

Appendix E – Travel Demand Model Update

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Kingsport 2045 Long Range Transportation Plan

Kingsport Metropolitan Transportation Planning Organization

April 2022

Prepared for:

Kingsport Metropolitan Transportation Planning Organization



Prepared by: AECOM

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Kingsport MTPO Regional Model Review

Model Owner	Kingsport MTPO, TN			
- TDOT Contact Person	Mohammad Molla, PhD			
Model Developer	AECOM			
- Consultant Contact Person	Jim Meyer, AICP			
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Reviewed by (Name)	Mohammad Molla, PhD; Golnaz Sarram, PhD	Date 4-5-2022		
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Forecasting Office	motion	Apr 5, 2022		
Supervisor	Mohammad Molla (Apr 5, 2022 11:12 CDT)	1 , .		
Accepted by	Chris McPhilamy, GISP	Date		
Planning Application Manager	Chargen Ge	Apr 5, 2022		
Approved by	David Lee, PhD	Date		
Data Management Assistant Director	David Lee	Apr 12, 2022		

1. Introduction

AECOM was retained by the Kingsport Metropolitan Transportation Planning Organization (MTPO) to support the development of the 2045 Long Range Transportation Plan (LRTP) for the region. As part of this project, AECOM updated the previous travel demand model to the validated base year 2018 and horizon year of 2045. The previous model updated for the 2040 LRTP had the base year 2015 and horizon year 2040. The model is intended to be used as a planning tool to assist the MTPO staff in analyzing and forecasting travel demand.

The Model study area consists of the cities of Kingsport, Mount Carmel, and Church Hill, Tennessee; Weber City and Gate City, Virginia; and portions of Hawkins County, Sullivan County, Washington County and Greene County in Tennessee, and Scott County in Virginia.

This memorandum documents only the updates to the previous model and does not replace the model documents developed during the previous updates in 2016. For more detailed information of all steps of the model, users should refer to the following documents from the 2040 LRTP:

- 1. Technical Memorandum # 2, Base Year Model, Kimley Horn and RFM Transportation Consultants, November 14, 2016, Draft Version 1.2
- 2. Technical Memorandum # 3, Future Year Models, Kimley Horn RFM Transportation Consultants, November 30, 2016, Draft Version 1.1

The 2045 LRTP model updates were limited to changing the base year from 2015 to 2018, revalidating the model to the 2018 travel conditions and updating input files for the future years – horizon year 2045 and an interim year 2030. The primary input files are socioeconomic data and the highway network. See Appendix F for the SE model data.

This memorandum also describes new traffic data and the validation of the model to new data for the base year 2018. This document references the "Minimum Travel Demand Model Calibration and Validation Guidelines for State of Tennessee, updated 2016". This guideline is abbreviated as "TN Guidelines" in validation tables.

2. Traffic Analysis Zones (TAZ) and External Stations Updates

The Kingsport MTPO Metropolitan Planning Area (MPA) boundary was expanded slightly to accommodate road maintenance jurisdiction. The existing TAZs in the area were enlarged to include an expanded MPA boundary and external stations in those areas

were moved further out to accommodate the new boundary. Primary changes are in the southwest corner of the MPA to include a small portion of the Greene County. The number of total internal and numbering system remains the same. There are a total 193 internal TAZ, ranging from 1 to 196 (TAZ 109, 110, and 111 are skipped) as per old TAZ numbering system. There are 35 external zones in the model numbered from 501 to 535. The internal zones are grouped into 23 planning districts for demographic forecasts and validation statistics. **Figure 1** shows the old and expanded TAZ in the model. The green color shows where the MPA was expanded.





3. Socioeconomic Data Updates

The base year 2018 and future years 2030 and 2045 population, households and employment data were developed in coordination with the MTPO staff at the 23-district level system. The district to TAZ level allocation was made using the proportions developed using the 2040 LRTP data.

Table 1 shows the base year 2018 population and households along with forecasted values for 2030 and 2045. The change and percent change from the previous scenario year are also provided in the table. The population of the model area grows from 134,700 in 2018 to 144,000 in 2030 and to 156,100 by 2045. The total number of households increases from 63,500 in 2018 to 67,900 by 2030 and to 73,600 by 2045. This represents a growth of approximately 7 percent between 2018 and 2030 and 8.4 percent between 2030 and 2045. See Appendix F for detailed SE data by TAZ.

