KINGSPORT METROPOLITAN TRANSPORTATION PLANNING ORGANIZATION

2040 Long Range Transportation Plan (LRTP)

Appendix

June 2017

Appendix I

i. Public Meeting Notices and Advertisements

ii. Public Meeting and Stakeholder Meeting Sign-in Sheets

iii. Public Meeting Presentation and Materials

iv. MTPO Board Meeting Agendas and Materials

v. Online Survey Results

vi. Financial Plan Documentation

vii. Travel Demand Model Development Report

Public Meeting Notices & Advertisements

Hawkins residents encouraged to attend long-range transportation plan meetings

Posted: Tuesday, October 4, 2016 11:28 am

By Joel Spears Managing Editor

KINGSPORT—Hawkins County residents are invited to chime in on the Kingsport area's long-range transportation plan.

The Kingsport Metro Transportation Planning Organization (MTPO) has invited the public to a series of meetings, including one that will take place in Hawkins County, to make comments and submit questions concerning the future plan.

"In addition to staff level analysis of our current and future infrastructure, we're reaching out to citizens for their thoughts and suggestions," Kingsport media specialist Adrienne Batara said in a press release. "Citizens drive, walk, bike or ride in a vehicle every day and know other people that utilize our transportation network."

There will be three meetings and the public is encouraged to drop in and share their thoughts. They will be held as follows:

October 5 — 10 a.m.-2 p.m., Kingsport Improvement Building, 201 W. Market Street.

October 5 — 4:30-7:30 p.m., ETSU at Kingsport (Allandale), 1501 University Blvd.

October 5 — 4:30-7:30 p.m., Scott County VA Board of Supervisors Auditorium, 336 Water St, Gate City, Va.

The meetings were made possible from the assistance of RPM Transportation Associates and the Planning District Commission (PDC).

For more information, contact MTPO at (423) 224-2670.

10/5/2016 Whats New with KMTPO | City of Kingsport Tennessee Metro Transportation Planning

Contact Where is Kingsport? Calendar Jobs A-Z Index Site Map

Our Community I Want To... City Hall Departments

WHATS NEW WITH KMTPO

MTPO

- Whats New with KMTPO
- About Us
- What We Do
- Meetings / Notices
- Plans and Documents
- ATRA
- Bicycle and Pedestrian Trails
- Kingsport Birding Trail
- Maps and Geographic Data
- ARRA
- Contracting Opportunities
- Air Quality
- Civil Rights
- DBE
- Other Area MTPO's
- TDOT Construction Projects Updates

CONTACT

Address:
201 West Market Street
Kingsport, TN 37660
Phone:
(423) 229-9332
Email:
Kingsport MTPO

You are Home Whats New with KMTPO

Whats New with KMTPO

NOTICE OF PUBLIC MEETINGS

The public is invited to make comments and submit questions concerning the

KINGSPORT AREA LONG-RANGE TRANSPORTATION PLAN

Tuesday, October 4, 2016; 4:30 p.m. to 7:30 p.m.

LaQuinta Inn & Suites, 10150 Airport Pky., Kingsport &
Kingsport Public Library Mead Auditorium,
400 Broad St. – Downtown Kingsport

Wednesday, October 5, 2016;
10:00 a.m. to 2:00 p.m.
Improvement Building, 201 W. Market St., Kingsport
Bob Clear Conference Room
4:30 p.m. to 7:30 p.m.
Kingsport University Center, 1501 University Blvd., Kingsport &
Gate City; Scott Co. VA Board of Supervisors Auditorium 336
Water St., Gate City, VA

This is a drop in event. For more information call the Kingsport MTPO at (423) 224-2677 or (423) 224-2670

To participate in the 2040 Long Range Transportation Plan Survey
CLICK HERE

News

Kingsport seeking input on transportation plan

By: Karthik Venkataraman

Posted: Oct 05, 2016 05:57 PM EDT
Updated: Oct 05, 2016 06:00 PM EDT

KINGSPORT, Tenn. - Kingsport is on the verge of producing a Long Range Transportation Plan for the city, but first they want public input.

The plan addresses not just roads, but also walking and biking trails.

"We want them to respond, we want their ideas, we want their concerns. We really want those to come out even if they don't make the meetings to come by and see us in our offices or email," said Kingsport Metro Transportation Planning Organization Planning Manager, Bill Albright.

If you want to voice your opinion a public hearing will be held October 5 in Kingsport and Gate City.

October 5 - 4:30 p.m. to 7:30 p.m. at the Kingsport University Center, located at 1501 University Blvd, Kingsport.

October 5 - 4:30 p.m. to 7:30 p.m. at the Scott County VA Board of Supervisors Auditorium, located at 336 Water St, Gate City, VA.

You can give input at https://www.surveymonkey.com/r/KingsportTransportationSurvey or email them at MTPO@kingsporttn.gov.

WCYB

Kingsport asking for public input on transportation issues

By Elizabeth Kuebel
Published: October 4, 2016, 3:20 pm

KINGSPORT, TN (WJHL) – The Kingsport Metro Transportation Planning Organization (MTPO) is asking the public for input regarding transportation issues in the area.

MTPO is hosting a series of meetings Tuesday and Wednesday, to find out what areas or projects the public wants fixed. Transportation Planning Manager for Kingsport MTPO, Bill Albright, says that may include traffic flow, safety or accessibility.

"We want to hear from people, understand what their concerns are, what their needs are, and maybe some recommendations for improvement," said Albright.

The public meetings are scheduled for October 4 from 4:30 to 7:30 p.m. at the Kingsport LaQuinta Inn and Suites and at the Kingsport Public Library. On October 5, one meeting will be held at the Kingsport Improvement Building on W. Market Street from 10 to 2 p.m. and two meetings from 4:30 to 7:30 p.m. at the Kingsport University Center and at the Scott County VA Board of Supervisors Auditorium.

Albright said the transportation plan is not yet in place, as MTPO is awaiting the public feedback.

Albright said he hopes to have a plan drafted by winter time.

Public Meeting and Stakeholder Meeting Sign-in Sheets

Sign-In Sheet

Kingsport MTPO 2040 Long Range Transportation Plan
Growth and Development Meeting
February 9, 2016

Name	Agency	Email
Corey Shepherd	City of Kingsport	CoreyShepherd@KingsportTN.gov
Lynda Tully	"	LyndaTully@KingsportTN.GOV
Ken Weems	"	KenWeems@Kingsporttn.gov
Justin Steinmann	KPT	steinmannj@kingsporttn.gov
Cory Osborne	First TN RPO	Cosborne@ftdd.org

Transportation Consultants

2040 Long Range Plan Stakeholders Meetings

Monday March 21, 2016

Freight & Logistics 10:30AM

	NAME	COMPANY	PHONE	EMAIL
1	Mark Canty	Tri-Cities Regional Airport	(423) 367-2345	mcanty@TRIflight.com
2	KEVIN COLE	I-81 CORRIDOR COALITION	540-315-5967	KCOLE@VTTI.VT.EDU
3	Rick Sizemore	Averitt Express	(423-612-1198 423-349-7111)	rsizemore@averittexpress.com
4	Ken Marsh	Rail Solutions	423-288-4321	Bookends@CHARTER.NET
5	Bill Albright	KPT. MTPO	(423) 224-2611	billalbright@kingsportTN.gov
6	DONNY NECESSARY	VDOT	(276) 696-3282	Donald.Necessary@VDOT.VIRGINIA.GOV
7	TRoy Ebbert	KPT MTPO	(423) 224-2670	Troy ebbert@ kingsportTN.gov
8				
9				
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Transportation Consultants

2040 Long Range Plan Stakeholders Meetings

Monday March 21, 2016

AREA MPO CONFERENCE CALL 1:00pm

	NAME	COMPANY	PHONE	EMAIL
1	Glenn Berry	JCMTPO		
2	Mary Butler	JCMTPO		
3	David Metzger	BMPO		
4	Rex Montgomery	BMPO		
5	Bill	KMTPO		
6	TRoy	KMTPO		
7	Donny	VDOT		
8	Chris Craig	FirstTN RPO		
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RPM Transportation Consultants

KINGSPORT METRO Transportation Planning Organization

2040 Long Range Plan Stakeholders Meetings

Monday March 21, 2016

CITY OF KINGSPORT 2PM

	NAME	COMPANY	PHONE	EMAIL	
1	Corey Shepherd	City of KPT	224-2877	" "	@KINGSPORTTN.GOV
2	Rob Dillon	"	229-9404	" "	@KINGSPORTTN.GOV
3	Justin Steinmann	"	224-2182	steinmannj	@KINGSPORTTN.GOV
4	Tim Elsea	"	224-2426	Tim Elsea	@KINGSPORTTN.GOV
5	Bill Albright	Kpt. MTPO	224-2611	billalbright	@KINGSPORTTN.GOV
6	Michael Thompson	"	423-224-2748	Michael Thompson	@KINGSPORTTN.GOV
7	TRoy Ebbert		224-2670	Troyebbert	@KINGSPORTTN.GOV
8					@KINGSPORTTN.GOV
9					
10					
11					

RPM Transportation Consultants

KINGSPORT METRO Transportation Planning Organization

2040 Long Range Plan Stakeholders Meetings

Tuesday March 22, 2016

LAW ENFORCEMENT 8:30AM

	NAME	AGENCY	PHONE	EMAIL
1	JEFF JACKSON	MT. CHARGL POLICE	423 817 2953	MCPD_JACKSON@YAHOO.COM
2	GARY MEDLIN	SULLIVAN CO. S.O.	423 279-6087	medlin@scsotn.com
3	Steve Summey	Kingsport PD	423 224-2750	steveSummey@KingsportTN.gov
4	Jarrett Ramsey	THP	423-348-6144	Jarrett.ramsey@tn.gov
5	Preston Elliott	RPM	615.370-8410	prestonelliott@rpmtraffic.net
6	Kayla Ferguson	RPM	"	Kaylaferguson@rpmtraffic.net
7	Bill			
8	Troy			
9	Mike Thompson			
10				
11				

Transportation Consultants

2040 Long Range Plan Stakeholders Meetings

Tuesday March 22, 2016

ECONOMIC DEVELOPMENT 10:30AM

	NAME	AGENCY	PHONE	EMAIL
1	ANDY TRUE	KINGSPORT CITY SCHOOLS	423.378.2130	atrue@K12K.com
2	PATSY STIVERS	KINGSPORT TOWN CENTER (FORT HENRY MALL)	423-246-1864	PATRICIA.STIVERS@KINGSPORTTOWNCENTER.COM
3	DOUG STAMPER	HOLSTON VALLEY MED CTR.	423-229-8587	doug.stamper@wellmont.org
4	TROY EBBERT	KMTPO		
5	MICHAEL MORRIS	DOMTAR PAPER	423-392-2805	MICHAEL.MORRIS@DOMTAR.COM
6	BILL WETHERHOLT	EASTMAN	423-229-2280	WCW@EASTMAN.COM
7	Miles Burdine	Kingsport Chamber	423-392-8807	mburdine@kingsportchamber.org
8	Bill Albright	KPT. MTPO	423-224-2697	billalbright@kingsportTN.gov
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Transportation Consultants

2040 Long Range Plan Stakeholders Meetings

Tuesday March 22, 2016

LOCAL AGENCIES 1:30PM

	NAME	AGENCY	PHONE	EMAIL
1	Dennis Deal	City of Church Hill		mayor@churchhilltn.gov
2	Mark Sandidge	"		wmsandidge@churchhilltn.gov
3	Melville Bailey	Hawkins Co.		melville.bailey@hawkinscountymayor.com
4	Donald Bean	H/C Highway Dept		beanl@hawkinscountyroads.com
5	JEFF JACKSON	TOWN OF MOUNT CARMEL	423 817 2955	MCPD_JACKSON@YAHOO.COM
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RPM Transportation Consultants

KINGSPORT METRO Transportation Planning Organization

2040 Long Range Plan Stakeholders Meetings

Wednesday March 23, 2016

TRANSIT, ACTIVE TRANSPORTATION & HEALTH 8:30AM

	NAME	AGENCY	PHONE	EMAIL
1	Johanna Morales	Healthy Kingsport	423-392-8822	jmorales@healthykingsport.org
2	Tiphanie Bigham	Greater Kingsport Family YMCA	423-765-9755	tbigham@ymcakpt.org
3	Maria Catron	KHRA	(423)384-6306	maria.catron@kingsporthousing.org
4	Chris Campbell	Kingsport Transit	423-224-2857	Kats@kingsporttn.gov
5	TRoy			
6	Bill			
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RPM Transportation Consultants

KINGSPORT METRO Transportation Planning Organization

2040 Long Range Plan Stakeholders Meetings

Wednesday March 23, 2016

VIRGINIA LOCALITIES 11:00AM

	NAME	AGENCY	PHONE	EMAIL
1	KATHIE NOE	Scott County	276-386-6521	knoe@scottcountyva.com
2	JIMMY ADKINS	VENAWISCO, PDC	276-431-2206	jadkins@lenowisco.org
3	Greg Jones	Town of Gate City	276-386-3831	townmanager@mygatecity.com
4	DONNY MACCESSARD	VDOT	(276) 696-3282	
5	Bill Albright	KPL MTPO	(423) 224-2611	billalbright@kingsporttn.gov
6	Troy Ebbert			
7	Brooke Ellis	RPM Associates (Marion)		
8	Kayla Kerguson	RPM Associates (Marion)		
9				
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Kingsport MTPO Long-Range Transportation Plan
Public Meeting
Sign-In Sheet

Name	Phone	Email
Don Barker	423-323-3783	
JOE DAVIS	423-646-4102	
Mike McIntire	423-676-3591	
Danny Necessary	276 591-9545	
MATTHEW COX	276.696.3281	
Matthew Justice	276-492-0708	
Troy Joiner	865-361-4765	
JASON CARDER	423-245-4970	
CALVIN CLIFTON	423-431-9114	cdcliftonmitternandcraig.com
ANTHONY WILLIAMS	423-502-1695	REEDYCREEKBICYCLES@GMAIL.COM
Kathik-WCYB		

Kingsport MTPO Long-Range Transportation Plan
Public Meeting
Sign-In Sheet

Name	Phone	Email
Preston Elliott	615.340.8710	prestonelliott@rpmtraffic.net
JIM BELGERI	423-612-2922	jim.belgeri@sullivancountytn.gov
James S Foster	423-426-2352	
Angie Stanley	423-742-0010	4ustanley@gmail.com
Troy Ebbert	423 224 2670	TroyEbbert@kingsportTN.gov

Kingsport MTPO - Public Meeting
Kingsport Metropolitan Area Long-range Transportation Plan
Kingsport Public Library - Mead Auditorium (400 Broad Street, Kingsport, TN)
October 4, 2016

ATTENDANCE SHEET

NAME (Please Print)	Address (Please Print)	Email
Ken Marsh	9 Pondlofer Place 37664	BOOKNUTS@CHARTERTN.NET
CALVIN CLIFTON	1108 FIDDLERS WAY KPT 37664	cdclifton@matternandcraig.com
Shirley Churchwell	157 Union St. Kspt TN 37660	churchwell@charterTn.net
Pat Shull	1338 Belmeade Dr Kpt TN 37664	patshull75@aol.com
Fay Ferguson	423-707-5127	Atlassfay@aol.com

Public Meeting Presentation and Materials

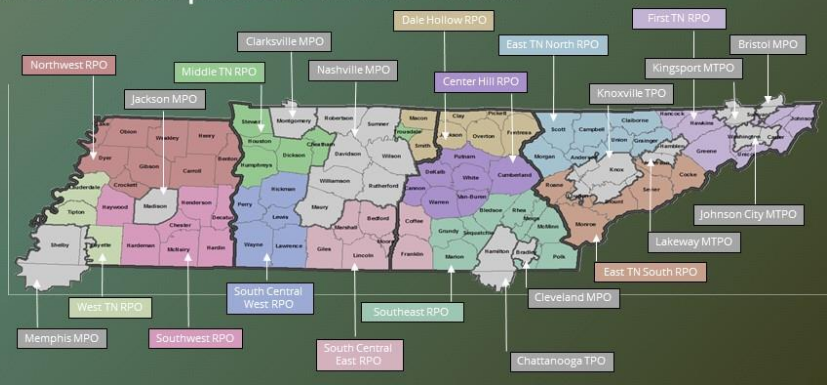
Kingsport MTPO
Long-Range Transportation Plan

Public Meeting

What is a MPO?

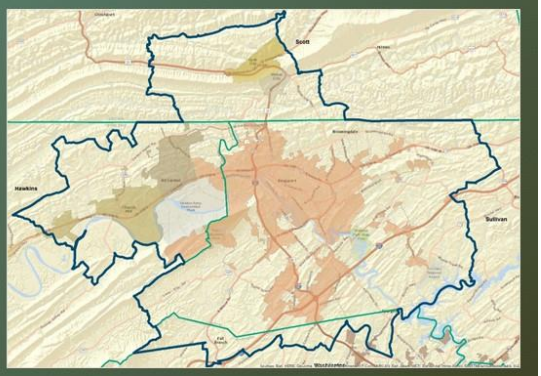
Metropolitan Planning Organizations (MPOs) are policy-making bodies that represent urban areas with populations over 50,000. They were initially established with a federal process in the 1960s.

There are currently 11 MPOs in Tennessee.



Kingsport MTPO

- The Kingsport MTPO was established in 1977 and is made up of representatives from local government and transportation authorities, which form a policy board and a technical board.
- The Kingsport MTPO is one of five bi-state MPOs in Tennessee. Kingsport & Bristol are the only Tennessee MPOs that include urbanized areas in Virginia.



Kingsport MTPO

The Kingsport MTPO includes four municipalities and portions of four counties.

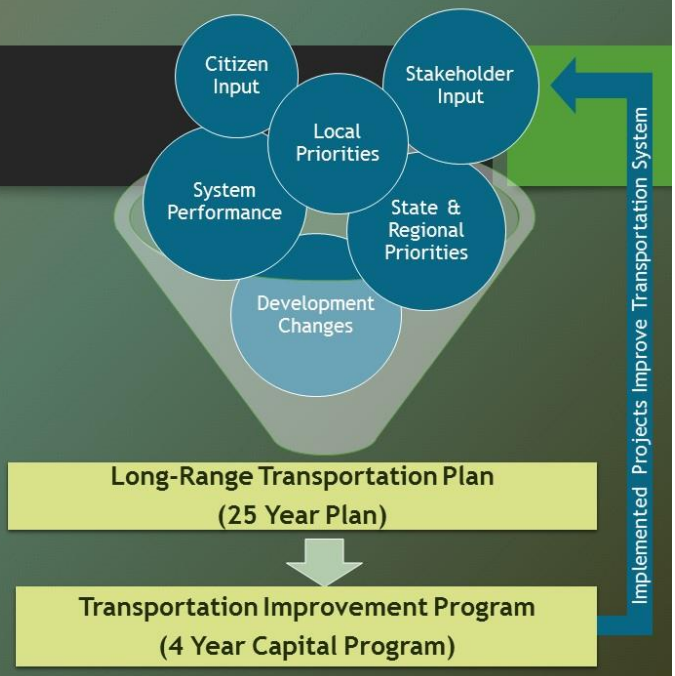
Tennessee
- Kingsport
- Mount Carmel
- Church Hill
- Portions of Hawkins, Sullivan and Washington County

Virginia
- Weber City
- Gate City
- Portions of Scott County

Church Hill
TENNESSEE

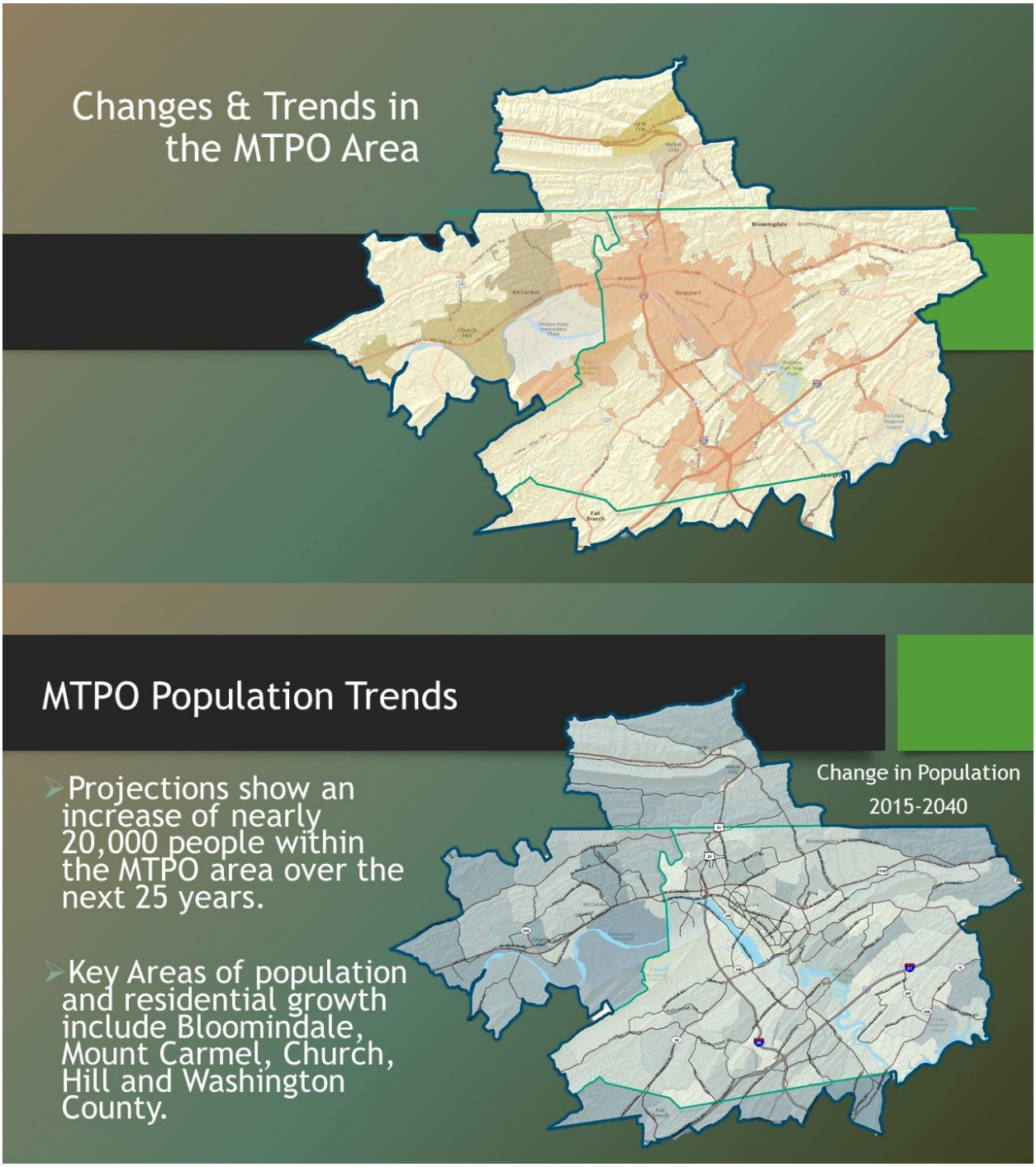
Purpose of the MTPO

- The Kingsport MTPO is responsible for maintaining a continuing, cooperative and comprehensive transportation planning process.
- This process is used to plan for and allocate federal funding for transportation improvements.
- One of the main planning tasks carried out by the MTPO is the development of the Long-Range Transportation Plan (LRTP), which covers a 20 Year Horizon.



The Long-Range Transportation Plan…

- Documents existing and future transportation conditions
- Includes a vision for the future in the region
- Guides transportation policies and federal transportation funds over the planning horizon
- Serves as a framework for transportation decisions and investments within the MTPO area


Changes & Trends in the MTPO Area
MTPO Population Trends
Projections show an increase of nearly 20,000 people within the MTPO area over the next 25 years.
Key Areas of population and residential growth include Bloomindale, Mount Carmel, Church, Hill and Washington County.
Change in Population
2015-2040

MTPO Population Profile

The Long-Range Transportation Plan takes into account the demographic and socioeconomic profile of residents in the area as they impact the consideration given to issues of non-motorized accommodations, accessibility, and transit service.

Population Group	MTPO Area 2015 Average	Tennessee 2015 Average
Zero-Auto	6% of households	7% of households
Low-Income	19% of households	18% of households
Disabled	37% of households	30% of households
Senior (65+)	20% of individuals	15% of individuals
Minority	6% of individuals	23% of individuals
Hispanic	2% of individuals	4% of individuals

MTPO Employment Trends

- Projections show an increase of approximately 14,000 more jobs within the MTPO area over the next 25 years.
- Employment growth is mainly focused in downtown Kingsport and along key corridors in the MTPO area.

Change in Employment 2015-2040

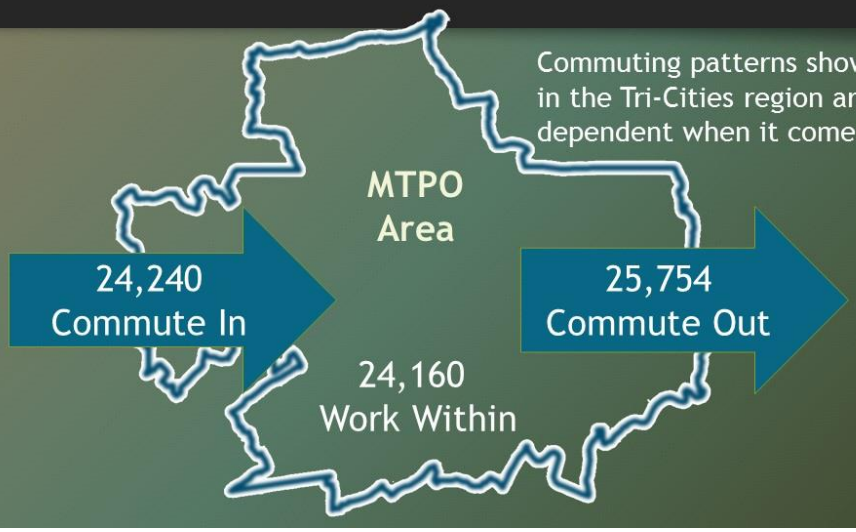
MTPO Employment Trends

- Projections show an increase of approximately 14,000 jobs in the MTPO area across the MTPO area.

County	2015 Employment	2040 Employment	Percent Change
Agricultural	3,694	4,949	34.0%
Manufacturing	13,989	14,621	4.5%
Retail	6,269	7,467	19.1%
Office	8,010	10,337	29.1%
Service	20,854	29,080	39.4%
Government	1,764	2,136	21.1%
Total	54,580	68,590	25.7%

- We can expect to see significant increases in service employment and small decreases in manufacturing employment.

MTPO Commuting Trends



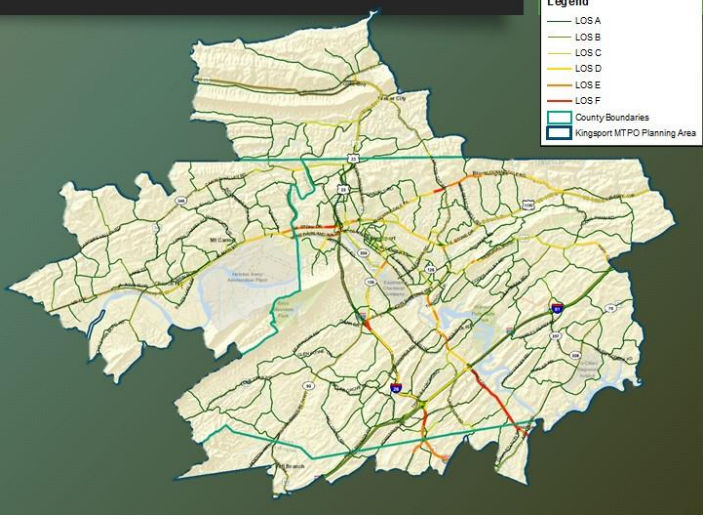
Commuting patterns show that the counties in the Tri-Cities region are very co-dependent when it comes to employment.

Existing Deficiencies

- Congestion on roadways is often measured by a Level of Service (LOS), which describes the general operational quality of a roadway and utilizes a letter grade scale (A-F).
- In urban areas, LOS C is generally considered acceptable. In the Kingsport MTPO area, nearly 97% of roadways operate at LOS A, B, or C.
- This means that certain roads in the MTPO area experience greater levels of roadway congestion.

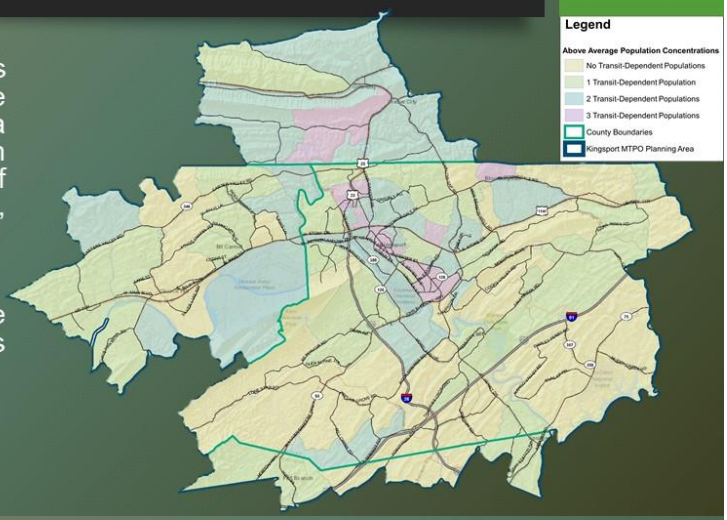
Preliminary Needs

- Without investment beyond what is identified today, many of the MTPO's major corridors will see increased levels of congestion by 2040.
- Residents traveling along key roadways such Stone Drive, Bloomingdale Pike, I-26, and Fort Henry Drive, among others, will experience significant increases delay in the future.



Accessibility Needs

- Certain population groups such as those over the age of 65, those households without access to a vehicle, and those families living in poverty rely on other modes of transportation such as walking, biking, and transit.
- Census data was used to determine where investments in these modes may be needed within the MTPO.



