

KINGSPORT 2040 LONG-RANGE TRANSPORTATION PLAN & MODEL UPDATE



Overview

■ Team

- Plan Development

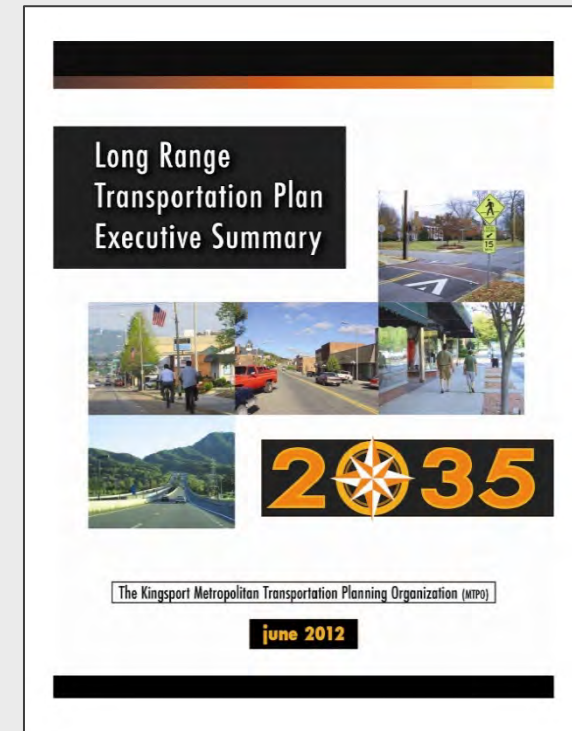


- Model Development

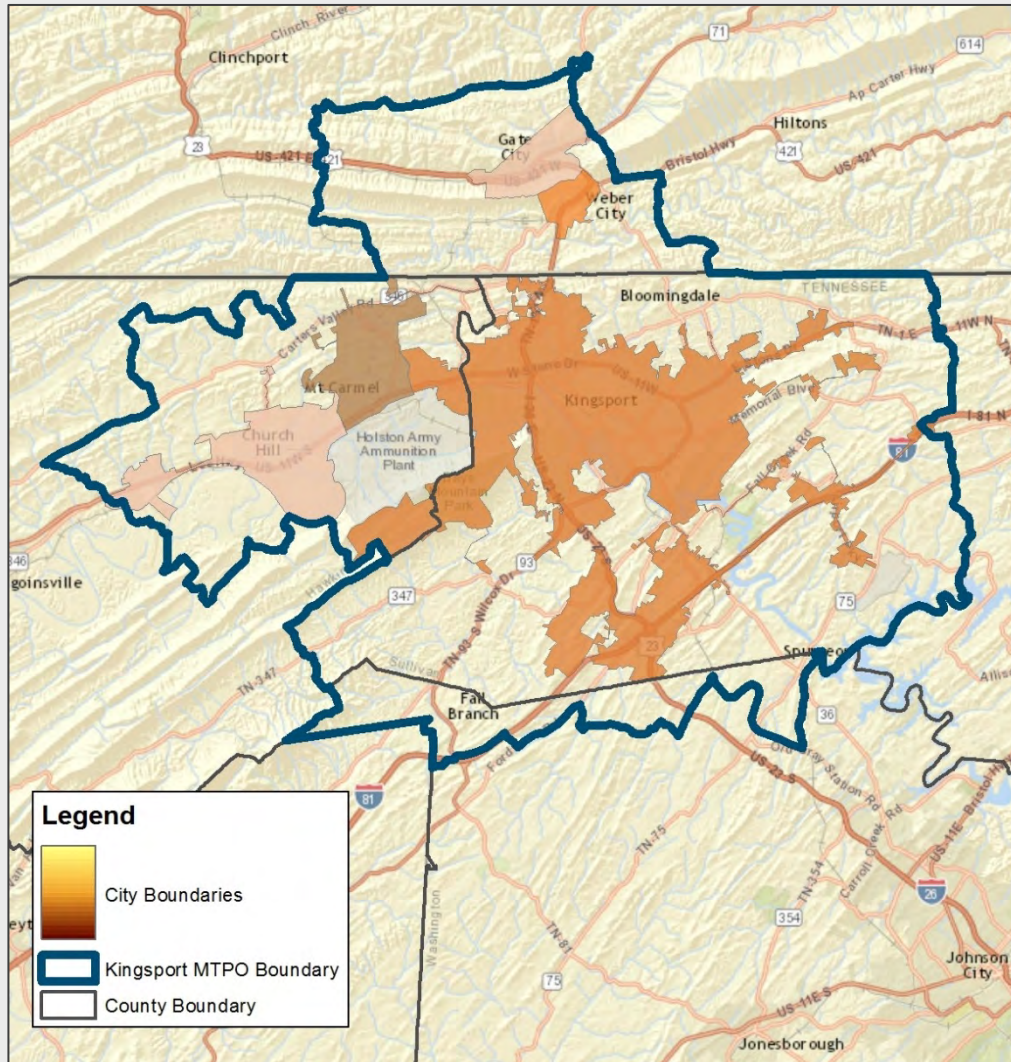
Kimley»Horn

► Update 2035 LRTP to 2040

- Previous Plan: Base Year 2009 – Future Year 2035
- Update: Base Year 2015 – Future Year 2040



Planning Area



MTPO Planning Area

Tennessee

- Kingsport
- Mount Carmel
- Church Hill
- Portions of Hawkins, Sullivan and Washington County

Virginia

- Weber City
- Gate City
- Portions of Scott County

Population

Data Sources Used

- Historic Trends
- Base Year Validation
- Future Year Projections



Population – Current & Future Growth

- Projections show an increase of **62,000** people across the four counties.

County	2015 Population	2040 Population	Percent Change
Sullivan County, TN	157,366	166,706	6%
Hawkins County, TN	57,811	71,800	24%
Washington County, TN	128,307	167,766	31%
Scott County, VA	22,617	22,243	-2%
Total	366,101	428,515	17%

Population

Table 2: Method for Allocating Base Year (2015) Population

Total Population	Census County 2010	MTPO Area 2010	Percent %	W&P County 2015	MTPO Area 2015	Absolute Change 2010-2015	MTPO 2015 Total Pop	Percent to MTPO Area	Average Annual Percent Growth 2010-2015
Hawkins County, TN	56,871	23,248	40.9%	57,811	23,632	384	23,632	40.9%	0.18%
Scott County, VA	23,133	8,300	35.9%	22,617	8,446	146	8,446	37.3%	
Sullivan County, TN	156,856	90,993	58.0%	157,366	91,289	296	91,289	58.0%	
Washington County, TN	123,310	8,501	6.9%	128,307	8,845	344	8,845	6.9%	
Total	360,170	131,042	36.4%	366,101	132,212	1,170	132,212	36.1%	

**Table 3: Method for Projecting Future Year (2040) Population –
Trend Scenario**

Total Population	Percent to MTPO Area	MTPO 2015 Total Pop	2020	2025	2030	2040	2015-2040 Absolute Change	2015-2040 Percent Change	Percent of Growth Attributed to MTPO Area	Average Annual Percent Growth 2015-2040
Hawkins County, TN	40.9%	23,632	24,782	25,968	27,161	29,351	5,718	24.2%	40.9%	0.44%
Scott County, VA	37.3%	8,446	8,594	8,624	8,774	9,080	634	7.5%	-	
Sullivan County, TN	58.0%	91,289	92,734	94,128	95,372	96,707	5,418	5.9%	58.0%	
Washington County, TN	6.9%	8,845	9,372	9,922	10,485	11,566	2,720	30.8%	6.9%	
Total	36.1%	132,212	135,482	138,641	141,792	146,703	14,491	11.0%	23.2%	

**Table 4: Method for Projecting Future Year (2040) Population –
Alternative Growth Scenario**

Total Population	Percent to MTPO Area	MTPO 2015 Total Pop	2020	2025	2030	2040	2015-2040 Absolute Change	2015-2040 Percent Change	Percent of Growth Attributed to MTPO Area	Average Annual Percent Growth 2015-2040
Hawkins County, TN	43.0%	23,632	26,068	27,315	28,571	30,874	7,242	30.6%	51.8%	0.60%
Scott County, VA	37.3%	8,446	8,787	9,136	9,499	10,253	1,808	21.4%	-	
Sullivan County, TN	59.0%	91,289	94,316	95,733	96,998	98,357	7,068	7.7%	75.7%	
Washington County, TN	7.5%	8,845	10,196	10,794	11,407	12,582	3,737	42.2%	9.5%	
Total	37.1%	132,212	139,366	142,978	146,475	152,066	19,854	15.0%	31.8%	

MTPO Population – Growth Alternative

- Projections show an increase of nearly **20,000 people** within the MTPO area over the next 25 years.