Veer Derulation Households		Cha	ange	% Change		
rear	ir Population Households		Population	Households	Population	Households
2018	134,677	63,542	na	na	na	na
2030	144,024	67,930	9,347	4,388	6.9%	6.9%
2045	156,086	73,552	12,061	5,623	8.4%	8.3%

Table 1: Population and Households Forecasts

Employment Data

Table 2 lists the 2018, 2030 and 2045 employment data by various categories and total employment used by the model along with the change and percent change from the previous scenario year. The total employment in the modeled area grows from 56,600 in 2018 to 61,700 by 2030 and 69,300 by 2045. This represents a growth rate of 9 percent between 2018 and 2030 and 12.4 percent between 2030 and 2045. Both rates are higher than population growth rates during the same periods. See Appendix F for detailed SE data by TAZ.

Voor	٨	Mfa	Potoil	Office	Service Gov	rvice Gov	Total Emp	Change	% Change
fedf	Agi	IVIIg	Reldii	Onte			TVICE GOV	TOLAI EMP	Total Emp
2018	3,813	13,022	6,697	8,655	22,336	2,032	56,554		
2030	4,317	13,317	7,206	9,495	25,239	2,125	61,698	5,144	9.1%
2045	4,998	13,823	7,951	10,795	29,508	2,257	69,331	7,634	12.4%

Table 2: Employment Forecasts by Category

School and College Enrollment

Table 3 provides a summary of the base year 2018 and future years 2030 and 2045 forecasted K-12 school and College enrollment for the study area along with growth from the previous scenario year. The K-12 enrollment is expected to grow by 2,300 (12.4%) between 2018 and 2030 and by 1,000 (4.6%) between 2030 and 2045. The college enrollment is expected to grow by 5% between 2018 and 2030 and by 7.1% between 2030 and 2045. See Appendix F for detailed SE data by TAZ.

Veer	Enrollment	Collogo	Callage			% Change	
rear	K12	College	K-12	College	K-12	College	
2018	18,714	10,300	na	na	na	na	
2030	21,037	10,815	2,323	515	12.4%	5.0%	
2045	21,998	11,588	961	773	4.6%	7.1%	

Table 3: School and College Enrollment Forecasts

4. 2018 Network Update

The Kingsport model uses the master network file to develop highway network for all scenario years in the model. In this system, one file maintains the records for all roadway links included in the base year 2018 as well as future years 2030 and 2045. AECOM updated the 2015 network to the new base year 2018 by incorporating roadway improvements that were completed between 2015 and 2018. **Table 4** lists the improvements that were added for 2018 network.

Table 4: Recent Improvements included in 2018 Network

PRJ_KEY_20	Route_Name	From	То	Description
101397.00	SR-75 (Airport Road)	SR-36	SR-357	Widen to 5 lanes including a TWLTL
13-TC_1	Sullivan Street West	Broad Street	Roller Street	Widen to 3 lanes including a TWLTL
City of Kingsport_1_2	Gibson Mill Road	Stone Drive	Robertson Street	Widen to 3 lanes including a TWLTL

The network was also modified to extend roadways in the expanded MPA boundary. **Figure 2**. The green color shows the new TAZ boundary, and the black color shows the old TAZ boundary.



Figure 2: Extension of existing roadway in the expanded MPA

5. 2017 National Household Travel Survey (NHTS) Data

The internal trip generation, trip distribution, and mode choice models for the Kingsport Model trips were developed using the 2009 National Household Travel Survey (NHTS) Data. During the 2009 data collection both Tennessee and Virginia participated in addon samples. There was a total of 3,135 households in the sample from the Metropolitan Statistics Area (MSA) having population of less than 500,000 in TN and VA. That data provided the basis for internal trip production rates based on various cross-classification schemes used for different trip purposes.

AECOM obtained and analyzed the 2017 NHTS data for this project. During the 2017 NHTS data collection, TDOT or VDOT did not purchase any add-on samples for the 2017 data. There were only 139 households in the sample in the MSA with less than a population of 500,000, compared to 3,135 households in 2009 NHTS. This low sample size did not provide statistically significant samples for calculating trip rates by a cross

classification scheme for six trip purposes employed by the model. AECOM calculated a total person trip rate and home-based work (HBW) trip rates from 2017 NHTS and compared with the rates from the 2009 NHTS used in model. **Table 5** provides this comparison. The 2017 NHTS based rates for all trips is 7.38 compared to 8.94 in the current model. The HBW trip rate from the 2017 NHTS is estimated to 1.57 compared to 1.28 in the current model. Due to the very low sample size in 2017 NHTS, it was decided to continue using the trips rates and other model estimated parameters in the current model.