Public Involvement

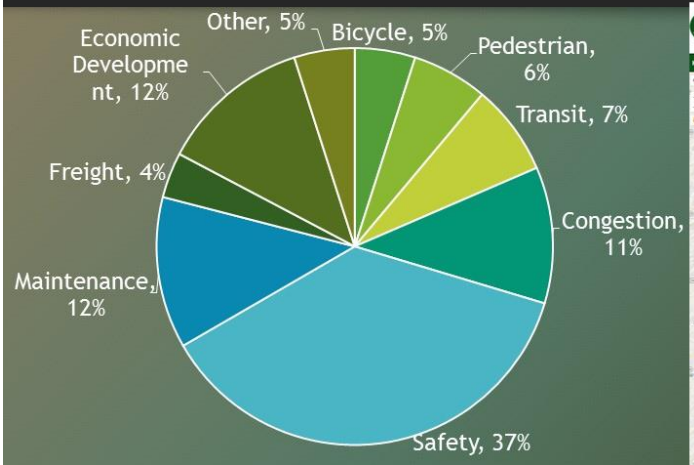
- A key part in the development of the Long-Range Transportation Plan is the engagement of stakeholders and citizens.
- The MTPO is utilizing a variety of methods for public involvement including:
  - Public Meetings
  - Online Survey
  - WikiMapping
  - Social Media
  - Press Releases

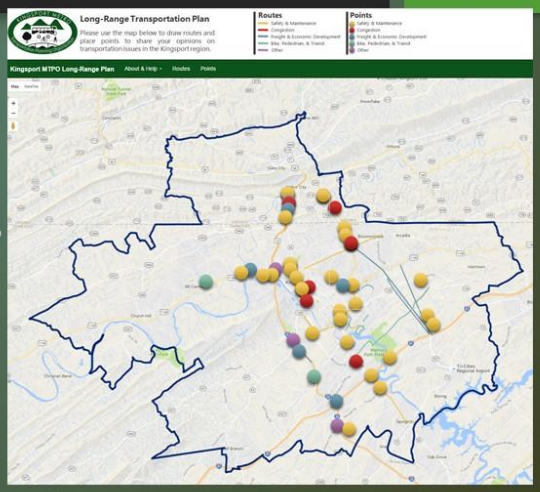
WikiMapping
SurveyMonkey
KINGSPORT TENNESSEE TimesNews

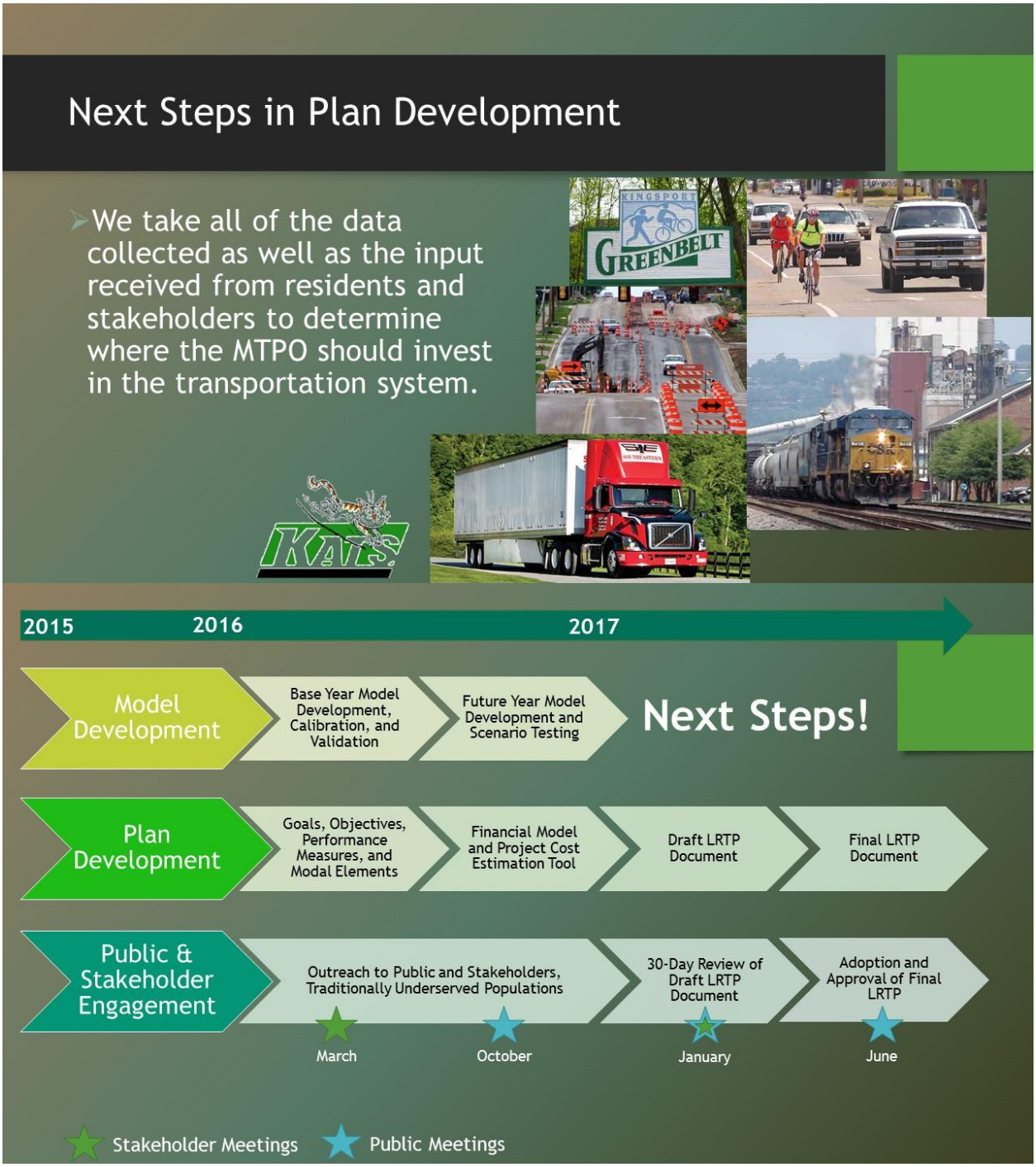
Online Survey Responses

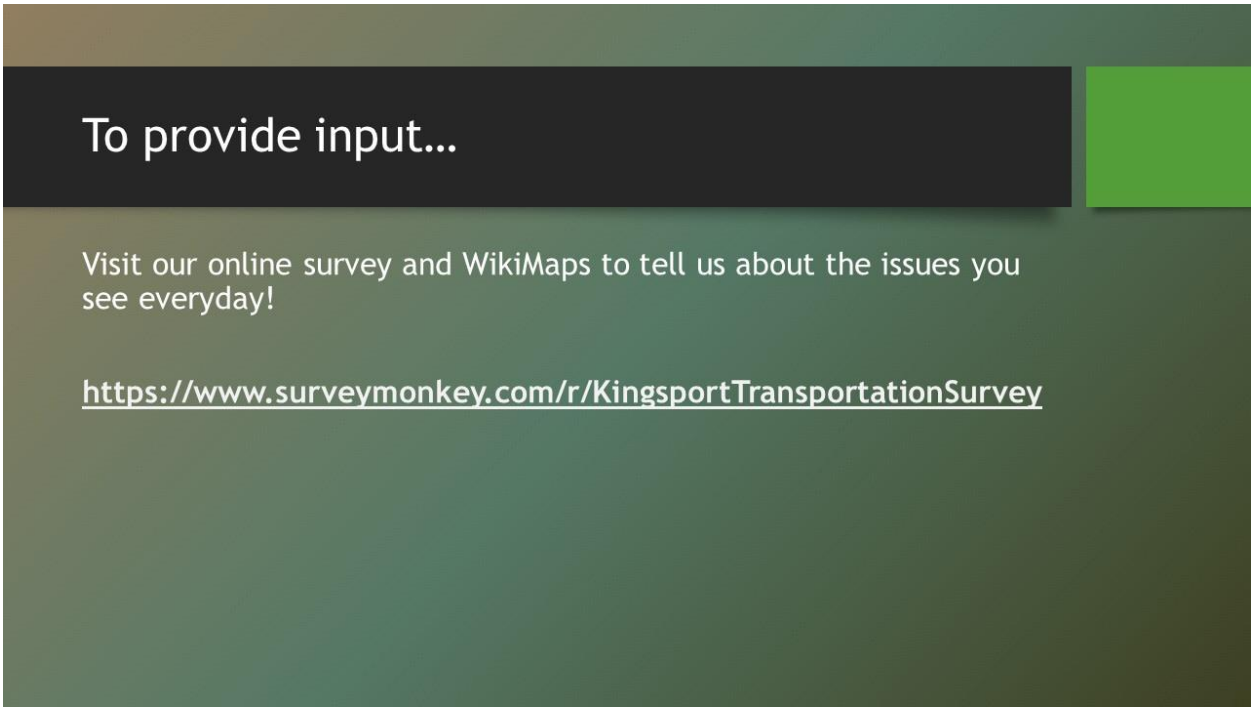
- The majority of residents think that growth in the Kingsport area has occurred at just the right density.
- 76% think that traffic has gotten worse in the past 5 years.
- Maintenance and Safety of the system are top priorities.
- As it relates to transit, top priorities include expanded service and non-motorized connections to bus stops.
- There's a heavy emphasis on pedestrian priorities overall.

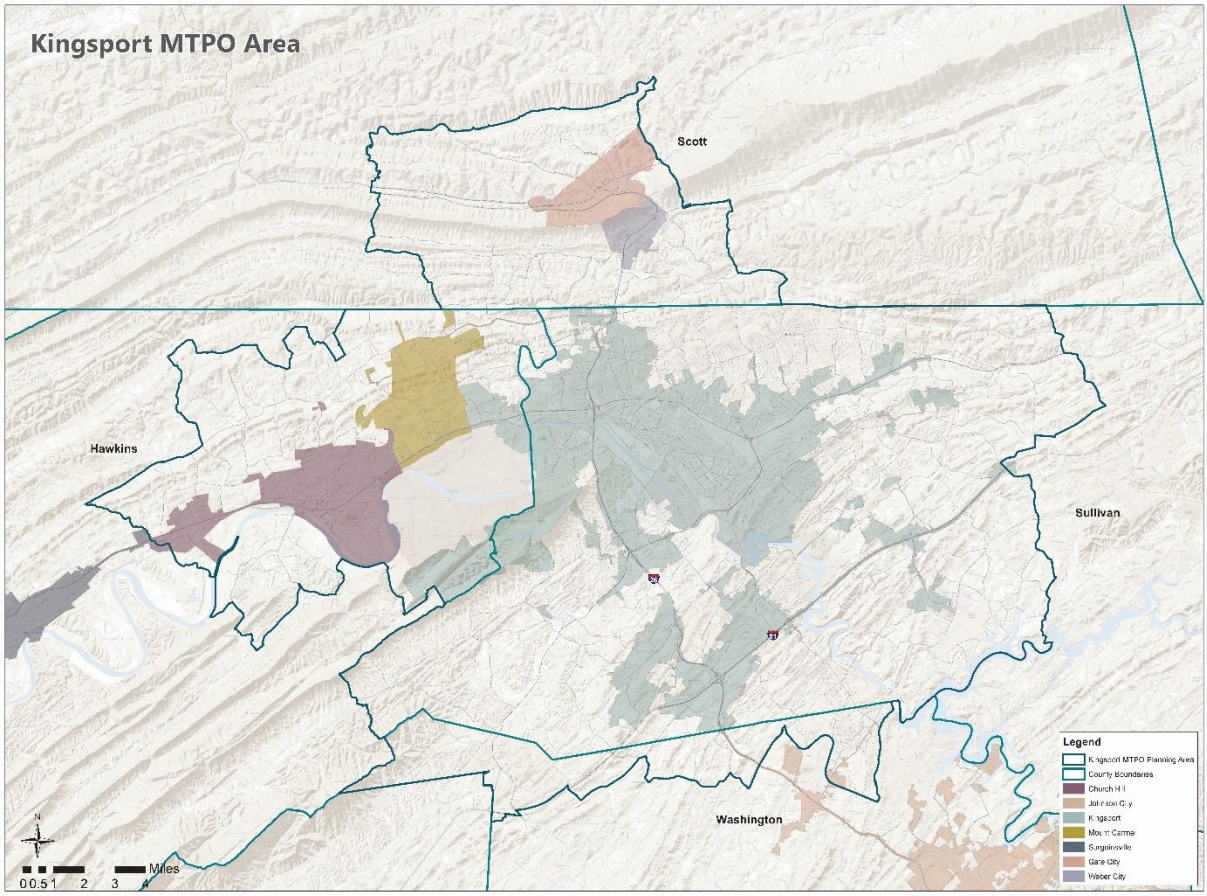
The issues in Kingsport people are talking about…






Next Steps in Plan Development
We take all of the data collected as well as the input received from residents and stakeholders to determine where the MTPO should invest in the transportation system.
KINGSPORT
GREENBELT
2015
2016
2017
Model Development
Base Year Model Development, Calibration, and Validation
Future Year Model Development and Scenario Testing
Next Steps!
Plan Development
Goals, Objectives, Performance Measures, and Modal Elements
Financial Model and Project Cost Estimation Tool
Draft LRTP Document
Final LRTP Document
Public & Stakeholder Engagement
Outreach to Public and Stakeholders, Traditionally Underserved Populations
30-Day Review of Draft LRTP Document
Adoption and Approval of Final LRTP
March
October
January
June
Stakeholder Meetings
Public Meetings


To provide input…
Visit our online survey and WikiMaps to tell us about the issues you see everyday!
https://www.surveymonkey.com/r/KingsportTransportationSurvey

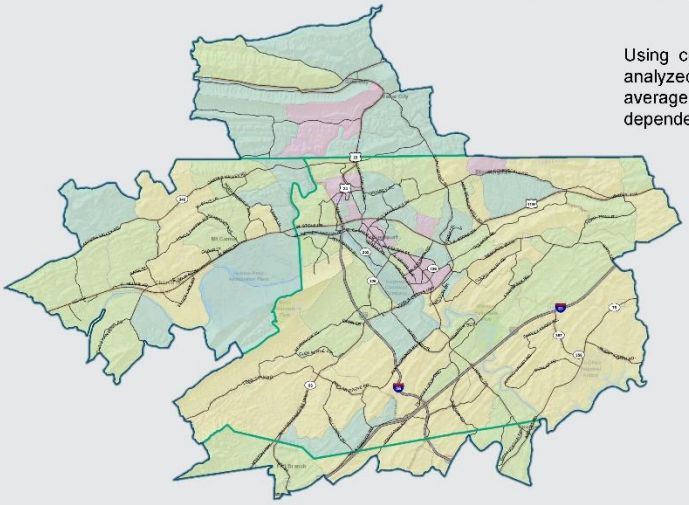

Kingsport MTPO Area
Scott
Hawkins
Sullivan
Washington
Legend
Kingsport MTPO Planning Area
County Boundaries
Church Hill
Johnson City
Kingsport
Mount Carmel
Surgoinsville
Gate City
Weber City
N
0 0.5 1 2 3 4
Miles

2040 Long-Range Transportation Plan

Kingsport Metropolitan Transportation Planning Organization

Kingsport's Transit Needs

Transit services operate in an effort to provide transportation options for those who may, by choice or limitation, not have access to a vehicle. In any urban area, there are concentrations of transit-dependent populations. Often, these population groups include those **over the age of 65**, those **households without access to a vehicle**, and those **families living in poverty**.



Using census data, the Kingsport MTPO area was analyzed to locate census block groups with above average concentrations of potentially transit-dependent populations.

Legend

Above Average Population Concentrations

- No Transit-Dependent Populations
- 1 Transit-Dependent Population
- 2 Transit-Dependent Populations
- 3 Transit-Dependent Populations
- County Boundaries
- Kingsport MTPO Planning Area

Kingsport Area Transit Service

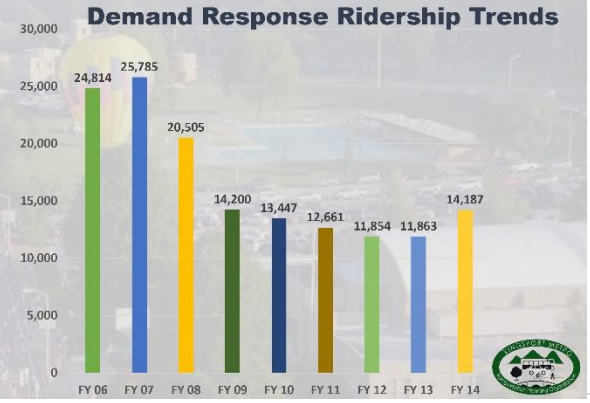
The Kingsport Area Transit Service (KATS) provides fixed route and demand response transit services for residents within the Kingsport urban area. Routes provide access to key destinations such as apartment complexes and senior centers, medical facilities, shopping centers, employment centers, and downtown Kingsport. Information on specific routes and stop times is conveniently located on the KATS website.

Ridership for both the fixed route and demand response services offered by KATS has seen an increasing trend overall in the past 10 years as shown in the graphs below.

System Map

Fixed Route Ridership Trends

Demand Response Ridership Trends

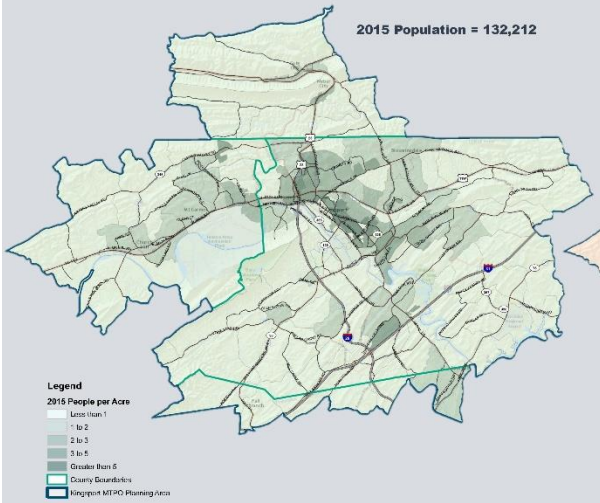


2040 Long-Range Transportation Plan

Kingsport Metropolitan Transportation Planning Organization

Population Changes

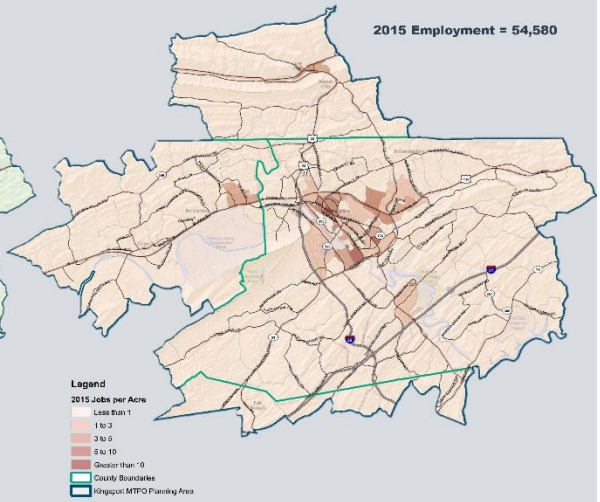
2015 Population Density



The Kingsport MTPO covers urbanized areas in Sullivan, Washington, and Hawkins Counties within Tennessee as well as Scott County, Virginia. Population within the MTPO area is expected to grow by nearly 20,000 people by 2040, a 15% increase. This population growth is expected to occur in the Colonial Heights area within Sullivan County and in portions of Hawkins and Washington Counties.

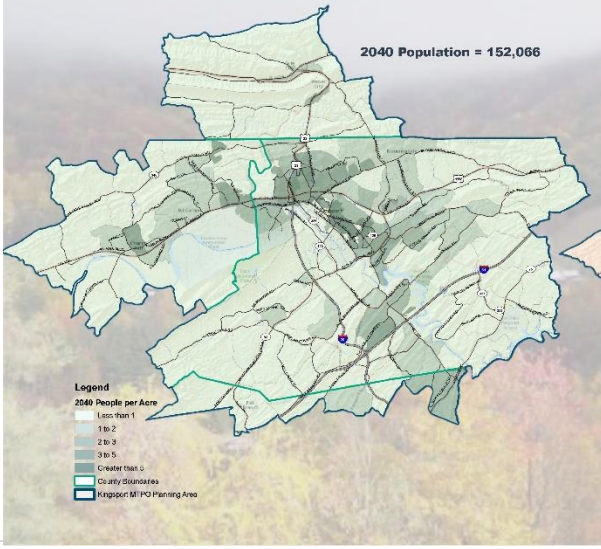
Employment Changes

2015 Employment Density

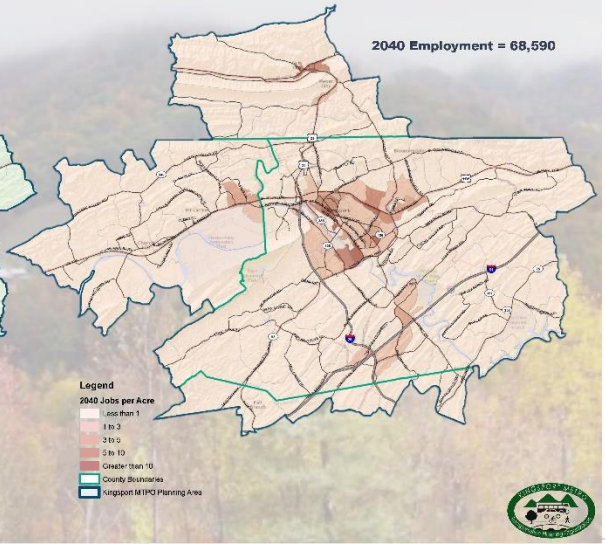


Employment within the Kingsport MTPO area is expected to increase by approximately 14,000 jobs, which is a 26% increase, by 2040. This growth is expected to primarily occur in areas surrounding existing employment centers such as Stone Drive, Downtown Kingsport, and the Tri-Cities Crossing area.

2040 Population Density



2040 Employment Density



2040 Long-Range Transportation Plan

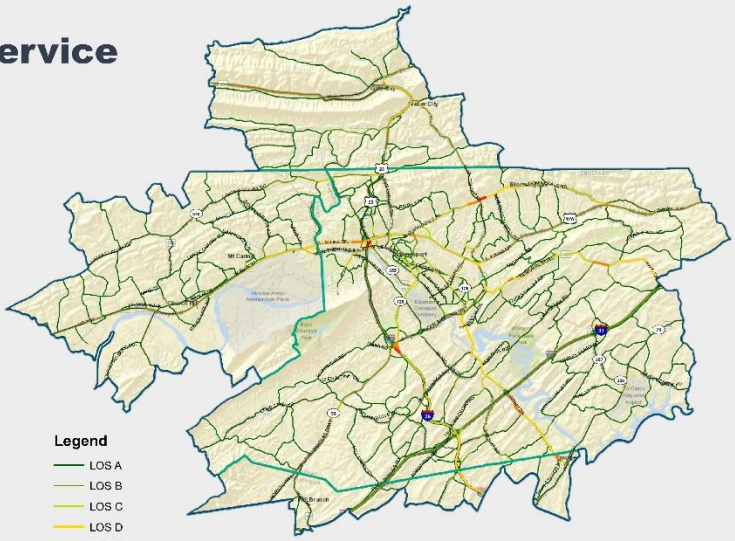
Kingsport Metropolitan Transportation Planning Organization

Roadway Level-of-Service

There are approximately 880 miles of roads included in the MTPO's travel demand model, which is a tool used for looking at congestion levels now and in the future. Congestion on roadways is often measured by a Level of Service (LOS), which describes the general operational quality of a roadway and utilizes a letter grade scale (A-F).

In urban areas, LOS C is generally considered acceptable. In the Kingsport MTPO area, nearly 97% of roadways operate at LOS A, B, or C. This means that certain roads in the MTPO area experience greater levels of roadway congestion as seen in the table below and the map to the right.

Level of Service	Miles of Roadway	Percent of Roadway Miles
C or Better	853	97%
D	22	2.5%
E	4	<1%
F	1	<1%



Areas along Stone Drive, Bloomingdale Pike, Fort Henry Drive, I-26, I-81, and Memorial Boulevard currently experience higher levels on congestion.

Safety Patterns

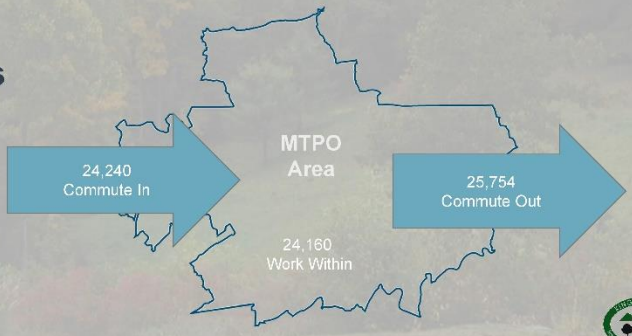
Using crash data from 2010-2015, crash frequencies were examined using a ¼ mile grid cell analysis. It can be seen that more crashes occur along the main corridors throughout the MTPO area such as Stone Drive, US-23, the Interstates, and others.

Commuting Patterns

Commuting patterns show that the counties in the Tri-Cities region are very co-dependent when it comes to employment.

Average commute times across the four counties are as follows:

- Hawkins – 24.7 minutes
- Scott – 28.4 minutes
- Sullivan – 21.7 minutes
- Washington – 20.9 minutes



MTPO Board Meeting Agendas and Materials

Kingsport MTPO

2040 Long Range Transportation Plan

Project Kick-Off Meeting
Agenda
10:30 to 12:00

1. Introductions

2. Overview of Project
   - Project Work Plan, Scope, & Schedule
     - Phase I – Model Development
     - Phase II – Plan Development

3. Planning Assumptions & Data Needs List
   - 2040 Plan – Base Year (2015), Horizon Years (2020), and Future Year (2040)
   - Socioeconomic Data – UT Forecasts, Woods & Poole, InfoGroup
   - TransCAD Version?
   - Data Needs List
   - Utilization of TDOT's Deficiency Analysis Tool?

4. Major Changes That Have Occurred Since the Last Plan
   - Completed Roadway Projects Since 2009
   - Potential Eastman Roadway Closures – Jared Drive/Moreland Drive, Etc.
   - Other Major Changes
   - Public Participation Plan, Adopted September 12, 2007
   - Plan Goals and Objectives

5. Public & Stakeholder Participation
   - Stakeholder Workshops – up to four sessions (including topics of safety, mobility & health, freight & logistics, and economic development)
   - Public Meetings – three public meetings
   - MTPO Meetings – two meetings with the MTPO Policy Board
   - Social Media – online survey, WikiMapping

6. Next Steps
   - KMTPO Board Kick-Off Meeting – December 3rd

Bill Albright
Transportation Manager

Troy Ebbert, CFM
Transportation Coordinator

Kingsport MTPO
201 West Market St
Kingsport, TN 37660
MTPO@KingsportTn.gov
423.224.2670

MEMORANDUM

To: Kingsport MTPO Executive Board

CC: Subscribed Interested Parties

From: Troy Ebbert

Date: November 24, 2015

Subject: MTPO Executive Board Meeting

Prior to the meeting at approximately (based on the arrival of the group from Bristol)

11:30 A.M. EST MTPO will serve lunch.

At noon ETSU will begin the Reedy Creek Trail Presentation.

At 12:30 TDOT Commissioner John Schroer

Please find the agenda for the next Kingsport MTPO Executive Board meeting scheduled for **Thursday December 3, 2015 at 1:00 PM (ET) in the Kingsport City Hall Council Chamber, 2nd Floor, 225 West Center Street, (downtown) Kingsport, Tennessee.**

In addition to the public comments, project updates and general information items

There are two actions Items:

- **Minutes**
- **Functional Classification Adoption**

If you are unable to attend, you may designate a proxy in writing to represent you. A sample proxy letter is enclosed. The minutes from the last Executive Board meeting are also enclosed.

KMTPO is a regional transportation planning agency representing all or portions of: Kingsport, Sullivan County, Hawkins County, Greene County, Washington County, Scott County, Church Hill, Mount Carmel, Gate City, Weber City

Agenda

Kingsport MTPO Executive Board
December 3, 2015 at 1:00 PM (ET)
Kingsport City Hall – 2nd floor Council Chambers
201 W. Center St, Kingsport, TN 37660

1. **Executive Board Welcome**

2. **Approval of Minutes from November 3, 2015 Meeting:**

   ■ Action □ Possible Action □ Discussion □ Information

3. **Public Comment on Agenda Items**

   □ Action □ Possible Action □ Discussion ■ Information

   Those wishing to make a comment pertaining to any of the agenda items may do so at this time with a five-minute time limitation. Comments not pertaining to a specific agenda item will be heard during the end of the meeting in the Public Hearing section.

4. **Adoption of Functional Classification**

   ■ Action □ Possible Action □ Discussion □Information

   Presenter: Troy Ebbert

   Item Summary: Because of the UZA changes after the 2010 census the functional classification of the roads are reviewed and adjusted. The proposed functional classification system was reviewed with each of the MTPO member jurisdictions to ensure that the roadways in their areas were properly classified based on the function they serve within the transportation system.

   Recommendation: Adoption of the changes as presented.

5. **Long Range Plan Update**

   □ Action □ Possible Action ■ Discussion □Information

   Presenter: Preston Elliott of RPM Consulting

   Item Summary: RPM will give a report on the status and development of the 2040 Long range Plan.

6. Staff Reports - Projects, Initiatives

□ Action □ Possible Action □ Discussion ■ Information

Presenter: Staff

- Multi Modal Grants are Due to the MTPO by December 16th
- SR 126 Public Hearing… plans and comment card is available here.
- Title VI Plan
- VDOT Obligated Projects

7. Meeting Schedule

□ Action ■ Possible Action ■ Discussion ■ Information

Presenter: Troy Ebbert

Item Summary: Presentation of 2016 Calendar of Meetings.

Recommendation: A Motion to accept the schedule as presented.

8. Public Comment

□ Action □ Possible Action □ Discussion ■ Information

Members of the public may address the Executive Board with issues related to the region's transportation system. There is a five-minute time limitation per individual and/or topic

9. Meeting Adjournment

Kingsport MTPO Board LRTP Kick-Off Meeting

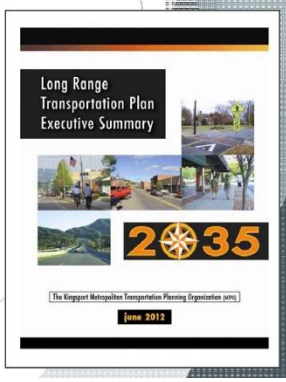
December 3, 2015

Agenda – Purpose of Presentation

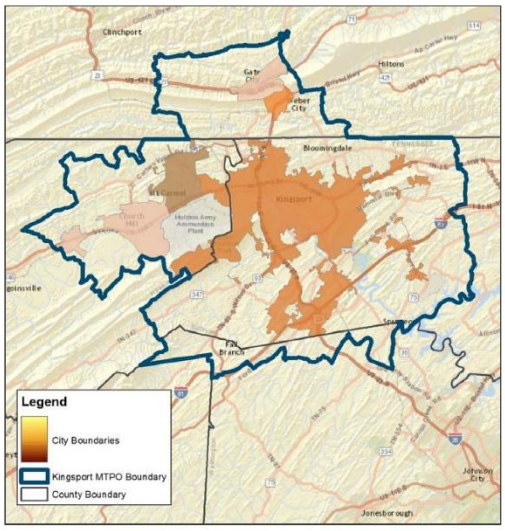
- Introduction & Background
- Setting the Stage in Kingsport
  - 2035 LRTP
  - Population and Socio-Demographics
  - Employment Growth
  - Existing Public Input & Trends
- Next Steps

Introductions & Background

- Our Team
  - Plan Development — RPM Transportation Consultants
  - Model Development — Kimley»Horn
- 2035 LRTP Guiding Principles
  - Livability – Safety & Active Transportation
  - Sustainability – Operational Solutions
  - Prosperity – Roadways, Freight, & Public Transportation



Setting the Stage – 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 – Current and 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 – Profile

- The demographic and socioeconomic profile of residents in the MTPO area impacts the consideration given to issues of non-motorized accommodations, accessibility, and transit service.

Population Group	MTPO Area Average	Tennessee Average
Zero-Auto	6% of households	7% of households
Low-Income	19% of households	18% of households
Disabled	37% of households	30% of households
Senior (65+)	20% of individuals	15% of individuals
Minority	6% of individuals	23% of individuals
Hispanic	2% of individuals	4% of individuals

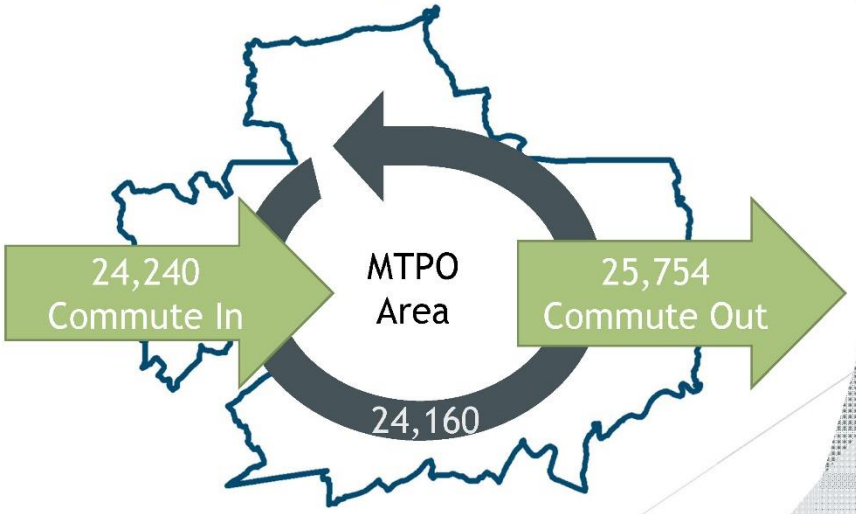
Employment – Current and Future Growth

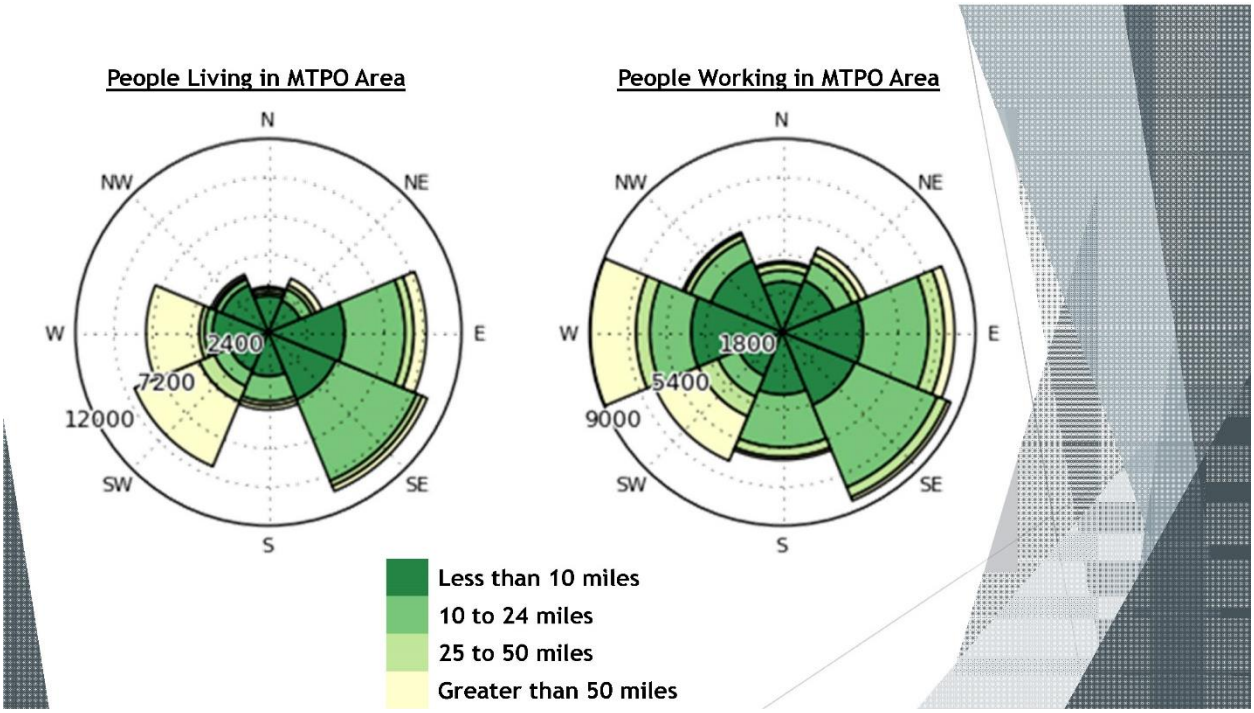
- Projections show an increase of 57,000 jobs across the four counties.