County	2015 Population	2040 Population	Absolute Change	Percent Change
Sullivan County, TN	91,289	98,357	7,068	7.7%
Hawkins County, TN	23,632	30,874	7,242	30.6%
Washington County, TN	8,845	12,582	3,737	42.2%
Scott County, VA	8,446	10,253	1,808	21.4%
Total	132,212	152,066	19,854	15%

Employment

Data Sources Used

- Ability to Look at Total Number of Jobs
- Ability to Look at Employment Sectors
- Historic, Current, and Projections



Employment – Current & Future Growth

- Projections show an increase of **43,000 jobs** across the four counties.

County	2015 Employment	2040 Employment	Percent Change
Sullivan County	70,420	82,850	17.7%
Hawkins County	12,682	15,929	25.6%
Washington County	60,197	86,868	44.3%
Scott County, VA	4,829	5,883	21.8%
Total	148,129	191,530	29.3%

Employment

Table 5: Historic and Future Year Employment Projections

Four County Region – Total Employment	2015	2016	2017	2018	2019	2020	2025	2030	2040	Absolute Employment Change 2015-2040	Percent Change 2015-2040
Hawkins County, TN	12,682	12,844	13,000	13,156	13,309	13,460	14,191	14,836	15,929	3,247	25.6%
Scott County, VA	4,829	4,886	4,941	4,993	5,046	5,095	5,339	5,552	5,883	1,053	21.8%
Sullivan County, TN	70,420	71,143	71,827	72,494	73,147	73,793	76,804	79,272	82,850	12,429	17.7%
Washington County, TN	60,197	61,252	62,295	63,335	64,377	65,431	70,759	76,124	86,868	26,671	44.3%
Total	148,129	150,125	152,064	153,976	155,878	157,781	167,094	175,784	191,530	43,400	29.3%

**Table 6: Method for Projecting Future Year (2040) Employment –
Trend Scenario**

Kingsport MTPO Planning Area - Trend Scenario	2015 Percentage to MTPO Area	2040 Percentage to MTPO Area	2015	2020	2025	2030	2040	Absolute Employment Change 2015-2040	Percent Change 2015-2040	Average Annual Percent Growth	Percent of County's Growth to MTPO Area
Hawkins County, TN	36%	36%	4,549	4,829	5,106	5,360	5,809	1,260	27.7%	0.76%	38.8%
Scott County, VA	53%	53%	2,561	2,700	2,828	2,942	3,119	558	21.8%		53.0%
Sullivan County, TN	65%	65%	46,055	48,145	50,045	51,637	53,990	7,935	17.2%		63.8%
Washington County, TN	2%	2%	1,415	1,533	1,653	1,772	2,010	595	42.0%		2.2%
Total	37%	34%	54,580	57,206	59,632	61,711	64,927	10,347	19.0%		23.8%

**Table 7: Method for Projecting Future Year (2040) Employment –
Alternative Growth Scenario**

Kingsport MTPO Planning Area - Growth Scenario	2015 Percentage to MTPO Area	2040 Percentage to MTPO Area	2015	2020	2025	2030	2040	Absolute Employment Change 2015-2040	Percent Change 2015-2040	Average Annual Percent Growth	Percent of County's Growth to MTPO Area
Hawkins County, TN	36%	40%	4,549	5,384	5,676	5,935	6,372	1,823	40.1%	1.03%	56.1%
Scott County, VA	53%	55%	2,561	2,803	2,937	3,053	3,236	675	26.3%		64.0%
Sullivan County, TN	65%	67%	46,055	49,442	51,459	53,112	55,509	9,454	20.5%		76.1%
Washington County, TN	2%	4%	1,415	2,617	2,830	3,045	3,475	2,060	145.6%		7.7%
Total	37%	36%	54,580	60,245	62,902	65,145	68,591	14,011	25.7%		32.3%

Employment – Growth Scenario

- Projections show an increase of approximately **14,000** more jobs within the MTPO area over the next 25 years.

County	2015 Employment	2040 Employment	Percent Change
Sullivan County	46,055	55,509	20.5%
Hawkins County	4,549	6,372	40.1%
Washington County	1,415	3,475	145.6%
Scott County, VA	2,561	3,236	26.3%
Total	54,580	68,591	25.7%

Employment – Current & Future Growth

- ▶ Projections show an increase of approximately **14,000 jobs** in the MTP0 area across the four counties.
- ▶ A significant increase in service employment and small decrease in manufacturing employment is expected.

County	2015 Employment	2040 Employment	Percent Change
Agricultural	3,694	4,949	34.0%
Manufacturing	13,989	14,622	4.5%
Retail	6,269	7,466	19.1%
Office	8,010	10,337	29.1%
Service	20,854	29,080	39.4%
Government	1,764	2,137	21.1%
Total	54,580	68,591	25.7%