Trip Purpose	2017 NHTS Trip Rate	Current Model (2009 NHTS)
All purposes	7.38	8.94
Home-Based Work	1.57	1.26

Table 5: Internal Person Trip Production Rates – 2009 vs 2017 NHTS

Source: 2009 and 2017 NHTS for MSA Size 1&2 in TN, VA

6. 2018 Traffic Counts

The base year model was validated to the 2018 travel patterns including traffic counts. The 2018 average annual daily traffic (AADT) volumes were provided by TDOT in an excel file with count station location coordinates. These counts were associated with the model network using a georeferenced GIS process. The 2018 counts provided by TDOT did not include a vehicle classification breakdown, but the 2019 database had AADT along with single unit (SU) trucks and combination units (CU) trucks for many locations. For locations with both 2018 and 2019 AADT, 2018 SU and CU vehicles were calculated using proportions from 2019 data. For the remaining 2019 locations with SU and CU data, a factor of 0.98 was applied to 2019 data to derive the 2018 numbers. The Virginia Department of Transportation's pathways for planning (p4p) site was accessed for traffic data in the Scott County portion of the model.

The AADT represents the two-way total volumes. For counts on major highways that are represented by directional links in the model network, such as I-81 and I-26, counts were divided by two and posted on each direction. Autos are calculated by subtracting SU and CU from the total AADT for each location. Extensive manual checks were carried out to remove duplicate and inconsistent counts or posting on wrong locations during the georeferencing process. The counts by time-periods were not compiled during this effort. There are 366 links in the network with 2018 AADT counts and 103 links with auto, SU and CU breakdown.

External Stations Traffic for 2018, 2030 and 2045

After posting all 2018 counts to the network some external locations, mostly small roads were 2018 missing counts. AECOM searched TDOT and VDOT counts databases for counts in nearby roadway segments and estimated the 2018 traffic at these external stations. The future year external ADT was developed by applying a growth rate to the base year 2018 external station counts. The growth rates developed during the previous model update were used to estimate 2030 and 2045 traffic forecasts for each external station. **Table 6** lists the external station traffic for 2018, 2030 and 2045 along with annual growth rates used for each location.

ID	Name	State	Fun Class	2018 ADT	Growth Rate	2030 ADT	2045 ADT
501	Caney Valley Road	TN	8	315	0.50%	334	360
502	Carters Valley Road	TN	8	1,224	0.97%	1,374	1,588
503	Highway11W	TN	14	15,368	1.68%	18,769	24,098
504	Millers Bluff Road	TN	8	204	0.50%	217	233
505	Goshen Valley Road	TN	8	282	0.50%	300	323
506	Beech Creek Road	TN	7	317	0.50%	336	362
507	Horton Highway	TN	8	599	0.50%	636	685
508	I-81	TN	1	31,195	0.99%	35,110	40,701
509	Jearoldstown Road	TN	8	1,015	0.50%	1,078	1,161
510	Highway 93	TN	6	2,167	1.63%	2,631	3,353
511	Fordtown Road	TN	6	906	0.50%	962	1,037
512	Harmony Road	TN	8	2,030	0.50%	2,155	2,323
513	Ford Creek Road	TN	17	508	0.50%	539	581
514	Gray Station Road	TN	17	1,660	0.50%	1,762	1,899
515	Suncrest Drive	TN	16	14,476	1.81%	17,953	23,496
516	I-26	TN	11	59,280	0.70%	64,456	71,566
517	Old Gray Station Road	TN	17	3,478	3.00%	4,959	7,726
518	Kingsport Highway	TN	14	13,167	2.00%	16,699	22,475
519	Muddy Creek Road	TN	9	1,674	0.93%	1,871	2,149
520	Highway 75	TN	6	5,754	1.65%	7,003	8,951
521	Highway 126	TN	6	3,593	0.52%	3,824	4,133
522	Highway 394	TN	2	17,966	1.34%	21,078	25,736
523	I-81	TN	1	36,530	0.57%	39,108	42,589
524	Highway 11W	TN	2	11,120	0.92%	12,412	14,239
525	Esterville Rd	VA	19	30	0.50%	32	34
526	East Carter's Valley Rd	VA	9	390	0.50%	414	446
527	Kingsport Highway	VA	2	3,075	0.75%	3,363	3,762
528	Nicklesville Highway	VA	16	3,900	0.75%	4,266	4,772
529	Veteran's Memorial Highway	VA	6	2,000	0.50%	2,123	2,288
530	Manville Road	VA	8	230	0.50%	244	263
531	Daniel Boone Heritage Highwa	уVА	2	13,282	0.24%	13,670	14,170
532	Daniel Boone Trail	VA	7	390	0.50%	414	446
533	Yuma Road	VA	8	660	0.50%	701	755
534	State Route 635	VA	9	90	0.50%	96	103
535	State Route 632	VA	9	230	0.50%	244	263