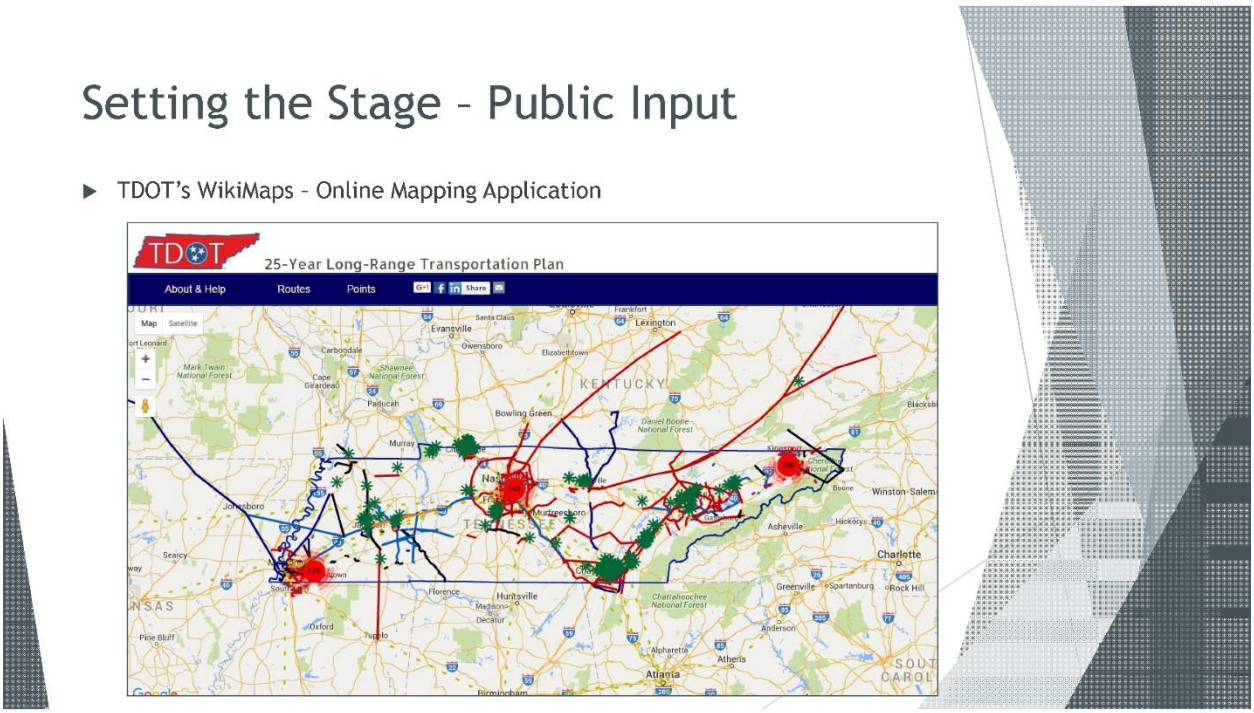
County	2015 Employment	2040 Employment	Percent Change
Sullivan County	92,763	109,136	18%
Hawkins County	18,387	23,094	26%
Washington County	77,450	111,765	44%
Scott County, VA	7,844	9,555	22%
Total	196,444	253,550	29%



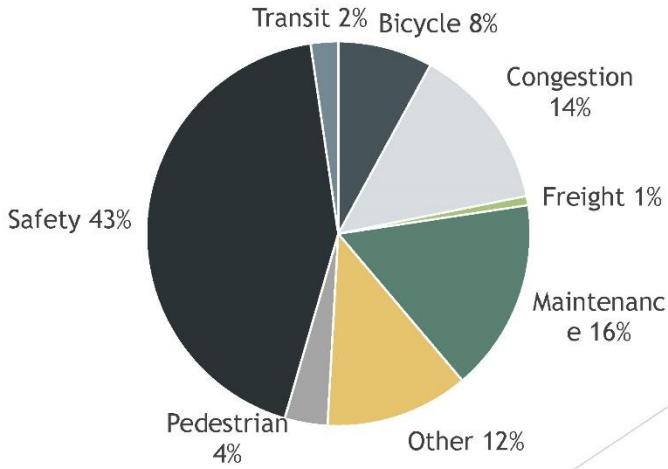
Economic Development – Commuting Patterns




People Living in MTPO Area
People Working in MTPO Area
N
NW
NE
W
E
SW
SE
S
2400
7200
12000
1800
5400
9000
Less than 10 miles
10 to 24 miles
25 to 50 miles
Greater than 50 miles

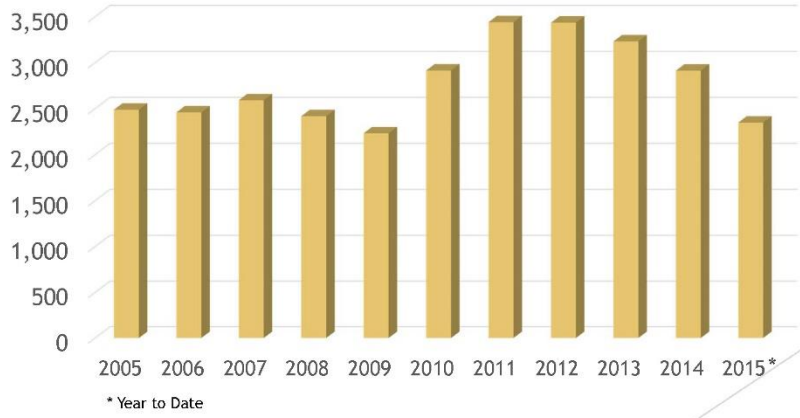

Setting the Stage – Public Input
TDOT's WikiMaps – Online Mapping Application
TDOT
25-Year Long-Range Transportation Plan
About & Help
Routes
Points

Setting the Stage – Public Input



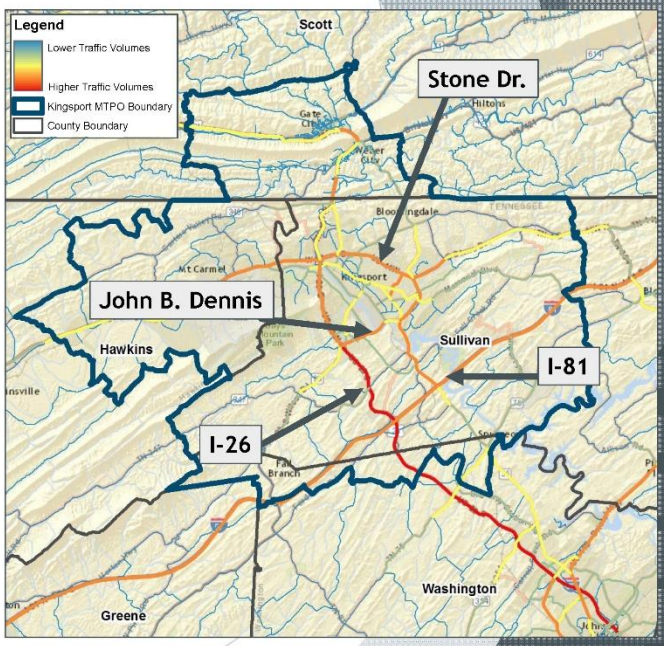
Safety

- WikiMaps comments related to safety comprised 43% of all Kingsport input.
- TDOT's ETRIMS database used to look at crash trends in the area from 2005 to 2015 – over 30,000 crashes.



Congestion

- WikiMaps input shows congestion is an issue in Kingsport (14% of comments).
- 2035 LRTP recommended nearly $300 million in cost-feasible projects, many of which would address congestion issues.

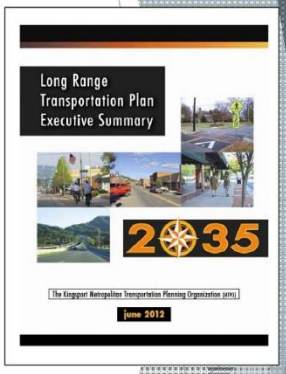


Important Considerations

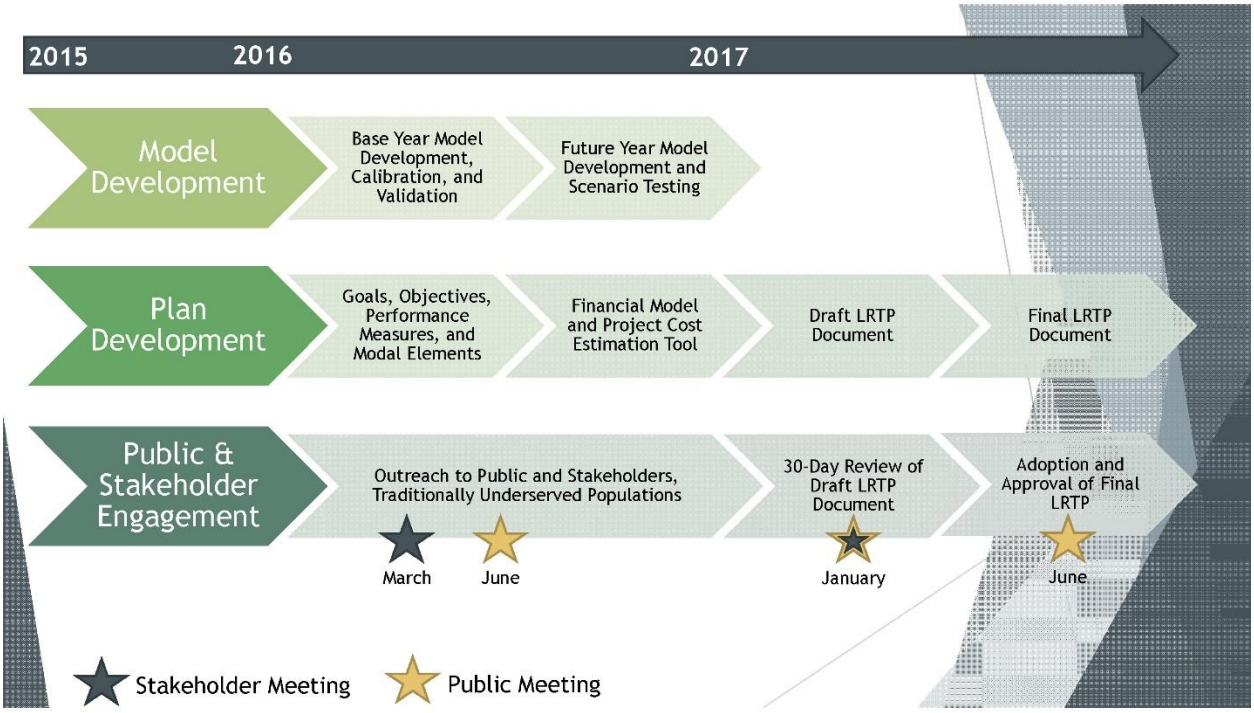
- ONEKingsport - 5 Year Strategic Plan
- Developments by Eastman & Other Employers
- Municipal Annexation

Revisit Goals

- 2035 LRTP Guiding Principles
  - Livability – Safety & Active Transportation
  - Sustainability – Operational Solutions
  - Prosperity – Roadways, Freight, & Public Transportation



- Do these Guiding Principles still accurately reflect the priorities for the Kingsport MTPO area?



Bill Albright
Transportation Manager

Troy Ebbert
Transportation Coordinator

Kingsport MTPO
201 West Market St
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423.224.2670

MEMORANDUM

To: Kingsport MTPO Executive Board

CC: Subscribed Interested Parties

From: Troy Ebbert, Transportation Planning Coordinator

Date: February 4, 2016

Subject: MTPO Executive Board Meeting

Please find the agenda for the next Kingsport MTPO Executive Board meeting scheduled for **Tuesday, February 9, 2016 at 10:00 AM (ET) Council Chambers, 2nd Floor of Kingsport City Hall, 225 Main Street, (downtown) Kingsport, Tennessee.**

In addition to the public comments, project updates and general information items

There are five actions Items:

- **Minutes**
- **Election of Vice Chair**
- **Amendment # 1 to the UPWP**
- **TIP Amendment 14 – Press Rd**
- **2040 Long Range Plan Base Year**

If you are unable to attend, you may designate a proxy in writing to represent you. A sample proxy letter is enclosed. The minutes from the last Executive Board meeting are also enclosed.

KMTPO is a regional transportation planning agency representing all or portions of: Kingsport, Sullivan County, Hawkins County, Greene County, Washington County, Scott County, Church Hill, Mount Carmel, Gate City, Weber City

Agenda

Kingsport MTPO Executive Board
February 9, 2016 at 10:00 AM (ET)
Kingsport City Hall – 2nd Floor Council Chambers
225 W. Center St, Kingsport, TN 37660

1. **Executive Board Welcome**

2. **Approval of Minutes from December 3, 2016 Meeting:**

   ■ Action □ Possible Action □ Discussion □ Information

3. **Public Comment on Agenda Items**

   □ Action □ Possible Action □ Discussion ■ Information

   Those wishing to make a comment pertaining to any of the agenda items may do so at this time with a five-minute time limitation. Comments not pertaining to a specific agenda item will be heard during the end of the meeting in the Public Hearing section.

4. **Election of Vice Chairman**

   ■ Action □ Possible Action □ Discussion □ Information

   Presenter: Troy Ebbert

   Item Summary:

   According to Article IV of the Kingsport MTPO Bylaws, during the first meeting of each year it is necessary to elect a vice-chairman to conduct the activities of the board in the absence of the chairman. The current Vice-Chairman is Jimmy Adkins from the Virginia LENOWISCO PDC.

   Recommendation:

   Elect a vice-chairman in accordance with the bylaws.

5. Amendment #1 to the UPWP (Work Program)

■ Action □ Possible Action □ Discussion □ Information

Presenter: Bill Albright

Item Summary: The amendment is being submitted for inclusion within the 2016-2017 UPWP, specifically identified as changes to the FY 2016 Budget within "Task E - Multi-Modal and Long-range Planning" that increases funding for development of the 2040 (Long-Range) Transportation Plan.

Recommendation: Adopt the amendment as presented.

6. Functional Classification Status

□ Action □ Possible Action ■ Discussion ■ Information

Presenter: TDOT Staff

Item Summary: The functional classification process is in its final phase as a result of the updated urbanized area approved in 2014. TDOT submitted the requests to Federal Highway Administration in the middle of January. TDOT will inform the board of the steps for completion.

7. Press Road TIP Amendment

□ Action ■ Possible Action □ Discussion □ Information

Presenter: Mark Sandi
dge

Item Summary: Press Road is located within the municipal limits of Church Hill and serves both industrial and residential land uses. In order use STP funds, the road is required to have a minimum functional classification. The City of Church Hill has requested STP funds to resurface Press Road.

Recommendation: With an approved functional class update, staff recommends approval of the project.

8. Virginia House Bill 2 Results for the Bristol Region

□ Action □ Possible Action □ Discussion ■ Information

Presenter: Donny Necessary

Item Summary: House Bill 2 projects were voted on by this board and submitted to VDOT last year for consideration and scoring via the new process established by HB 2. We will

briefly review the projects and see the results of the scoring and discuss the next step of the process.

9. KATS Update

□Action □Possible Action □ Discussion ■ Information

Presenter: Chris Campbell

Item Summary: KATS is updating the routes for the City of Kingsport; Mr. Campbell will give a presentation showing the updates. We will also receive updates on the status of the proposed transit center.

10. Call for Projects – FY18-FY22 TIP Development

□ Action □ Possible Action ■ Discussion ■ Information

Presenter: Troy Ebbert

Item Summary: A call for projects was advertised on February 1, 2016 and a letter announcing the call was sent at the end of January to all stakeholders. The application can be downloaded from the MTPO website. All completed applications shall be submitted to the MTPO Coordinator on or prior to April 1, 2016. They will be scored and recommendations will be formed in the TCC. Recommendations will be forwarded to the Executive Board for final approval for inclusion in the TIP.

11. Review, Discussion, and Endorsement of Several Items Pertaining to the Development of the Region's 2040 Long Range Transportation Plan (LRTP)

■ Action □ Possible Action ■ Discussion □ Information

Presenter: MTPO Staff & RPM Transportation Consultants

Item Summary: This agenda item includes two discussion items of which one requires endorsement by the Board. These items and the associated actions are described below:

Project Update – A brief update on the overall project and project schedule will be presented (Action - Information Only)

Base Year & Future Year Population & Employment Control Totals and Horizon Year Assumptions
It is important early in the planning process to establish certain planning assumptions, which drive the development of the LRTP for the MTPO. These include establishing the base year and future planning horizons for the LRTP as well as the population and employment control totals for the region (i.e. the projected population and employment for which the region is likely to grow in the future). Staff is recommending the base year of the Plan be 2015 and the future year be 2040 (with an interim horizon year of 2025 for air quality planning purposes). Some of this information has been previously presented to the Board. Attached are summary tables with the proposed population and employment projections by horizon year. (Action – Endorsement)

Recommendation: Endorsement of the following items as presented:
Base Year & Future Year Population & Employment Control Totals and Horizon Year Assumptions

12. Staff Reports - Projects, Initiatives, Updates

□ Action □ Possible Action □ Discussion ■ Information

Presenter: Staff

- Wilcox Drive Sidewalk project
- Stone Drive Multimodal Grant
- 2015 Multimodal Grant submissions
- TDOT Long Range Plan

13. Future Meeting Dates

□ Action □ Possible Action ■ Discussion ■ Information

Presenter: Troy Ebbert

Item Summary: The next TCC meeting will be held on April 8th @ 9:30AM EDT
Executive Meeting Board is scheduled for May 5th @1PM. EDT

14. Public Comment

□ Action □ Possible Action □ Discussion ■ Information

Members of the public may address the Executive Board with issues related to the region's transportation system. There is a five-minute time limitation per individual and/or topic

15. Meeting Adjournment

25-Year Long-Range Transportation Plan Update

Plan Development Schedule

Goals, Objectives, Performance Measures, and Modal Elements → Financial Model and Project Cost Estimation Tool → Draft LRTP Document → Final LRTP Document

Efforts to Date:

- Thorough review of the Fixing America's Surface Transportation (FAST) Act legislation for impacts to the long-range planning process
- Review of 2035 LRTP goals and objectives as they pertain to other planning efforts and FAST compliance
- Modifications to objectives (to be presented at a later date)

Model Development Schedule

Base Year Model Development, Calibration, and Validation → Future Year Model Development and Scenario Testing

Efforts to Date:

- Collection of various data from MTPO, TDOT, and VDOT
- Development of highway network and zonal structure for base year model
- Processing of MTPO, TDOT, and VDOT traffic count data
- Review of 2035 LRTP E+C project list
- Development of base year population and employment county-level control totals

Kingsport MTPO
2015 Allocation Tables
Historical and Projected Population Summary Tables

Table 1: Woods & Poole Historic and Future Year Population Projections

Four County Region – Total Population	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2025	2030	2040	Absolute Population Change 2015-2040	Annual Percent Change 2015-2040
Hawkins County, TN	56,871	56,659	56,607	56,800	57,290	57,811	58,364	58,923	59,486	60,053	60,624	63,524	66,444	71,800	13,989	0.97%
Scott County, VA	23,133	22,943	22,770	22,640	22,623	22,617	22,621	22,626	22,629	22,633	22,636	22,637	22,598	22,243	(374)	-0.07%
Sullivan County, TN	156,856	156,938	156,655	156,595	156,944	157,366	157,866	158,367	158,865	159,363	159,857	162,260	164,404	166,706	9,340	0.24%
Washington County, TN	123,310	123,983	124,924	125,546	126,889	128,307	129,803	131,315	132,843	134,386	135,942	143,918	152,090	167,766	39,459	1.23%
Total	360,170	360,523	360,956	361,581	363,746	366,101	368,654	371,231	373,823	376,435	379,059	392,339	405,536	428,515	62,414	0.68%

Source: Woods & Poole, 2015

To begin the allocation of population for the base year (2015), the three Tennessee counties (Hawkins, Sullivan, and Washington) and one Virginia county (Scott) were examined separately. The steps below outline the different procedures used:

Hawkins, Sullivan, and Washington Counties

1. Using 2010 Census data at the block level and the Woods & Poole data shown in Table 1, the percentage of each county's population that lied within the MTPO area was determined. For example, it was found that approximately 40.9% of Hawkins County's population actually live in the MTPO area.
2. Those proportions were held constant for each Tennessee county, and it was assumed that in 2015, the same percentage of each county's population resided in the MTPO area. So for Hawkins County, 40.9% of the 2015 Woods & Poole population (57,811) equates to 23,632.
3. The difference in population between 2010 and 2015 was then calculated to determine the population change within the MTPO area over the 5-year period.

Scott County

1. Comparison of Census data from 2000 and 2010 showed that over the 10-year period, the portion of Scott County that lies within the MTPO area grew by approximately 0.79% each year. However, Woods & Poole county-level estimates show that Scott County as a whole decreased in population by an average of 0.45% each year.
2. Based on the different levels of growth and decline shown between the two datasets, the difference between the two average annual growth rates was used to determine the 2015 Scott County population in the MTPO area. This equates to 0.35% (0.79% - 0.45%). This growth rate was then applied to the 2010 Census population for areas within the MTPO area, yielding a growth of 146 people between 2010 and 2015.

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
Hawkins County, TN	56,871	23,248	40.9%	57,811	23,632	384	**23,632**	**40.9%**
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%

Average Annual Percent Growth 2010-2015
0.18%

Kingsport MTPO

2015-2040 Allocation Tables
Projected Population Summary Tables

For Hawkins, Sullivan, and Washington counties, the Trend Scenario assumes that the proportion of the county population residing within the MTPO area remains the same over the 25-year horizon period and grows as the same rate as Wood's & Poole county-level population estimates. For Scott County, Virginia, the Trend Scenario assumes that the portion of Scott County within the MTPO area continues to grow at the same average annual growth rate used to determine the 2015 base year population (0.35%).

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
Hawkins County, TN	40.9%	**23,632**	24,782	25,968	27,161	**29,351**	**5,718**	**24.2%**	**40.9%**
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%**

Average Annual Percent Growth 2015-2040
0.44%

For Hawkins, Sullivan, and Washington counties, the Alternative Growth Scenario assumes that a larger proportion of each county's population resides within the MTPO area over the 25-year horizon period. This increased proportion of the population is still assumed to grow at the same rate as Wood's & Poole county-level population estimates. For Scott County, Virginia, the Alternative Growth Scenario assumes that the portion of Scott County within the MTPO area continues to grow at the same average annual growth rate seen between the 2000 and 2010 Census (0.79%).

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
Hawkins County, TN	43.0%	**23,632**	26,068	27,315	28,571	**30,874**	**7,242**	**30.6%**	**51.8%**
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%**

Average Annual Percent Growth 2015-2040
0.60%

Kingsport MTPO
2015-2040 Allocation Tables
Historic and Projected Employment Summary Tables

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%

The process of allocating employment control totals for the base year (2015) and the future year (2040) utilized a combination of data sources including 2015 InfoGroup data purchased by the MTPO, 2014 data produced by the Census Bureau through the Longitudinal Employer Household Dynamics survey (LEHD), and 2015 Woods & Poole (W&P) data. To determine county-level employment estimates, annual growth rates were established by the W&P data and were applied to the 2014 LEHD data. The 2015 InfoGroup data was used to determine base year employment totals within the MTPO area by county as well as by the following six employment types: agricultural, manufacturing, retail, office, service, and government. Additionally, based on the W&P data, annual county-specific growth rates were calculated for each of these employment types and were then applied to project employment within the MTPO area. Table 6 below shows the trend scenario with existing and projected employment for each county within the MTPO area using this method. Table 7 shows an alternative growth scenario, where a larger percentage of each county's growth is attributed to the MTPO area. Tables 8, 9, 10, and 11 show the distribution of employment by the six service types previously mentioned, both in the base year and in the future year. These distributions were determined using the 2015 InfoGroup data.

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%		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%	**0.76%**	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%		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%	**1.03%**	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%**

Bill Albright
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MEMORANDUM

To: Kingsport MTPO Executive Board

CC: Subscribed Interested Parties

From: Troy Ebbert, Transportation Planning Coordinator

Date: April 29, 2016

Subject: MTPO Executive Board Meeting

Please find the agenda for the next Kingsport MTPO Executive Board meeting scheduled for **Thursday, May 5, 2016 at 1:00 P.M. (ET) Jimmy Walker Conference Room, 2nd Floor of the Improvement Building, 201 W. Market Street, (downtown) Kingsport, Tennessee.**

In addition to the public comments, project updates and general information items

There are four actions Items:

- **Minutes**
- **Adoption of the Virginia 16-17 UPWP**
- **TIP Amendment 14 – Press Rd**
- **TIP Amendment 15 – 5339 Funds for KATS**

If you are unable to attend, you may designate a proxy in writing to represent you. A sample proxy letter is enclosed. The minutes from the last Executive Board meeting are also enclosed.

KMTPO is a regional transportation planning agency representing all or portions of: Kingsport, Sullivan County, Hawkins County, Greene County, Washington County, Scott County, Church Hill, Mount Carmel, Gate City, Weber City

Agenda

Kingsport MTPO Executive Board
May 5, 2016 at 1:00 PM (EDT)
Improvement Building – 2nd Floor Conference Room
201 W. Market St, Kingsport, TN 37660

1. Executive Board Welcome

2. Approval of Minutes from February 9, 2016 Meeting:

■ Action □ Possible Action □ Discussion □ Information

3. Public Comment on Agenda Items

□ Action □ Possible Action □ Discussion ■ Information

Those wishing to make a comment pertaining to any of the agenda items may do so at this time with a five-minute time limitation. Comments not pertaining to a specific agenda item will be heard during the end of the meeting in the Public Hearing section.

4. Adoption of the Virginia 2016-2017 UPWP (Work Program)

■ Action □ Possible Action □ Discussion □ Information

Presenter: Bill Albright

Item Summary: This is the yearly review and update of the work program as required by FHWA, TDOT and VDOT.

Recommendation: Adopt the UPWP as presented.

5. Functional Classification Status

□ Action □ Possible Action ■ Discussion ■ Information

Presenter: TDOT Staff

Item Summary: The functional classification process in complete, the MPO has received the approval letter from FHWA and TDOT.

6. TIP Amendment # 14 – Press Road

■ Action □Possible Action □ Discussion □ Information

Presenter: Mark Sandidge

Item Summary: Press Road is located within the municipal limits of Church Hill and serves both industrial and residential land uses. In order use STP funds, the road is required to have a minimum functional classification. The City of Church Hill has requested STP funds to resurface Press Road.

Recommendation: With an approved functional class update, staff recommends approval of the project.

7. **TIP Amendment # 15 - KATS 5339 Capital Purchase Funds**

■ Action □Possible Action □ Discussion □ Information

Presenter: Chris Campbell

Item Summary: Based on the new FAST Act eligibility rules, TDOT Multimodal has allocated FTA Section 5339 small urban program funds for Federal Fiscal Years 2013, 2014, 2015, and 2016 to direct recipients in small UZAs. KATS is receiving $373,000 in federal funds with a ten percent match from both the state and the city.

Recommendation: Approval of TIP amendment as presented

8. FY17-FY22 TIP Development

□ Action □ Possible Action ■ Discussion □Information

Presenter: Troy Ebbert

Item Summary: A call for projects was advertised on February 1, 2016 and a letter announcing the call was sent at the end of January to all stakeholders. Two sidewalk projects were submitted, with new projects at this time. The new TIP will carry projects forward and the remaining will remain programed at this time until a need has been identified and approved. Final adoption of the new TIP is scheduled for November 3, 2016

9. 2040 Long Range Plan

■ Action □ Possible Action □ Discussion □Information

Presenter: RPM

Item Summary:

1. Update the board regarding the outcomes from our first round of stakeholder meetings
2. Update the board on the public engagement to date (through the WikiMaps and online survey)
3. Get the board to review and approve the goals and objectives for the LRTP (we have slightly revised these due to language included in the FAST Act)
4. Get the board to review and approve the E+C project list

10. Staff Reports - Projects, Initiatives, Updates

□ Action □ Possible Action □ Discussion ■ Information

Presenter: Staff

- Stone Drive Multimodal Grant, East and West
- 5317 Funding for sidewalks

11. Public Comment

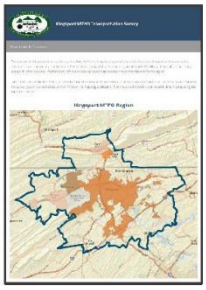
□ Action □ Possible Action □ Discussion ■ Information

Members of the public may address the Executive Board with issues related to the region's transportation system. There is a five-minute time limitation per individual and/or topic

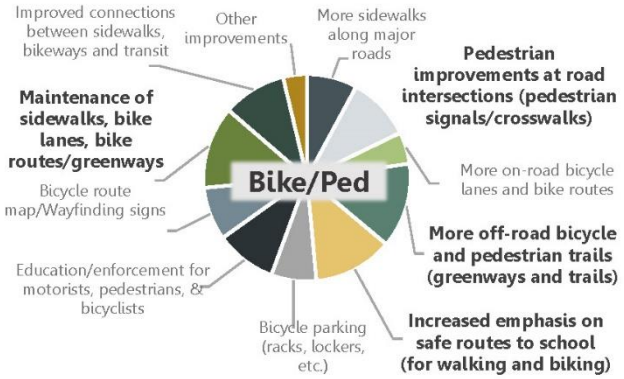
12. Meeting Adjournment

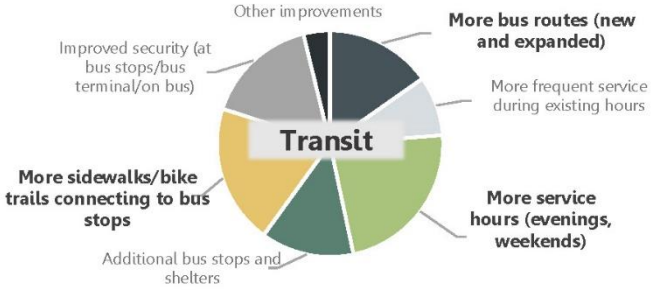
Kingsport's 2040 Long-Range Transportation Plan Update

Public Involvement



Using an online survey and mapping application, we've been able to engage nearly 150 residents in the Kingsport area to date. They've told us about their roadway, transit, non-motorized needs among other priorities for the region.





Stakeholder Engagement

We were able to conduct eight meetings with over 40 stakeholders related to various topics and groups including:

- Freight & Logistics
- Safety & Law Enforcement
- Economic Development
- Transit, Active Transportation & Health
- Hawkins County Agencies
- Scott County Agencies
- Regional Agency Coordination
- Local Agency Coordination

Key Take-Aways

- **Greenbelt** is extremely important for economic development and as a transportation option
- Identification of **safety and capacity issues** at key intersections and on major roadways
- **Interchange at I-26 / I-81** is generally congested, unsafe, and problematic for large trucks
- Consensus from MPOs on **expected population and employment growth**
- Identification of other plans and **redevelopment opportunities** around the Kingsport area
- Need for better linkage between **multimodal investments** and low-income populations
- Implications of **House Bill 2 (HB2)** on transportation projects in Gate City and Weber City

2040 Kingsport MPO Long-Range Transportation Plan

Review of Goals & Objectives from 2035 Kingsport Transportation Plan to ~~MAP-21~~FAST Act Planning Factors, TDOT's LRTP, and VDOT's LRTP

Proposed 2040 Kingsport Metropolitan Area Transportation Plan	~~MAP-21 (2012)~~FAST Act (2015)		TDOT's 25-Year Long-Range Transportation Plan (2015) Guiding Principles	VTrans2040 (2015) Goals
	Planning Factors	National Goals		
Goal # 1: Livability - Provide safe, secure, convenient, and active transportation choices to all citizens that strengthen the livability and health of our communities and region. • Objective: Improve safety by reducing transportation-related fatalities and injuries • Objective: Make streets a place for all users - "Complete Streets" • Objective: Promote active transportation by increasing opportunities for short trips through improved accessibility to alternative modes • ~~Increase opportunities for short trips to be made by non-motorized modes to promote active transportation~~ • Objective: Increase transit and other transportation demand management opportunities as a means of providing affordable transportation options • Objective: Strive to balance capacity and mobility needs for all users whereby connections to and across modes and land uses function harmoniously	Increase the safety of the transportation system for motorized and non-motorized users. Increase the security of the transportation system for motorized and non-motorized users. Increase accessibility and mobility of people and freight.	**Safety** - Achieve a significant reduction in traffic fatalities and serious injuries on all public roads.	**Maximize Safety and Security** Reduce injuries and fatalities in all modes of transportation; minimize construction-related safety incidents; improve disaster and extreme weather preparedness and incident response. **Provide for the Efficient Movement of People and Freight** Deliver an integrated, multimodal transportation system that optimizes the movement of people and goods by providing greater access to transportation services for all people and by building better connections among different modes of transportation. **Build Partnerships for Sustainable and Livable Communities** Provide early and ongoing opportunities for broad public input on plans and programs; work closely with local public and private planning efforts; proactively coordinate land use and transportation planning to optimize the efficiency and long term viability of the transportation system.	**Goal C: Safety for All Users** Provide a safe transportation system for passengers and goods on all travel modes. **Goal E: Healthy and Sustainable Communities** Support a variety of community types promoting local economies and healthy multi-modal lifestyles that minimize vehicle travel, while preserving agricultural, natural, historic and cultural resources.
Goal # 2: Sustainability - Promote and advance sustainable transportation choices for the greater Kingsport Region that support long-term economic, social, and environmental sustainability within and throughout the region. • Objective: Maintain what we have – take a "state of good repair" approach to our community's transportation assets • Objective: Seek cost-effective management solutions and new technologies as a means of addressing congestion, improving travel time reliability, reducing transportation delay, and improving system operations • Objective: Seek improvement options which minimize adverse impacts of surface transportation to historical, social, cultural, and natural environments including stormwater impacts • Objective: Promote investment solutions that improve the resiliency of the transportation system and~~that reduce carbon and other harmful emissions from transportation~~reduce transportation impacts on air-quality	Promote efficient system management and operation. Emphasize the preservation of the existing transportation system. Improve the resiliency of the transportation system and reduce or mitigate stormwater impacts of surface transportation Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns.	**Infrastructure condition** - Maintain the highway infrastructure asset system in a state of good repair. **Congestion reduction** - Achieve a significant reduction in congestion on the National Highway System. **System reliability** - Improve the efficiency of the surface transportation system. **Environmental sustainability** - Enhance the performance of the transportation system while protecting and enhancing the natural environment.	**Preserve and Manage the Existing System** Balance maintenance and preservation needs with critical capacity enhancements and operations. Optimize system capacity and safety through cost effective management and new technologies. **Protect Natural, Cultural and Environmental Resources** Responsibly plan and manage the transportation system to maintain the integrity of communities, historical sites and the natural environment, minimize and mitigate impacts of transportation projects, and develop a transportation network that improves congestion and addresses air quality issues.	**Goal D: Proactive System Management** Maintain the transportation system in good condition and leverage technology to optimize existing and new infrastructure.
Goal # 3: Prosperity - Promote transportation policies and investments that advance quality economic development and redevelopment, economic competitiveness, and ~~increased~~ efficient access to people, places, and goods and services within and throughout the region. • Objective: Strategically target transportation investments to areas supportive and conducive to growth and redevelopment initiatives • Objective: Support transportation investments and policies that work to create jobs, efficiently move freight, promote tourism, and improve access to all modes and destinations ~~people, places, and goods~~ while embracing access management and corridor management strategies that preserve the long-term functionality of a roadway's capacity and safety • Objective: Support land use and development patterns that reduce transportation costs and expenditures and improve accessibility for all • Objective: Continue to promote and foster an environment by which citizens, communities, jurisdictions, elected officials, and other stakeholders can collaboratively advance a sustainable multimodal transportation system that provides safe and secure connections throughout a livable and prosperous region	Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight. Enhance travel and tourism Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency.	**Freight movement and economic vitality** - Improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development. **Reduced project delivery delays** - Reduce project costs, promote jobs and the economy, and expedite the movement of people and goods by accelerating project completion through eliminating delays in the project development and delivery process, including reducing regulatory burdens and improving agencies' work practices.	**Support the State's Economy** Invest in transportation infrastructure that advances quality economic development and redevelopment, economic competitiveness, tourism, and increased access to people, places, goods and services within and through the State. **Emphasize Financial Responsibility** Provide accountability; maximize Tennessee's share of federal transportation funding; develop alternative funding strategies; select projects based on identified regional needs; allow flexibility in local management of projects where feasible	**Goal A: Economic Competitiveness and Prosperity** Invest in a transportation system that supports a robust, diverse, and competitive economy. **Goal B: Accessible and Connected Places** Increase the opportunities for people and businesses to efficiently access jobs, services, activity centers, and distribution hubs.

