typically, FHWA does not recommend "pass-fail" validation techniques as they can lead to over confidence of the modeled results. Rather, the validation techniques are meant to provide an impression for how well the model performs. Furthermore, localized studies that use the

regional model should be refined within the study area during the project level modeling process.

Once the 2010 inputs were updated, the model was run and compared to existing traffic data as a means of checking model validity. Additional information regarding the run parameters under which the model was run can be found in the "2010 Morgantown Monongalia Metropolitan Planning Organization Model Performance," dated October 2, 2012 and attached in Appendix C. The previously mentioned memo also details the checks performed and the resulting comparisons.

6.3 2040 Existing Plus Committed (E+C) Network

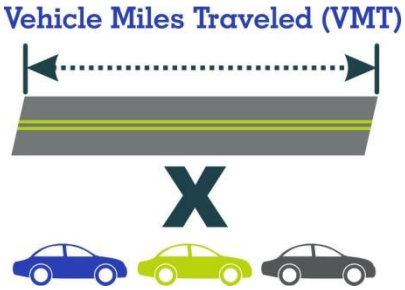
Before the LRTP transportation improvements could be evaluated, a basis for comparison had to be generated. This is accomplished by using a model run that considers future year inputs, but not the LRTP transportation improvements.

Everything in the model stream is updated to reflect the future year, including a roadway network which incorporates only those transportation improvements that have already been funded, the future socioeconomic data, and adjustments to the E-E trips mentioned previously. In the case of MMMPO's network, there are only two transportation improvements that needed to be included in the 2040 E+C network.

- Mileground Improvements – part of a plan to relieve traffic congestion, improve safety, and provide better accessibility
- The Mon-Fayette Expressway extension to the county border

6.4 Forecasted 2040 Average Daily Volumes on the E+C Network

The volumes in Figure 6-2 are a reflection of the 2040 forecasted traffic volumes on the E+C network. These volumes do not consider additional improvements to the transportation system.



6.5 Changes in Vehicle Travel

Vehicle Miles Traveled (VMT) is a measure of the level of travel within an area. It is calculated by multiplying the length of a link by the number of vehicles traveling on that link. The regional VMT comparison, represented by the total in Table 6-3, shows a growth in the 2010 VMT of 77 percent. Person trips, on the other hand, grew by a total of 55 percent.

Table 6-3. Vehicle Miles Traveled Comparison

Facility Type	2010 VMT	2040 E+C VMT	Percent Growth
Arterials	1,278,411	2,218,959	74%
Freeways	1,180,492	2,140,963	81%
Ramps	51,339	84,450	65%
Total	2,510,242	4,444,372	77%

6.6 Level of Congestion

The forecasted volumes on the transportation network can also describe a level of congestion. For this model, capacities are assigned to each link in the network which creates a base line for how many vehicles can travel on that link. Model locations where links have a large volume to capacity (V/C) ratio are locations where the model is forcing larger vehicle flows through the area. Figure 6-3 highlights the V/Cs for the 2040 E+C model run.

6.7 Mode Split

Transit plays a key role in evaluating the area-wide transportation system improvements of the MMMPO LRTP. In order to reflect how future transit scenarios would impact the congestion on the roadways, a methodology outside the model stream was developed. A detailed description of this process can be found in the "Transit Scenario Methodology" memo dated November 27, 2012 and included in Appendix D.

Figure 6-2. 2040 Forecasted E+C Average Daily Volumes

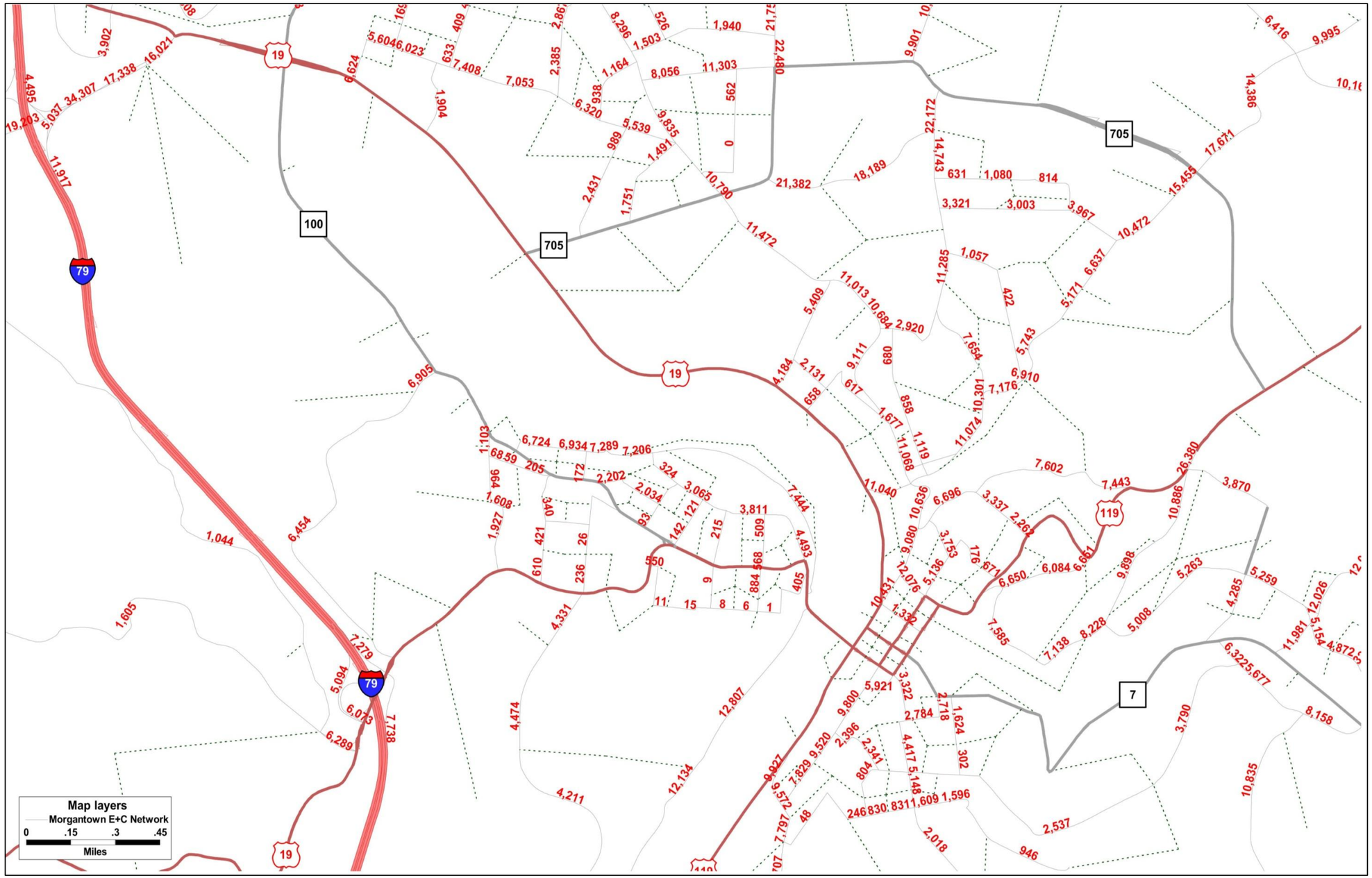


Figure 6-3. 2040 Forecasted E+C Volume to Capacity Ratios