Table 6: External Station ADTs

7. Travel Speeds Review

TDOT provided the INRIX speed data file for 2019 with speed data in 15-minutes interval for the entire year for major roadways for the northern Tennessee (we do not expect any major differences in speed data between 2018 and 2019). AECOM selected a weekday in November to compare AM peak period speeds for a quick check on model estimated speeds vs observed speeds. There are 147 INRIX segments in the Kingsport MTPO area which were extracted from the larger database. The average speeds for 7 to 8 AM (four 15-minute intervals) were calculated for each segment and plotted on a map in various speed bins. The model estimated congested speeds for the AM peak period were also mapped using the same speed bins. The network includes many local roads that are not in the INRIX database so some of these network links were hidden to make visual comparison easy. **Figure 3** depicts a comparison between INRIX and model estimated speeds on major roadways and shows a generally reasonable match. During the highway assignment validation some adjustments to the model estimated speeds were made to obtain a better validation with traffic counts.





8. 2018 Validation

The base year 2018 model validation checks were conducted against the "Minimum Travel Demand Model Calibration and Validation Guidelines for State of Tennessee, updated 2016" referenced as TN Guidelines in the tables.

The validation is an iterative process of adjusting model parameters to obtain a better match between observed and model estimated values. Some of the changes made during 2018 highway validation included:

- 1. Adjustments to free flow speed
- 2. Review of counts and correcting errors
- 3. Checking and correcting network coding.

After correcting the network and traffic counts errors, the speed adjustments were the primary method for model validation. Two types of speed adjustments were made: global speed adjustment factors which are applied to network by functional class and area type and link specific speed override; both are described below.

<u>Global adjustments to free flow speeds</u>: The model uses posted speed on each link along with speed adjustment factors to estimate a free flow speed – the speed of traffic when there is very little traffic on the road. AECOM changed some of these adjustment factors used in the previous 2015 model validation. The changed cells are highlighted in **Table 7** below. Primarily interstate and major arterial adjustment factors were lowered from the previous version of the factors to improve model performance against the observed 2018 counts.

Facility Type / Area Type	CBD	Urban	Suburban	Rural
Interstate	1.00	1.00	1.00	1.00
Major Arterial (Posted Speed >= 45 mph	1.00	1.15	1.05	1.05
Major Arterial (Posted Speed < 45 mph)	0.98	1.08	1.05	1.05
Minor Arterial (Posted Speed >= 45 mph	1.00	1.12	1.15	1.15
Minor Arterial (Posted Speed < 45 mph)	0.98	1.08	1.10	1.12
Collector	0.95	1.05	1.10	1.10
Local	0.95	1.05	1.10	1.10

Table 7: Free Flow Speed Adjustment Factors

<u>Free flow speed override</u>: The model is also setup to override the free flow speed calculated using posted speed and adjustment factors listed above. The user can insert

a value that will override the model calculated value. AECOM used this approach to override free flow speed on three corridors listed in **Table 8.**

Roadway Name	Segment Termini	Posted Speed	FF Speed Override
1-26	Eastern Star Road to External End	70	65
Hwy 126	I-81 to Hawthorne St.	45	40
Hwy 394	I-81 to Hwy 11	55	40

Table 8: Free Flow Speed Override Segments

Trip Generation Validation

The trip production models were applied using the year 2018 demographic data. **Table 9** compares the aggregate person trip rates per TAZ, person, households, and employee with those contained in the TN Guidelines. Values for person trips per TAZ, person trips per household, and HBW trips per employee are within the range of values described in the TN Guidelines. The value of 4.2 trips per person is high in comparison to the TN Guidelines.