DRAFT 5/5/16

Projects Completed Since 2009 & Committed Improvements (E+C Network)

TDOT/VA #	Project/Route	From/To	Type of Improvement	Improvement Description	Status	Funding Source
Projects Completed Since Last Plan						
17747.00	Intersection of SR-224, US-23, & US-58 (RTE 58) (Moccasin Gap)	From: 0.486 Kilometer West ECL Weber City to: 0.491 Kilometer East ECL Weber City	New Intersection	Modify intersection to accommodate the Moccasin Gap Bypass	Completed	--
112769.00	SR-1 - Main St / Hammond Ave Signalization & Geometric Improvements	Intersection of SR 1/Hammond Ave and Main St/Hammond Ave	Intersection	Dual signal arrangement with a coordinated timing plan along with the installation of additional geometric improvement to add turning lanes and other safety improvements as designed.	Completed	--
040028.01	I-26 Tennessee Welcome Center	Proposed Welcome Station South of Bell Ridge Road	Welcome Center	Construct New Tennessee Welcome Station	Completed	--
101397.00	SR-75	SR-36 to SR-357 (HPP ID# 2026, 388 & 4969)	Widening	Widen from 2 lanes to 5 lanes	Completed	--
City of Kingsport	Gibson Mill	From Gibson St to Watauga St	Reconstruction	Reconstruct to 3 lanes as part of Gibson Mill Rd Improvements (transition to 2 lanes near Robertson St) (Phase V from Stone Drive (US 11)to Bloomingdale Pike is forthcoming)	Completed	--
City of Kingsport	Rock Springs Road	From Edinburgh Channel Rd (entrance to new elementary school) to Cox Hollow/Rock Springs Drive	Safety/ Reconstruction	Add shoulders, multi-use path, and eliminate horizontal/vertical curves	Completed	--
15-TSTI	Stone Dr East (US 11W/SR 1)	John B. Dennis (SR 93) to Lynn Garden Dr (SR 36)	Signal Synchronization	Improve intersections and coordinate signal timings	Completed	--
13-TSTI	Sevier Ave	From Eastman Road to East Ravine Road	Intersection Improvements	Add turning lanes at various intersections as part of redevelopment corridor study	Completed	--
13-TC	Sullivan St. West	Church Circle Dr to Roller Lane	Reconstruction	Reconstruct existing 2-lane roadway to include a center turn lane (paved shoulder and other geometric improvements at select locations/intersections as determined thru the project development process)	Completed	--
Committed Projects						
86598.00	US-23 (RTE 23)	SBL Over North Fork Holston River(VA Structure #1103)	Bridge Replacement	Bridge Replacement	Design Complete	State STP
101359.00	US-23 (RTE 23)	NBL Over North Fork Holsten River(VA Structure #1108)	Bridge Replacement	Bridge Replacement	Design Complete	State STP
13-TC	Sullivan St. West	From Roller Lane to Lynn Garden Dr (SR-36)	Reconstruction	Reconstruct existing 2-lane roadway to include a center turn lane (paved shoulder and other geometric improvements at select locations/intersections as determined thru the project development process)	Under Design	City of Kingsport
293.00	Route 614 (Yuma Road)	From .06 miles west of intersection Route 713 to .02 miles east of Route 867 West	Reconstruction	Reconstruction to widen shoulders and straighten curves	Under Construction	State STP
114173.00	I-81	Eastbound truck climbing lane at mile marker 60 to Exit 63	Widening	Add an eastbound truck climbing lane from mile marker 60 to Exit 63 to improve congestion.	Under Construction	State STP
105467.00	SR-126 (Memorial Blvd)	From East Center Street in Kingsport to East of Cooks Valley Road	Widening	Widening project from 3 to 4 with grass median to Harbor Chapel Road and from 2 to 3 lanes from Old Stage Road to Cooks Valley Road	Design Complete, ROW	State STP (IMPROVE)
8-TC	SR-126 (Memorial Blvd)	Cooks Valley Rd to Interstate 81	Reconstruction	Reconstruct existing 2 lane roadway to include a center turn lane (paved shoulder and other geometric improvements at select locations/intersections as determined thru the project development process)	Design	State STP (IMPROVE)
112834.00	SR-93 (Sullivan Gardens Pkwy) Phase I	From Derby Drive to Murrell Road	Safety/Geometric Improvements	Various safety spot improvements along the corridor at five locations. Improvements range from the addition of a center turn lane at two locations, the flattening of existing horizontal curves, the addition of paved shoulders at several locations, and sidewalk improvements at one location.	ROW	State STP (IMPROVE)
112834.02	SR-93 (Sullivan Gardens Pkwy) Phase II	Morgan Lane to South of Baileyton Road	Safety/Geometric Improvements	Various safety spot improvements along the corridor at five locations. Improvements range from the addition of a center turn lane at two locations, the flattening of existing horizontal curves, the addition of paved shoulders at several locations, and sidewalk improvements at one location.	ROW	State STP (IMPROVE)
112834.0*	SR-93 (Sullivan Gardens Pkwy) Phase III	From Warren Street to Davis Road	Safety/Geometric Improvements	Various safety spot improvements along the corridor at five locations. Improvements range from the addition of a center turn lane at two locations, the flattening of existing horizontal curves, the addition of paved shoulders at several locations, and sidewalk improvements at one location.	ROW	State STP (IMPROVE)
11-TC	Rock Springs Rd	Interstate 26 (I-26) to Cox Hollow Rd	Reconstruction	Reconstruct existing 2 lane roadway to include a center turn lane (paved shoulder and other geometric improvements at select locations/intersections as determined thru the project development process)	Under TDOT Contract	Local STP/MPO and State STP and City of Kingsport
3-TSTI	US 11W/SR 1	Intersection with Englewood Ave. and Belmont Ave.	Intersection Improvements Signalization	Install new signal at Englewood and US 11W. Correct median alignment and turning lanes for Belmont and US 11W.	Design	Federal HSIP
7-TSTI	Lynn Garden Dr (SR 36)	West Center Street to West Carters Valley Rd (SR 346)	Signalization	Intersection and signalization improvements (including signal system interconnection and signal timing/coordination)	Under Contract	Local STP
1-TSTI	Airport Pkwy (SR 357)	At Flagship Dr.	Intersection Improvements	Install new signal at Flagship Dr, - Add turning lanes & improve geometry	Design Complete	Federal HSIP
34-TSTI	Riverport Rd.	From Holston River Sluice Bridge to Wilcox Dr. (SR 126)	Safety/Geometric Improvements	Perform slope stabilization to correct erosion and maintenance issues	Under Design	City of Kingsport

TDOT/VA #	Project/Route	From/To	Type of Improvement	Improvement Description	Status	Funding Source
Committed Projects (cont.)						
City of Kingsport	Indian Trail Drive	From Reedy Creek Road to Stone Drive	New Roadway	Construct new 2 lane roadway to divert traffic from Eastman Road and Stone Drive	Design Complete	City of Kingsport
City of Kingsport	Main Street	From Clinchfield Street to Sullivan Street	Reconstruction	Resurfacing, repairing curb, sidewalk, additions of bulbouts, ADA enhancements, removal of rail siding, diamond grinding, specific areas of sub-surface repair and rebuild.	Under Design	Local STP (MPO)
121031.00	SR-126 (Memorial Blvd)	At Island Road	Signalization and Geometric Improvements	Installation of new 4-way traffic signal and associated equipment; geometric improvements to lane configuration (4th access will be from existing shopping center and planned multifamily development)	ROW	Local STP (MPO)
122158.00	Fort Robinson Bridge Replacement		Bridge Replacement	Bridge Replacement	Under Contract	Federal BR program (IMPROVE)
City of Kingsport	Sevier Avenue (Crosstown Connector from Gibson Mill to Sevier to Centre)	At Boone Street, Tennessee Street, and East Ravine Road	Reconstruction	Realign portion of Sevier Avenue to link with Gibson Mill and existing Sevier Avenue. Improve intersections and turning movements	Under Design	City of Kingsport
City of Kingsport	Island Road Improvements	From Memorial Blvd to Golf Ridge Drive	Multimodal Improvements	Correct geometric deficiencies, widen shoulders and provide buffered multiuse path	Under Design	City of Kingsport

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Transportation Manager

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MEMORANDUM

To: Kingsport MTPO Executive Board

CC: Subscribed Interested Parties

From: Troy Ebbert, Transportation Planning Coordinator

Date: October 28, 2016

Subject: MTPO Executive Board Meeting

Please find the agenda for the next Kingsport MTPO Executive Board meeting scheduled for **Thursday, November 3, 2016 at 1:00 P.M. (EST), Council Chambers, 2nd Floor of City Hall, 225 W. Center Street, (downtown) Kingsport, Tennessee.**

In addition to the public comments, project updates and general information items

There are four actions Items:

- **Minutes**
- **2017-2021 TIP Adoption**
- **2017 Executive Board Meeting Schedule**
- **Endorsement of Project Evaluation Criteria**

If you are unable to attend, you may designate a proxy in writing to represent you. A sample proxy letter is enclosed. The minutes from the last Executive Board meeting are also enclosed.

KMTPO is a regional transportation planning agency representing all or portions of: Kingsport, Sullivan County, Hawkins County, Greene County, Washington County, Scott County, Church Hill, Mount Carmel, Gate City, Weber City

Agenda

Kingsport MTPO Executive Board
November 3, 2016 at 1:00 PM (EST)
City Hall – 2nd Floor Council Room
225 W. Center St, Kingsport, TN 37660

1. Executive Board Welcome

2. Approval of Minutes from August 8, 2016 Meeting:

■ Action □ Possible Action □ Discussion □ Information

3. Public Comment on Agenda Items

□ Action □ Possible Action □ Discussion ■ Information

Those wishing to make a comment pertaining to any of the agenda items may do so at this time with a five-minute time limitation. Comments not pertaining to a specific agenda item will be heard during the end of the meeting in the Public Hearing section.

4. Adoption 2017-2021 Transportation Improvement Program

■ Action □ Possible Action □ Discussion □ Information

Presenter: Bill Albright/Troy Ebbert

Item Summary: Per 23 CFR 134(J)(1)(D)(i) the Transportation Improvement Plan (TIP) at least every 4 years. We are presenting a 5-year TIP with the last year being illustrative. (Attachment Included)

Recommendation: Adopt the TIP subject to final approval from FHWA

5. Presentation of Federally Obligated Projects

□ Action □ Possible Action □ Discussion ■ Information

Presenter: Bill Albright

Item Summary: Per 23 CFR 450.332 we are required to publish the obligated projects within 90 days from the end of the program year as outlined in the Kingsport MTPO Public Participation Plan. This information is published online and available on the Library, City Hall and the Improvement Building per the PPP for review by the public. (Attachment included)

6. 2017 Meeting Schedule

■ Action □Possible Action □ Discussion □ Information

Presenter: Troy Ebbert

Item Summary: Staff has presented a tentative schedule for 2017.

Recommendation: Approve schedule as presented or make changes.

7. 2040 Long Range Transportation Plan Update

■ Action □Possible Action ■ Discussion ■ Information

Presenter: Preston Elliott AICP- RPM Planning Consultants

Item Summary:

- Stakeholder Input
- Public Input
- Schedule of Current and Remaining Activities

Endorsement of Project Evaluation Criteria (Action Item)
This item would include presenting proposed project evaluation criteria which would be used to assess projects being considered for the long-range plan. This criteria is not the same as what the MTPO uses for the TIP but is rather criteria that supports the direction of the long-range transportation goals and objectives. The use of the criteria allows for the MTPO to see how one project compared to another furthers the MTPO's LRTP vision. The criteria to be presented would include the current plan criteria and minor additions/changes to criteria to account for FAST Act provisions (2 new planning factors), TDOT's deficiency analysis tool, and VDOT's SMART SCALE.

8. Project Updates
A list of staff updates is attached to the agenda; Staff will not cover the material unless requested.

9. Public Comment

□ Action □ Possible Action □ Discussion ■ Information

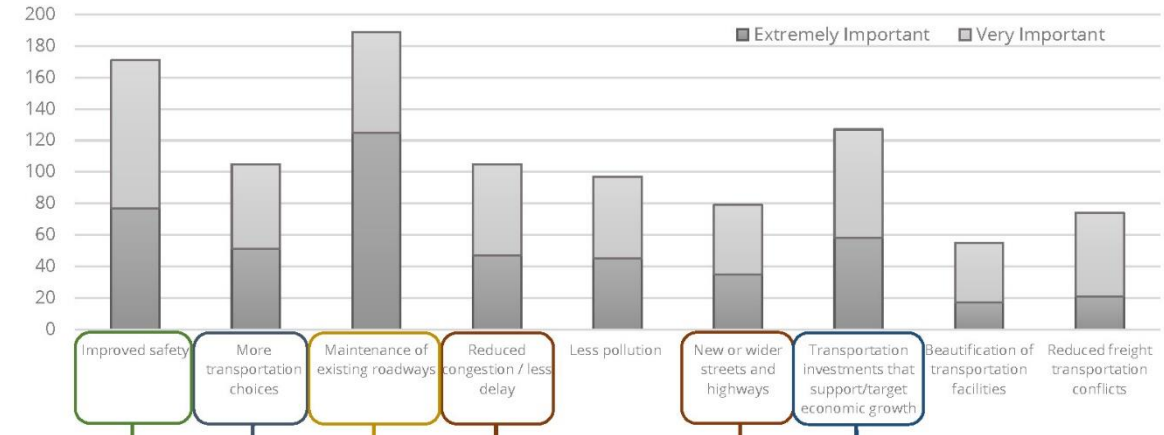
Members of the public may address the Executive Board with issues related to the region's transportation system. There is a five-minute time limitation per individual and/or topic

10. Meeting Adjournment

Kingsport's 2040 Long-Range Transportation Plan Update

Public and Stakeholder Engagement Update

Using five public meetings as well as an online survey and mapping application, we've been able to engage nearly 250 residents in the Kingsport area to date. They've revealed their priorities, concerns, and issues for the region.



Areas of importance:
- Focused development in existing, urban areas
- Focused development in high-growth areas

Areas of importance:
- Improved safety of roadways
- Improved security at bus stops
- Interchanges ramp improvements

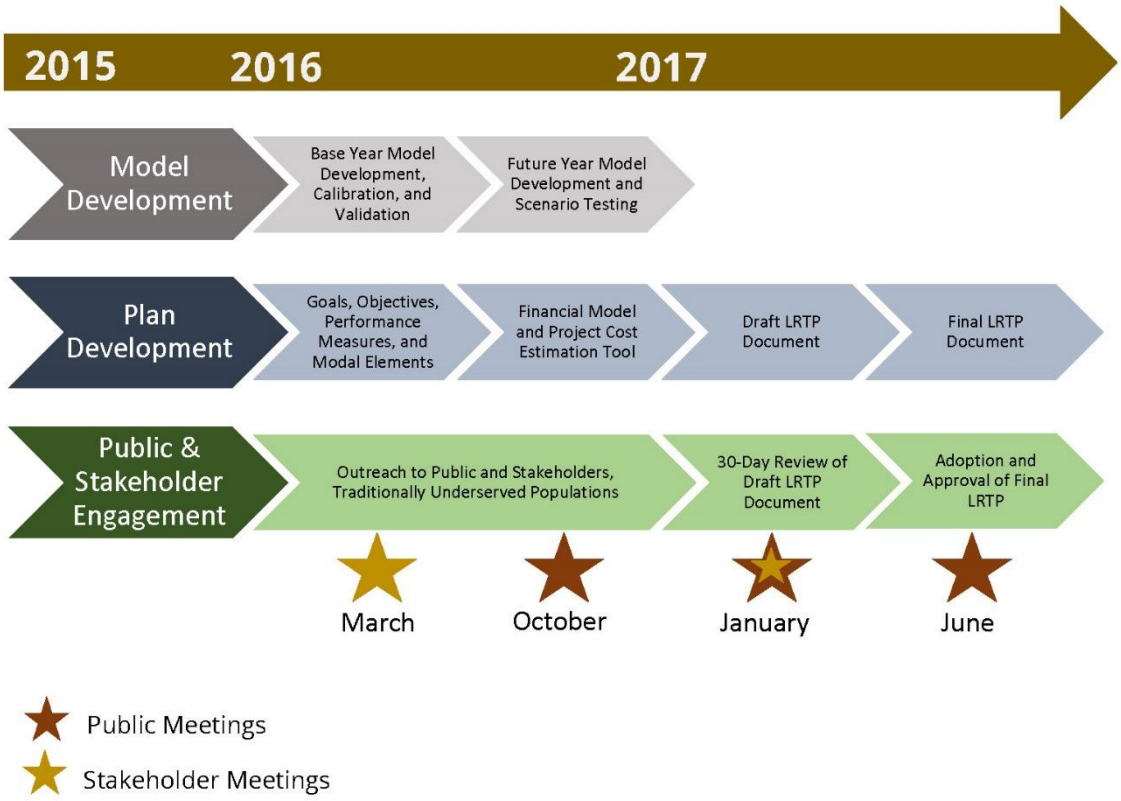
Areas of importance:
- Improved timing of traffic signals
- Better connections between travel options

Areas of importance:
- Improve pavement and bridges
- Maintenance of non-motorized infrastructure

Areas of importance:
- Pedestrian improvements at intersections
- Off-road bicycle and pedestrian trails
- Emphasis on safe routes to school
- Improved security at bus stops
- Increased transit service hours

Kingsport's 2040 Long-Range Transportation Plan Update

Long-Range Transportation Plan Update



Kingsport MTPO
2040 Long-Range Transportation Plan
Project Evaluation Criteria – Review & Recommendation

KMTPO 2035 LRTP (2012)	Percentage	TDOT Highway Deficiency Analysis Tool (HDAT) (2016)	Percentage	VDOT SMART SCALE (2016)	Percentage
Safety	25%	Safety & Security	33%	Safety	30%
Operational Efficiency (Congestion)	20%	Preserve & Manage the Existing System	32%	Congestion Mitigation	10%
Access (Accessibility)	5%	Livable Communities (Accessibility)	5%	Accessibility	15%
Active Transportation (Multimodal)	25%	Efficient Movement of People & Freight	5%		
Environmental	10%	Environmental Impact	4%	Environmental Quality	10%
Economic	15%	Support the State's Economy	21%	Economic Development	35%
Total Points	**100%**		**100%***		**100%***

* Normalized to 100%

KMTPO 2040 LRTP (Proposed)	Percentage
Safety	25%
Operational Efficiency (Congestion)	20%
Access (Accessibility)	10%
Active Transportation (Multimodal)	15%
Environmental	10%
Economic	20%
Total Points	**100%**

DRAFT – 11/3/16

Bill Albright
Transportation Manager

Troy Ebbert
Transportation Coordinator

Kingsport MTPO
201 West Market St
Kingsport, TN 37660
MTPO@KingsportTn.gov
423.224.2670

MEMORANDUM

To: Kingsport MTPO Executive Board

CC: Subscribed Interested Parties

From: Troy Ebbert, Transportation Planning Coordinator

Date: February 2, 2017

Subject: MTPO Executive Board Meeting

Please find the agenda for the next Kingsport MTPO Executive Board meeting scheduled for **Thursday, February 9, 2017 at 10:00 A.M. (EST), Engineering Building, (behind Improvement Building) 130 Shelby Street (downtown) Kingsport, Tennessee.**

In addition to the public comments, project updates and general information items

There are six actions Items:

- **Minutes**
- **Election of Vice-Chairman**
- **TIP Amendment 1 Virginia Projects**
- **TIP Amendment 2 TN STIP Amendment 24 Highway Safety Improvement Program**
- **TIP Amendment 3 TN `STIP Amendment 25 National Highway Performance Program**
- **Support for the LRTP financial plan and project evaluation.**

If you are unable to attend, you may designate a proxy in writing to represent you. A sample proxy letter is enclosed. The minutes from the last Executive Board meeting are also enclosed.

KMTPO is a regional transportation planning agency representing all or portions of: Kingsport, Sullivan County, Hawkins County, Greene County, Washington County, Scott County, Church Hill, Mount Carmel, Gate City, Weber City

Agenda

Kingsport MTPO Executive Board
February 9, 2017 at 10:00 AM (EST)
Engineering Building Conference Room
130 Shelby Street, Kingsport, TN 37660

1. **Executive Board Welcome**

2. **Approval of Minutes from November 3, 2016 Meeting:**

   ■ Action □ Possible Action □ Discussion □ Information

3. **Public Comment on Agenda Items**

   □ Action □ Possible Action □ Discussion ■ Information

   Those wishing to make a comment pertaining to any of the agenda items may do so at this time with a five-minute time limitation. Comments not pertaining to a specific agenda item will be heard during the end of the meeting in the Public Hearing section.

4. Election of Executive Board Vice-Chairman

   ■ Action □ Possible Action □ Discussion □ Information

   Presenter: Troy Ebbert

   Item Summary: The By-laws of the Kingsport MTPO require an election of a Vice-chairman at the first meeting of each calendar year. This seat is currently held by Mr. Jimmy Adkins of LENOWISCO.

5. **TIP Amendment #1 Virginia Projects**

   ■ Action □ Possible Action □ Discussion □ Information

   Presenter: Troy Ebbert/Donny Necessary

   Item Summary: The Virginia TIP development and adoption schedule is not the same as TDOT's schedule this year. This is amendment # 1 to the 2017-2022 TIP to add all of the Virginia projects.

   Recommendation: Adopt the TIP subject to final approval from VDOT

6. TIP Amendment #2, TN STIP Amendment 24 Highway Safety Improvement Program

■ Action □ Possible Action □ Discussion □ Information

Presenter: Troy Ebbert

Item Summary: TDOT is requesting to add $1.0 million to the HSIP grouping for FY- 2017.

Recommendation: Adopt the amendment as presented.

7. TIP Amendment #3, TN `STIP Amendment 25 National Highway Performance Program

■ Action □ Possible Action □ Discussion □ Information

Presenter: Troy Ebbert

Item Summary: TDOT is requesting to add $3.5 million to the NHPP grouping for FY-2017.

Recommendation: Adopt the amendment as presented.

8. Tennessee IMPROVE Act Information

□ Action ■ Possible Action ■ Discussion ■ Information

Presenter: Michelle Christian

Item Summary: Tennessee Governor has introduced a transportation funding proposal that includes an increase in the TN gas tax. The presentation will outline the act and give information how it effects the transportation projects in Tennessee. A resolution of support will be available to the board if requested.

9. 2040 Long Range Transportation Plan Update

■ Action □Possible Action ■ Discussion ■ Information

Presenter: Preston Elliott AICP- RPM Planning Consultants/ KCI Technologies

Item Summary: The 2040 LRTP is nearing completion; RPM will present the financial plan and project evaluation process and request guidance/support from the executive board.

10. Project Updates

A list of staff updates is attached to the agenda; Staff will not cover the material unless requested.

11. Public Comment

□ Action □ Possible Action □ Discussion ■ Information

Members of the public may address the Executive Board with issues related to the region's transportation system. There is a five-minute time limitation per individual and/or topic

12. Meeting Adjournment

The next schedule meeting date in May 4, 2017 at 1:00 P.M. in the Kingsport City Hall.

Project Scoring Criteria

Priority	Points	Measure	Thresholds	Score
Safety (25 points)	15	Number of auto crashes	< 50	3
			50 - 100	6
			100 - 150	9
			150 - 200	12
			> 200	15
	5	Number of bike/pedestrian crashes	0	0
			1 - 2	5
			> 2	10
	3	Existing Crash Rate	< 1	1
			1 - 5	2
			> 5	3
	2	Low-volume, narrow streets	Yes	2
			No	0
Operational Efficiency (20 points)	5	LOS improved between 2015 and 2040 E+C	< -10%	5
			-10% - 0%	2
			> 0%	0
	5	LOS improved between 2040 E+C and 2040 vision run	<5%	0
			5% - 20%	2
			> 20%	5
	5	Traffic signal projects	Yes	5
			No	0
	2	Creates parallel facility/system redundancy	Yes	2
			No	0
	3	Difference between 2015 and 2040 vision AADT	< 1000	1
			1000 - 2500	2
			> 2500	3
Accessibility (10 points)	3	Population growth surrounding project 2015-2040	< 100	1
			100 - 500	2
			> 500	3
	3	Employment growth surrounding project 2015-2040	< 100	1
			100 - 500	2
			> 500	3
	4	Improves connectivity of system	Yes	4
			No	0
Active Transportation (15 points)	5	Qualitative non-motorized demand near project	Low	1
			Medium	3
			High	5
	5	Number of above average EJ populations touched by project (65+, low income, disabled)	1	1
			2	3
			3	5
	5	PLOS or BLOS of D or worse	Neither	0
			Single	2
			Both	5
Environmental (10 points)	5	Number of challenging areas the project touches (floodplains, historical areas, steep slopes, and parks)	0	5
			1	4
			2	3
			3	1
			4	0
	5	Projects improves capacity without widening or adding new facility	Yes	5
			No	0
Economic (20 points)	4	Percent of trucks in 2040 E+C	< 2%	1
			2% - 5%	2
			> 5%	4
	4	Within 1/2 mile of freight-dependent industries	Yes	4
			No	0
	4	Number of ATRI truck trip origins and destinations	< 400	2
			> 400	4
	2	Accessibility of HS Educated Workforce and Jobs	< 1400	1
			> 1400	2
	2	Accessibility of College Educated Workforce and Jobs	< 2400	1
			> 2400	2
	4	Improves access to identified tourist destinations	Yes	4
			No	0

DRAFT 2/8/17

Kingsport Area MTPO
2040 Long Range Transportation Plan
Revenue Forecasts

Capital Funding - Tennessee

Revenue Source	Annual Average*				Revenue Projections		
Tennessee Revenue Sources	**Federal Share**	**Non-Federal Share**	**Total**	**Inflation Factor ****	**2025 Horizon Year**	**2040 Horizon Year**	**Total 2015-2040**
National Highway Performance Program (NHPP) (80%/20%)	$ 2,200,000	$ 550,000	$ 2,750,000	1.03	$ 36,278,000	$ 72,923,000	$ 109,201,000
Surface Transportation Block Grant Program (S-STBG) Funds State Selected Projects (80%/20%)	$ 1,300,000	$ 325,000	$ 1,625,000	1.03	$ 21,437,000	$ 43,091,000	$ 64,528,000
Safety Funding (90%/10%)	$ 450,000	$ 50,000	$ 500,000	1.03	$ 6,596,000	$ 13,259,000	$ 19,855,000
Bridge Rehabilitation & Replacement (BRR or BR) (80%/20%)	$ 455,000	$ 113,750	$ 568,750	1.03	$ 7,503,000	$ 15,082,000	$ 22,585,000
Surface Transportation Block Grant Program (L-STBG) Funds MPO Selected Projects (80%/20%)	$ 1,400,000	$ 350,000	$ 1,750,000	1.03	$ 23,088,000	$ 46,406,000	$ 69,492,000
Enhancement Funds (EHN, TAP, or RTP) (80%/20%)	$ 200,000	$ 50,000	$ 250,000	1.03	$ 3,298,000	$ 6,629,000	$ 9,927,000
Safe Routes to School (100% Federal)	$ 50,000	$ -	$ 50,000	1.03	$ 660,000	$ 1,326,000	$ 1,986,000
Other Federal-Aid Programs & Discretionary Funds (e.g. APD, ARRA, TIGER, NHFP) (80%/20%)	$ 320,000	$ 80,000	$ 400,000	1.03	$ 5,277,000	$ 10,607,000	$ 15,884,000
State Funds (STA or SP and SPPR) (100% State)		$ 400,000	$ 400,000	1.03	$ 5,277,000	$ 10,607,000	$ 15,884,000
City of Kingsport, TN (100% Local)		$ 1,800,000	$ 1,800,000	1.03	$ 23,746,000	$ 47,732,000	$ 71,478,000
Sullivan County, TN (100% Local)		$ 190,000	$ 190,000	1.03	$ 2,506,000	$ 5,038,000	$ 7,544,000
Town of Mt Carmel TN (100% Local)		$ 14,000	$ 14,000	1.03	$ 185,000	$ 371,000	$ 556,000
City of Church Hill, TN (100% Local)		$ 58,000	$ 58,000	1.03	$ 765,000	$ 1,538,000	$ 2,303,000
Hawkins County, TN (100% Local)		$ 65,000	$ 65,000	1.03	$ 857,000	$ 1,724,000	$ 2,581,000
Sub-Total (TN)	**$ 6,375,000**	**$ 4,045,750**	**$ 10,420,750**		**$ 137,471,000**	**$ 278,333,000**	**$ 413,804,000**

* Based on a review of historic funding levels to the MTPO region.
** Revenue forecasts assume a 3 percent annual growth rate of funding.
Projections rounded to the nearest thousands

Draft 02/08/17

Kingsport Area MTPO
2040 Long Range Transportation Plan
Revenue Forecasts

Capital Funding - Virginia

Revenue Source	Annual Average*				Revenue Projections		
Virginia Revenue Sources	Federal Share	Non-Federal Share	Total	Inflation Factor**	2025 Horizon Year	2040 Horizon Year	Total 2015 - 2040
Interstate, Primary, Secondary, and Statewide Construction***	$ 1,191,040	$ 297,760	$ 1,488,800		$ 25,690,000	$ 11,530,000	$ 37,220,000
Gate City, VA (100% Local)		$ -	$ -		$ -	$ -	$ -
Weber City, VA (100% Local)		$ -	$ -		$ -	$ -	$ -
Sub-Total (VA)	**$ 1,191,040**	**$ 297,760**	**$ 1,488,800**		**$ 25,690,000**	**$ 11,530,000**	**$ 37,220,000**

* Annual Average figures are presented for illustrative purposes only. Figures are presented to illustrate a hypothetical annual amount of revenues and share splits to the MTPO area. Actual annual projections are reflected in the Revenue Projections provided to the MTPO by VDOT.