Suballocation Process

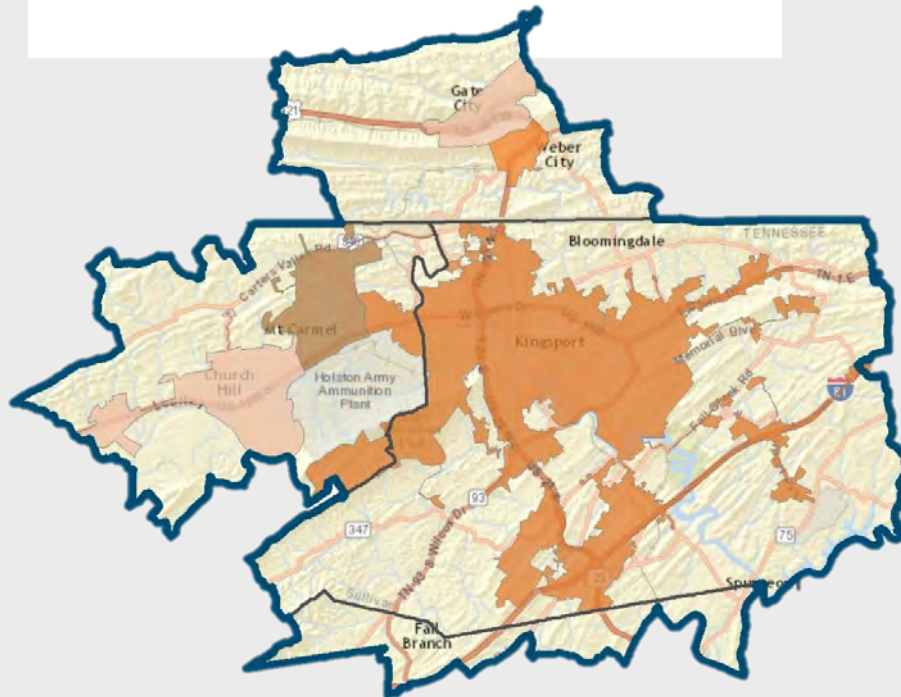


Suballocation Process

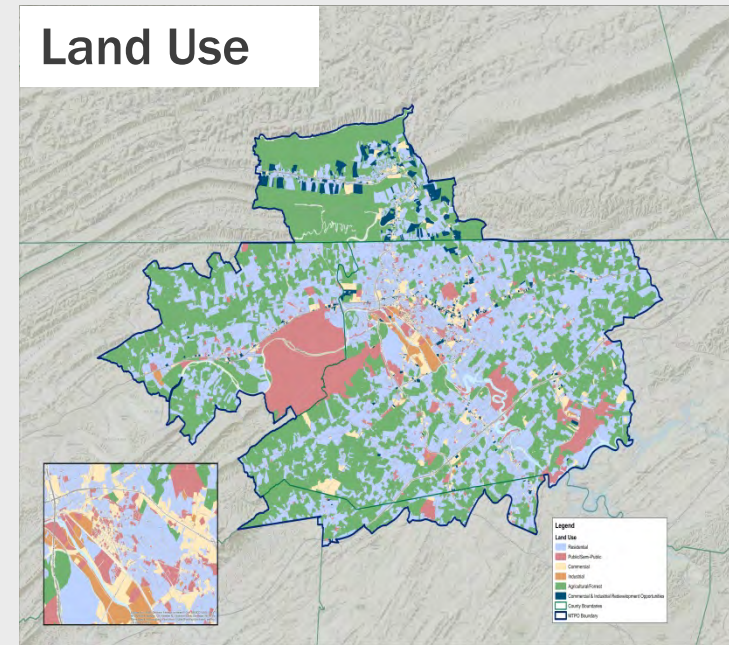
Development Trends

Targeted Growth Areas

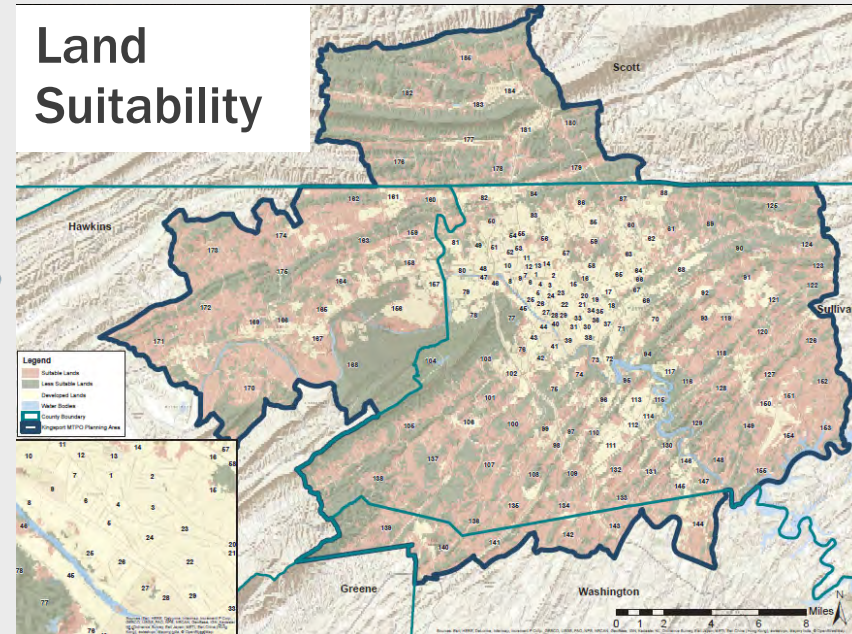
Infrastructure Investments



Land Use



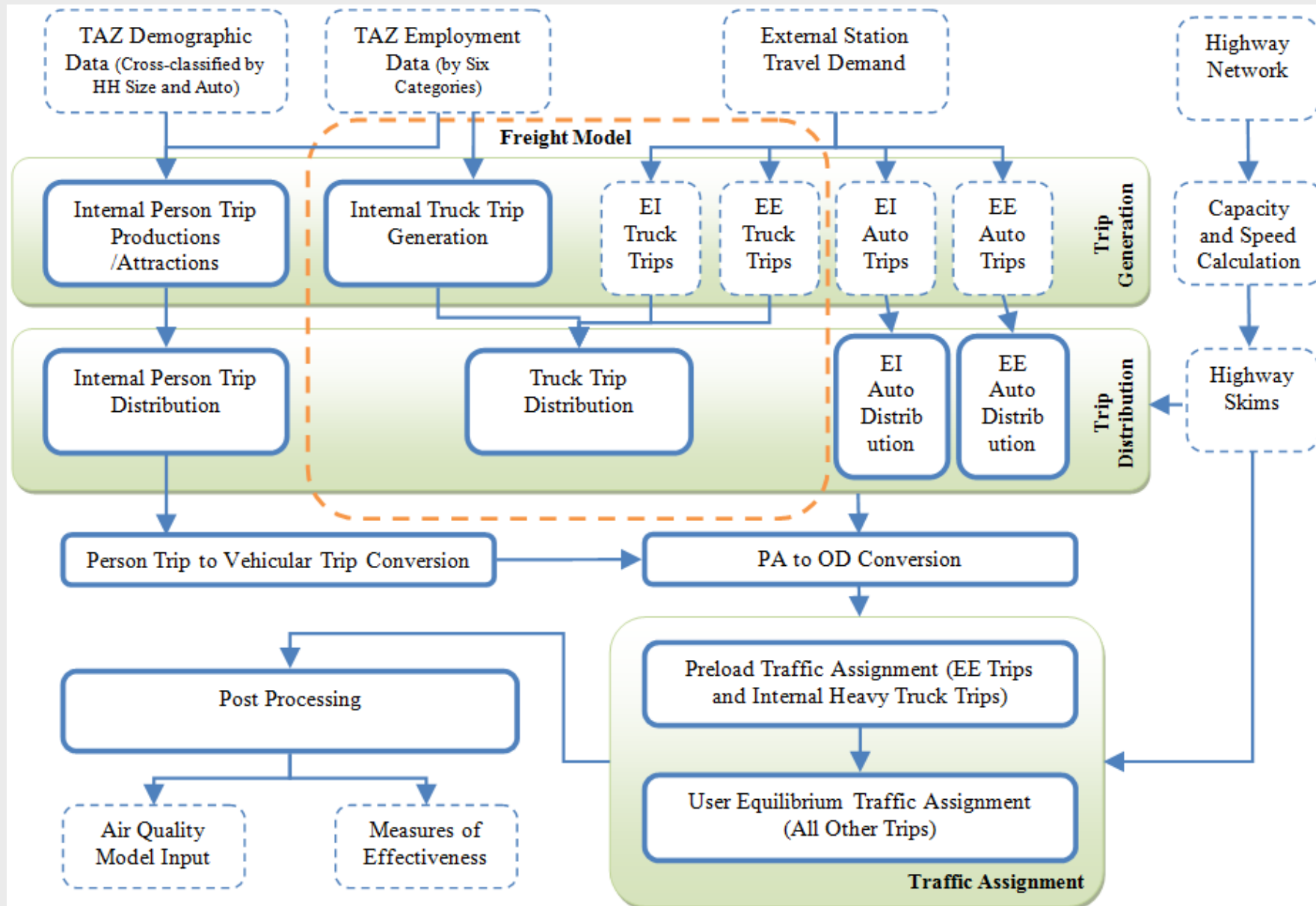
Land Suitability



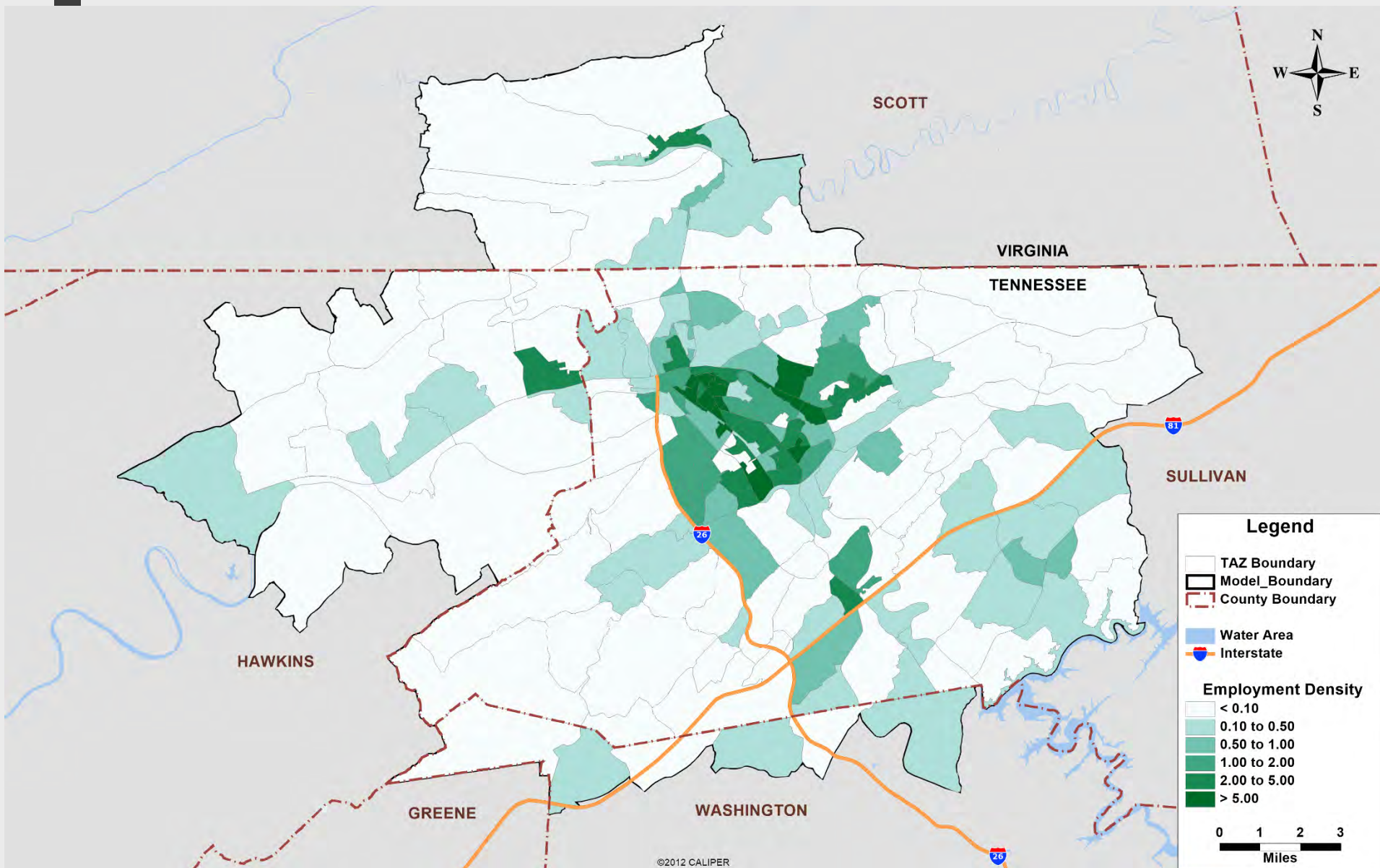
Model Enhancements

- Base year 2015 and horizon year 2040
- Trip rates from NHTS 2009 Add-ons
- New Home-based School (HBSchool), Shopping (HBShop), and Social-recreational (HBSR) trip purposes
- New time-of-day model
- New mode split model
- Enhanced QRFM truck model