 Table 9:
 Aggregate Trip Generation Validation

PURPOSE	Kingsport	TN Guidelines			
	woder	Low	High		
Person Trips/TAZ*	2,923	N/A	15000		
Person Trips/ Person	4.19	3.3	4		
Person Trips/DU (or HH)	8.88	8	10		
HBW Person Trips/Employee	1.51	1.20	1.55		

* average trips per TAZ; there are 3 TAZ with trip attractions higher than 15,000

The percent of trips by trip purpose after applying the trip production models are listed in **Table 10** and compared them with the values from the TN Guidelines. The results show general consistency and fit within the range described in the TN Guidelines.

Trip Purpose	Purpose	Percent	TN Guidelines
Home Base Work	HBW	15.1%	12-24%
Home Based School	HBSC	7.5%	5-8%
Home Based Shopping	HBSP	18.2%	10-20%
Home Based Social Recreational	HBSR	12.1%	9-12%
Home Based Others	HBO	14.3%	14-28%
Non Home Based	NHB	32.8%	20-33%

Table 10:	Percent	Trips	by Tri	p Purpose
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Average Trip Lengths

Table 11 compares the model estimated average trip lengths against the TN Guidelines by trip purposes. The 2010 CTPP data for HBWS trips is also included as a reference. The comparison shows a reasonable match between model results and observed trip lengths for work trips and the model estimated average times for all trip purposes are within ranges in TN Guidelines.

	Average Travel Time (minutes)				
Trip Purpose	Observed (CTPP 2010)	Model Predicted	TN Guidelines		
HBW	16.10	15.65	12-35		
HBSC	-	11.27	7-16		
HBSP	-	12.82	9-19		
HBSR	-	13.18	11-19		
НВО	-	13.56	8-20		
NHB	-	12.72	6-19		

 Table 11: Average Trip Lengths by Trip Purpose

8.1 Highway Assignment Validation

This section presents the final highway assignment validation results after the model validation adjustments listed above. The highway assignment results were validated at varying levels of aggregation, based on the requirements from the TN Guidelines.

Vehicle Miles of Travel (VMT)

The HPMS data within the model study area in Tennessee and Virginia were reviewed from TDOT and VDOT website. The HPMS link level data for 2018 VMT are not available from FHWA yet for the model area but TDOT has county level VMT available for all past years up to 2019. AECOM compared the 2018 and 2015 VMT for the six counties around

the Kingsport MTPO. Based on this analysis, 2018 VMT for the modeled area was calculated by applying a 1.04 factor to the 2015 observed VMT by functional class. VMT for local roads cannot be directly interpolated as not all local roads are included in the model. The percentage of VMT on local roads in HPMS data was used to estimate the local road VMTs within the model boundary.

As shown in **Table 12**, region wide, the current model produces a per capita VMT of 28.2 and VMT per household of 59.7. The VMT per Person model estimate is within the acceptable range. The VMT per Household of 59.7 is slightly below the low end of the range (60.0), but for modeling purposes this would generally be considered as an acceptable estimate compared to the ranges provided by TN Guidelines.

Regional VMT	Model	TN Guidelines
VMT per Person	28.2	24-32
VMT per Household	59.7	60-75

Table 12: VMT per Person and Household

Table 13 shows comparison of observed and model estimated VMT by functional class. The overall model estimate is 1% higher than the observed VMT and percent difference for each functional class is also within the reasonable ranges provided by TN Guidelines.

Facility Type	Observed	Model	% Difference	TN Guidelines
Freeway	1,114,161	1,079,382	-3.1%	7%
Major Arterial	1,093,042	1,090,605	-0.2%	15%
Minor Arterial	783,342	815,089	4.1%	15%
Collector	225,276	259,763	15.3%	25%
Total	3,215,820	3,244,839	0.9%	5%

Table 13: VMT by Functional Classification

Table 14 compares the daily volumes with targets by functional classification. **Table 15** presents the model volumes and validation targets by volume groups. The results show that the model effectively estimates model volumes both by functional classification and volume group.