** Revenue forecasts are derived from VDOT's Financial Planning Division, Assumptions - Constrained Long Range Plan documentation (October 2015)

*** VDOT manages highway revenues through a variety of Construction Programs (Interstate, Primary, Secondary, Statewide, etc.). Through these Programs Virginia revenues (state and federal revenues) are allocated. The following revenues are reflected in these Construction Programs and assumed available to the MTPO area: Bridge Replacement\Rehabilitation (BR/BROS), Interstate Maintenance (IM), National Highway Systems (NHS), National Highway Performance Program (NHPP) Hazard Elimination (HSIP), Surface Transportation Block Grant (STBG), Transportation Alternative Program/Enhancement (TAP/EN), High Priority Projects (HPP), Appalachian Development (APD), Federal Demonstration (DEMO), Safe Routes to School (SRS), High Priority Development (HPD), Intelligent Technology Systems (ITS), Regional STP (RSTP), and Equity Bonus/Minimum Guarantee (EB/MG)

Projections rounded to the nearest thousands

Draft - 02/08/17

Kingsport Area MTPO
2040 Long Range Transportation Plan
Revenue Forecasts

Operations and Maintenance Funding

Revenue Source	Annual Average *	Inflation Factor **	Revenue Projections		
			2025 Horizon Year	2040 Horizon Year	Total 2015 - 2040
Tennessee Revenue Sources					
TDOT (Various State Sources) ***	$ 4,260,000	1.03	$ 56,198,000	$ 112,965,000	$ 169,163,000
City of Kingsport - State & Local Gas/State Aid Funds	$ 2,230,000	1.03	$ 29,418,000	$ 59,134,000	$ 88,552,000
Sullivan County - State & Local Gas/State Aid Funds ****	$ 8,100,000	1.03	$ 106,855,000	$ 214,793,000	$ 321,648,000
Town of Mt Carmel - State & Local Gas/State Aid Funds	$ 146,000	1.03	$ 1,926,000	$ 3,872,000	$ 5,798,000
City of Church Hill - State & Local Gas/State Aid Funds	$ 174,000	1.03	$ 2,295,000	$ 4,614,000	$ 6,909,000
Hawkins County - State & Local Gas/State Aid Funds ****	$ 3,000,000	1.03	$ 39,576,000	$ 79,553,000	$ 119,129,000
Sub-Total (TN)	**$ 17,910,000**		**$ 236,268,000**	**$ 474,931,000**	**$ 711,199,000**
Virginia Revenue Sources					
VDOT (State) *****	$ 4,431,320		$ 40,134,000	$ 70,649,000	$ 110,783,000
Sub-Total (VA)	**$ 4,431,320**		**$ 40,134,000**	**$ 70,649,000**	**$ 110,783,000**
Total	**$ 22,341,320**		**$ 276,402,000**	**$ 545,580,000**	**$ 821,982,000**

* Tennessee and Virginia's annual average revenues are based on a review of historic funding levels to the MTPO region.
** Revenue forecasts assume a 3 percent annual growth rate of funding unless otherwise noted.
*** TDOT maintenance funds shown are for state maintained roadways for the complete counties of Sullivan and Hawkins Counties
**** County maintenance funds shown are for the complete counties of Sullivan and Hawkins Counties
***** VDOT maintenance funds were developed based on a review of VDOT's Maintenance and Operations Budgets 2012 thru 2017 for the Bristol District and derived from VDOT's Financial Planning Division, Assumptions - Constrained Long Range Plan documentation (October 2015)
Projections rounded to the nearest thousands

DRAFT - 02/08/17

Kingsport Area MTPO
2040 Long Range Transportation Plan
Revenue Forecasts

Transit - Capital Funding

Revenue Source	Annual Average*	Inflation Factor**	2025*** Horizon Year	2040 Horizon Year	Total 2015 - 2040
KATS					
Capital Assistance - FTA 5307 (Federal) 80%	$ 520,000	1.03	$ 9,640,000	$ 13,789,000	$ 23,429,000
Capital Assistance - TN (State) 10%	$ 65,000	1.03	$ 1,205,000	$ 1,724,000	$ 2,929,000
Capital Assistance - Kingsport (Local) 10%	$ 65,000	1.03	$ 1,205,000	$ 1,724,000	$ 2,929,000
FTA 5307 Total	**$ 650,000**		**$ 12,050,000**	**$ 17,237,000**	**$ 29,287,000**
Capital Assistance - Other FTA Programs (Federal) 80%	$ 120,000	1.03	$ 1,583,000	$ 3,182,000	$ 4,765,000
Capital Assistance - Other FTA Programs (Non-Federal Match) 20%	$ 30,000	1.03	$ 396,000	$ 796,000	$ 1,192,000
Other Transit Providers including KATS, MEOC, & NET Trans					
Other FTA Programs (FTA 5310, 5339) & Discretionary Funds** Total**	**$ 150,000**		**$ 1,979,000**	**$ 3,978,000**	**$ 5,957,000**
Total Capital Assistance	**$ 800,000**		**$ 14,029,000**	**$ 21,215,000**	**$ 35,244,000**

* Based on a review of historic and current funding levels to the MTPO region (FY11-FY14 MTPO TIP, FY14-FY17 MTPO TIP, and FY17-FY21 MTPO TIP)
** Revenue forecasts assume a 3 percent annual growth rate of funding.
*** Revenue forecasts for the 2025 horizon are derived from the FY17-FY21 MTPO TIP for FTA 5307 funding levels.
**** Conservative estimate of FTA funds likely to be available within the MTPO region over the 25-Year Planning Horizon
Projections rounded to the nearest thousands

Draft - 02/08/17

Kingsport Area MTPO
2040 Long Range Transportation Plan
Revenue Forecasts

Transit - Operating Funding

Revenue Source	Annual Average*	Inflation Factor**	2025 Horizon Year	2040 Horizon Year	Total 2015 - 2040
KATS					
Operating Assistance - FTA 5307 (Federal)	$ 750,000	1.03	$ 9,894,000	$ 19,888,000	$ 29,782,000
Operating Assistance - TN (State)	$ 375,000	1.03	$ 4,947,000	$ 9,944,000	$ 14,891,000
Operating Assistance - Kingsport (Local)	$ 375,000	1.03	$ 4,947,000	$ 9,944,000	$ 14,891,000
FTA 5307 Tennessee Total	**$ 1,500,000**		**$ 19,788,000**	**$ 39,776,000**	**$ 59,564,000**
Other Transit Providers Including KATS, MEOC, & NET Trans					
Operating Assistance - Other FTA Programs (Federal) 50%	$ 25,000	1.03	$ 330,000	$ 663,000	$ 993,000
Operating Assistance - Other FTA Programs (Non-Federal Match) 50%	$ 25,000	1.03	$ 330,000	$ 663,000	$ 993,000
Other FTA Programs (FTA 5310) & Discretionary Funds * Total**	**$ 50,000**		**$ 660,000**	**$ 1,326,000**	**$ 1,986,000**
Total Operating Assistance	**$ 1,550,000**		**$ 20,448,000**	**$ 41,102,000**	**$ 61,550,000**

* Based on a review of historic and current funding levels to the MTPO region (FY11-FY14 MTPO TIP, FY14-FY17 MTPO TIP, and FY17-FY21 MTPO TIP)
** Revenue forecasts assume a 3 percent annual growth rate of funding.
*** Conservative estimate of FTA funds likely to be available within the MTPO region over the 25-Year Planning Horizon
Projections rounded to the nearest thousands

Draft - 02/08/17

ID	Rank	Route	From Road	To Road	Description	Length	YOE 2025	Funding Eligibility
L54	1	Clinchfield Street	Main Street	Stone Drive (US 11)	Coordinate signal system to improve traffic flow	1.2	$320,000	L-STP
L62	2	Stone Drive (US 11)	Gibson Mill Road	Deneen Lane	Coordinate signal system	2.8	$190,000	NHS
L22	3	Stone Drive (US 11)	John B. Dennis (SR 93)	Cleek Road	Improve intersections and coordinate signal timings	3.1	$1,080,000	NHS
L12	4	Fort Henry (SR 36)	Moreland Dr/ Hemlock Rd	Interstate 81 (I-81)	Improve intersections, coordinate signal timings, and evaluate driveway cuts	1.4	$1,900,000	NHS
L20	5	Stone Dr West (US 11W/SR 1)	Kaywood Ave (City of Mt Carmel)	Granby Rd	Install signal system with advanced warning signals to improve safety at intersections	2.5	$80,000	NHS
L35	6	East Sullivan Street	Church Circle	Main Street	Widen to 2/3 lanes with multimodal and aesthetic improvements	1.0	$6,330,000	Local
L53	7	Bloomingdale Pike	John B. Dennis (SR 93)	Packinghouse Road	Improve shoulders and geometry with spot safety improvements	1.5	$1,270,000	L-STP
L11	8	Fort Henry (SR 36)	John B Dennis (SR 93)	Moreland Dr/ Hemlock Rd	Improve intersections and coordinate signal timings; install median where non-existent	2.0	$950,000	NHS
L15	13	Carters Valley Rd East (VA SR-704)	Lynn Garden Dr (SR 36)	Wadlow Gap Rd (SR 224)	Improve shoulders and geometry with spot safety improvements	2.9	$2,530,000	VS-STP
L17	15	Tranbarger Dr	Lynn Garden Dr (SR 36)	Virgil Ave	Improve shoulders and geometry with spot safety improvements with additional safety improvements	1.0	$920,000	Local
L65	17	Interstate 26	John B. Dennis (SR 93)	I-26 Exit 6 (SR 347 Rock Springs Road)	Add eastbound truck climbing lane	1.9	$2,790,000	NHS
L60	19	Lincoln Street	John B. Dennis (SR 93)	Wilcox Drive (SR 126)	Coordinate signal system	1.7	$630,000	NHS
L58	21	John B. Dennis (SR 93)	Stone Drive (US 11)	Bloomingdale Pike	Implement access management	2.4	$760,000	NHS
L63	26	Wadlow Gap Road (SR 224)	Near North Fork Holston River		Straighten horizontal curves near North Fork Holston River bridge	0.6	$5,070,000	VS-STP
L14	27	Gravely Rd	Lynn Garden Dr (SR 36)	Shipps Spring Rd	Improve shoulders and geometry with spot safety improvements	0.9	$840,000	L-STP
L44	30	Memorial Blvd (SR 126) - Phase II	Harbor Chapel Road	Cooks Valley Road	Widen to 3 lanes with improved shoulders and geometry, reduce access points, add sidewalks	2.5	$26,600,000	S-STP
L49	31	West Sullivan Street	Roller Street	Lynn Garden Drive	Widen to 3 lanes	0.3	$3,170,000	Local
L21	33	May Ave	Bell Ridge Dr	Lynn Garden	Improve shoulders and geometry with spot safety improvements	0.4	$320,000	HSIP
L52	34	Airport Parkway (SR 357)	Interstate 81	Airport Road (SR 75)	Improve median breaks and add left turn lanes at various intersections	2.0	$570,000	NHS
L59	36	Lewis Lane	Rearden Lane	Ripley Street	Improve shoulders and geometry with spot safety improvements	1.2	$1,040,000	L-STP
L8	37	Memorial Blvd (SR 126) - Phase III	Cooks Valley Rd	Harr Town Rd	Widen to 3 lanes with improved shoulders and geometry, reduce access points	2.5	$22,800,000	S-STP
L43	38	Jared Drive	Sluice Bridge	Wilcox Drive (SR 126)	New 2-lane roadway linking Moreland Drive and Wilcox Drive at Jan Way	0.2	$2,280,000	S-STP
L19	44	Lebanon Rd	Intersection at Fort Henry Rd (SR 36)	Colonial Heights Road	Improve sight distance and extend left turn lanes	0.1	$440,000	L-STP
L37	45	Gibson Mill Road	Stone Drive (US 11)	Bloomingdale Pike	Widen to 3 lanes as part of Gibson Mill Road improvements	0.1	$2,410,000	Local
P12	47	Lynn Garden Drive	Stone Drive (US 11)		Improve interchange ramps to alleviate weaving issues		$530,000	S-STP
L13	48	Fairview Ave	Stone Dr West (US 1/11W)	Virgil Ave	Improve shoulders and geometry with spot safety improvements	0.9	$790,000	L-STP
L16	50	Bell Ridge Road / Drive	May Ave	Harrison Ave	Improve shoulders and geometry with spot safety improvements	1.1	$960,000	L-STP
L46	55	Stone Drive (US 11)	John B. Dennis (SR 93)		Extend left turn lanes on Stone Drive under John B. Dennis Interchange	0.2	$7,600,000	NHS
L61	56	Reservoir Road	Saratoga Road	Hood Road	Improve shoulders and geometry with spot safety improvements	1.1	$990,000	HSIP
P13	66	John B. Dennis (SR 93)	Moreland Drive		Improve interchange ramps on south side		$610,000	NHS
P11	67	John B. Dennis (SR 93)	At Pavilion Drive		Realign intersections at Indian Path Medical Center and Kroger to improve safety		$1,270,000	NHS
L5	70	Fort Henry Dr (SR 36)	Holston River Bridge	Hemlock Rd	Safety improvements, install median, add center turn lane (consider widening bridge over railroad tracks and widening lanes near railroad bridge)	0.8	$4,560,000	NHS
P15	74	Wadlow Gap Road (SR 224)	North Fork Holston River		Replace bridge over North Fork Holston River	1.2	$7,090,000	S-STP

ID	Rank	Route	From Road	To Road	Description	Total	Safety	Efficiency	Accessibility	Active Trans.	Env.	Economic
L54	1	Clinchfield Street	Main Street	Stone Drive (US 11)	Coordinate signal system to improve traffic flow	74	18	10	4	15	9	18
L62	2	Stone Drive (US 11)	Gibson Mill Road	Deneen Lane	Coordinate signal system	69	18	13	4	12	10	12
L22	3	Stone Drive (US 11)	John B. Dennis (SR 93)	Cleek Road	Improve intersections and coordinate signal timings	61	12	18	4	6	5	16
L12	4	Fort Henry (SR 36)	Moreland Dr/ Hemlock Rd	Interstate 81 (I-81)	Improve intersections, coordinate signal timings, and evaluate driveway cuts	61	15	15	2	6	9	14
L20	5	Stone Dr West (US 11W/SR 1)	Kaywood Ave (City of Mt Carmel)	Granby Rd	Install signal system with advanced warning signals to improve safety at intersections	56	13	13	5	6	0	19
L35	6	East Sullivan Street	Church Circle	Main Street	Widen to 2/3 lanes with multimodal and aesthetic improvements	52	14	11	3	12	0	12
L53	7	Bloomingdale Pike	John B. Dennis (SR 93)	Packinghouse Road	Improve shoulders and geometry with spot safety improvements	54	13	9	2	13	5	12
L11	8	Fort Henry (SR 36)	John B Dennis (SR 93)	Moreland Dr/ Hemlock Rd	Improve intersections and coordinate signal timings; install median where non-existent	52	14	14	2	3	9	10
L15	13	Carters Valley Rd East (VA SR-704)	Lynn Garden Dr (SR 36)	Wadlow Gap Rd (SR 224)	Improve shoulders and geometry with spot safety improvements	49	12	8	3	9	5	12
L17	15	Tranbarger Dr	Lynn Garden Dr (SR 36)	Virgil Ave	Improve shoulders and geometry with spot safety improvements with additional safety improvements	48	14	6	3	13	5	7
L65	17	Interstate 26	John B. Dennis (SR 93)	I-26 Exit 6 (SR 347 Rock Springs Road)	Add eastbound truck climbing lane	44	12	13	4	1	0	14
L60	19	Lincoln Street	John B. Dennis (SR 93)	Wilcox Drive (SR 126)	Coordinate signal system	47	5	12	3	8	9	10
L58	21	John B. Dennis (SR 93)	Stone Drive (US 11)	Bloomingdale Pike	Implement access management	43	12	3	4	4	10	10
L63	26	Wadlow Gap Road (SR 224)	Near North Fork Holston River		Straighten horizontal curves near North Fork Holston River bridge	41	4	3	3	11	10	10
L14	27	Gravely Rd	Lynn Garden Dr (SR 36)	Shipps Spring Rd	Improve shoulders and geometry with spot safety improvements	40	6	3	3	15	5	8
L44	30	Memorial Blvd (SR 126) - Phase II	Harbor Chapel Road	Cooks Valley Road	Widen to 3 lanes with improved shoulders and geometry, reduce access points, add sidewalks	39	16	3	2	8	0	10
L49	31	West Sullivan Street	Roller Street	Lynn Garden Drive	Widen to 3 lanes	39	6	5	3	12	0	13
L21	33	May Ave	Bell Ridge Dr	Lynn Garden	Improve shoulders and geometry with spot safety improvements	39	8	6	2	12	5	6
L52	34	Airport Parkway (SR 357)	Interstate 81	Airport Road (SR 75)	Improve median breaks and add left turn lanes at various intersections	39	8	8	3	3	5	12
L59	36	Lewis Lane	Rearden Lane	Ripley Street	Improve shoulders and geometry with spot safety improvements	39	5	6	4	13	5	6
L8	37	Memorial Blvd (SR 126) - Phase III	Cooks Valley Rd	Harr Town Rd	Widen to 3 lanes with improved shoulders and geometry, reduce access points	39	14	2	2	6	5	10
L43	38	Jared Drive	Sluice Bridge	Wilcox Drive (SR 126)	New 2-lane roadway linking Moreland Drive and Wilcox Drive at Jan Way	41	5	11	6	4	3	12
L19	44	Lebanon Rd	Intersection at Fort Henry Rd (SR 36)	Colonial Heights Road	Improve sight distance and extend left turn lanes	37	11	8	2	1	5	10
L37	45	Gibson Mill Road	Stone Drive (US 11)	Bloomingdale Pike	Widen to 3 lanes as part of Gibson Mill Road improvements	37	9	5	4	8	5	6
P12	47	Lynn Garden Drive	Stone Drive (US 11)		Improve interchange ramps to alleviate weaving issues	37	4	8	3	8	5	9
L13	48	Fairview Ave	Stone Dr West (US 1/11W)	Virgil Ave	Improve shoulders and geometry with spot safety improvements	36	9	3	3	10	5	6
L16	50	Bell Ridge Road / Drive	May Ave	Harrison Ave	Improve shoulders and geometry with spot safety improvements	35	8	3	2	11	5	6
L46	55	Stone Drive (US 11)	John B. Dennis (SR 93)		Extend left turn lanes on Stone Drive under John B. Dennis Interchange	33	6	2	4	6	5	10
L61	56	Reservoir Road	Saratoga Road	Hood Road	Improve shoulders and geometry with spot safety improvements	29	5	3	3	8	0	10
P13	66	John B. Dennis (SR 93)	Moreland Drive		Improve interchange ramps on south side	28	6	3	2	4	5	8
P11	67	John B. Dennis (SR 93)	At Pavilion Drive		Realign intersections at Indian Path Medical Center and Kroger to improve safety	27	3	2	4	3	5	10
L5	70	Fort Henry Dr (SR 36)	Holston River Bridge	Hemlock Rd	Safety improvements, install median, add center turn lane (consider widening bridge over railroad tracks and widening lanes near railroad bridge)	25	4	8	2	3	0	8
P15	74	Wadlow Gap Road (SR 224)	North Fork Holston River		Replace bridge over North Fork Holston River	23	0	3	3	2	5	10

ID	Rank	Route	From Road	To Road	Description	Length	YOE 2040	Funding Eligibility
L30	11	Fall Creek Road	Colonial Heights Road	Memorial Blvd (SR 126)	Improve shoulders and geometry with spot safety improvements	4.6	$5,780,000	L-STP
L47	14	Stone Drive (US11)	John B. Dennis (SR 93)	New Beasonwell Road	Widen to 6 lanes	1.7	$37,930,000	NHS
L10	18	Bloomingdale Pk	Stone Dr West (US 1/11W)	Orbin Dr	Widen to 3 lanes to include center turn lane with paved shoulders and other safety and geometric spot safety improvements	0.2	$3,250,000	L-STP
L51	20	Wilcox Drive (SR 126)	John B. Dennis (SR 93)	Industry Drive	Replace center turn lane with raised landscaped median, providing left turn lanes where needed	2.0	$450,000	S-STP
P1	22	Center Street	Sullivan Street	Fairview Avenue	Reconfigure turning movements with roundabout		$1,810,000	S-STP
L34	40	Cox Hollow Road	Snapps Ferry	Interstate 81 MM 56	Widen to 3 lanes as economic development occurs	0.6	$4,520,000	S-STP
P10	41	Industry Drive	At CSX railroad overpass		Replace/widen railroad overpass approximately .25 miles east of Kingsport City garage with possibility to convert to at-grade crossing		$7,220,000	L-STP
L29	49	Airport Parkway (SR 357)	Fall Creek Road	Interstate 81	Extend SR 357 northbound with limited access super 2-lane cross section	2.1	$14,450,000	L-STP,S-STP, Local
L3	51	Tri-Cities Crossing	Kendricks Creek Rd	Fordtown Road	Widen to 3 lanes with improved left turns as economic development occurs	1.0	$4,880,000	L-STP
P14	52	Hammond Avenue	Near Main Street		Replace railroad overpass to improve traffic flow and emergency services		$7,220,000	FRA
L9	53	Lincoln St/MLK Jr Dr Connector	Lincoln St/MLK Jr Dr	Industry Dr (SR 355)	Extend Lincoln St/MLK JR Dr to Industry Dr	0.8	$11,920,000	S-STP
L7	54	Netherland Inn Road	Center St (SR 36)	Ridgefields Rd	Widen to 3 lanes	0.7	$9,030,000	Local
P3	57	John B. Dennis (SR 93)	Lincoln Street		Extend length of interchange ramps		$380,000	NHS
P4	59	John B. Dennis (SR 93)	Fort Henry Dr (SR 36)		Extend length of interchange ramps		$3,610,000	NHS
P5	60	John B. Dennis (SR 93)	Stone Drive (US 11)		Extend length of interchange ramps		$3,610,000	NHS
P7	61	John B. Dennis (SR 93)	Orebank Road		Construct new interchange exit ramp northbound		$3,070,000	NHS
L18	62	Summerville Rd	Fort Henry Dr (SR 36)	New Summerville Rd	Improve shoulders and geometry with spot safety improvements	1.8	$2,170,000	Local
L64	65	Moccasin Gap Bypass	Route 71	Wadlow Gap Road	Contruct new 2-lane divided highway with connection to Filter Plant Road	1.2	$84,550,000	VS-STP
L57	71	Fort Henry Drive (SR 36)	Wesley Road	Rock Springs Road	Replace southbound bridge over the South Fork Holston River for safety	0.2	$27,090,000	NHS
L23	72	Wilcox Drive (SR 126)	John B Dennis (SR 93)	Moreland Drive	Extend 4-lane roadway as economic development occurs	0.9	$28,900,000	S-STP
P9	75	Interstate 26	Interstate 81		Add capacity at intersections including study of frontage roads along interstates		$6,320,000	NHS
P16	76	Rock Springs Road	Railroad Tunnel		Replace / widen railroad tunnel		$3,790,000	NHS
L39	77	Indian Trail Drive North	Stone Drive (US 11)	John B. Dennis (SR 93)	Re-alignment and new connection to John B. Dennis (SR 93)	0.1	$2,350,000	L-STP
L26	79	Moreland Drive - Lebanon Road Connector	Near Shady Side Dr	Kendricks Creek Road	New 3-lane bypass away from Fort Henry Drive	0.5	$8,670,000	S-STP
L38	80	Huntington Hills Connector	Birchwood Road	Burke Road	New 2-lane roadway to provide additional access	0.1	$900,000	Local

ID	Rank	Route	From Road	To Road	Description	Total	Safety	Efficiency	Accessibility	Active Trans.	Env.	Economic
L30	11	Fall Creek Road	Colonial Heights Road	Memorial Blvd (SR 126)	Improve shoulders and geometry with spot safety improvements	50	10	11	3	6	4	16
L47	14	Stone Drive (US11)	John B. Dennis (SR 93)	New Beasonwell Road	Widen to 6 lanes	45	12	13	4	6	0	10
L10	18	Bloomingdale Pk	Stone Dr West (US 1/11W)	Orbin Dr	Widen to 3 lanes to include center turn lane with paved shoulders and other safety and geometric spot safety improvements	44	17	3	3	8	5	8
L51	20	Wilcox Drive (SR 126)	John B. Dennis (SR 93)	Industry Drive	Replace center turn lane with raised landscaped median, providing left turn lanes where needed	43	13	10	3	9	0	8
P1	22	Center Street	Sullivan Street	Fairview Avenue	Reconfigure turning movements with roundabout	43	4	8	3	10	10	8
L34	40	Cox Hollow Road	Snapps Ferry	Interstate 81 MM 56	Widen to 3 lanes as economic development occurs	38	5	11	4	7	5	6
P10	41	Industry Drive	At CSX railroad overpass		Replace/widen railroad overpass approximately .25 miles east of Kingsport City garage with possibility to convert to at-grade crossing	34	4	8	2	6	0	14
L29	49	Airport Parkway (SR 357)	Fall Creek Road	Interstate 81	Extend SR 357 northbound with limited access super 2-lane cross section	32	3	4	8	3	0	14
L3	51	Tri-Cities Crossing	Kendricks Creek Rd	Fordtown Road	Widen to 3 lanes with improved left turns as economic development occurs	31	5	9	4	7	0	6
P14	52	Hammond Avenue	Near Main Street		Replace railroad overpass to improve traffic flow and emergency services	35	0	7	3	6	5	14
L9	53	Lincoln St/MLK Jr Dr Connector	Lincoln St/MLK Jr Dr	Industry Dr (SR 355)	Extend Lincoln St/MLK JR Dr to Industry Dr	35	0	2	7	4	4	18
L7	54	Netherland Inn Road	Center St (SR 36)	Ridgefields Rd	Widen to 3 lanes	37	9	5	3	6	4	10
P3	57	John B. Dennis (SR 93)	Lincoln Street		Extend length of interchange ramps	33	5	9	2	4	5	8
P4	59	John B. Dennis (SR 93)	Fort Henry Dr (SR 36)		Extend length of interchange ramps	30	4	5	2	6	5	8
P5	60	John B. Dennis (SR 93)	Stone Drive (US 11)		Extend length of interchange ramps	30	4	3	4	4	5	10
P7	61	John B. Dennis (SR 93)	Orebank Road		Construct new interchange exit ramp northbound	30	5	6	2	4	5	8
L18	62	Summerville Rd	Fort Henry Dr (SR 36)	New Summerville Rd	Improve shoulders and geometry with spot safety improvements	32	8	6	2	6	4	6
L64	65	Moccasin Gap Bypass	Route 71	Wadlow Gap Road	Contruct new 2-lane divided highway with connection to Filter Plant Road	24	0	4	8	6	0	6
L57	71	Fort Henry Drive (SR 36)	Wesley Road	Rock Springs Road	Replace southbound bridge over the South Fork Holston River for safety	25	4	9	2	1	0	9
L23	72	Wilcox Drive (SR 126)	John B Dennis (SR 93)	Moreland Drive	Extend 4-lane roadway as economic development occurs	22	3	2	7	4	0	6
P9	75	Interstate 26	Interstate 81		Add capacity at intersections including study of frontage roads along interstates	23	0	2	3	1	5	12
P16	76	Rock Springs Road	Railroad Tunnel		Replace / widen railroad tunnel	22	4	1	2	9	0	6
L39	77	Indian Trail Drive North	Stone Drive (US 11)	John B. Dennis (SR 93)	Re-alignment and new connection to John B. Dennis (SR 93)	21	3	2	4	1	5	6
L26	79	Moreland Drive - Lebanon Road Connector	Near Shady Side Dr	Kendricks Creek Road	New 3-lane bypass away from Fort Henry Drive	21	0	2	6	1	4	8
L38	80	Huntington Hills Connector	Birchwood Road	Burke Road	New 2-lane roadway to provide additional access	20	0	2	6	3	5	4

ID	Rank	Route	From Road	To Road	Description	Length	YOE 2040	Funding Eligibility
L1	9	Fort Henry Drive (SR 36)	Interstate 81 (I-81)	Airport Road (SR 75)	Widen existing 2 lane road to 4 lanes to match Washington County portion	3.5	$113,790,000	NHS
L36	10	Fort Henry Drive (SR 36)	Moreland Drive	Interstate 81	Frontage road to improve traffic along Fort Henry Drive	1.4	$21,670,000	S-STP
L33	12	BAE Frontage Road	Old Armory	Hammond Avenue	Develop in conjunction with economic development along Netherland Inn Road	1.7	$21,670,000	SIA
L25	16	Stone Drive (US 11)	Hammond Ave	East Avenue	Widen to 6 lanes	1.2	$39,730,000	NHS
L32	23	Cherokee Street Viaduct	MLK Extension	Main Street	Construct vehicular and non-motorized bridge over railroad tracks	0.2	$5,780,000	ARC
L31	24	Hemlock Drive	Fort Henry Dr (SR 36)	Fall Creek Road	Improve shoulders and geometry with spot safety improvements, add multiuse path on north side of roadway to link to park	1.6	$2,350,000	S-STP
L24	25	Interstate 81	Fort Henry Dr (SR 36)	Tri-Cities Crossing (MM 56)	Widen to 6 lanes	4.0	$32,510,000	NHS
L4	28	Eastern Star Rd	Mitchell Rd	Fordtown Rd	Widen to 3 lanes as economic development occurs	0.7	$4,150,000	L-STP
L56	29	Fort Henry Drive (SR 36)	Lebanon Road	Wendover Drive	Improve vertical geometry	0.1	$5,960,000	NHS
L50	32	Sullivan Garden Parkway (SR 93)	Lonestar Road	Derby Drive	Widen to 4 lanes	1.0	$14,810,000	NHS
L55	35	Fordtown Road	Eastern Star Road	Lebanon Road	Install left turn lanes at key intersections through industrial park	1.0	$6,140,000	Local
L2	39	Memorial Blvd (SR 126) - Phase IV	Harr Town Rd	Interstate 81	Widen to 3 lanes with improved shoulders and geometry, reduce access points	2.0	$23,480,000	S-STP
P8	42	Lebanon Road	Kendricks Creek Road	Grove Drive	Replace signalized intersection with roundabout		$1,440,000	Local
L66	43	Stone Drive (US 11)	Deneen Lane	East Avenue	Widen to 6 lanes	1.0	$19,870,000	NHS
L40	46	Interstate 26	MM 8	MM 10	Widen to 6 lanes	1.4	$23,480,000	NHS
L48	58	Stone Drive (US 11) / Center Street Connector	Stone Drive (US 11) near Interstate 26 ramp	Center Street	New 3-lane roadway using Riverside Drive and Interstate 26 ramp	0.1	$5,420,000	S-STP
L28	63	Airport Parkway (SR 357)	Stone Drive East (US 11 W/SR 1)	Fall Creek Road	Extend SR 357 northbound with limited access super 2-lane cross section	2.5	$34,320,000	S-STP
L6	64	Mitchell Rd Connector	Fordtown Rd	Eastern Star Rd	Construct new 3 lane roadway to link Fordtown Rd to Eastern Star at I-26 interchange	0.6	$9,210,000	L-STP
L45	68	Netherland Inn Road / Stone Drive Connector	Union Street	Netherland Inn Road	Realign and reconstruct Union Street to improve access to Netherland Inn Road and economic redevelopment areas	0.1	$9,030,000	L-STP
P2	69	Interstate 81	Buttermilk Road		Construct new interchange		$5,780,000	L-STP
L42	73	Jack White Drive	Idel Hour Road		Extend west to connect to Stone Drive at Idel Hour Road	0.7	$19,870,000	Local
L41	78	I-81 Buttermilk Road Connection	Buttermilk Road	Fall Creek Road	New super 2-lane connector to link proposed interchange at Buttermilk Road	1.4	$14,450,000	S-STP

Illustrative DRAFT Project List

ID	Rank	Route	From Road	To Road	Description	Total	Safety	Efficiency	Accessibility	Active Trans.	Env.	Economic
L1	9	Fort Henry Drive (SR 36)	Interstate 81 (I-81)	Airport Road (SR 75)	Widen existing 2 lane road to 4 lanes to match Washington County portion	51	14	13	5	6	1	12
L36	10	Fort Henry Drive (SR 36)	Moreland Drive	Interstate 81	Frontage road to improve traffic along Fort Henry Drive	54	15	12	3	6	4	14
L33	12	BAE Frontage Road	Old Armory	Hammond Avenue	Develop in conjunction with economic development along Netherland Inn Road	49	12	13	5	3	0	16
L25	16	Stone Drive (US 11)	Hammond Ave	East Avenue	Widen to 6 lanes	46	4	13	5	4	5	15
L32	23	Cherokee Street Viaduct	MLK Extension	Main Street	Construct vehicular and non-motorized bridge over railroad tracks	42	3	2	6	10	5	16
L31	24	Hemlock Drive	Fort Henry Dr (SR 36)	Fall Creek Road	Improve shoulders and geometry with spot safety improvements, add multiuse path on north side of roadway to link to park	45	14	11	2	6	4	8
L24	25	Interstate 81	Fort Henry Dr (SR 36)	Tri-Cities Crossing (MM 56)	Widen to 6 lanes	41	4	13	4	2	4	14
L4	28	Eastern Star Rd	Mitchell Rd	Fordtown Rd	Widen to 3 lanes as economic development occurs	40	6	8	3	6	5	12
L56	29	Fort Henry Drive (SR 36)	Lebanon Road	Wendover Drive	Improve vertical geometry	40	14	10	2	1	5	8
L50	32	Sullivan Garden Parkway (SR 93)	Lonestar Road	Derby Drive	Widen to 4 lanes	39	8	12	2	6	0	11
L55	35	Fordtown Road	Eastern Star Road	Lebanon Road	Install left turn lanes at key intersections through industrial park	39	5	11	3	3	5	12
L2	39	Memorial Blvd (SR 126) - Phase IV	Harr Town Rd	Interstate 81	Widen to 3 lanes with improved shoulders and geometry, reduce access points	38	8	11	2	6	5	6
P8	42	Lebanon Road	Kendricks Creek Road	Grove Drive	Replace signalized intersection with roundabout	38	4	3	3	6	10	12
L66	43	Stone Drive (US 11)	Deneen Lane	East Avenue	Widen to 6 lanes	41	6	13	4	4	4	10
L40	46	Interstate 26	MM 8	MM 10	Widen to 6 lanes	37	0	13	4	1	5	14
L48	58	Stone Drive (US 11) / Center Street Connector	Stone Drive (US 11) near Interstate 26 ramp	Center Street	New 3-lane roadway using Riverside Drive and Interstate 26 ramp	33	3	2	7	8	3	10
L28	63	Airport Parkway (SR 357)	Stone Drive East (US 11 W/SR 1)	Fall Creek Road	Extend SR 357 northbound with limited access super 2-lane cross section	28	3	4	6	1	0	14
L6	64	Mitchell Rd Connector	Fordtown Rd	Eastern Star Rd	Construct new 3 lane roadway to link Fordtown Rd to Eastern Star at I-26 interchange	28	0	2	8	1	5	12
L45	68	Netherland Inn Road / Stone Drive Connector	Union Street	Netherland Inn Road	Realign and reconstruct Union Street to improve access to Netherland Inn Road and economic redevelopment areas	26	4	3	6	3	0	10
P2	69	Interstate 81	Buttermilk Road		Construct new interchange	26	0	8	2	1	5	10
L42	73	Jack White Drive	Idel Hour Road		Extend west to connect to Stone Drive at Idel Hour Road	23	3	4	7	1	0	8
L41	78	I-81 Buttermilk Road Connection	Buttermilk Road	Fall Creek Road	New super 2-lane connector to link proposed interchange at Buttermilk Road	20	0	2	7	1	0	10

Illustrative DRAFT Project List

Online Survey Results

To be included at the conclusion of public involvement

Financial Plan Documentation

Transportation Consultants
A DIVISION OF KCI TECHNOLOGIES INC.
1101 17th Avenue South • Nashville, TN 37212 • (615) 370-8410 • Fax (615) 370-8455

Memorandum (via Email)

To: Troy Ebert, Kingsport MTPO
Bill Albright, Kingsport MTPO

From: Preston Elliott, RPM Transportation Consultants

Date: January 30, 2017

Re: Kingsport MTPO 2040 Long Range Transportation Plan - Financial Plan Revenue Assumptions

The purpose of this memorandum is document the methodology and assumptions used in developing revenue projections as part of the Kingsport MTPO's Financial Plan for their 2040 Long Range Transportation Plan (LRTP). Concluding your review of the revenue forecast methodology and assumptions we are requesting your concurrence with the revenue forecast assumptions of the Financial Plan for use in the Kingsport MTPO 2040 LRTP.

Federal Regulations on Financial Plan of the MTPO's LRTP

23 CFR Part 450 Subpart A - Transportation Planning and Programming Definitions and Subpart C - Metropolitan Transportation Planning and Programming speak to the level and intent of financial plan requirements as part of a MPO's LRTP. The following highlight several key provisions of these requirements:

§ 450.104 Definitions.
Financially constrained or Fiscal constraint means that the metropolitan transportation plan, TIP, and STIP includes sufficient financial information for demonstrating that projects in the metropolitan transportation plan, TIP, and STIP can be implemented using committed, available, or reasonably available revenue sources, with reasonable assurance that the federally supported transportation system is being adequately operated and maintained.

§ 450.324 Development and content of the metropolitan transportation plan.
(11) A financial plan that demonstrates how the adopted transportation plan can be implemented.

(i) For purposes of transportation system operations and maintenance, the financial plan shall contain system-level estimates of costs and revenue sources that are reasonably expected to be available to adequately operate and maintain the Federal-aid highways (as defined by 23 U.S.C. 101(a)(5)) and public transportation (as defined by title 49 U.S.C. Chapter 53).

(ii) For the purpose of developing the metropolitan transportation plan, the MPO, public transportation operator(s), and State shall cooperatively develop estimates of funds that will be available to support metropolitan transportation plan implementation, as required under § 450.314(a). All necessary financial resources from public and private sources that are reasonably expected to be made available to carry out the transportation plan shall be identified.