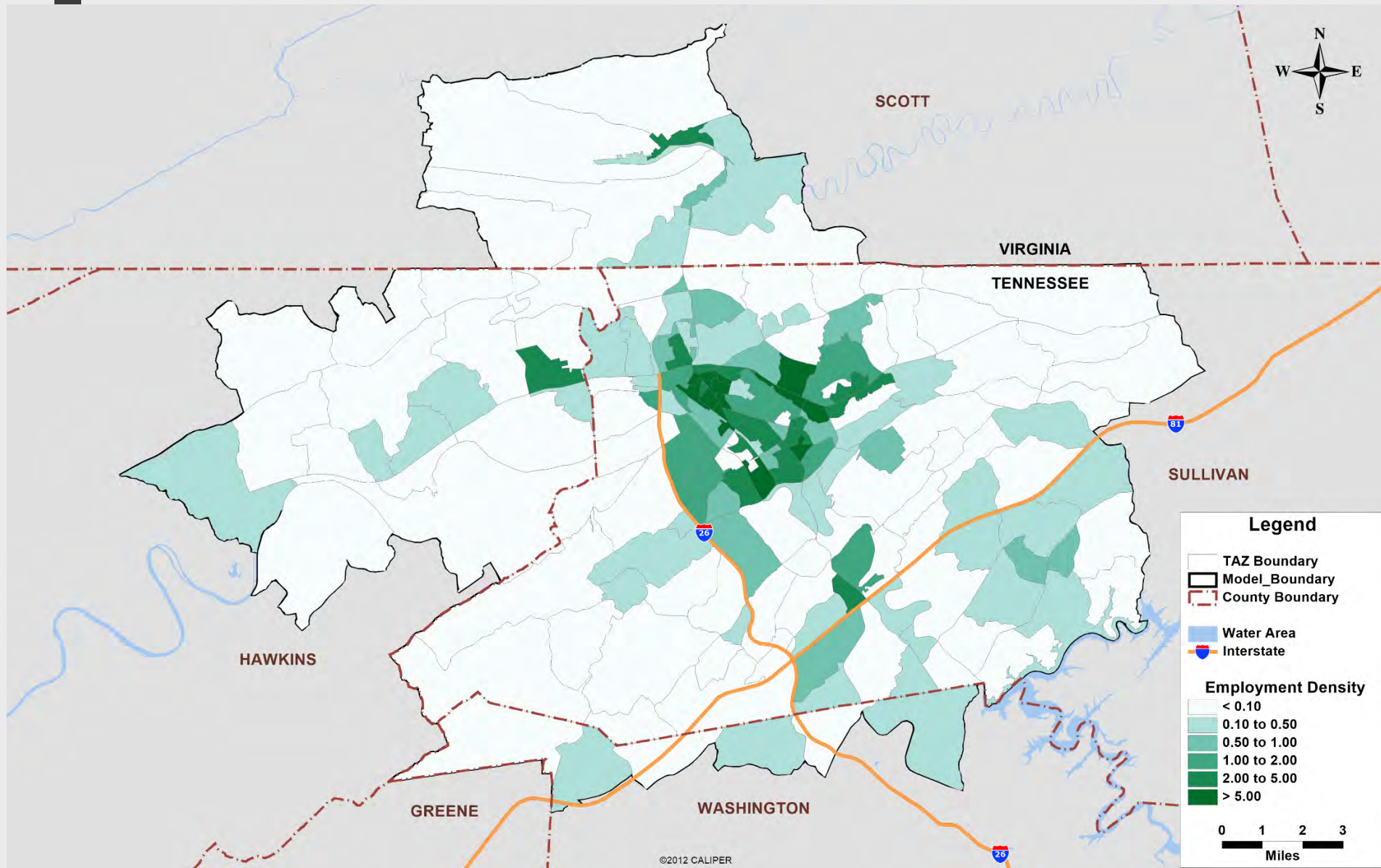
Model Structure



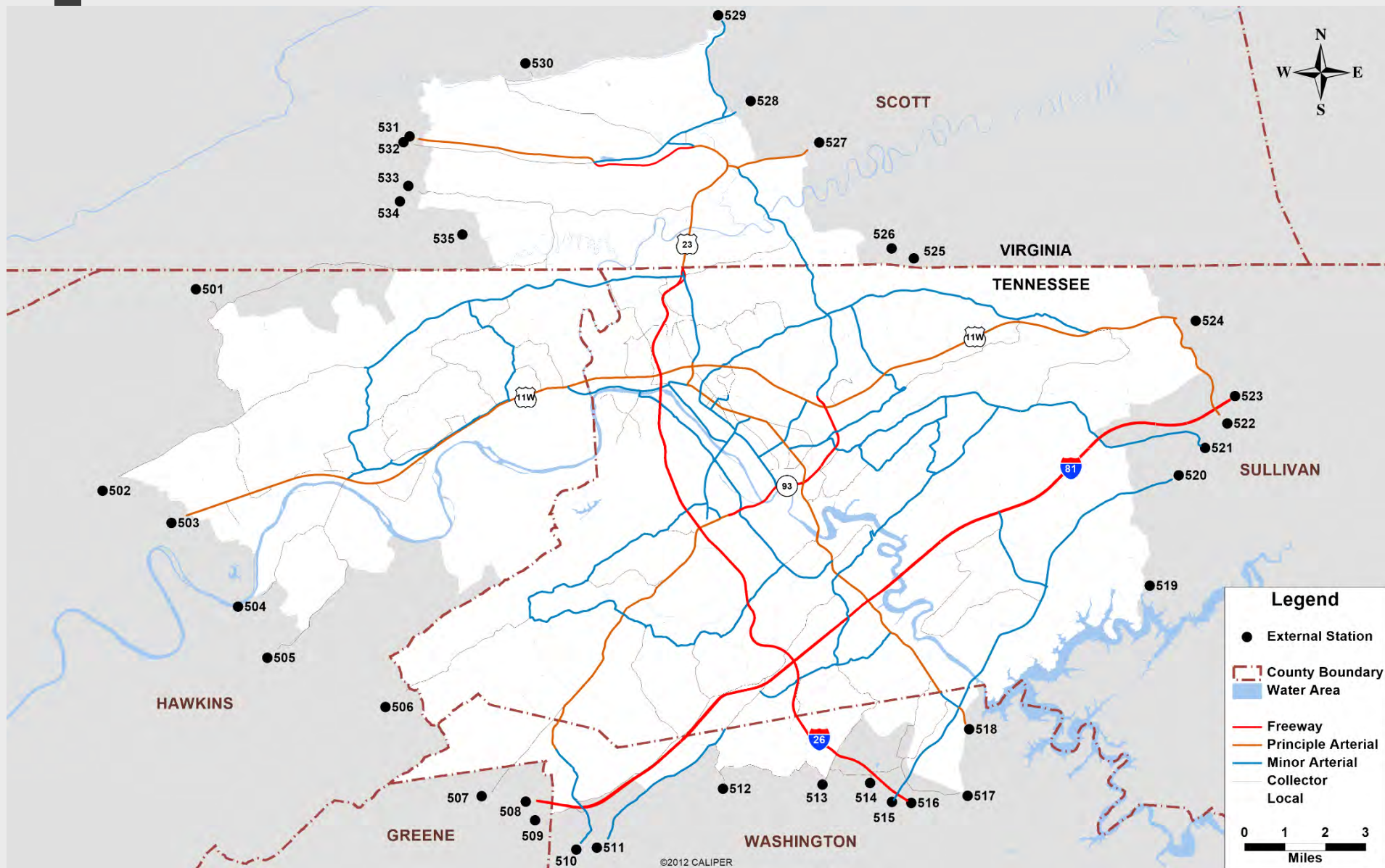
TAZs - Population Density



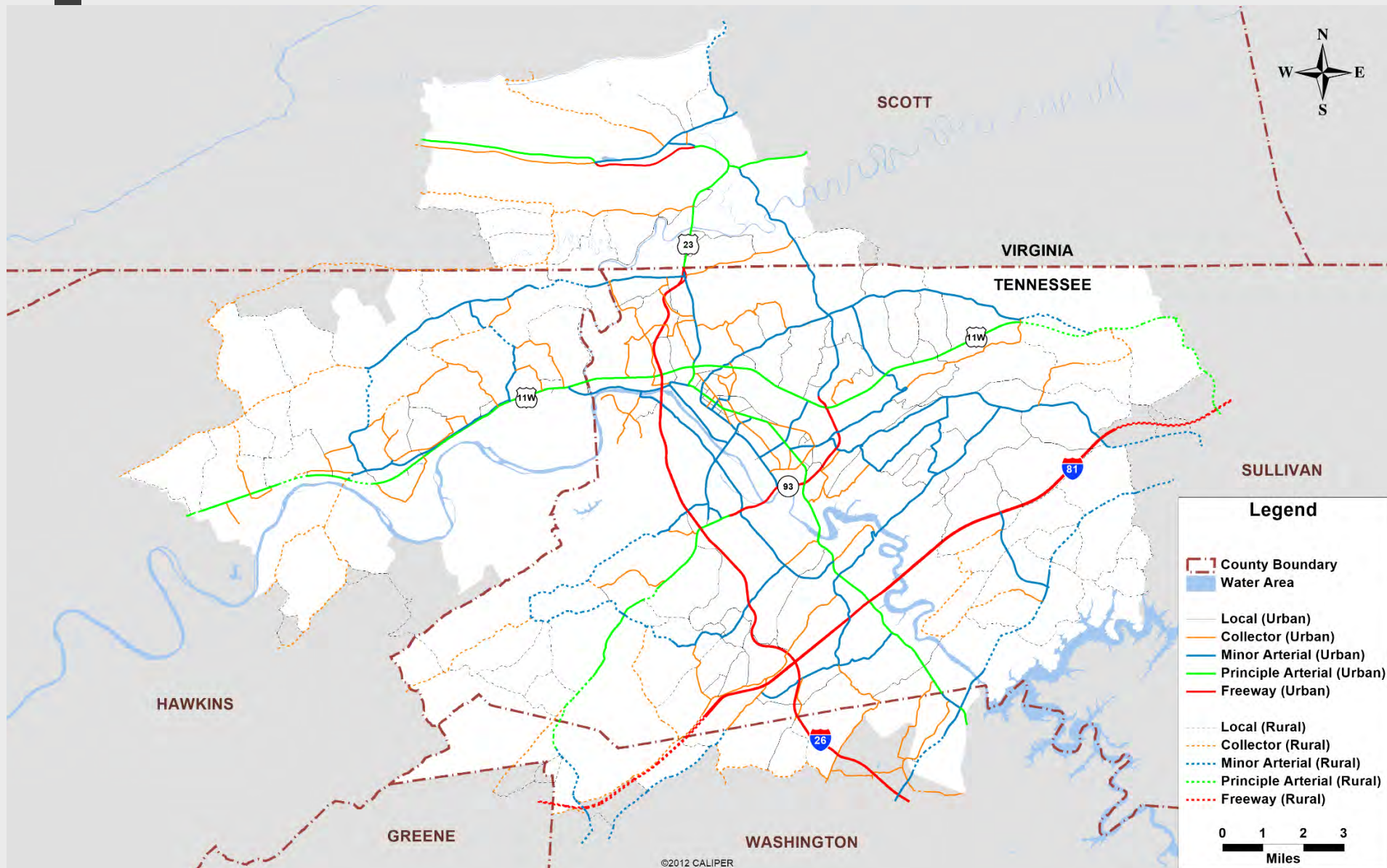
TAZs - Employment Density



External Stations



Highway Network



Capacity Calculation

[3-2] Interstate/Freeway Capacity Equations (Functional classification = 1, 11, or 12)

$$SF = c \times N \times F_w \times F_{hv} \times F_p \times (v/c)_i$$

Where:

$$c = \begin{array}{ll} 2,200 & \text{(two lanes)} \\ 2,300 & \text{(three or more lanes)} \end{array}$$

$$N = \text{Number of lanes, by direction}$$

$$F_w =$$

Lane Width	Shoulder Width		
	0-1'	2-4'	5'+
Narrow ($\leq 10'$)	0.78	0.83	0.88
Normal ($> 10'$)	0.90	0.95	1.00

$$F_{hv} = 0.88$$

$$F_p = \begin{array}{ll} 0.90 & \text{(Rural)} \\ 0.92 & \text{(Urban)} \end{array}$$

$$(v/c)_i = \begin{array}{ll} 0.88 & \text{(LOS D)} \\ 1.00 & \text{(LOS E)} \end{array}$$

Internal Trip Purposes

- **Home-Based Work (HBW)**
- **Home-Based School (HBSC)**