	Volume	Per Day	% Difference		erence
Roadway Functional Classification	Observed (Traffic Counts)	Model Estimated	Number of Traffic Count Locations	Model compared to observed	TN Guidelines (Target)
Freeway	758,416	751,585	47	-0.9%	7%
Major Arterial	1,201,079	1,248,025	63	3.9%	15%
Minor Arterial	559,779	537,277	79	-4.0%	15%
Collector	171,021	173,538	87	1.5%	25%
Total	2,690,295	2,710,425	276	0.7%	5%

Table 14: Volume-to-Count Percent Difference by Functional Classification

Table 15: Percent Difference Volume Targets by Daily Volume Groups

	Volume	e Per Day	% Di		erence	
Volume Group	Observed (Traffic counts)	Model Estimated	Number of Traffic Count Locations	Model compared to observed	TN Guide lines (FHWA Targets)	
< 1000	21,532	33,312	39	54.7%	200%	
1000 - 2500	62,279	58,123	38	-6.7%	100%	
2500 - 5000	152,903	154,905	45	1.3%	50%	
5000-10000	257,588	244,706	33	-5.0%	25%	
10000 - 25000	1,069,514	1,091,869	70	2.1%	20%	
25000 - 50000	965,145	951,573	45	-1.4%	15%	
> 50000	161,334	175,937	6	9.1%	10%	
Total	2,690,295	2,710,425	276	0.7%	na	

Table 16 shows the root mean square error (RMSE) values by functional classification. All RMSE errors are below the target values provided by TN Guidelines, except for minor arterial. Overall, the modeled %RMSE is 27.1%, which is considered very good.

Table 16: Root Mean Square Error (RMSE) by Functional Classification

	Number of	% RMSE		
Roadway Functional Classification	Traffic Count Locations	Model Compared to Observed	TN Guidelines (Small Region)	
Freeway	47	12.9%	20%	
Major Arterial	63	19.2%	30%	
Minor Arterial	79	44.0%	40%	
Collector	87	57.8%	70%	
Total	276	27.1%	45%	

Table 17Shows the %RMSE values by volume groups which are below the targetvalues provided by TN Guidelines in all volume groups.

	Number of	% R	MSE
Volume Group	Traffic Count Locations	Model Compared to Observed	TN Guidelines (Target)
< 5000	122	78.6%	100%
5000 - 10000	33	36.1%	45%
10000 - 15000	30	24.0%	35%
15000 - 20000	18	27.3%	30%
20000 - 30000	40	19.1%	27%
30000 - 50000	27	10.4%	25%
50000 - 60000	6	11.3%	20%
Total	276	27.1%	45%

 Table 17: Root Mean Square Error (RMSE) by Volume Group

Screen Line and Cut Line Volumes

As a part of the model calibration and validation process, six screen lines that were developed for the Kingsport model during 2015 model validation were used for the 2018 validation checks. The screen line analysis gauges how well the model replicates traffic between different areas within the MPO area. **Figure 4** shows the screen line locations. **Table 18** shows the percent errors at screen lines. All screen line and cut line locations, except E-W Cutline (NE Sullivan) and N-S Cut Line (I-81), fell within the TN Guideline targets.



Figure 4: Screen Line Locations

Source: Technical Memorandum # 2, Base Year Model, Kimley Horn and RFM Transportation Consultants, November 14, 2016, Draft Version 1.2

Table 18: Volume-to-Count Percent Difference at Screen Lines / Cut Lines

	Volume per Day			% Diffe	erence
Screen Line Name	Observed (Traffic Counts)	Model Estimated	Number of Traffic Count Locations	Model compared to Observed	TN Guidelines (FHWA Targets)
State Line	33,903	32,991	4	-2.7%	20%
Holston River - Scott	30,043	29,152	2	-3.0%	20%
Holston River - Hawkins	41,915	43,725	3	4.3%	15%
Holston River - Sullivan	118,096	127,506	9	8.0%	10%
Urban Core Cordon	161,739	157,052	14	-2.9%	10%
E-W Cut Line (I-26)	58,674	64,630	8	10.2%	15%
N-S Cut Line (I-81)	91,715	102,048	7	11.3%	10%
E-W Cut Line (NE Sullivan)	40,109	49,499	7	23.4%	15%
Cordon Line	250,598	249,106	38	-0.6%	1%

Based on all validation checks perfromed for the base year 2018, the Kingsport Model is considered reasonably well validated with the observed travel pattern.

FUTURE YEAR MODELS

This section describes the development of future year network and presents the results of the future year models. An interim year of 2030 and a horizon year of 2045 were selected for this analysis. The future year model results are compared with the base year 2018 model results.

FUTURE YEAR HIGHWAY NETWORK DEVELOPMENT

Development of the future year highway network includes identifying the future year roadway improvement projects and coding the projects based on the location and improvement type. In the Kingsport model, a master network and a project table are used to organize the future year network improvements. This approach greatly simplifies the future year scenario management.