(iv) In developing the financial plan, the MPO shall take into account all projects and strategies proposed for funding under title 23 U.S.C., title 49 U.S.C. Chapter 53 or with other Federal funds; State assistance; local sources; and private participation. Revenue and cost estimates that support the metropolitan transportation plan must use an inflation rate(s) to reflect "year of expenditure dollars," based on reasonable financial principles and information, developed cooperatively by the MPO, State(s), and public transportation operator(s).

Source: Part III Department of Transportation, Federal Highway Administration 23 CFR Parts 450 and 500 and Federal Transit Administration 49 CFR Part 613, Statewide Transportation Planning; Metropolitan Transportation Planning; Final Rule, May 27, 2016.

Resources Reviewed

In developing revenue forecasts for the Financial Plan of the MTPO's 2040 LRTP the following most readily available documents and resources were reviewed.

MTPO Resources
- Kingsport MTPO Transportation Improvement Program Fiscal Year 2011-2014, October 2010
- Kingsport MTPO Transportation Improvement Program Fiscal Year 2014-2017, December 2013
- Kingsport MTPO Transportation Improvement Program Fiscal Year 2017-2021, November 2016

City and County Resources
- City of Church Hill, TN Annual Financial Reports for the Fiscal Years 2009 thru 2015
- City of Kingsport, TN Annual Financial Reports for the Fiscal Years 2009 thru 2015
- Hawkins County, TN Annual Financial Reports for the Fiscal Years 2009 thru 2015
- Scott County, VA Budgets for the Fiscal Year 2009 thru 2015
- Sullivan County, TN Annual Financial Reports for the Fiscal Years 2009 thru 2015
- Town of Mount Carmel, TN Annual Financial Statements for the Fiscal Years 2009 thru 2015

State Resources
- Mileage Tables the State Highway Systems, VDOT Maintenance Division, 2015
- TDOT Fiscal Years 2017-2020 Tennessee Transportation Improvement Program
- Tennessee Comptroller of the Treasury, Division of County Audit - Annual Financial Reports (website - http://www.comptroller.tn.gov/la/ReportsAudits.asp)
- Tennessee Comptroller of the Treasury, Transparency and Accountability for Governments (TAG) in Tennessee (website - http://www.comptroller.tn.gov/TAG/tag.aspx)
- Tennessee General Assembly Budget Information County by County Budget Reporting (website - http://www.capitol.tn.gov/joint/staff/budget-analysis/county-reports/
- VDOT Maintenance & Operations Program for the Fiscal Years 2012 thru 2017
- Virginia Statewide Transportation Improvement Program Fiscal Years 2017-2022

Summary financial data were developed from these resources creating historic and annual averages for various federal, state, and local funding sources/programs. The attached PDF file titled "KAMTPO 2040 LRTP Historic Revenues" contains summary funding level tables for federal, state, and local funds within the MTPO area for both transportation capital and operating/maintenance activities.

Revenue Forecasts

Based on a review of the resources previously mentioned and summary financial tables contained in the PDF file "KAMTPO 2040 LRTP Historic Revenues", annual revenue estimates were established. The attached PDF file titled "KAMTPO 2040 LRTP Financial Plan" provides revenue projections for the Kingsport Area MTPO's 2040 LRTP. Revenues projections are categorized by Capital funding for the Tennessee portion of the MTPO, Capital funding for the Virginia portion of the MTPO, Operations and Maintenance funding for the MTPO by jurisdiction, Transit Capital funding for the MTPO, and Transit Operating funding for the MTPO.

To comply with the requirement of 23 CFR 450.324 (11), (iv) "year of expenditure dollars", US inflation rate data were evaluated. Inflation is an increase in the price you pay or a decline in the purchasing power of money. In other words, Price Inflation is when prices get higher or it takes more money to buy the same item. Inflation is measured by the Bureau of Labor Statistics in the United States using the Consumer Price Index. Long term US inflation trends (over a 25 to 30 year time period) track at about 3 percent per year (source: http://inflationdata.com). Based on the long term average 3 percent, revenues have been projected to increase at a 3 percent annual growth rate compounded annually over current

funding levels. Consequently, project costs and program categories of the 2040 LRTP will be escalated at the same rate to reflect a likely project cost at "year of expenditure".

Revenue forecasts have been projected by horizon year (2025 and 2040) and reflect appropriate match requirements.

Requested Action

To fulfill federal planning requirements relative to the Financial Plan of the MTPO's long range transportation plan, we are requesting your concurrence with the revenue forecast assumptions of the Financial Plan for use in the Kingsport MTPO 2040 Long Range Transportation Plan. Once we receive concurrence on the revenue assumptions we will move to the next stage of the Financial Plan which is the balancing of project costs, reflecting year of expenditure cost estimates, to available revenues.

Should you have any questions regarding this memorandum or the attached items, please let me know.

Attachments:

KAMTPO 2040 LRTP Historic Revenues.PDF (electronic file)
KAMTPO 2040 LRTP Financial Plan.PDF (electronic file)

Kingsport MTPO

2040 Long Range Transportation Plan

Financial Plan - Historic Revenues

Summary of Historic Transportation Expenditures within the Kingsport MTPO Area (1980-2015)

Project Costs are Estimated Costs based on Historic TIPs and Plans

Kingsport MTPO - TN Projects: 1980-1995

Project Name	Location / Type Improvement	Source	Estimated Cost
Airport Parkway / SR 357	I-81 to SR 75 / Tri-Cities Airport; construct new 4-lanes	State/State STP	$20,000,000
Brookside Drive	Stone Dr to Pavilion Dr; reconstruct and widen to 3-4 lanes	City of Kingsport	$2,000,000
Stone Drive at Clinchfield Street	Intersection; reconstruct to improve geometry and turning lanes	Local STP	$900,000
Eastman Road, North	Stone Drive to Ft. Henry Drive; reconstruct to 4-5 lanes	Local STP	$3,600,000
Fort Henry Drive Bridge	Over Holston River; construct new 2 lane bridge (southbound)	Federal Bridge	$5,000,000
Fort Robinson Drive	Center St. to Union St.; reconstruct to 4 lanes (part of Center St. reconstruction)	State/State STP	$1,000,000
Granby Road	Stone Drive to ½ Mile North; reconstruct / widen	City of Kingsport	$1,000,000
Harbor Chapel Road at Memorial Boulevard	Intersection; widen shoulders / travel lanes, add turning lane	City of Kingsport	$1,000,000
Interstate 181 at Meadowview Parkway	MM 52; construct new diamond interchange	State/State STP	$2,500,000
Interstate 81	SR 126 to SR 93 (Fall Branch)	Federal Interstate/NHS	$50,000,000
Interstate 181 (now I-26)	Eastern Star Road to Virginia Line; construct new 4 lanes	Federal Interstate/NHS	$60,000,000
John B. Dennis Highway / SR 93	Stone Drive to Bloomingdale Pike; construct new 4 lanes with median	State/State STP	$8,000,000
Lewis Lane	Stone Drive to ¼ Mile North; reconstruct to 4 lanes	City of Kingsport	$500,000
Lincoln Street at John B. Dennis	Intersection; reconstruct	State/State STP	$300,000
Lincoln Street at Wilcox Drive	Railroad Overpasses; construct new overpasses (replace old at Wilcox)	Federal Bridge	$7,000,000
Main Street (Kingsport)	Clinchfield St. to Cherokee St.; reconstruct / remodel (aesthetic)	Local STP	$3,000,000
Manor Drive	Manor Court to Tilthammer; construct new 2 lanes	City of Kingsport	$300,000
Meadowview Parkway	Wilcox Dr. to Saratoga Road; reconstruct Reservoir Rd to 4 lanes	Local STP	$2,300,000
Ravine Road	Near Holston Valley Hospital; re-align for hospital development	City of Kingsport	$150,000
Carter's Valley Road, West	U.S. 23 to Holston River; reconstruct, widen shoulders (remains 2-lanes)	State/State STP	$500,000
Eastern Star Road	Intersection with Fordtown Road; reconstruct / widen	Sullivan County	$200,000
Fall Creek Road Bridge	Ft. P. Henry Lake to Fall Creek Road; construct new bridge (replace old)	Federal Bridge	$3,000,000
Jared Drive	Moreland Drive to Wilcox Drive; Reconstruct to 4-5 lanes	Sullivan County	$4,000,000
Moreland Drive	Fort Henry Drive to Jared Drive; reconstruct to 4-5 lanes	Sullivan County	$4,000,000
New Moore Road	Reservoir Road to Wilcox Drive; reconstruct / widen	Sullivan County	$1,000,000
Rock Springs Road	I-181 to Moreland Drive; reconstruct and widen (remains 2 lanes)	Local STP	$1,000,000
Greenbelt (BikePed Trail)	1993 - Phase 1 - Bike/Ped Trail	Federal Enhancement	$112,000
Ridgefields Road Bridge	Holston River at Netherland Inn Rd.; reconstruct to 3 lanes	State/State STP	$3,000,000
Stone Drive, East	Morrison Ave to past Beechnut Drive	State/State STP	$3,600,000
Stone Drive at Netherland Inn Road	Intersection; reconstruct – widen, add turning lanes	State/State STP	$2,000,000
Wilcox Drive	Lincoln Street to JB Dennis; reconstruct bridges, widen lanes	State/State STP	$10,000,000
	Total Projects: 1980–1995 ---------- (Includes Interstate Projects: $110,000,000)		**$200,962,000**

Kingsport MTPO - TN Projects: 1995-2005

Project Name	Location / Type Improvement	Source	Estimated Cost
SR 126 / Wilcox Dr at SR 93/JB Dennis	Old Wilcox Dr. to JB Denis; Relocate (Ph I) - construct new 4-5 lanes	State/State STP	$3,300,000
SR 93 / JB Dennis	Moreland Drive; widen bridge over Moreland and reconstruct to 6 lanes	State/State STP	$5,000,000
Gateway Industrial Access Road	Kendricks Ck. Rd at I-26; construct new 2 lanes	SIA (State)	$1,700,000
Eastman Rd Bridge at Lincoln St.	Over Lincoln Street; reconstruct / repair bridge	City of Kingsport	$500,000
Stone Drive Bridge at Lynn Garden Dr	Over Lynn Garden Drive; reconstruct / repair bridge	Federal Bridge	$500,000
Park Street at Center Street	Intersection; install new signal with intersection imp's	Local STP	$130,000
Shipp's Springs Road	Bloomingdale Road to Gravely Road; reconstruct / widen	Sullivan County	$4,000,000
Wilcox Drive / SR 93	Sullivan Gardens (Gaylemont to Lonestar Road); reconstruct to 4-5 lanes	State/State STP	$7,000,000
Wadlow Gap Road / SR 93	Va. Line to Bloomingdale Pike; widen to 4 lanes	State/State STP	$3,500,000
Interstate 81; MM 56 Interchange (Sullivan Co)	Kendricks Creek Rd. (now Tri-Cities Crossing); construct new interchange	State/State STP	$6,500,000
Eastern Star Road at Interstate 26 (Sullivan Co)	I-26 interchange; reconstruct / widen existing ramps and bridge	State/State STP	$2,300,000
Lebanon Rd. at Kendricks Ck. Rd. (Sullivan Co)	Intersection; Install new signal with minor geometric improvements	Sullivan County	$70,000
Lakecrest Drive Railroad Crossing (Sullivan Co)	At-Grade Railroad Crossing; Install new gates and warning signals	Federal Safety	$150,000
Midland Drive at Fort Henry Drive	Intersection; install new signal with intersection imp's	Local STP	$430,000
John B. Dennis at New Wilcox Dr.	Terminus of New Wilcox Drive / SR 126; Install new signal	State	$250,000
Thornton / Atoka at Ft. Henry Dr.	Intersections; install new signals with development	Private	$200,000
Ridgefields Road at Netherland Inn Rd.	Intersection; install new signal	Local STP	$45,000
North Central Ave. (Hawkins Co)	Main Street to Miller Woods Rd.; reconstruct and widen to 3 lanes	State/State STP	$2,500,000
N. Central Ave. at N Southern Railroad (Hawkins Co)	Railroad Overpass near Main St.; Construct new railroad overpass (replace old)	State/State STP	$3,100,000
N. Central Ave Signal (Hawkins Co)	Intersection with U.S. 11-W; install new signal	Federal Safety	$65,000
Goshen Valley Rd. (Hawkins Co)	Intersection with U.S. 11-W; install new signal	Federal Safety	$65,000
Silver Lake Rd. (Hawkins Co)	Intersection with U.S. 11-W; reconstruct and improve signal	Local STP	$330,000
Greenbelt (BikePed Trail)	1996 - Bike/Ped Trail	Federal Enhancement	$120,000
Greenbelt (BikePed Trail)	1996 - Bike/Ped Trail	Federal Enhancement	$157,000
Greenbelt (BikePed Trail)	1997 - Bike/Ped Trail Sections #3, #4, and #6	Federal Enhancement	$250,000
Hawkins County Bicycle Trail	1997 - Marking/signing existing roads to create a trail to link Sullivan Co and Hamblen Co	Federal Enhancement	$8,000
Greenbelt (BikePed Trail)	1998 - Continuation of Bike/Ped Trail	Federal Enhancement	$250,000
Greenbelt (BikePed Trail)	2001 - Bike/Ped Trail	Federal Enhancement	$301,000
SR 75 / Gray Station Road (Washington Co)	Within MPO Area (1 mile); reconstruct / widen to 5 lanes	State/State STP	$3,000,000
Harbor Chapel Road at SR 126	Intersection; install new signal	City of Kingsport	$20,000
Stone Drive at Idlehour Road	Intersection; install new signal and link to closed-loop system	Private	$60,000
Stone Drive at Lawson Drive	Intersection; install new signal	Private	$150,000
Stone Drive at Deneen Lane	Intersection; install new signal	Private	$250,000
	Total Projects: 1995–2005 ----------		**$46,201,000**

Kingsport MTPO - TN Projects: 2005-2015

Project Name	Location / Type Improvement	Source	Estimated Cost
ARRA Paving	Center St, Eastman Rd, Bloomingdale Pk, Clinchfield St, Orebank Rd Mill & install new pavement	ARRA	$2,000,000
State Route 126	Centerline rumble-strips; safety improvements	Federal Safety	$350,000
Harbor Chapel Road	(SR 126 to Cook's Valley Road) – reconstruct	City of Kingsport	$1,500,000
U.S. 11-W (Stone Drive)	Intersection of U.S. 11-W (Stone Drive) and Cleek Road - reconstruct	City of Kingsport	$500,000
Gibson Mill Road / Watauga Street	Roundabout – install new "roundabout"	City of Kingsport	$800,000
Gibson Mill Road	Re-Alignment (Phase I) – new construction (relocation)	City of Kingsport/ Private	$3,000,000
Rock Springs Road – Phase I	Rock Springs Road – Phase I (not state route section) – widening	City of Kingsport	$1,300,000
Netherland Inn Rd / Center Street / Industry Drive	Netherland Inn Rd / Center Street / Industry Drive – install new "roundabout"	City of Kingsport	$800,000
Pavilion Drive at John B. Dennis Highway	Pavilion Drive at John B. Dennis Highway – construct new signal	Local STP	$350,000
Greenbelt (BikePed Trail)	2005 - Bike/Ped Trail (Sections 1 and 3)	Federal Enhancement	$424,000
Netherland Inn Road Bridge Replacement	2008 - Netherland Inn Road over North Fork Holston River in Sullivan / Hawkins County	Federal Bridge	$3,300,000
Safe Routes to School	2008 - Sidewalk construction, crosswalk improvements, and signage Kennedy Elementary and Roosevelt Elementary (2008)	SRTS	$216,000
Safe Routes to School	2010 - Sidewalk construction, crosswalks, and signage Jackson Elementary School (2010)	SRTS	$173,000

Summary of Historic Transportation Expenditures within the Kingsport MTPO Area (1980-2015)

Project Costs are Estimated Costs based on Historic TIPs and Plans

Kingsport MTPO - TN Projects: 2005-2015			
Project Name	**Location / Type Improvement**	**Source**	**Estimated Cost**
Greenbelt (Cherokee to Center Street) – new section	Greenbelt (Cherokee to Center Street) – new section	Federal Enhancement	$260,000
Broad Street	Install streetscaping items on Broad Street (includes 2 new roundabouts)	Federal Enhancement	$700,000
Reconstruct Historic "Bank Barn" (Transportation Museum) at Netherland Inn	Reconstruct Historic "Bank Barn" (Transportation Museum) at Netherland Inn	Federal Enhancement	$600,000
SR-1 - Main St / Hammond Ave	Signal and geometric improvements at SR 1/Hammond Ave and Main St/Hammond Ave	Local STP	$350,000
I-26 Tennessee Welcome Center	Construct New Tennessee Welcome Station South of Bell Ridge Road	ARC and TDOT	$12,000,000
SR-75	SR-36 to SR-357 (HPP ID# 2026, 388 & 4969) - Widen from 2 lanes to 5 lanes	State STP	$45,000,000
Gibson Mill	From Gibson St to Watauga St - Reconstruct to 3 lanes	City of Kingsport	$3,000,000
Rock Springs Road	From Edinburgh Channel Rd to Rock Springs Dr - Safety improvements & multiuse path	City of Kingsport	$2,000,000
Stone Dr East (US 11W/SR 1)	SR 93 to Lynn Garden Dr (SR 36) - Improve intersections and coordinate signal timings	Local STP	$500,000
Sevier Ave	From Eastman Road to East Ravine Road - Intersection improvements	City of Kingsport	$2,000,000
Sullivan St. West	Church Circle Dr to Roller Lane - Reconstruct existing 2-lane roadway	City of Kingsport	$3,000,000
Sullivan St. West	From Roller Lane to Lynn Garden Dr (SR-36) - Reconstruct existing 2-lane roadway	City of Kingsport	$2,000,000
I-81	Eastbound truck climbing lane at mile marker 60 to Exit 63	State STP	$11,000,000
SR-126 (Memorial Blvd)	Widening from East Center Street in Kingsport to East of Cooks Valley Road	State STP	$1,000,000
SR-126 (Memorial Blvd)	Cooks Valley Rd to Harr Town Rd - Reconstruct existing 2 lane roadway	State STP	$500,000
SR-93 (Sullivan Gardens Pkwy) Phase I	From Derby Dr to Murrell Rd - Various safety spot improvements along the corridor	State STP	$4,500,000
SR-93 (Sullivan Gardens Pkwy) Phase II	Morgan Ln to South of Baileyton Rd - Various safety spot improvements along the corridor	State STP	$4,500,000
SR-93 (Sullivan Gardens Pkwy) Phase III	From Warren St to Davis Rd - Various safety spot improvements along the corridor	State STP	$4,500,000
Rock Springs Rd	Interstate 26 to Cox Hollow Rd - Reconstruct existing 2 lane roadway	Local STP/MPO and State STP and City of Kingsport	$6,000,000
US 11W/SR 1	Intersection with Englewood Ave and Belmont Ave - New signal & safety improvements	Federal HSIP	$500,000
Lynn Garden Dr (SR 36)	West Center St to West Carters Valley Rd - Intersection & signalization improvements	Local STP	$500,000
Airport Pkwy (SR 357)	At Flagship Dr. - Install new signal at Flagship Dr, - Add turning lanes & improve geometry	Federal HSIP	$300,000
Riverport Rd.	From Holston River Sluice Bridge to Wilcox Dr - Slope stabilization & maintenance	City of Kingsport	$1,000,000
Indian Trail Drive	From Reedy Creek Rd to Stone Dr - Construct new 2 lane roadway	City of Kingsport	$3,000,000
Main Street	From Clinchfield St to Sullivan St - Resurfacing, repairing curb, & sidewalks	Local STP	$3,000,000
SR-126 (Memorial Blvd)	At Island Road - Installation of new 4-way traffic signal and various improvements	Local STP	$500,000
SR-224 (Wadlow Gap Road)	From SR 704 to bridge over North Fork of Holston River - Safety & bridge improvements	State STP	$1,000,000
Fort Robinson Bridge Replacement	Bridge Replacement	Federal BR program	$1,000,000
Sevier Ave	Realign portion of Sevier Avenue to link with Gibson Mill and existing Sevier Ave	City of Kingsport	$2,000,000
Island Road Improvements	From Memorial Blvd to Golf Ridge Drive - Safety improvements and multiuse path	City of Kingsport	$3,000,000
Martin Luther King Extension		City of Kingsport	$2,000,000
Total Projects: 2005–2015 ----------			**$135,923,000**

1980-2015 Total By Source (including Interstates)		
	Sullivan County (Local)	**$13,270,000**
	City of Kingsport (Local)	**$33,370,000**
	Local STP	**$22,935,000**
	State/State STP	**$161,050,000**
	Federal Safety	**$1,430,000**
	Federal Enhancement	**$3,182,000**
	Federal SRTS	**$389,000**
	Federal Bridge	**$19,800,000**
	Federal Interstate/NHS	**$110,000,000**
	Federal ARRA/ARC	**$14,000,000**
	Private	**$3,660,000**

All Sources (All)	**Average Annual $10,945,314**

Federal Programs	**Average Annual $9,508,171**

Virginia Projects (in MTPO area): 1980-2015			
Project Name	**Location/ Type Improvement**	**Source**	**Estimated Cost**
Kane Street Bridge	Gate City - reconstruct bridge over Big Moccasin Creek	Federal Bridge	$2,500,000
Kane Street Bridge / US-23 / US-58	Intersection – repair / reconstruct	State STP	$7,300,000
Moccasin Gap Interchange - Phase I	New construction / re-alignments	State STP	$7,500,000
SR-71 / SR-72 Intersection	Gate City - widen shoulders, improve geometry	State STP	$100,000
SR-714	Replace bridge over Possum Creek	Federal Bridge	$150,000
SR-613	Replace bridge over Big Moccasin Creek	Federal Bridge	$130,000
SR-72	Phase I (SR 71 north towards Ft Blackmore) – widen / improve	State STP	$3,500,000
US-23 at US-58/421	Weber City - intersection and signal improvements	State STP	$200,000
Wadlow Gap Road	Scott County - widen, straighten	State STP	$10,000,000
Yuma Road	Weber City – widen, straighten	Local STP	$3,000,000
SR-224, US-23, & US-58 (RTE 58) (Moccasin Gap)	Modify intersection to accommodate the Moccasin Gap Bypass	State STP	$6,000,000
US-23 (RTE 23)	SBL Over North Fork Holston River(VA Structure #1103)	State STP	$5,000,000
US-23 (RTE 23)	NBL Over North Fork Holsten River(VA Structure #1108)	State STP	$5,000,000
Route 614 (Yuma Road)	From Route 713 to Route 867 West - Reconstruction/Safety	State STP	$7,000,000
		Total Cost – Virginia Projects: 1980–2015 ----------	**$57,380,000**

Virginia Projects (in MTPO area) 1980-2015 Total by Source		
	Federal Bridge	**$2,780,000**
	State STP	**$51,600,000**
	Local STP	**$3,000,000**

All Sources (All)	**Average Annual $1,639,429**

Federal Programs	**Average Annual $1,639,429**

Kingsport Area MTPO
2040 Long Range Transportation Plan
Local Capital Funding
Revenues/Expenditures - Historic

Review of City of Church Hill Local Transportation Capital Outlay Expenditures

Church Hill - 2010 Public Works

Highways and Streets	Original Budget	Final Budget	Actual	Difference
Street Lighting	100,500	97,050	96,997	53
Sign Parts and Supplies	2,500	3,600	3,557	43
Traffic Light Maintenance	4,000	500	-	500
Materials Supplies	4,500	45,000	27,483	16,517
Capital Outlay/Paving	300,000	270,050	159,234	109,816
Total	**411,500**	**416,000**	**287,271**	**126,729**

Church Hill - 2011 Public Works

Highways and Streets	Original Budget	Final Budget	Actual	Difference
Street Lighting	100,500	101,000	100,985	15
Sign Parts and Supplies	2,500	4,500	4,458	42
Traffic Light Maintenance	-	-	-	-
Materials Supplies	6,500	4,610	4,560	50
Capital Outlay/Paving	15,400	39,725	39,718	7
Total	**126,900**	**148,835**	**148,721**	**114**

Church Hill - 2012 Public Works

Highways and Streets	Original Budget	Final Budget	Actual	Difference
Street Lighting	113,000	101,000	110,606	(9,606)
Sign Parts and Supplies	8,000	8,000	5,176	2,824
Traffic Light Maintenance	4,000	4,000	1,819	2,181
Materials Supplies	9,390	9,390	-	9,390
Capital Outlay/Paving	9,400	87,943	11,504	76,437
Total	**135,790**	**188,333**	**127,105**	**81,227**

Church Hill - 2013 Public Works

Highways and Streets	Original Budget	Final Budget	Actual	Difference
Street Lighting	113,000	113,000	103,684	9,316
Sign Parts and Supplies	4,000	4,000	752	3,248
Traffic Light Maintenance	6,000	6,000	4,327	1,673
Materials Supplies	9,390	9,340	-	9,340
Capital Outlay/Paving	30,033	30,033	-	30,033
Total	**162,423**	**162,373**	**108,863**	**53,510**

Church Hill - 2014 Public Works

Highways and Streets	Original Budget	Final Budget	Actual	Difference
Street Lighting	110,000	104,750	104,726	24
Sign Parts and Supplies	6,000	750	723	27
Traffic Light Maintenance	4,000	-	-	-
Materials Supplies	10,000	21,350	21,327	23
Capital Outlay/Paving	73,350	76,900	59,016	17,884
Total	**203,350**	**203,750**	**186,792**	**17,958**

Church Hill - 2015 Public Works

Highways and Streets	Original Budget	Final Budget	Actual	Difference
Street Lighting	110,000	110,000	105,157	4,843
Sign Parts and Supplies	6,000	1,000	56	944
Traffic Light Maintenance	10,000	1,000	92	908
Materials Supplies	26,304	304	-	304
Capital Outlay/Paving	37,000	76,000	71,566	4,434
Total	**188,304**	**188,304**	**176,871**	**11,433**

Church Hill
Annual Average Capital
$58,357

Source: City of Church Hill Financial Statements 2010 - 2015

Review of Mount Carmel Local Transportation Capital Outlay Expenditures

Mount Carmel - 2010 Highways and Streets

Highways and Streets	Original Budget	Final Budget	Actual	Difference
Street Lighting	63,000	58,600	49,616	8,990
Sign Parts and Supplies	2,000	2,350	2,302	48
Traffic Light Maintenance		19,002	16,427	2,575
Materials Supplies	21,352			-
Capital Outlay/Paving	-	33,750	33,756	-
Total	**86,352**	**113,702**	**102,099**	**11,613**

Mount Carmel - 2011 Highways and Streets

Highways and Streets	Original Budget	Final Budget	Actual	Difference
Street Lighting	43,000	43,000	42,208	792
Sign Parts and Supplies	4,837	4,937	1,940	2,997
Traffic Light Maintenance				-
Materials Supplies	17,000	17,000	17,000	-
Capital Outlay/Paving	-	-	-	-
Total	**64,837**	**64,837**	**61,148**	**3,689**

Mount Carmel - 2012 Highways and Streets

Highways and Streets	Original Budget	Final Budget	Actual	Difference
Street Lighting	43,000	39,700	38,387	1,313
Sign Parts and Supplies	2,500	4,000	3,986	14
Traffic Light Maintenance	-	-	-	-
Materials Supplies	27,000	27,000	24,064	2,936
Capital Outlay/Paving	20,297	20,297	15,625	4,672
Total	**92,797**	**90,997**	**82,062**	**8,935**

Mount Carmel - 2013 Highways and Streets

Highways and Streets	Original Budget	Final Budget	Actual	Difference
Street Lighting	43,000	42,809	41,952	848
Sign Parts and Supplies	6,000	2,400	2,377	23
Traffic Light Maintenance	-	-	-	-
Materials Supplies	41,457	41,457	41,456	1
Capital Outlay/Paving	-	-	-	-
Total	**89,457**	**86,667**	**85,785**	**872**

Mount Carmel - 2014 Highways and Streets

Highways and Streets	Original Budget	Final Budget	Actual	Difference
Street Lighting	43,000	43,000	42,155	845
Sign Parts and Supplies	6,000	6,000	-	6,000
Traffic Light Maintenance	3,000	3,000	1,170	1,830
Materials Supplies				-
Capital Outlay/Paving	88,510	88,510	27,279	59,231
Total	**137,510**	**137,510**	**70,604**	**66,906**

Mount Carmel - 2015 Highways and Streets

Highways and Streets	Original Budget	Final Budget	Actual	Difference
Street Lighting	43,500	45,300	45,220	80
Sign Parts and Supplies	8,000	6,200	1,242	4,958
Traffic Light Maintenance	-	-	-	-
Materials Supplies	81,000	81,000	18,353	62,647
Capital Outlay/Paving	25,000	25,000	5,058	19,942
Total	**157,500**	**157,500**	**69,873**	**87,627**

Mount Carmel
Annual Average Capital
$13,619

Source: Town of Mount Carmel Financial Statements 2010 - 2015

Review of Sullivan County and Hawkins County Local Transportation Capital Outlay Expenditures

Capital Outlay	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Average Annual	Portion of MTPO Area	Assumed Capital*
Sullivan County	$130,336	$477,250	$817,018	$951,422	$304,269	$133,940	$190,392	$264,862	$878,885	$318,004	**$380,259**	50%	**$190,129**
Hawkins County	$372,554	$256,393	$297,470	$292,230	$300,726	$1,536,710	$375,068	$635,182	$1,802,395	$581,117	**$651,876**	10%	**$65,188**

Source: http://www.comptroller.tn.gov/FA/Oltag.aspx
* Assumed Capital Funds is based on a proportional share of the county within the MTPO area

Review of City of Kingsport Capital Improvement Programs - Locally Funded Transportation Projects

City of Kingsport		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY2013	FY2014	FY 2015	Average Annual
Bonds & General Funds		$1,315,800	$1,490,000	$2,419,200	$600,000	$1,400,000	$800,000	$950,000	$4,150,000	$1,475,000	**$1,811,089**

Source: City of Kingsport, TN Fiscal Year 2007-2008 Budget Book - Fiscal Year 2015-2016 Budget Book

Kingsport Area MTPO
2040 Long Range Transportation Plan
County and TDOT Operations and Maintenance Revenues/Expenditures - Historic

Sullivan County Detailed Expenditure Accounts	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY2015	Average Annual
Administration	$279,397	$301,107	$301,341	$313,119	$297,907	$296,350	$291,810	$311,688	$321,697	$355,043	
Asphalt Plant Operations	$501,762	$1,203,202	$1,111,000	$706,353	$683,043	$855,940	$1,303,014	$1,279,869	$1,237,894	$1,096,571	
Capital Outlay	$130,336	$477,250	$917,019	$351,422	$304,269	$183,940	$180,982	$264,662	$676,685	$316,004	**$380,269**
Highway and Bridge Maintenance	$5,557,600	$6,125,766	$7,080,736	$6,915,775	$6,687,842	$6,227,151	$5,713,078	$5,555,281	$5,581,894	$5,854,355	
Operation and Maintenance of Equipment	$446,483	$583,081	$589,476	$701,224	$644,049	$586,033	$565,136	$605,693	$626,710	$625,078	
Other Charges	$116,551	$98,693	$113,660	$120,939	$87,376	$88,671	$78,716	$90,856	$92,688	$219,702	
Traffic Control	$9,419	$8,746	$7,002	$11,580	$10,727	$12,505	$24,203	$30,153	$27,781	$39,949	
Total	**$7,040,548**	**$8,797,845**	**$10,120,234**	**$9,120,412**	**$8,715,033**	**$8,250,290**	**$8,156,939**	**$8,137,202**	**$8,565,269**	**$8,306,702**	**$8,521,049**
Total (Without Capital Outlay)	**$6,910,212**	**$8,320,595**	**$9,203,215**	**$8,768,990**	**$8,410,744**	**$8,066,350**	**$7,975,957**	**$7,872,540**	**$7,888,604**	**$7,990,698**	**$8,140,791**

Hawkins County Detailed Expenditure Accounts	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY2015	Average Annual
Administration	$150,424	$156,546	$166,217	$158,589	$153,754	$172,907	$432,346	$447,889	$506,227	$552,377	
Asphalt Plant Operations	$309,639	$215,617	$531,325	$493,306	$236,135	$0	$0	$0	$0	$0	
Capital Outlay	$372,564	$255,303	$267,470	$292,230	$300,725	$1,536,710	$375,048	$635,192	$1,902,395	$581,117	**$651,875**
Highway and Bridge Maintenance	$1,901,768	$1,656,938	$1,511,211	$1,775,985	$2,140,427	$2,833,200	$1,707,582	$1,911,174	$1,930,704	$2,027,398	
Operation and Maintenance of Equipment	$472,236	$38,147	$43,370	$52,474	$43,116	$739,364	$473,814	$457,719	$477,886	$465,327	
Other Charges	$252,807	$383,525	$412,266	$363,815	$429,088	$136,500	$142,533	$140,919	$158,543	$190,154	
Traffic Control	$148,114	$134,483	$127,091	$112,009	$123,078	$0	$0	$0	$0	$0	
Total	**$3,607,352**	**$2,840,559**	**$3,058,950**	**$3,248,408**	**$3,426,323**	**$5,418,681**	**$3,131,323**	**$3,592,893**	**$4,975,755**	**$3,816,373**	**$3,711,662**
Total (Without Capital Outlay)	**$3,234,788**	**$2,585,256**	**$2,791,480**	**$2,956,178**	**$3,125,598**	**$3,881,971**	**$2,756,275**	**$2,957,701**	**$3,073,360**	**$3,235,256**	**$3,059,786**

Source: http://www.comptroller.tn.gov/TAG/tag.aspx

TDOT - Hawkins County	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY2012	FY 2013	FY 2014	FY 2015	Average Annual
Bridge Replacement	$103,178	$76,800	$87,600	$115,700	$92,700	$89,900	$59,800	$62,601	$72,843	$70,979	
Highway Betterments and Maintenance	$1,051,228	$1,782,500	$2,124,000	$1,509,200	$1,417,600	$1,519,400	$906,700	$943,527	$872,236	$1,211,360	
Safe Growth Grants - Litter	$39,115	$66,800	$66,100	$48,700	$39,800	$39,800	$56,500	$114,057	$99,967	$55,967	
State Aid	$192,734	$273,300	$311,100	$232,200	$221,700	$221,700	$251,800	$220,433	$220,433	$534,127	
Highway Construction	$0	$457,100	$0	$0	$0	$0	$0	$0	$0	$0	
	$1,386,255	**$2,656,300**	**$2,588,800**	**$1,905,800**	**$1,771,800**	**$1,870,800**	**$1,274,800**	**$1,340,618**	**$1,265,479**	**$1,872,433**	
TDOT O & M	**$1,386,255**	**$2,199,200**	**$2,588,800**	**$1,905,800**	**$1,771,800**	**$1,870,800**	**$1,274,800**	**$1,340,618**	**$1,265,479**	**$1,872,433**	**$1,747,599**