- **Home-Based Shopping (HBSP)**
- **Home-Based Social-Recreational (HBSR)**
- **Home-Based Other (HBO)**
- **Non Home-Based (NHB)**

NHTS 2009 Data Application

■ Data:

- *NHTS 2009 add-on for Tennessee and Virginia*
- *All MSAs in TN and VA with < 500,000 population*

■ Applied to Kingsport Model:

- *Trip production – Internal Trip rates*
- *Time-of-day model*
- *Average vehicle occupancy by purpose*
- *Mode split model based on travel distance*

Trip Production Rates

Table 4-1 Trip Production Rates for Home-based Work (HBW) Trips

Workers	Vehicles				Weighted Average
	0	1	2	3+	
0	-	-	-	-	-
1	0.701	1.173	1.500	1.598	1.446
2	2.315			2.630	2.467
3+	4.053			5.229	5.079
Weighted Average	0.079	0.459	1.436	1.978	1.261

Table 4-2 Trip Production Rates for Home-based School (HBSC) Trips

Persons	Children			Weighted Average
	0	1	2+	
1	0.002	-	-	0.002
2	0.040	0.772	-	0.094
3	0.869	1.238	1.599	1.133
4+		2.252	2.642	2.422
Weighted Average	0.118	1.325	2.605	0.661