Existing + Committed Projects

Ten projects listed in **Table 19** were identified in existing plus committed (E+C) scenario that were added into the master network to prepare future year networks for 2030 and 2045. A new project file (project.bin) was created with required link attributes as model input file for these projects. A new project ID was placed on appropriate links in the master network to read the project file during the model run.

Proj_ID	PRJ_KEY	Route_Name	From	То	Description	First Model Year
2030001	112834.03	SR-93 (Sullivan Gardens Parkway)	Derby Drive	Murrell Road	Widen to 2 lanes with two-way left turn lane	2030
2030002	L43	Jared Drive	Moreland Drive	Riverport Road	New 2 lane Road	2030
2030003	112965.00_2	Rock Springs Road	Westfield Place	I-26	Widen to 2 lanes with two-way left turn lane	2030
2030004	112834.01	SR-93 (Sullivan Gardens Parkway)	Near Fire Hall Road	Near Davis Road	Widen to 2 lanes with two-way left turn lane	2030
2030005	114173.00	I-81NB	MM 60	MM63	Widen to add Truck Climbing Lane	2030
2030006	City of Kingsport_7	Spring Meadow Court/Park Meadow Place	Wilcox Drive	Meadowview Parkway	New Roadway	2030
2045001	105467.01_1	SR-126 (Memorial Boulevard)	East Center Street	Harbor Chapel Road	Widen to 4 lanes	2045
2045002	105467.01_2A	SR-126 (Memorial Boulevard)	Harbor Chapel Road	Old Stage Road	Widen to 2 lanes EB, 1 lane WB and a two-way left turn lane	2045
2045003	105467.01_2B	SR-126 (Memorial Boulevard)	Old Stage Road	Cooks Valley Road	Widen to 2 lanes with two-way left turn lane	2045
2045004	124663.00	Fort Henry Drive (SR-36)	1-81	Airport Road (SR-75)	Widen to 5 lanes with two-way left turn lane	2045

Table 19:	Existing +	Committed	Projects
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FUTURE YEAR MODEL RESULTS

Future year 2030 and 2045 E+C model runs were conducted using the future year demographic and employment forecasts along with the E+C network. Additional details regarding the SE projections are included in the 2045 LRTP. This section summarizes the highway assignment results for the 2030 and 2045 E+C scenarios. The Vehicle Miles of Travel (VMT) are summarized by roadway functional classification and districts and compared with the base year 2018 results. The model predicted traffic volumes crossing screen lines and cut lines are also compared with the base year 2018 results.

Regional VMT

Table 20 shows a comparison of the base year 2018, 2030 and 2045 average VMT per capita and per household estimated by the model. The 2045 model predicted VMT per capita of 29.5 and VMT per household of 62.6, which shows a modest increase from the base.

Regional VMT with local	2018 Model	2030 Model	2045 Model
VMT per Person	28.2	28.6	29.5
VMT per Household	59.7	60.7	62.6

Table 20: Comparison of VMT per Person and Household

Table 21 compares the 2030 and 2045 VMT by functional classification with 2018. Overall, the regional VMT increased by 22.3% from 2018 to 2045. VMT growth is estimated to be 9.7% between 2018 and 2030 and 11.5% between 2030 and 2045.

		VMT		% Change	% Change	% Change
Functional Classification	2018 Observed	2030 Model Estimated	2045 Model Estimated	from 2018 to 2030	from 2030 to 2045	from 2018 to 2045
Freeway	1,114,161	1,158,135	1,280,794	3.9%	10.6%	15.0%
Major Arterial	1,093,042	1,192,019	1,343,698	9.1%	12.7%	22.9%
Minor Arterial	783,342	893,037	995,342	14.0%	11.5%	27.1%
Collector	225,276	283,049	312,542	25.6%	10.4%	38.7%
Total	3,215,820	3,526,241	3,932,377	9.7%	11.5%	22.3%

Table 21: Future Year VMT by Functional Classification

VMT by Districts

Table 22 shows a comparison of the model years VMT at a district level using the 23 subareas defined during the development of demographic data. Fordtown/Spurgeon, Arcadia/Central Heights and Mount Carmel/Church Hill districts shows higher growth in traffic and VMT.