TDOT - Sullivan County	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY2012	FY 2013	FY 2014	FY 2015	Average Annual
Bridge Replacement	$65,088	$78,600	$87,600	$85,100	$74,500	$89,400	$92,000	$80,672	$87,603	$66,722	
Highway Betterments and Maintenance	$1,697,485	$1,782,500	$2,124,000	$2,430,400	$2,279,800	$2,454,300	$1,585,800	$1,849,026	$1,813,528	$1,721,696	
Safe Growth Grants - Litter	$66,949	$66,800	$66,100	$66,300	$66,100	$66,100	$89,900	$325,891	$327,017	$242,135	
State Aid	$265,398	$273,300	$311,100	$319,600	$305,100	$305,100	$335,900	$294,016	$294,016	$712,406	
Highway Construction	$1,320,000	$457,100	$0	$0	$1,096,000	$1,390,000	$2,740,000	$0	$0	$0	
	$3,414,788	**$2,656,300**	**$2,588,800**	**$2,921,400**	**$3,820,500**	**$4,284,900**	**$4,837,600**	**$2,349,605**	**$2,522,164**	**$2,744,961**	
TDOT O & M	**$2,094,788**	**$2,199,200**	**$2,588,800**	**$2,921,400**	**$2,724,500**	**$2,894,900**	**$2,097,600**	**$2,349,605**	**$2,522,164**	**$2,744,961**	**$2,513,792**

TDOT (Hawkins & Sullivan Co)	**$3,481,043**	**$4,398,400**	**$5,177,600**	**$4,827,200**	**$4,496,300**	**$4,765,700**	**$3,372,400**	**$3,690,223**	**$3,787,643**	**$4,617,394**	**$4,261,390**

Source: http://www.capitol.tn.gov/joint/staff/budget-analysis/county-reports/

Kingsport Area MTPO
2040 Long Range Transportation Plan
Municipal and VDOT
Operations and Maintenance Revenues/Expenditures - Historic

City of Church Hill	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Average Annual	
Total Revenues			$3,782,096	$4,133,218	$3,737,126	$3,269,227	$3,396,351	$3,398,562	$3,464,865	$3,814,521		
Total Expenses			$3,457,990	$4,178,863	$3,957,584	$2,949,216	$3,071,582	$3,127,205	$3,282,360	$3,005,213		
Public Works			$835,288	$1,316,030	$1,102,088	$1,068,580	$1,113,389	$1,102,974	$1,210,116	$1,072,153		
% of Total Expenses			24%	31%	28%	36%	36%	35%	37%	36%		
State Street Aid Fund	**$180,088**	**$179,316**	**$180,600**	**$168,200**	**$169,100**	**$162,522**	**$174,654**	**$173,399**	**$174,300**	**$177,869**	**$174,005**	**State Street Aid Fund**
Gas & Motor Fuel Tax	$180,088	$179,316	$180,600	$168,200	$169,100	$162,522	$174,654	$173,399	$174,300	$177,869	$174,005	Gas & Motor Fuel Tax
Church Hill Maintained Road Miles	**47**	**47**	**47**	**47**	**47**	**47**	**47**	**47**	**47**	**47**	**Average Annual**	
Average Cost Per Mile	**$3,832**	**$3,815**	**$3,843**	**$3,579**	**$3,598**	**$3,458**	**$3,716**	**$3,689**	**$3,709**	**$3,784**	**$3,702**	**Average Cost Per Mile**

Source: City of Church Hill Annual Financial Statements Fiscal Years 2006 - 2015

Town of Mount Carmel	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Average Annual	
Total Revenues			$3,070,353	$3,249,295	$2,938,358	$2,400,175	$2,509,242	$2,508,424	$2,499,701	$2,502,458		
Total Expenses			$2,723,045	$2,702,180	$2,785,052	$2,018,328	$2,079,280	$2,297,391	$2,450,045	$2,310,407		
Streets & Highways			$520,127	$507,143	$563,359	$475,226	$472,053	$683,266	$920,949	$826,133		
% of Total Expenses			19%	19%	20%	24%	23%	30%	38%	36%		
State Street Aid Fund	**$145,954**	**$145,340**	**$146,400**	**$136,300**	**$137,100**	**$141,048**	**$151,232**	**$150,589**	**$152,228**	**$153,441**	**$145,963**	**State Street Aid Fund**
Gas & Motor Fuel Tax	$145,954	$145,340	$146,400	$136,300	$137,100	$141,048	$151,232	$150,589	$152,228	$153,441	$145,963	Gas & Motor Fuel Tax
Mount Carmel Maintained Road Miles	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**Average Annual**	
Average Cost Per Mile	**$3,243**	**$3,230**	**$3,253**	**$3,029**	**$3,047**	**$3,134**	**$3,361**	**$3,346**	**$3,383**	**$3,410**	**$3,244**	**Average Cost Per Mile**

Source: Town of Mount Carmel Annual Financial Statements Fiscal Years 2006 - 2015

City of Kingsport	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Average Annual	
Total Revenues		$115,250,000	$127,451,000	$124,264,000	$127,693,000	$136,799,000	$136,085,000	$134,094,000	$138,396,000	$145,194,000		
Total Expenses		$111,676,000	$126,993,000	$127,976,000	$136,700,000	$146,237,000	$142,413,000	$141,643,000	$143,147,000	$141,981,000		
Public Works		$11,388,000	$13,371,000	$12,872,000	$14,690,000	$16,325,000	$13,398,000	$13,505,000	$13,921,000	$14,606,000		
% of Total Expenses		10%	11%	10%	11%	10%	9%	10%	10%	10%		
State Street Aid Fund	**$2,088,549**	**$1,774,006**	**$2,172,728**	**$2,079,429**	**$2,488,545**	**$2,060,609**	**$2,287,010**	**$2,235,731**	**$2,357,809**	**$2,769,481**	**$2,231,390**	**State Street Aid Fund**
Gas & Motor Fuel Tax	$1,261,428	$1,267,240	$1,263,557	$1,184,789	$1,200,000	$1,254,295	$1,280,474	$1,303,048	$1,326,329	$1,353,727	$1,269,489	Gas & Motor Fuel Tax
Gen. Fund / Other Local	$827,121	$506,766	$909,171	$894,640	$1,288,545	$806,314	$1,006,536	$932,683	$1,031,480	$1,415,754	$961,901	Gen. Fund / Other Local
Kingsport Maintained Road Miles	**402**	**436**	**456**	**459**	**466**	**472**	**490**	**496**	**498**	**498**	**Average Annual**	
Average Cost Per Mile	**$5,195**	**$4,069**	**$4,765**	**$4,530**	**$5,340**	**$4,366**	**$4,667**	**$4,508**	**$4,735**	**$5,561**	**$4,774**	**Average Cost Per Mile**

Source: City of Kingsport Annual Budget Book, Fiscal Years 2007 - 2015

VDOT Maintained Lane Mileage By System, 2015

Lane Mileage	Scott County	Bristol District	% of District	VA MPO (Miles of Road)	% of County	Scott Co Road Miles	Average Annual
Interstate	-	528.08	0%				
Primary	290.30	3,004.52	10%				
Secondary	1,393.34	12,306.99	11%				
Urban	-	-	0%				
Frontage Road	6.87	112.75	6%				
Total	**1,690.51**	**15,952.34**	**11%**	**752**	**23.8%**	**3,164**	
						Scott County	**$15,977,127**
				23.8%		**MPO-VA Area**	**$3,795,395**

Source: Mileage Tables The State Highway Systems, VDOT Maintenance Division, 2015

Total VDOT Budget (without Urban dollars)

District	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017	Average Annual
Bristol - District	$135,400,000	$135,800,000	$155,200,000	$156,600,000	$151,900,000	$169,700,000	**$150,766,667**
Average Cost Per Lane Mile	**$8,488**	**$8,513**	**$9,729**	**$9,817**	**$9,522**	**$10,638**	**$9,451**

Source: VDOT Maintenance and Operations, 2012-2017

Kingsport Area MTPO
2040 Long Range Transportation Plan
Virginia DOT Federal and State Highway Capital Funds - Historic and Current

	FFY 2015		FFY 2016		FFY 2017		FFY 2018		FFY 2016 - FFY 2018 Average	
Fund Source	Projected Obligation Authority	Planned Obligation	Projected Obligation Authority	Planned Obligation	Projected Obligation Authority	Planned Obligation	Projected Obligation Authority	Planned Obligation	Projected Obligation Authority	Planned Obligation
Federal										
BR/BROS	$ 3,611,723	$ 3,611,723	$ -	$ -	$ 737,640	$ 737,640	$ (205,332)	$ (205,332)	$ 177,436	$ 177,436
NHS/NHPP	$ 3,500,000	$ 3,500,000	$ 2,392,288	$ 2,392,288	$ 791,944	$ 791,944	$ 9,129	$ 9,129	$ 1,064,454	$ 1,064,454
STP/STBG	$ 759,257	$ 759,257	$ 1,625,000	$ 1,625,000	$ 1,625,000	$ 1,625,000	$ 1,135,434	$ 1,135,434	$ 1,461,811	$ 1,461,811
Subtotal - Federal	**$ 7,870,980**	**$ 7,870,980**	**$ 4,017,288**	**$ 4,017,288**	**$ 3,154,584**	**$ 3,154,584**	**$ 939,231**	**$ 939,231**	**$ 2,703,701**	**$ 2,703,701**
Other										
Non-Federal	$ 9,645,510	$ 9,645,510	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State Match	$ 922,529	$ 922,529	$ -	$ -	$ 28	$ 28	$ 373,374	$ 373,374	$ 124,467	$ 124,467
Subtotal - Other	**$ 10,568,039**	**$ 10,568,039**	**$ -**	**$ -**	**$ 28**	**$ 28**	**$ 373,374**	**$ 373,374**	**$ 124,467**	**$ 124,467**
Subtotal - (Federal & Other)	**$18,439,019**	**$18,439,019**	**$ 4,017,288**	**$ 4,017,288**	**$ 3,154,612**	**$ 3,154,612**	**$ 1,312,605**	**$ 1,312,605**	**$ 2,828,168**	**$ 2,828,168**
Federal - ACC										
HSIP	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
BR	$ -	$ -	$ -	$ -	$ -	$ -	$ 405,636	$ 405,636	$ 135,212	$ 135,212
Subtotal - Federal ACC	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 405,636**	**$ 405,636**	**$ 418,046**	**$ 418,046**
Statewide - Federal										
NHFP	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,000,000	$ 2,000,000	$ 666,667	$ 666,667
Subtotal - Statewide Federal	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 2,000,000**	**$ 2,000,000**	**$ 666,667**	**$ 666,667**
Subtotal (Federal, Other, ACC, & Statewide)	**$ 18,439,019**	**$ 18,439,019**	**$ 4,017,288**	**$ 4,017,288**	**$ 3,154,612**	**$ 3,154,612**	**$ 3,718,241**	**$ 3,718,241**	**$ 3,912,881**	**$ 3,912,881**
Maintenance - Federal										
BR/BROS	$ 1,202,218	$ 1,202,218	$ 1,230,454	$ 1,230,454	$ 1,258,691	$ 1,258,691	$ 1,258,691	$ 1,258,691	$ 1,249,279	$ 1,249,279
STP/STBG	$ 7,279,867	$ 7,279,867	$ 6,835,089	$ 6,835,089	$ 5,707,153	$ 5,707,153	$ 7,020,333	$ 7,020,333	$ 6,520,858	$ 6,520,858
Subtotal - Maintenance Federal	**$ 8,482,085**	**$ 8,482,085**	**$ 8,065,543**	**$ 8,065,543**	**$ 6,965,844**	**$ 6,965,844**	**$ 8,279,024**	**$ 8,279,024**	**$ 7,770,137**	**$ 7,770,137**
Total (All)	**$ 26,921,104**	**$ 26,921,104**	**$ 12,082,831**	**$ 12,082,831**	**$ 10,120,456**	**$ 10,120,456**	**$ 11,997,265**	**$ 11,997,265**	**$ 11,683,018**	**$ 11,683,018**

Source:
Kingsport Area MTPO Fiscal Years 2014-2017 Transportation Improvement Program and VDOT FFY 2018-2021 Working STIP

Kingsport Area MTPO
2040 Long Range Transportation Plan
Transit Funding - Historic and Current

Funding Source/Amount Allocated	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014	Average
	Available	Available	Available	Available	Available	Available	Available	Annual
FTA - 5307 - Operating Funds (OP)	$345,500	$587,000	$687,500	$667,500	$700,000	$750,000	$800,000	$648,214
State Match Funds (OP)	$172,750	$293,500	$343,750	$333,750	$350,000	$375,000	$400,000	$324,107
Local Match Funds (OP)	$172,750	$293,500	$343,750	$333,750	$350,000	$375,000	$400,000	$324,107
Total Allocated	**$691,000**	**$1,174,000**	**$1,375,000**	**$1,335,000**	**$1,400,000**	**$1,500,000**	**$1,600,000**	**$1,296,429**
FTA - 5307 - Capital and Planning Funds (CAP, PL)	$692,000	$549,600	$448,000	$440,000	$440,000	$440,000	$400,000	$487,086
State Match Funds (CAP, PL)	$86,500	$68,700	$56,000	$55,000	$55,000	$55,000	$50,000	$60,886
Local Match Funds (CAP, PL)	$86,500	$68,700	$56,000	$55,000	$55,000	$55,000	$50,000	$60,886
Total Allocated	**$865,000**	**$687,000**	**$560,000**	**$550,000**	**$550,000**	**$550,000**	**$500,000**	**$608,857**

Amount Programmed to be Spent	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014	Average
FTA - 5307-Operating Funds (OP)	$345,500	$587,000	$687,500	$667,500	$700,000	$750,000	$800,000	$648,214
FTA - 5307 - Capital and Planning Funds (CAP, PL)	$692,000	$549,600	$448,000	$240,000	$350,000	$250,000	$400,000	$418,514
State Match Funds (CAP, PL)	$86,500	$68,700	$56,000	$30,000	$175,000	$125,000	$200,000	$105,886
State Match Funds (OP)	$350,000	$293,750	$343,750	$333,750	$350,000	$375,000	$400,000	$349,464
Local Match Funds (CAP, PL)	$347,750	$362,450	$399,750	$30,000	$175,000	$125,000	$200,000	$234,279
Local Match Funds (OP)	$0	$125,000	$125,000	$333,750	$350,000	$375,000	$400,000	$244,107
Total Programmed	**$1,821,750**	**$1,986,500**	**$2,060,000**	**$1,635,000**	**$2,100,000**	**$2,000,000**	**$2,400,000**	**$2,000,464**

Source: Kingsport Area MPO Fiscal Year 2008-2011 Transportation Improvement Program, October 2007 and Fiscal Year 2011-2014 Transportation Improvement Program, October 2010

Funding Source/Amount Allocated	FY2017	FY2018	FY2019	FY2020	FY2021	Average	Average
	Available	Available	Available	Available	Available	Annual FY17-FY21	Annual FY14-FY21
FTA - 5307 - Operating Funds (OP)	$800,000	$850,000	$900,000	$950,000	$1,000,000	$900,000	$753,125
State Match Funds (OP)	$400,000	$425,000	$450,000	$475,000	$500,000	$450,000	$376,563
Local Match Funds (OP)	$400,000	$425,000	$450,000	$475,000	$500,000	$450,000	$376,563
Total Allocated	**$1,600,000**	**$1,700,000**	**$1,800,000**	**$1,900,000**	**$2,000,000**	**$1,800,000**	**$1,506,250**
FTA - 5307 - Capital and Planning Funds (CAP, PL)	$1,056,000	$6,080,000	$340,000	$340,000	$340,000	$1,631,200	$963,800
FTA - 5339 - Capital (CAP)	$372,960	$90,950	$90,950	$90,950	$90,950	$147,352	$147,352
State Match Funds (CAP, PL)	$132,000	$760,000	$42,500	$42,500	$42,500	$203,900	$120,475
Local Match Funds (CAP, PL)	$132,000	$760,000	$42,500	$42,500	$42,500	$203,900	$120,475
Total Allocated	**$1,692,960**	**$7,690,950**	**$515,950**	**$515,950**	**$515,950**	**$2,186,352**	**$1,352,102**

Amount Programmed to be Spent	FY2017	FY2018	FY2019	FY2020	FY2021	Average
FTA - 5307-Operating Funds (OP)	$800,000	$850,000	$900,000	$950,000	$1,000,000	$900,000
FTA - 5307 - Capital and Planning Funds (CAP, PL)	$360,000	$360,000	$340,000	$340,000	$340,000	$348,000
FTA - 5307 - NEPA, PE ROW, CONST	$696,000	$5,720,000	$0	$0	$0	$1,283,200
FTA - 5339 - Capital (CAP)	$372,960	$90,950	$90,950	$90,950	$90,950	$147,352
State Match Funds (OP)	$400,000	$425,000	$450,000	$475,000	$500,000	$450,000
State Match Funds (CAP, PL)	$45,000	$45,000	$42,500	$42,500	$42,500	$43,500
State Match Funds - NEPA, PE, ROW, CONST	$87,000	$715,000	$0	$0	$0	$160,400
Local Match Funds (OP)	$400,000	$425,000	$450,000	$475,000	$500,000	$450,000
Local Match Funds (CAP, PL)	$45,000	$45,000	$42,500	$42,500	$42,500	$43,500
Local Match Funds - NEPA, PE, ROW, CONST	$87,000	$715,000	$0	$0	$0	$160,400
Total Programmed	**$3,292,960**	**$9,390,950**	**$2,315,950**	**$2,415,950**	**$2,515,950**	**$3,986,352**

Source: Kingsport MTPO Fiscacl Year 2017-FY2021 Transportation Improvement Program (TIP)

Kingsport Area MTPO
2040 Long Range Transportation Plan
Transit Funding (MEOC and NET Trans) - Historic and Current

MEOC (Operations)	FY2006	FY2007	FY2008	FY2009	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017	Annual Average
Operating Funds (Federal)	$ 447,503	$ 461,088	$ 488,858	$ 589,217	$ 698,856	$ 717,350	$ 779,888	$ 822,158	$ 857,726	$ 863,078	$ 672,572
Operating Funds (State)	$ 172,022	$ 164,246	$ 174,244	$ 212,224	$ 243,270	$ 283,228	$ 275,051	$ 286,217	$ 284,391	$ 339,563	$ 243,445
Operating Funds (Other)	$ 315,481	$ 328,342	$ 341,614	$ 416,993	$ 501,574	$ 479,122	$ 551,761	$ 867,158	$ 902,726	$ 908,078	$ 561,285
Operating Funds - Total	**$ 935,006**	**$ 953,676**	**$ 1,004,716**	**$ 1,218,434**	**$ 1,443,700**	**$ 1,479,700**	**$ 1,606,700**	**$ 1,975,533**	**$ 2,044,843**	**$ 2,110,709**	**$ 1,477,302**

MEOC (Capital)	FY2006	FY2007	FY2008	FY2009	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017	Annual Average
Capital Funds (Federal)	$ 20,000	$ 48,000	$ 190,400	$ 216,000	$ -	$ 199,600	$ 201,680	$ 361,117	$ -	$ 22,800	$ 125,960
Capital Funds (State)	$ 145,650	$ 219,240	$ 38,080	$ 36,000	$ -	$ 24,950	$ 25,210	$ 72,223	$ 46,732	$ 62,218	$ 67,030
Capital Funds (Other)	$ 9,350	$ 20,760	$ 9,520	$ 18,000	$ -	$ 24,950	$ 25,210	$ 18,055	$ 11,683	$ 15,555	$ 15,308
Capital Funds - Total	**$ 175,000**	**$ 288,000**	**$ 238,000**	**$ 270,000**	**$ -**	**$ 249,500**	**$ 252,100**	**$ 451,395**	**$ 58,415**	**$ 100,573**	**$ 208,298**

NET Trans (Operations)*	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015	Annual Average
Operating Funds (Federal)	$ 939,470	$ 1,063,509	$ 1,174,916	$ 1,400,883	$ 820,435	$ 869,495	$ 936,931	$ 1,128,133	$ 1,071,819	$ 1,445,879	$ 1,084,947
Operating Funds (State)	$ 469,735	$ 531,754	$ 587,458	$ 700,441	$ 410,218	$ 434,747	$ 468,465	$ 563,066	$ 535,909	$ 722,939	$ 542,473
Operating Funds (Other)	$ 469,735	$ 531,754	$ 587,458	$ 700,441	$ 410,218	$ 434,747	$ 468,465	$ 563,066	$ 535,909	$ 722,939	$ 542,473
Operating Funds - Total	**$ 1,878,939**	**$ 2,127,017**	**$ 2,349,832**	**$ 2,801,765**	**$ 1,640,870**	**$ 1,738,989**	**$ 1,873,861**	**$ 2,252,265**	**$ 2,143,637**	**$ 2,891,757**	**$ 2,169,893**

NET Trans (Capital)*	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015	Annual Average
Capital Funds (Federal)	$ 111,200	$ -	$ 191,370	$ 145,562	$ 204,166	$ 250,321	$ -	$ 492,557	$ 272,534	$ 550,340	$ 221,805
Capital Funds (State)	$ 13,900	$ -	$ 23,921	$ 18,195	$ 25,521	$ 31,290	$ -	$ 61,570	$ 34,067	$ 68,793	$ 27,726
Capital Funds (Other)	$ 13,900	$ -	$ 23,921	$ 18,195	$ 25,521	$ 31,290	$ -	$ 61,570	$ 34,067	$ 68,793	$ 27,726
Capital Funds - Total	**$ 139,000**	**$ -**	**$ 239,212**	**$ 181,953**	**$ 255,207**	**$ 312,901**	**$ -**	**$ 615,696**	**$ 340,667**	**$ 687,925**	**$ 277,256**

* Funding splits (federal, state, and local shares) are an approximation
Source:
VA Department of Rail & Public Transportation FY2006 thru FY2009 and FY2012-FY2017 Rail & Public Transportation Improvement Program
First TN HRA Financial Statements FY2006 thru FY2015

Kingsport Area MTPO
2040 Long Range Transportation Plan
Revenue Forecasts

Capital Funding - Tennessee							
Revenue Source	Annual Average*				Revenue Projections		
Tennessee Revenue Sources	Federal Share	Non-Federal Share	Total	Inflation Factor **	2025 Horizon Year	2040 Horizon Year	Total 2015-2040
National Highway Performance Program (NHPP) (80%/20%)	$ 2,200,000	$ 550,000	$ 2,750,000	1.03	$ 36,278,000	$ 72,923,000	$ 109,201,000
Surface Transportation Block Grant Program (S-STBG) Funds State Selected Projects (80%/20%)	$ 1,300,000	$ 325,000	$ 1,625,000	1.03	$ 21,437,000	$ 43,091,000	$ 64,528,000
Safety Funding (90%/10%)	$ 450,000	$ 50,000	$ 500,000	1.03	$ 6,596,000	$ 13,259,000	$ 19,855,000
Bridge Rehabilitation & Replacement (BRR or BR) (80%/20%)	$ 455,000	$ 113,750	$ 568,750	1.03	$ 7,503,000	$ 15,082,000	$ 22,585,000
Surface Transportation Block Grant Program (L-STBG) Funds MPO Selected Projects (80%/20%)	$ 1,400,000	$ 350,000	$ 1,750,000	1.03	$ 23,088,000	$ 46,406,000	$ 69,492,000
Enhancement Funds (EHN, TAP, or RTP) (80%/20%)	$ 200,000	$ 50,000	$ 250,000	1.03	$ 3,298,000	$ 6,629,000	$ 9,927,000
Safe Routes to School (100% Federal)	$ 50,000	$ -	$ 50,000	1.03	$ 660,000	$ 1,326,000	$ 1,986,000
Other Federal-Aid Programs & Discretionary Funds (e.g. APD, ARRA, TIGER, NHFP) (80%/20%)	$ 320,000	$ 80,000	$ 400,000	1.03	$ 5,277,000	$ 10,607,000	$ 15,884,000
State Funds (STA or SP and SPPR) (100% State)		$ 400,000	$ 400,000	1.03	$ 5,277,000	$ 10,607,000	$ 15,884,000
City of Kingsport, TN (100% Local)		$ 1,800,000	$ 1,800,000	1.03	$ 23,746,000	$ 47,732,000	$ 71,478,000
Sullivan County, TN (100% Local)		$ 190,000	$ 190,000	1.03	$ 2,506,000	$ 5,038,000	$ 7,544,000
Town of Mt Carmel TN (100% Local)		$ 14,000	$ 14,000	1.03	$ 185,000	$ 371,000	$ 556,000
City of Church Hill, TN (100% Local)		$ 58,000	$ 58,000	1.03	$ 765,000	$ 1,538,000	$ 2,303,000
Hawkins County, TN (100% Local)		$ 65,000	$ 65,000	1.03	$ 857,000	$ 1,724,000	$ 2,581,000
Sub-Total (TN)	**$ 6,375,000**	**$ 4,045,750**	**$ 10,420,750**		**$ 137,471,000**	**$ 276,333,000**	**$ 413,804,000**

* Based on a review of historic funding levels to the MTPO region.
** Revenue forecasts assume a 3 percent annual growth rate of funding.
Projections rounded to the nearest thousands

Draft 02/08/17

Kingsport Area MTPO
2040 Long Range Transportation Plan
Revenue Forecasts

Capital Funding - Virginia							
Revenue Source	Annual Average*				Revenue Projections		
Virginia Revenue Sources	Federal Share	Non-Federal Share	Total	Inflation Factor**	2025 Horizon Year	2040 Horizon Year	Total 2015 - 2040
Interstate, Primary, Secondary, and Statewide Construction***	$ 1,191,040	$ 297,760	$ 1,488,800		$ 25,690,000	$ 11,530,000	$ 37,220,000
Gate City, VA (100% Local)		$ -	$ -		$ -	$ -	$ -
Weber City, VA (100% Local)		$ -	$ -		$ -	$ -	$ -
Sub-Total (VA)	**$ 1,191,040**	**$ 297,760**	**$ 1,488,800**		**$ 25,690,000**	**$ 11,530,000**	**$ 37,220,000**

* Annual Average figures are presented for illustrative purposes only. Figures are presented to illustrate a hypothetical annual amount of revenues and share splits to the MTPO area. Actual annual projections are reflected in the Revenue Projections provided to the MTPO by VDOT.

** Revenue forecasts are derived from VDOT's Financial Planning Division, Assumptions - Constrained Long Range Plan documentation (October 2015)

*** VDOT manages highway revenues through a variety of Construction Programs (Interstate, Primary, Secondary, Statewide, etc.). Through these Programs Virginia revenues (state and federal revenues) are allocated. The following revenues are reflected in these Construction Programs and assumed available to the MTPO area: Bridge Replacement\Rehabilitation (BR/BROS), Interstate Maintenance (IM), National Highway Systems (NHS), National Highway Performance Program (NHPP) Hazard Elimination (HSIP), Surface Transportation Block Grant (STBG), Transportation Alternative Program/Enhancement (TAP/EN), High Priority Projects (HPP), Appalachian Development (APD), Federal Demonstration (DEMO), Safe Routes to School (SRS), High Priority Development (HPD), Intelligent Technology Systems (ITS), Regional STP (RSTP), and Equity Bonus/Minimum Guarantee (EB/MG)

Projections rounded to the nearest thousands

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Kingsport Area MTPO
2040 Long Range Transportation Plan
Revenue Forecasts

Operations and Maintenance Funding

Revenue Source	Annual Average *	Inflation Factor **	Revenue Projections		
			2025 Horizon Year	2040 Horizon Year	Total 2015 - 2040
Tennessee Revenue Sources					
TDOT (Various State Sources) ***	$ 4,260,000	1.03	$ 56,198,000	$ 112,965,000	$ 169,163,000
City of Kingsport - State & Local Gas/State Aid Funds	$ 2,230,000	1.03	$ 29,418,000	$ 59,134,000	$ 88,552,000
Sullivan County - State & Local Gas/State Aid Funds ****	$ 8,100,000	1.03	$ 106,855,000	$ 214,793,000	$ 321,648,000
Town of Mt Carmel - State & Local Gas/State Aid Funds	$ 146,000	1.03	$ 1,926,000	$ 3,872,000	$ 5,798,000
City of Church Hill - State & Local Gas/State Aid Funds	$ 174,000	1.03	$ 2,295,000	$ 4,614,000	$ 6,909,000
Hawkins County - State & Local Gas/State Aid Funds ****	$ 3,000,000	1.03	$ 39,576,000	$ 79,553,000	$ 119,129,000
Sub-Total (TN)	**$ 17,910,000**		**$ 236,268,000**	**$ 474,931,000**	**$ 711,199,000**
Virginia Revenue Sources					
VDOT (State) *****	$ 4,431,320		$ 40,134,000	$ 70,649,000	$ 110,783,000
Sub-Total (VA)	**$ 4,431,320**		**$ 40,134,000**	**$ 70,649,000**	**$ 110,783,000**
Total	**$ 22,341,320**		**$ 276,402,000**	**$ 545,580,000**	**$ 821,982,000**

* Tennessee and Virginia's annual average revenues are based on a review of historic funding levels to the MTPO region.
** Revenue forecasts assume a 3 percent annual growth rate of funding unless otherwise noted.
*** TDOT maintenance funds shown are for state maintained roadways for the complete counties of Sullivan and Hawkins Counties
**** County maintenance funds shown are for the complete counties of Sullivan and Hawkins Counties
***** VDOT maintenance funds were developed based on a review of VDOT's Maintenance and Operations Budgets 2012 thru 2017 for the Bristol District and derived from VDOT's Financial Planning Division, Assumptions - Constrained Long Range Plan documentation (October 2015)
Projections rounded to the nearest thousands

DRAFT - 02/08/17

Kingsport Area MTPO
2040 Long Range Transportation Plan
Revenue Forecasts

Transit - Capital Funding

Revenue Source	Annual Average*	Inflation Factor**	2025*** Horizon Year	2040 Horizon Year	Total 2015 - 2040
KATS					
Capital Assistance - FTA 5307 (Federal) 80%	$ 520,000	1.03	$ 9,640,000	$ 13,789,000	$ 23,429,000
Capital Assistance - TN (State) 10%	$ 65,000	1.03	$ 1,205,000	$ 1,724,000	$ 2,929,000
Capital Assistance - Kingsport (Local) 10%	$ 65,000	1.03	$ 1,205,000	$ 1,724,000	$ 2,929,000
FTA 5307 Total	**$ 650,000**		**$ 12,050,000**	**$ 17,237,000**	**$ 29,287,000**
Capital Assistance - Other FTA Programs (Federal) 80%	$ 120,000	1.03	$ 1,583,000	$ 3,182,000	$ 4,765,000
Capital Assistance - Other FTA Programs (Non-Federal Match) 20%	$ 30,000	1.03	$ 396,000	$ 796,000	$ 1,192,000
Other Transit Providers Including KATS, MEOC, & NET Trans					
Other FTA Programs (FTA 5310, 5339) & Discretionary Funds** Total**	**$ 150,000**		**$ 1,979,000**	**$ 3,978,000**	**$ 5,957,000**
Total Capital Assistance	**$ 800,000**		**$ 14,029,000**	**$ 21,215,000**	**$ 35,244,000**

* Based on a review of historic and current funding levels to the MTPO region (FY11-FY14 MTPO TIP, FY14-FY17 MTPO TIP, and FY17-FY21 MTPO TIP)
** Revenue forecasts assume a 3 percent annual growth rate of funding.
*** Revenue forecasts for the 2025 horizon are derived from the FY17-FY21 MTPO TIP for FTA 5307 funding levels.
**** Conservative estimate of FTA funds likely to be available within the MTPO region over the 25-Year Planning Horizon
Projections rounded to the nearest thousands

Draft - 02/08/17

Kingsport Area MTPO
2040 Long Range Transportation Plan
Revenue Forecasts

Transit - Operating Funding

Revenue Source	Annual Average*	Inflation Factor**	2025 Horizon Year	2040 Horizon Year	Total 2015 - 2040
KATS					
Operating Assistance - FTA 5307 (Federal)	$ 750,000	1.03	$ 9,894,000	$ 19,888,000	$ 29,782,000
Operating Assistance - TN (State)	$ 375,000	1.03	$ 4,947,000	$ 9,944,000	$ 14,891,000
Operating Assistance - Kingsport (Local)	$ 375,000	1.03	$ 4,947,000	$ 9,944,000	$ 14,891,000
FTA 5307 Tennessee Total	**$ 1,500,000**		**$ 19,788,000**	**$ 39,776,000**	**$ 59,564,000**
Other Transit Providers Including KATS, MEOC, & NET Trans					
Operating Assistance - Other FTA Programs (Federal) 50%	$ 25,000	1.03	$ 330,000	$ 663,000	$ 993,000
Operating Assistance - Other FTA Programs (Non-Federal Match) 50%	$ 25,000	1.03	$ 330,000	$ 663,000	$ 993,000
Other FTA Programs (FTA 5310) & Discretionary Funds * Total**	**$ 50,000**		**$ 660,000**	**$ 1,326,000**	**$ 1,986,000**
Total Operating Assistance	**$ 1,550,000**		**$ 20,448,000**	**$ 41,102,000**	**$ 61,550,000**

* Based on a review of historic and current funding levels to the MTPO region (FY11-FY14 MTPO TIP, FY14-FY17 MTPO TIP, and FY17-FY21 MTPO TIP)
** Revenue forecasts assume a 3 percent annual growth rate of funding.
*** Conservative estimate of FTA funds likely to be available within the MTPO region over the 25-Year Planning Horizon
Projections rounded to the nearest thousands

Draft - 02/08/17

Travel Demand Model Development Report

Technical Memorandum #1

KINGSPORT TRAVEL DEMAND MODEL UPDATE

STUDY DESIGN

Developed for

KINGSPORT METROPOLITAN TRANSPORTATION PLANNING ORGANIZATION

Developed by

Kimley»Horn

In association with:

RPM Transportation Consultants

March 16, 2016

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1.0 INTRODUCTION

The Kingsport Metropolitan Transportation Planning Organization (MTPO) developed the existing travel demand model in 2012. The existing model has a validated base year of 2009 and horizon year of 2035. The model was used for preparing the MTPO 2035 Long Range Transportation Plan (LRTP).