Time of Day Model

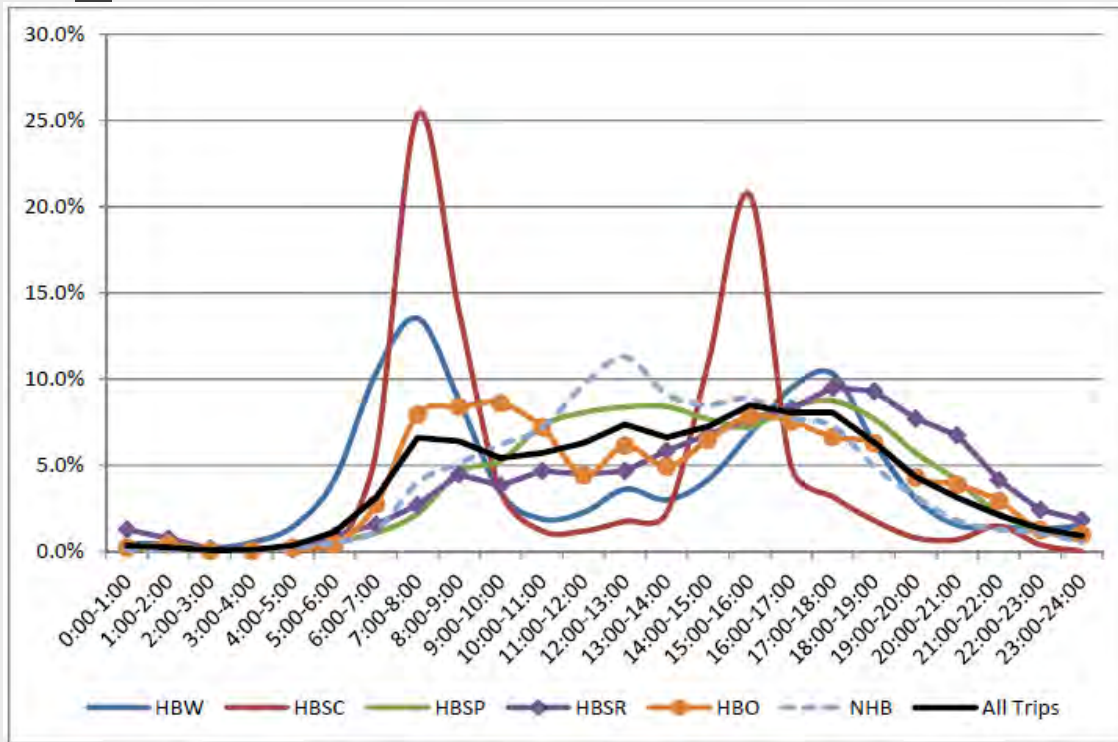


Figure 5-1 Auto Trips by Purpose by Time of Day

Table 5-2 Time of Day Period Definition

Time Period	Time Range	Period Length	% Auto Trips (NHTS 2009 Survey)
AM Peak	6 AM - 9 AM	3 Hours	16.2%
Midday Off-peak	9 AM - 3 PM	6 Hours	38.7%
PM Peak	3 PM - 6 PM	3 Hours	24.7%
Night Off-peak	6 PM - 6 AM	12 Hours	20.5%

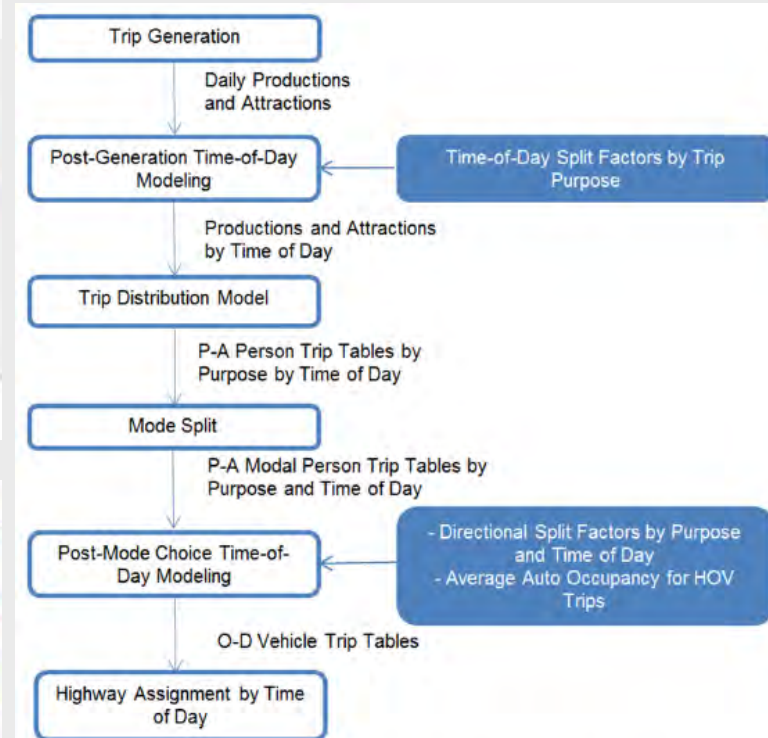


Figure 5-2 Time-of-day Model Application

Trip Distribution Models

Table 6-3 Average Travel Times by Trip Purpose

Trip Purpose	Average Travel Time (minutes)		
	Observed (CTPP 2010)	Model Predicted	TN Guidelines
HBW	16.10	15.39	12 - 35
HBSC	-	11.20	7 - 16
HBSP	-	12.62	9 - 19
HBSR	-	13.08	11 - 19
HBO	-	13.47	8 - 20
NHB	-	12.72	6 - 19