		Model VMT		% Change	% Change	% Change
District Name	2018	2030	2045	from 2018 to 2030	from 2030 to 2045	from 2018 to 2045
Gate City / Weber City	107,291	110,976	114,953	3.4%	3.6%	7.1%
Scott County Remainder	168,474	174,320	183,148	3.5%	5.1%	8.7%
Mount Carmel / Church Hill	156,992	174,045	199,881	10.9%	14.8%	27.3%
Hawkins County Remainder	109,256	123,292	146,073	12.8%	18.5%	33.7%
Granby / North Fork / County Line	53,148	55,287	57,860	4.0%	4.7%	8.9%
Ridgefields / Rotherwood / Ft. Robinson Area	163,804	170,305	183,120	4.0%	7.5%	11.8%
Lynn Garden	131,053	138,388	145,586	5.6%	5.2%	11.1%
Downtown	218,168	233,508	257,123	7.0%	10.1%	17.9%
East Stone Drive	176,462	188,127	205,629	6.6%	9.3%	16.5%
Bloomingdale	92,726	103,016	111,879	11.1%	8.6%	20.7%
Orebank	27,846	30,483	34,327	9.5%	12.6%	23.3%
Arcadia / Central Heights	200,264	234,135	272,507	16.9%	16.4%	36.1%
Preston Forest	101,126	107,939	118,811	6.7%	10.1%	17.5%
Chestnut Ridge / Cooks Valley	43,278	46,416	52,556	7.3%	13.2%	21.4%
Fall Creek / Indian Springs / Interstate 81	121,245	129,754	141,069	7.0%	8.7%	16.4%
Tri-Cities Airport / Interstate 81	159,098	174,776	197,922	9.9%	13.2%	24.4%
Fordtown / Spurgeon / Washington County	109,208	127,653	168,036	16.9%	31.6%	53.9%
Colonial Heights	292,526	323,613	356,630	10.6%	10.2%	21.9%
Rock Springs / Interstate 81 / Washington County	313,262	345,067	388,813	10.2%	12.7%	24.1%
Pactolus / Moreland Dr.	79,557	84,723	94,716	6.5%	11.8%	19.1%
Fall Branch and Vicinity	103,937	116,799	133,809	12.4%	14.6%	28.7%
Sullivin Gardens / North Rock Springs	170,778	179,008	197,132	4.8%	10.1%	15.4%
Eastman / Meadowview	144,810	154,048	170,189	6.4%	10.5%	17.5%

Table 22: District VMT Results Comparison

Estimated Traffic at Screen Lines/Cut Lines

Table 23 shows the comparison of model predicted traffic volumes at the screen lines and cut lines. The location of the screen and cut lines is shown in **Figure 6** earlier in this memo.

Table 23: Estimated Traffic Volume at Screen line /Cut Lines

Screen line /Cut Lines Name	Model Pre	edicted Volum	ne Per day	% Change from 2018 to	% Change from 2030 to	% Change from 2018
	2018	2030	2045	2030	2045	to 2045
State Line	32,991	34,188	35,647	3.6%	4.3%	8.1%
Holston River - Scott	29,152	29,820	30,785	2.3%	3.2%	5.6%
Holston River - Hawkins	43,725	45,411	47,659	3.9%	5.0%	9.0%
Holston River - Sullivan	127,506	138,868	153,546	8.9%	10.6%	20.4%
Urban Core Cordon	157,052	168,047	185,163	7.0%	10.2%	17.9%
E-W Cut Line (I-26)	64,630	70,807	79,213	9.6%	11.9%	22.6%
N-S Cut Line (I-81)	102,048	113,057	131,270	10.8%	16.1%	28.6%
E-W Cut Line (NE Sullivan)	49,499	55,055	61,836	11.2%	12.3%	24.9%
Cordon Line	249,106	281,134	329,067	12.9%	17.0%	32.1%

Estimated Congestion Hot-spots and Level of Service (LOS)

The level of service (LOS) for roadways was developed based on the 2030 E+C and 2045 E+C model results. The level of service is categorized as the following four levels based on the volume to capacity ratio (V/C ratio) at the daily level:

LOS F: V/C Ratio \ge 1.0 LOS E: 0.85 \le V/C Ratio < 1.0 LOS D: 0.7 \le V/C Ratio < 0.85 LOS C or Better: V/C Ratio < 0.7

Figures 7, 8 and 9 depict the LOS maps for the years 2018, 2030 E+C and 2045 E+C scenarios, respectively. These maps were used to identify congestion hot spots.