HBW - All households

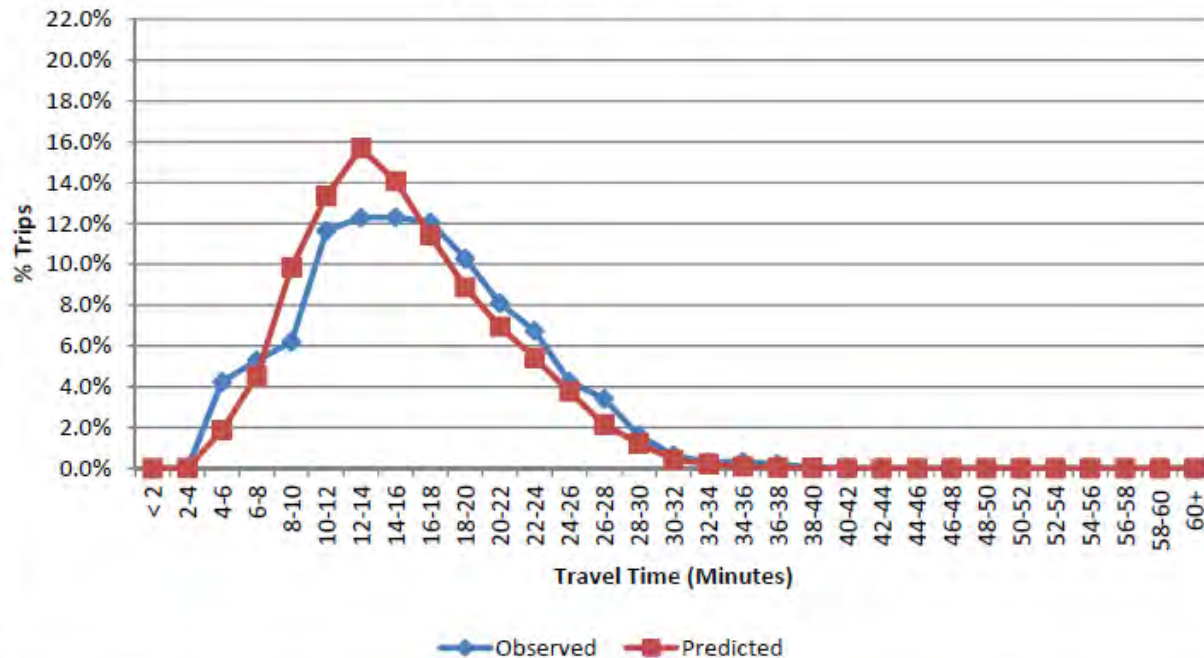


Figure 6-1 Observed and Predicted Trip Length Distribution for HBW Trips

Mode Split Model

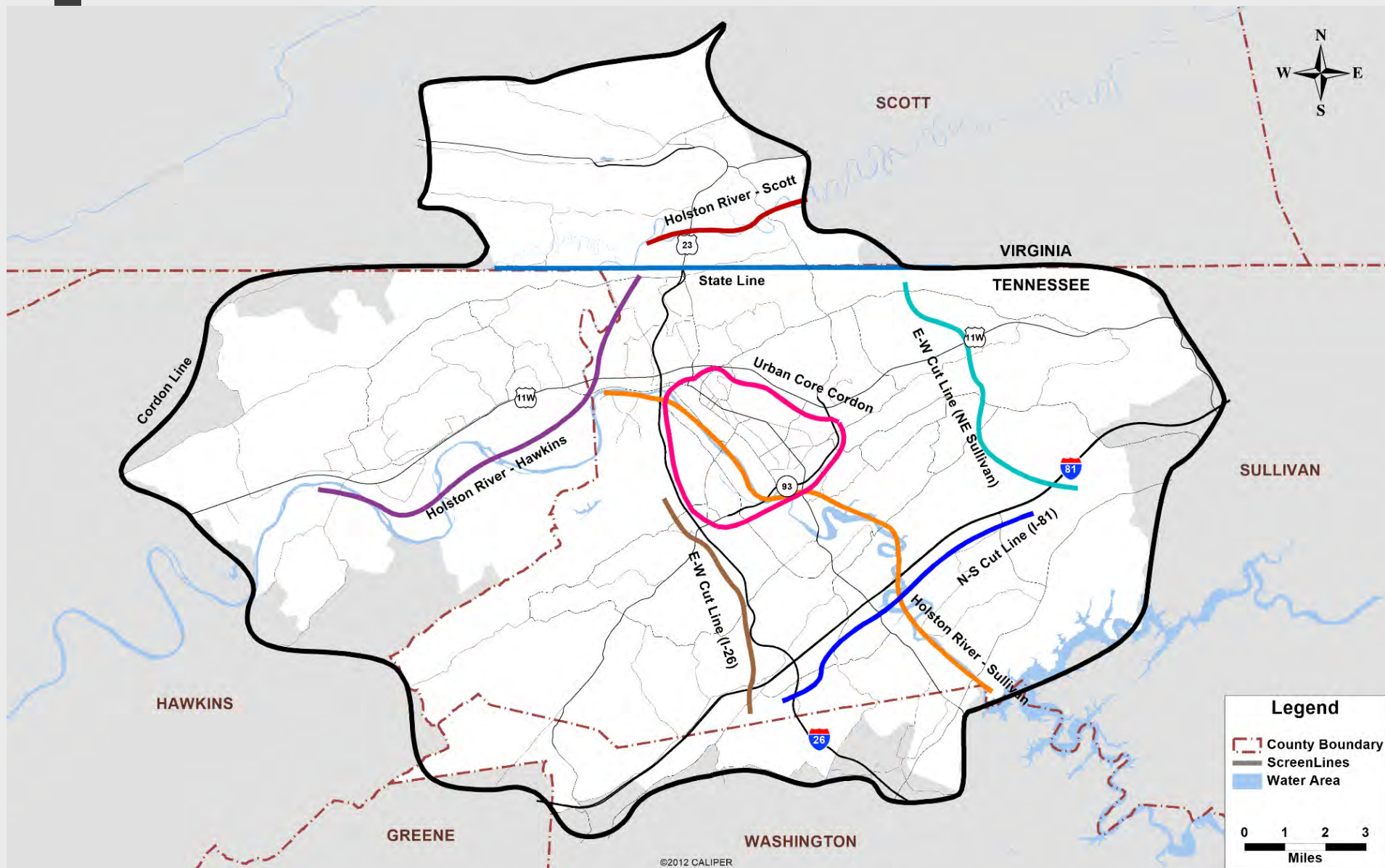
Table 7-1 Auto Mode Share by Travel Distance

P-A Distance	HBW	HBSC	HBSP	HBSR	HBO	NHB
0 - 0.5 miles	0.698	0.338	0.433	0.130	0.308	0.528
0.5 - 1 miles	0.698	0.412	0.669	0.160	0.541	0.697
1 - 2 miles	0.913	0.412	0.966	0.558	0.881	0.937
2 - 3 miles	0.913	0.602	0.988	0.822	0.984	0.963
3 - 4 miles	0.923	0.602	0.988	0.968	0.984	0.963
4 - 5 miles	0.923	0.602	0.988	0.968	0.984	0.963
> 5 miles	0.970	0.693	0.992	0.987	0.992	0.968

Table 7-2 Aggregated Auto Mode Share by Trip Purpose

Trip Purpose	Total Person Trips	Auto Mode Person Trips	Auto Mode Share
HBW	83,699	78,721	94.1%
HBSC	41,367	23,706	57.3%
HBSP	100,825	95,928	95.1%
HBSR	66,669	56,633	84.9%
HBO	79,116	74,970	94.8%
NHB	181,751	168,655	92.8%

Highway Assignment Validation



Highway Assignment Validation

Table 13-5 Volume-to-Count Percent Difference by Functional Classification

Roadway Functional Classification	Volume Per Day		Number of Traffic Count Locations	% Difference	
	Observed (Traffic Counts)	Model Estimated		Model Compared to Observed	TN Guidelines (Target)
Freeways	682,658	690,713	42	1.2%	7%
Principal Arterials	593,505	614,136	33	3.5%	15%
Minor Arterials	583,096	574,569	88	-1.5%	15%
Collectors	180,362	186,162	85	3.2%	25%
Total	2,039,621	2,065,581	248	1.3%	-

Table 13-9 Volume-to-Count Percent Difference at Screen Lines / Cut Lines

Screen Line Name	Volume (VPD)		Number of Traffic Count Locations	% Difference	
	Observed (Traffic Counts)	Model Estimated		Model Compared to Observed	TN Guidelines (Targets)
State Line	35,343	36,340	8	2.8%	15%
Holston River - Scott	29,300	29,469	2	0.6%	20%
Holston River - Hawkins	51,108	56,201	4	10.0%	15%
Holston River - Sullivan	136,354	133,415	12	-2.2%	10%
Urban Core Cordon	210,215	211,075	18	0.4%	10%
E-W Cut Line (I-26)	58,867	62,624	8	6.4%	15%
N-S Cut Line (I-81)	98,979	109,931	8	11.1%	15%
E-W Cut Line (NE Sullivan)	61,859	68,295	9	10.4%	15%
Cordon Line	228,918	229,331	38	0.2%	1%

Modeling Highway Projects

Project Coding Tools

Click and Query Tool:



Click a link on map

Browse Projects:

Alternative:

Sort By:

PRJ_ID	LRTP_ID	Year	PRJ_Name	Description
2025001		2025	W Sullivan St	Add center turn lane
2025002		2025	Yoma Rd	Widen shoulder/Improve geometry
2025003		2025	I-81	Add EB truck climbing lane
2025004		2025	Memorial Blvd	Widening to 4 lanes divided
2025005		2025	Memorial Blvd	Widening to 3 lanes
2025006		2025	Memorial Blvd	Widening to 3 lanes
2025007		2025	Rock Springs Rd	Widen to 3 lanes
2025008		2025	Proposed Indian Trail Dr	New 2-lane Road

Edit Project Attributes

Projects:

2025004

Shortcuts for Filling Project Info:

Project Description

Route

Born Year

From

To

TIP ID

LRTP ID

Description

Comment

Network Alternatives

E_Plus_C ☒

LRTP ☒

Vision ☒

ALT_1 ☒

ALT_2 ☒

Link Attributes

In Network ☒

Functional Class

Speed Limit

Median Type

AB Lanes

BA Lanes

AB Lane Width

BA Lane Width

AB Shoulder Width

BA Shoulder Width

AB Parking

BA Parking

Scenario Management Interface

Scenario Settings

Scenario Input Output



Loaded Scenario:

File Path: C:\KingsportTDM2040\Scenarios\2040 Vision.scn Load...

Scenario Description: 2040 Vision Evaluation

Target Year:

☐ 2015 ☐ 2025 ☒ 2040

Network Alternatives:

☐ E_Plus_C ☐ LRTP ☒ Vision ☐ ALT_1 ☐ ALT_2

Save Save As... Export File Paths Return (Don't Save)

Scenario Settings

Scenario Input Output

Default Input Folder:

Input Folder: C:\KingsportTDM2040\Input ... Apply Default

Model Initialization:

Highway Network: Kingsport_Master_Network_v1.dbd ...

TAZ Database: Kingsport_TAZ_2040_v1.dbd ...

HH/EMP Data Table: SE_Data_2040.bin ...

Project Table: Kingsport_Highway_Projects.bin ...

Capacity Alpha/Beta: Capacity_Equation_AlphaBeta.bin ...

Speed Factors: Speed_factors.bin ...

Trip Generation:

Trip Production Rates: Trip_Production_Rates.bin ...

Trip Attraction Rates: Trip_Attraction_Rates.bin ...

Trip Distribution / Time of Day:

Gravity Model: Gravity_Model_Parameters.bin ...

K Factors: Gravity_K_Factors.mtx ...

Time of Day Factors: TOD_Factors.bin ...

Mode Split/ PA to OD:

Mode Split: Mode_Split_Factors.bin ...

Dir. Splits/Veh. Occ.: TOD_Directional_Splits_Auto_Occupancy.bin ...

Assignment:

Agn Parameters: Assignment_Parameters.bin ...

Specific Turn Penalties: Link_Specific_Turn_Penalties.bin ...

Save Save As... Export File Paths Return (Don't Save)

Model Main Interface

Kingsport MTPO Travel Demand Model



Loaded Scenario:

Description: 2040 Vision Evaluation

Year: 2040

Alternative: Vision

Load...

Settings...

Run Step by Step:

Initialization

Trip Generation

Network/Skimming

Trip Distribution

Mode Split/PA to OD

Highway Assignment

Run All Steps with Feedback:

Start Loop: 1

Max Loop: 4

Run All

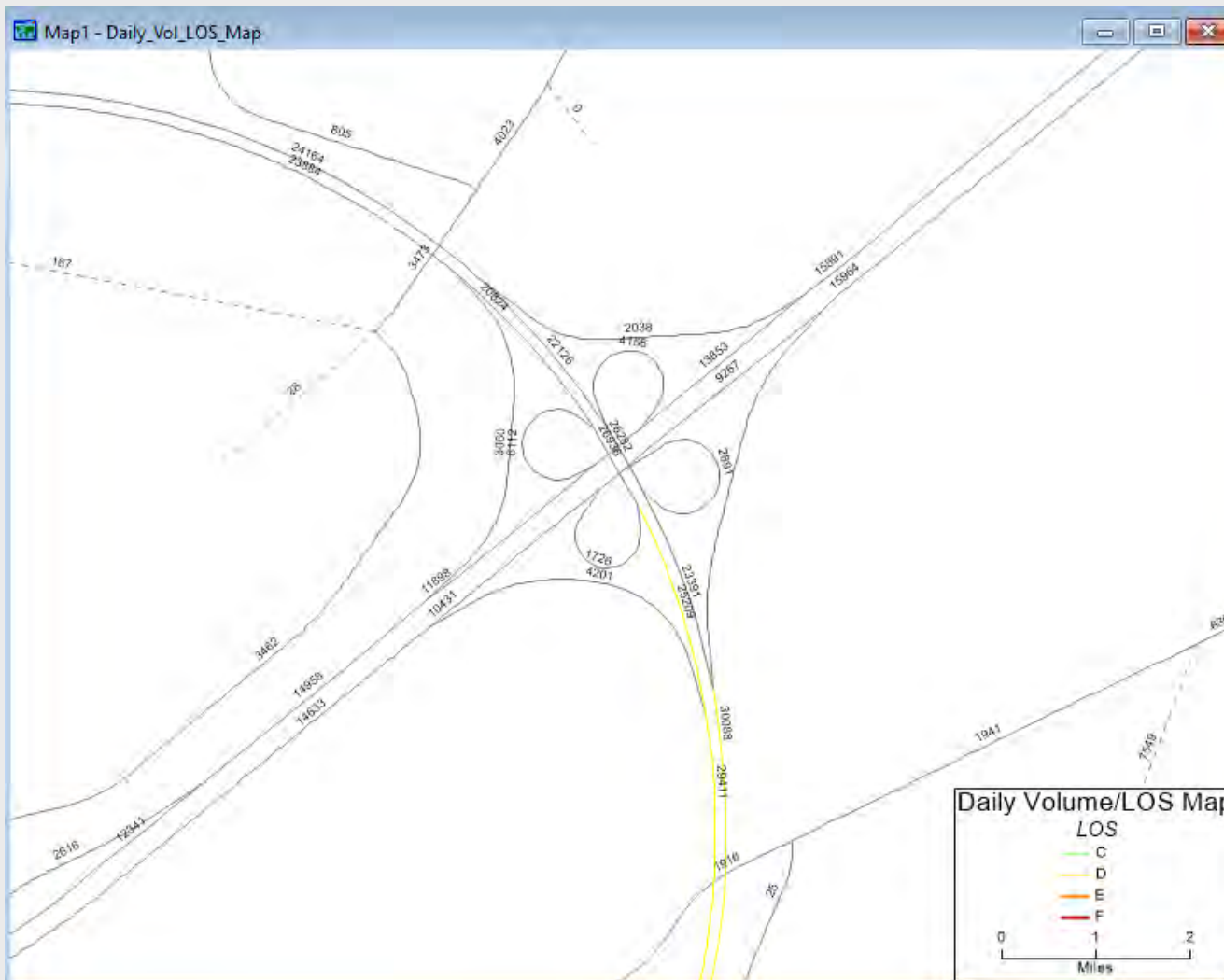
Maps and Utilities

Model Script Version: 11-10-2016

Open Log

Clear Log

Close



Traffic Forecast Post Processor

Forecast Traffic = Delta Traffic if Ratio > 2
 = Ratio Traffic if Ratio < 0.5
 = Average Traffic if $0.5 \leq \text{Ratio} \leq 2.0$

Whereas:

Forecast Traffic = Final Adjusted Forecast Traffic Based on Observed Counts

Base Traffic = Base Year Traffic Counts

Ratio = Future Year Model Volume / Base Year Model Volume

Delta = Future Year Model Volume - Base Year Model Volume

Ratio Traffic = Ratio * Base Traffic

Delta Traffic = Delta + Base Traffic

Average Traffic = $(\text{Ratio Traffic} * (2 - \text{Ratio}) + \text{Delta Traffic} * (\text{Ratio} - 0.5)) / 1.5$

Forecasting_PP

Input:

Base Traffic (Counts) - Layer: Field Name:

Base Year Model - Layer: Field Name:

Forecast Year Model - Layer: Field Name:

Output - Forecast Traffic Table:

...

Calculate Traffic Volumes Cancel

e_Model_Vol	Future_Model_Vol	Ratio	Delta	Ratio_Traffic	Delta_Traffic	Average_Traffic	Forecast_Traffic
26801	34450	1.29	7649.14	43525	41510	42470	42470
30564	36749	1.20	6184.56	39138	38736	38950	38950
35402	41444	1.17	6041.75	35857	36672	36221	36221
31182	36964	1.19	5782.37	34397	34798	34580	34580
30226	33822	1.12	3596.36	31709	31933	31801	31801
36412	43661	1.20	7248.98	33947	35560	34699	34699
27745	28079	1.19	5349.50	33428	33429	33428	33428
26012	28079	1.19	5349.60	33429	33429	33429	33429
28014	27926	1.17	5485.94	32609	33412	32966	32966
15595	27816	1.12	3663.67	31027	31480	31213	31213
16877	26165	1.20	5527.06	31341	31692	31504	31504
15389	24622	1.18	5417.37	29158	30039	29560	29560
27765	24622	1.18	5545.09	29161	30167	29620	29620

Input for MOVES Air Quality Modeling

■ What the Kingsport Model provides:

- *Ramp Fractions*
- *Vehicle Type VMT*
- *Road Type VMT Fractions*

13	AQ_report_Ramp_Fraction.bin	A table with Ramp Fraction by Road Type (Input for <u>MOVES AQ</u> model).
14	AQ_report_Ramp_Fraction.xls	An Excel version of Item 13 above.
15	AQ_report_Vehicle_Type_VMT.bin	A table with VMT by vehicle types (Input for <u>MOVES AQ</u> model).
16	AQ_report_Vehicle_Type_VMT.xls	An Excel version of Item 15 above.
17	AQ_report_Road_Type_VMTFraction.bin	A table with VMT Fraction by Road Type (Input for <u>MOVES AQ</u> model).
18	AQ_report_Road_Type_VMTFraction.xls	An Excel version of Item 17 above.