RPM Transportation Consultants (RPM) and Kimley-Horn and Associates, Inc. (Kimley-Horn) are currently under contract with the MTPO to update the existing travel demand model using a validated base year of 2015. The updated model will have the capability to forecast highway traffic for interim year 2025 and horizon year of 2040 and will be used in the development of the 2040 LRTP. If air quality analysis is required for Sullivan County, Tennessee in the future, the output from this new model can also be used as input to the Environmental Protection Agency (EPA)'s Motor Vehicle Emission Simulator (MOVES) air quality model for the purpose of determining air quality conformity.

The Tennessee Department of Transportation (TDOT) is the lead review agency for this model update. In addition, technical memoranda developed during the process will be submitted to Virginia Department of Transportation (VDOT) and Federal Highway Administration (FHWA) for review and comment. VDOT and FHWA are cooperating review agencies for the model update and will provide inputs and comments as necessary.

The purpose of this technical memorandum is to present the proposed model development approach at a sub-task level. The MTPO desires that all review agencies are involved early so their comments and suggestions can be addressed and incorporated into the model development process.

Section 2 of this memorandum provides an overview of the existing travel demand model. Sections 3 and 4 describe the proposed model structure and the model validation criteria. Section 5 outlines the future year model development process. Section 6 discusses the model review and approval process, and Section 7 provides a brief overview of the proposed model user interface.

2.0 OVERVIEW OF THE EXISTING MODEL

The MTPO's existing model (2012 model) was developed using TransCAD software version 5.0. The existing model has a validated base year of 2009, interim years of 2015 and 2025, and horizon year of 2035. There are 190 Traffic Analysis Zones (TAZs) included in the existing model.

The 2012 model has the following three internal trip purposes:

- Home-Based Work (HBW)
- Home-Based Other (HBO)
- Non Home-Based (NHB)

Trip Generation

The existing trip production models are two-dimensional, cross-classification models. Households were cross-classified by auto ownership levels of zero, one, two, three, and four plus vehicles as well as by household size of one, two, three, and four plus persons. Because there is no local household travel survey available for the Kingsport region, trip production rates were developed using the 2009 National Household Travel Survey Tennessee Add-on data for the entire state.

The existing trip attraction models are linear equations with zero intercept. Trip attraction rates were based on NCHRP 365 and rates for urban areas of similar size.

Trip Distribution

Gravity models were used in the 2012 model for all trip purposes. Free-flow travel times were used as the measure of travel impedance between Production and Attraction (PA) zone pairs. Gamma functions were used to calculate the friction factors for the gravity models.

Mode Choice

There is no mode choice component in the existing model structure as the 2012 model does not model transit or other non-motorized modes. A conversion factor was developed using the NHTS 2009 Tennessee Add-on data for each trip purpose to convert the number of person trips to the number of auto trips.

Highway Assignment

In the 2012 model, the highway traffic assignment was implemented as a single user equilibrium assignment applied at the daily level only. Volume Delay functions used for the assignment are Bureau of Public Road (BPR) curves based on free flow travel time and capacity. The volume-delay curves have varied coefficients based on roadway functional classification and link type (intersection links or non-intersection links).

Truck Model

A truck model was implemented using the quick response method defined in Quick Response Freight Manual (QRFM). Truck trips were modeled as two classes: Commercial Vehicles and Freight Trucks. Truck trip rates were borrowed from the QRFM and adjusted downward for the Kingsport area. Gravity models were then used to distribute the truck trips.

External Trip Models

The total external trips at 34 external stations were modeled largely based on the older version (2004) of the MTPO Model. Trips at external station were then split into External-External (EE) trips that pass through the region and External-Internal (EI) trips that have one trip end within the region. EE trips were modeled as a fixed trip table. EI trips were further divided into the aforementioned three trip purposes (HBW, HBO, and NHB). Gravity models were then used to distribute EI trips to internal zones.

3.0 PROPOSED KINGSPORT MODEL SYSTEM

The purpose of this project is to update the Kingsport model to aid the MTPO with their various transportation plan programming, transportation project evaluation activities, and future air quality analysis, if needed. An updated and validated model for use with the 2040 LRTP development is a critical need for this project. The proposed model structure is outlined below.

The Kingsport regional model is proposed to be a "state of the practice" model for small area MPOs. After a detailed review of the available data, the MTPO's vision and needs of model applications, and budget and schedule constraints, the RPM/Kimley-Horn team worked with the MTPO staff to identify the desired structure of each model component. The proposed model will remain a conventional 4-step model with the following proposed changes and enhancements:

- Slightly revised TAZ boundaries to accommodate the proposed changes as part of recent transportation studies
- New base year of 2015 using the following new datasets:
  - Census 2010 demographic data forecasted to a base year of 2015
  - Census Transportation Planning Package (CTPP) 2010 data for demographic cross-classifications
  - 2015 employment data set purchased from InfoGroup
- New Home-based School (HBSchool), Shopping (HBShop), and Social-recreational (HBSR) trip purposes
- Revised trip generation rates using the National Household Travel Survey 2009 Add-on data from both Tennessee and Virginia
- New time of day model
- Application of mode split factors based on trip distance
- Enhanced QRFM truck model using other truck datasets acquired by TDOT and VDOT at the state level
- Forecasted regional demographic and employment data to future year 2040

Figure 3-1 shows the proposed model structure in a flow chart format.

The new model will be implemented using TransCAD 7.0. Kimley-Horn will apply the model in a modular way to allow future upgrades to occur more efficiently. All components of the model will be implemented in native TransCAD GISDK scripts.

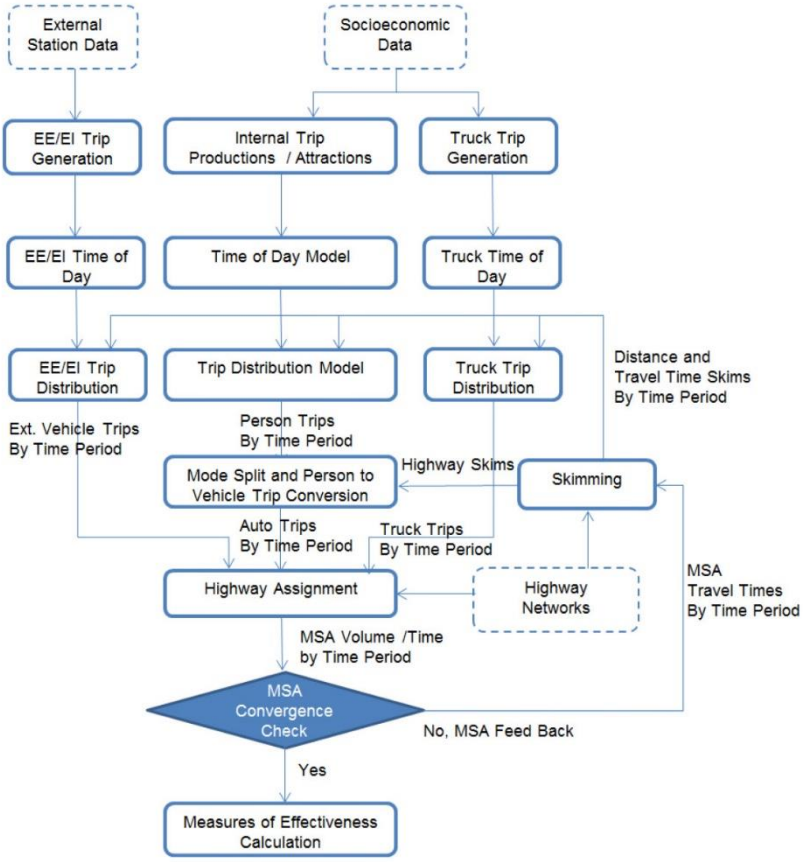


Figure 3-1 Proposed Model Structure

3.1 Traffic Analysis Zones and External Stations

The Kingsport MTPO Metropolitan Planning Area (MPA) boundary includes the cities of Kingsport, Mount Carmel, and Church Hill, Tennessee; Weber City and Gate City, Virginia; and portions of Hawkins County, Sullivan County, and Washington County in Tennessee, and Scott County in Virginia).

The revised TAZ boundaries are mostly the same as the 2012 Model and the 2010 Census TAZ boundaries. Three TAZs in the vicinity of the proposed I-81/I-26 interchange area were split into multiple TAZs to better accommodate future planning analysis needs. Compared with the 190 internal TAZs in the 2012 model, the proposed 2015 TAZ structure includes 193 internal TAZs. The revised TAZ boundaries were reviewed by the MTPO and the final recommended TAZ structure will be presented in the next technical memorandum.

Base Year TAZ Attributes

Given the unique multi-county and bi-state structure of the Kingsport MTPO, the process for allocating base year population to the traffic analysis zones (TAZs) within the MTPO area differed between the three counties located in Tennessee (Hawkins, Sullivan, and Washington counties) and the single county location in Virginia (Scott County). The Woods & Poole 2015 Complete Economic and Demographic Data Source was used as county-level control totals for population within all four counties.

The process for determining the portion of each county's population that lies within the MTPO area for Tennessee counties first began with an analysis of 2010 US Census data. Using this data at the block geography as well as Woods & Poole county-level estimates, the percentage of each county's population within the MTPO area was determined. Those proportions were held constant for each Tennessee county, and it was assumed that in 2015, the same percentage of each county's population resided in the MTPO area as in 2010. The 2015 population for each county in the MTPO area was then calculated using the 2015 Woods & Poole county population and those percentages.

For Scott County, data from the 2000 and 2010 US Census was used in the analysis. Within this 10-year time period, the portion of Scott County that lies within the MTPO area grew by approximately 0.79% each year. However, Woods & Poole county-level estimates show that Scott County as a whole decreased in population by an average of 0.45% each year. As such, based on the different levels of growth and decline shown between the two datasets, the difference between the two average annual growth rates, 0.35%, was used to determine the 2015 Scott County population in the MTPO area. This growth rate was applied to the 2010 US Census population for areas within the MTPO area to determine the portion of Scott County's 2015 population within the MTPO area.

The sub-allocation of population and household data for the base year was derived using 2010 US Census data at the block level and allocated to the corresponding TAZ.

To determine the base year employment within the MTPO area, 2015 InfoGroup data was purchased by the MTPO. This data was geocoded by address, cleaned, and allocated to the TAZs for 2015. Employment totals were then sub-allocated to the appropriate employment classification (agricultural, manufacturing, retail, office, service, and government employment).

External Stations

There were no proposed changes to the 34 external stations from the 2012 model.

3.2 Highway Network

Highway network development

The following steps will be taken to develop the new base year 2015 highway network, using the latest TRIMS highway geographic layer provided by TDOT:

- Develop and verify the year 2015 highway link attributes based on the existing travel demand model, the highway link attributes from TDOT TRIMS database, and aerial photos;
- Review and refine centroid connector locations;
- Review the calculated link capacity and identify and resolve issues;
- Organize and geocode traffic counts and vehicle classification information; and
- Code finalized screen lines and cut lines for validation purposes.

Highway Speed

A set of adjustment factors will be developed to estimate the highway free flow and congested speeds based on the posted speed on network links. The adjustment factors will be developed using observed local speed data. The factors will be based on area type and functional classification of the roadway as shown in **Table 3-1**, with the actual values to be reported later. Free flow speed will be used as input to the volume-delay functions of the highway traffic assignment algorithm. Estimated congested speed will be used in the first iteration of the feedback loop to give the trip distribution model a starting value when congested speed is still unknown.

Table 3-1 Speed Adjustment Factor Categories

Roadway Functional Classification	Area Type		
	CBD	Urban	Rural
Freeway			
Arterial (posted speed >= 45 mph)			
Arterial (posted speed < 45 mph)			
Collector			
Local			

Highway Capacity

Using the collected street data, the proposed capacity calculation for the Kingsport model will be implemented using an equation which takes into account data such as functional classification, speed limit, lanes, median treatment, area type, average lane width, and average shoulder width. The equations were originally developed using the Highway Capacity Manual (HCM) and analysis performed by the Indiana Department of Transportation in 1997 for the Indiana State Highway Congestion Analysis Plan. Kimley-Horn successfully applied this method in other urban area models, in conjunction with analysis performed using North Carolina DOT's Level of Service (LOS) software. The equations will be adopted to the Kingsport region and adjusted based on local conditions. The general form of the equation is:

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

Where:

$SF =$ *Maximum service flow for desired level of service*

$c =$ *Capacity under ideal conditions (vehicles per hour per lane)*

$N =$ *Number of lanes*

$F_w =$ *Factor due to lane and shoulder width*

$F_{hv} =$ *Factor due to percent heavy vehicles*

$F_p =$ *Factor due to driver population*

$F_e =$ *Factor due to driving environment*

$F_d =$ *Factor due to directional distribution*

$F_{clt} = Factor\ for\ continuous\ left-turn\ lane\ (for\ undivided\ sections)$

$F_{park} = Factor\ due\ to\ on-street\ parking$

$(v/c)_i = Rate\ of\ service\ flow\ for\ levels-of-service\ A\ through\ E$

The capacity setup has several benefits, including:

- Better representation of capacity based on roadway attributes
- Ability to load the model network with LOS D or E capacity
- Hourly capacities are calculated and utilized in the time-of-day model
- Ability to automatically recalculate capacities for future networks as improvements occur
- Ability to make adjustments to capacity equations throughout the process

3.3 Trip Generation Model

In addition to the three trip purposes used in the 2012 model, three new trip purposes (Home-based School, Shopping, and Social-recreational) will be introduced in the new model. The proposed trip purposes are:

- Home-based work (HBW),
- Home-based school (HBSchool),
- Home-based shopping (HBShop),
- Home-based social-recreational (HBSR),
- Home-based other (HBO), and
- Non-home based (NHB).

Trip Productions

Two-dimensional, cross-classification trip production models will be developed for each internal trip purpose. Production rates will be developed using the National Household Travel Survey (NHTS) 2009 add-on data from Tennessee and Virginia. Tentatively, the following cross-classification categories will be used:

- By vehicle availability – Zero, one, and two plus vehicles per household
- By children – Zero, one, two, and three plus school-aged children per household
- By worker – Zero, one, two, and three plus workers per household
- By household size – One, two, three, and four plus persons per household

The household cross-classification distribution will be obtained from the Census Transportation Planning Package (CTPP) 2010 data set. The total number of households in each TAZ from Census 2010 will be distributed to each cross-classification bin by applying the distributions from the CTPP data.

The tentative two-dimensional cross classification production models are as follows:

- HBW - By vehicle availability, then by number of workers
- HBSchool - By household size, then by number of school aged children
- HBShop - By Vehicle availability, then by household size
- HBSR - By Vehicle availability, then by household size
- HBO - By Vehicle availability, then by household size
- NHB - By Vehicle availability, then by household size

Trip Attractions

Trip attraction models will be developed using linear equations based on various employment categories and the total number of households. The following employment categories will be classified using the 2015 employment data set collected by InfoGroup and purchased by the MTPO:

- Agriculture, mining and construction;
- Manufacturing, transportation, communications, utilities and wholesale trades;
- Retail;
- Office;
- Service; and
- Government.

In addition, K-12 and university enrollment numbers were collected by the MTPO. The school enrollment numbers will be the dependent variable for calculating the number of school trips to be attracted to each zone with a school establishment.

The initial trip attraction rates will be borrowed from the Chattanooga regional travel demand model. The 2010 Chattanooga household travel survey was used to develop these initial attraction rates. The rates will be adjusted during the model calibration and validation process, if necessary.

3.4 Time-of-Day Model

The proposed time-of-day model structure is illustrated in **Figure 3-2**. Four time-of-day periods will be incorporated into the model stream from the trip distribution to assignment steps. The four time-of-day periods are AM peak, Midday, PM peak, and off-peak. In absence of a local household travel survey, Kimley-Horn will analyze the time-of-day distribution of the local traffic counts to determine the appropriate hours to be included in each time-of-day period. If no substantial differences are found using the local data, the following standardized time-of-day periods recommended by TDOT will be used:

- AM peak: 6 AM to 9 AM
- Midday: 9 AM to 3 PM
- PM peak: 3 PM to 6 PM
- Off-peak: 6 PM to 6 AM

After balancing daily productions and attractions at the end of the trip generation models, time-of-day splits developed from local traffic counts will be applied to the daily trips to get the total trips for each time-of-day period. Downstream model components, including trip distribution, mode split, and assignment models, will be applied for each time-of-day period.

In addition, directional split factors (departure and return splits) by time of day for each trip purpose will be borrowed from the Chattanooga household travel survey. These factors will be applied after the mode split model to convert the vehicle trip tables from production-attraction format to origin-destination format.

Truck time-of-day factors will be developed using the vehicle classification counts by time of day and applied to the truck trip distribution component.

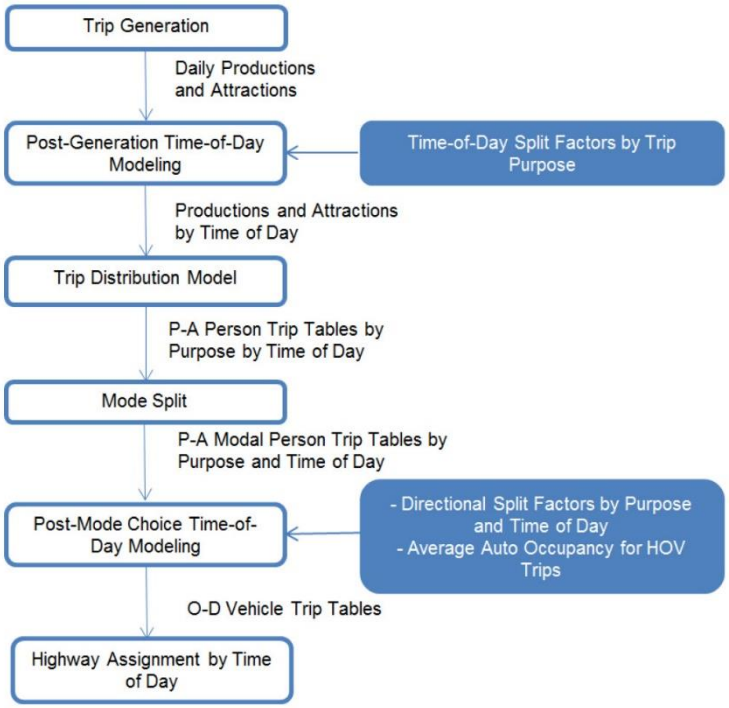


Figure 3-2 Time-of-day Model Application

3.5 Trip Distribution Model

Gravity models will be developed or updated for trip distribution models for each trip purpose. Travel impedances will be based on the congested travel times by each time-of-day period. The friction factors will be entered into the gravity model as a gamma function equation. Friction factors for each trip purpose will be adjusted through an iterative process to obtain the desired trip length distribution.

3.6 Mode Split Factors

The development of a true utility-based mode choice model is not planned as part of this model update due to the lack of a local survey, the high level of investment required to create a sound mode choice model, and the relatively low number of non-auto users. The existing 2012 model used a flat factor per trip purpose to convert person trips to auto trips. In this model update, an improved factoring process is proposed. For each trip purpose, a set of conversion factors will be developed based on the travel distance between production-attraction zone pairs. The proposed structure is shown in **Table 3-2** below:

Table 3-2 Mode Split Factors By Travel Distance

Distance between P-A zone pair	Trip Purpose					
	HBW	HBSchool	HBShop	HBSR	HBO	NHB
0 – 1 mile						
1 – 2.5 miles						
2.5 – 7.5 miles						
> 7.5 miles						

The mode split factors can be read as percentages. For example, a HBW factor of 0.7 for trips less than a mile means 70% of these trips are automobile trips. As the trip distance increases, the share of non-auto trips decreases. This approach allows a more realistic conversion, as travel distance is a statistically significant variable in most mode choice models. These factors will be estimated using the NHTS 2009 add-on data for small MSA areas with population less than 500,000.

After the mode split factors are applied, an auto occupancy factor per trip purpose will be applied to convert the person trips to vehicle trips. The auto occupancy factors will also be estimated using the NHTS 2009 travel survey add-on data.

3.7 External-External (EE) and External-Internal (EI) Models

The external trip models are proposed as follows.

Trip Generation

The number of vehicle trips at each external station will be set equal to the traffic count at the station for the base year. Autos and trucks (Single-unit (SU) and Combination Unit (CU) trucks) will be modeled separately based on the vehicle classification counts at the external station. Time-of-day factors will also be developed for each external station based on available time-of-day information. The Tennessee Statewide Travel Demand Model will be used to determine the percent splits between External-External (EE) and External-Internal (EI) for each station.

EI trips are assumed to be produced at external stations and attracted to internal zones. External trip productions will be held at the external station locations, and the attractions will be derived at the TAZ level based on various employment categories and total number of households. The EI productions and attractions will then be balanced by holding the production vectors constant.

Trip Distribution

Gravity models will be used to distribute both EE and EI trips. Friction factors will be entered into the gravity models as a gamma function.

For EE trips, a K factor matrix will be developed and used to get desired distribution of through trips between external stations. EI trips will also be distributed from each external station to internal TAZs for each time-of-day period using gravity models.

3.8 Truck Model

The proposed truck model for Kingsport will use the "quick response" methods defined in QUICK RESPONSE FREIGHT MANUAL II, FHWA 2007(QRFM). Three truck types will be modeled: light (4-tire), medium (single-unit,

or SU), and heavy (combination-unit, or CU). Initial trip generation rates and gravity model friction factor function parameters from the QRFM will be used and adjusted during the calibration process.

The truck model will be validated using the vehicle classification counts collected by TDOT, VDOT, and the supplemental counts by the MTPO. In addition, Kimley-Horn will obtain the truck GPS tracking data by American Transportation Research Institute (ATRI) from TDOT. Kimley-Horn will also obtain the truck trip matrices in the MTPO area developed by TDOT as part of the Statewide Travel Demand Model update project. Both datasets will be analyzed for the purpose of determining EE and EI truck flow patterns in the Kingsport region. Depending on the quality and resolution of the datasets, Kimley-Horn will apply the analysis results to the truck model calibration and validation process.

3.9 Highway Assignment

The highway traffic assignment step for the Kingsport model will be conducted by each time-of-day period. OD trip tables from the mode split and auto trip conversion step will be combined into three vehicle classes: Auto, SU Truck, and CU Truck. The OD trip tables will be assigned to the model network using a two-step process: a multimodal multi-class (MMA) all-or-nothing assignment, and a MMA user equilibrium assignment.

Preload Assignment

An initial all-or-nothing assignment will be used to preload through trips and large commercial vehicle trips. This assignment procedure is intended to reflect the insensitivity congestion has on through trips and heavy truck trips, since they are typically much less likely to divert to another roadway than other types of trips, either due to lack of knowledge about the area, perceived inconvenience, or restrictions against heavy trucks. Three trip tables will be assigned using the preload assignment procedure:

- Preload auto trips (includes EE Auto trips),
- Preload SU trips (includes EE SU truck trips), and
- Preload CU trips (includes EE CU trucks, IE CU trucks, and Internal CU trucks).

User Equilibrium Assignment

The second step of the highway assignment procedure is to load all remaining trips not considered in the preload assignment. Preloaded trips will be treated in the assignment procedure as background traffic that reduces capacity but cannot divert to another route. In this step, trips will be assigned using a MMA user-equilibrium assignment, which assigns trips between origin-destination pairs in an iterative fashion that accounts for link congestion in route choice. The user-equilibrium assignment procedure computes the link travel time, assigns link traffic based on shortest path, and recalculates the link travel time. This step is repeated until the user equilibrium conditions are met: all used paths for each O-D pair are minimal and equal; and any unused path for a given O-D pair has a greater travel time than any used paths for that O-D pair.

Standard Bureau of Public Road (BPR) volume-delay functions will be used for the assignment procedures. The volume-delay function parameters curves have varied coefficients for different area types, functional classification, and link speed.

Two trip tables will be assigned using the equilibrium assignment procedure:

- MMA auto trips (Including Internal auto trips, light commercial truck trips, and IE auto trips), and
- MMA SU trips (Including Internal and IE SU trucks)

3.10 Feedback Loops

The objective of the feedback process is to execute the travel model system in an integrated manner so that the time outputs from the traffic assignment model are reasonably consistent with the inputs assumed at the trip distribution and mode choice steps. The trip distribution, mode split, and highway assignment steps are repeated until a sufficient convergence — output times being close to input times — is achieved.

The Method of Successive Averages (MSA) feedback loop procedure is proposed for the Kingsport model. In the MSA method, output volumes from trip assignment from previous iterations are weighted together to produce the current iteration's link volumes. Adjusted congested times are then calculated based on the normal volume-delay relationship. This adjusted congested time is then fed back to the skimming procedures. The benefits of using MSA method are that the convergence is assured and the TransCAD assignment algorithm supports it for easy implementation.

The adjusted volume is calculated based on the following equation:

$$MSAFlow_n = MSAFlow_{n-1} + \frac{1}{n}(Flow_n - MSAFlow_{n-1})$$

where:

n = current MSA iteration number

$MSAFlow_n$ = calculated MSA flow at iteration n

$Flow_n$ = resulting flow directly from trip assignment

4.0 BASE YEAR MODEL CALIBRATION AND VALIDATION CRITERIA

Calibration and validation for each model component will follow the MINIMUM TRAVEL DEMAND MODEL CALIBRATION AND VALIDATION GUIDELINES FOR STATE OF TENNESSEE, UPDATED 2012, and the latest addendum dated December 2015. Model validation and agency review submittal process will follow the TDOT TRAVEL DEMAND MODEL APPLICATION CHECKLIST, DECEMBER 2015.

Key comparisons between the modeled results and the observed data will be made in the process. The observed data sets include National Household Travel Survey (NHTS), household travel surveys from comparable regions, ranges defined in the guideline documents, and local traffic counts. The following comparison will be conducted for each model component:

Trip Generation

- Overall person trip rate per capita and per household
- Person trip rates by trip purpose
- Percent of total trips by trip purpose

Trip Distribution

- Average trip length by trip purpose
- Trip length frequency distribution by trip purpose
- Percent intrazonal trips by trip purpose
- Travel patterns at planning district level

Mode Split and Person to Auto Trip Conversion

- Mode split and auto occupancy factors by trip purpose compared with existing household travel surveys from comparable regions

Highway Assignment

- VMT per capita and per household
- VMT by facility type and by functional classifications
- Percent Root Mean Square Error (RMSE) area wide, by volume group, and by functional classification
- Coefficient of determination (R square)
- Percent difference of volume by facility type
- Percent difference of volume by volume group
- Percent difference of volume at screen lines and cut lines

A series of technical memoranda documenting the base year model development and validation tasks will be developed. Each technical memorandum will document the final sub-model structure, initial and adjusted model parameters, and the validation results.

5.0 FUTURE YEAR MODELS

Kimley-Horn will develop the horizon year model for 2040 and interim year model for 2025.

Demographic and Socioeconomic Data

The Woods & Poole 2015 Complete Economic and Demographic Data Source was used as county-level control totals for forecasting demographic and employment data for years 2025 and 2040.

For future years 2025 and 2040, population growth by county was sub-allocated based on stakeholder input received on February 9, 2016 as well as an examination of growth between 2000 and 2010 (by Census Block Group for the complete MTPO area). In addition to these variables, land availability and suitability were considered (looking at currently zoned residential, commercial, industrial and agricultural lands as well as lands classified as vacant by TAZ). Each of these factors were balanced to the control totals for population (for each county and by year 2025 and 2040).

Based on the 2015 employment, county-specific growth rates established from the Woods & Poole data were used to project employment within the MTPO area. Additionally, Woods & Poole data was used to determine the relative share of employment by employment classification for future years. For future years 2025 and 2040, employment growth was sub-allocated based on stakeholder input received on February 9, 2016 as well as an examination of growth between 2000 and 2010. In addition to these variables, land availability and suitability were considered (looking at currently zoned residential, commercial, industrial and agricultural lands as well as lands classified as vacant - by TAZ). Each of these factors were balanced to the control totals for employment (for each county as well as for each job classification – agricultural, manufacturing, retail, office, service, and government employment – and by year 2025 and 2040).

Highway network development

A project lookup table for future year networks will be developed. A single master network will be used for the base year and all future year models. Future year projects will be organized in a table format with project information such as the anticipated opening year, the network scenario alternatives, and the proposed number of lanes and other attributes relevant to capacity. A future year project toolbox will be developed for the model and will be used to code projects to the master network. Kimley-Horn will create an interface that allows the user to select the model year and network alternative, from which the projects to be included in a particular scenario analysis will be automatically selected. The Existing Plus Committed (E+C) network will be constructed by incorporating all completed highway projects between 2010 and 2014, and projects committed in the MTPO's current Transportation Improvement Program (TIP).

Future year external trip forecasts

The future year external trips will be developed by applying a growth rate to the base year external trips. The growth rate at each external station will be estimated using the following information:

- Growth rate based on historic traffic count data from TDOT or VDOT,
- Average growth rate for the same functional class roadways within the region,
- Historic population growth by census tract inside and outside the model boundary, and
- Growth projected by the Tennessee Statewide Travel Demand Model.

6.0 MODEL REVIEW AND APPROVAL PROCESS

The Tennessee Department of Transportation (TDOT) is the lead review agency for this model update. The updated model will be reviewed by the Long Range Planning Division of TDOT based on its MPO MODEL APPROVAL PROCEDURES, 2008. Calibration and validation for each model component will follow the MINIMUM TRAVEL DEMAND MODEL CALIBRATION AND VALIDATION GUIDELINES FOR STATE OF TENNESSEE, UPDATED 2012, and the latest addendum dated December 2015. The model validation and agency review submittal process will follow the TDOT TRAVEL DEMAND MODEL APPLICATION CHECKLIST, DECEMBER 2015. The Long Range Planning Division will review all stages of the model development and will be requested to approve the model for use in the MTPO's LRTP development process.

In addition, technical memoranda developed during the process will be submitted to Virginia Department of Transportation (VDOT) and Federal Highway Administration (FHWA) for review and comment. VDOT and FHWA are cooperating review agencies for the model update and will provide inputs and comments as necessary.

The tentative review submittals are organized as follows:

- Technical Memorandum #1 – Study Design
- Technical Memorandum #2 – Network, TAZ, Trip Generation, and Time-of-day Models
- Technical Memorandum #3 – Trip Distribution, External, and Truck Models
- Technical Memorandum #4 – Highway Assignment and Validation
- Technical Memorandum #5 – Future Year Forecasts, Models, and Results
- Kingsport Travel Demand Model User's Manual

Kimley-Horn will submit all documents in electronic format. Interim and final model input and output files, model interface, and other model documentation will also be submitted in stages for review and approval. Comments from the review agencies will be addressed and model adjustments will be made.

7.0 MODEL USER INTERFACE AND TRAINING

The proposed Kingsport Model will use standard folder structure, scenario names, file names, and network field names suggested by the latest TDOT Addendum to Tennessee Guidelines.

A user-friendly model interface will be developed with a focus on usability. The proposed model interface will provide the following functionality:

- Model runs – ability to conduct model runs either step by step or all steps at once.
- Scenario management – ability to save and retrieve analysis years, network alternatives, and input and output file locations inside the model interface.
- Future year project management and coding tool – ability to query, add, delete, and modify future year projects in the master network.
- Automated reporting – automatically generate reports to summarize results for trip generation, trip length distribution, mode split, and assignment results compared to observed data. Reports generated by the model will be Microsoft Excel file format.
- Automated mapping – automatically generate maps in TransCAD with links labeled by daily highway traffic volume and color themes by level-of-service from the current model run.

A screen shot of the preliminary main interface is provided in **Figure 7-1**.

A comprehensive model user's manual will be developed to provide instructions for:

- A quick reference guide providing high-level summary of steps to setup model, run scenarios, and conduct common tasks.
- Installing the model,
- Using the model interface,
- Managing scenarios,
- Structure of input and output files for each model steps, and
- Using model utilities, reports, and maps.

A training workshop will be conducted to equip the staff with hands-on knowledge of running the model, managing scenarios, and conducting common analysis and maintenance tasks effectively.

Figure 7-1 Preliminary Main Model User Interface

Technical Memorandum #2

KINGSPORT TRAVEL DEMAND MODEL UPDATE

BASE YEAR MODEL

Developed for

KINGSPORT METROPOLITAN TRANSPORTATION PLANNING ORGANIZATION

Developed by

Kimley»Horn

In association with:

RPM Transportation Consultants

November 14, 2016

TABLE OF CONTENTS

1.0 INTRODUCTION

RPM Transportation Consultants (RPM) and Kimley-Horn and Associates, Inc. (Kimley-Horn) are updating the Kingsport Travel Demand Model with a validated base year of 2015 for the Kingsport Metropolitan Transpotation Planning Organization (MTPO). In March 2016, a study design was conducted as the first step of this model development effort. **Technical Memorandum #1 – Study Design** was submitted to the reviewing agencies. The study design document outlines the proposed model development approach at sub-task levels.

Based on the approach outlined in the study design document, various components of the Kingsport Travel Demand Model were updated. The purpose of this memorandum is to document the development process and the validation results of the base year 2015 model.

This document references the "**Minimum Travel Demand Model Calibration and Validation Guidelines for State of Tennessee, Updated 2012**" in multiple locations. For reference, this document is abbreviated as "TN Guidelines".

2.0 TRAFFIC ANALYSIS ZONES (TAZ) AND EXTERNAL STATIONS

The Kingsport MTPO Metropolitan Planning Area (MPA) boundary includes the cities of Kingsport, Mount Carmel, and Church Hill, Tennessee; Weber City and Gate City, Virginia; and portions of Hawkins County, Sullivan County, and Washington County in Tennessee, and Scott County in Virginia.

2.1 TAZ Structure

A TAZ is a geographic area that is used to divide the planning region into small, relatively homogeneous areas in terms of land use and activity. TAZs are used to represent travel within a model study area because it is not practical or feasible to model individual parcels for households and employment. Housing and employment data are aggregated to the TAZ data, and the TAZs are used through the model process to calculate the origin and destination of trips in the model.

The revised TAZ boundaries are mostly the same as the 2012 Model and the 2010 Census TAZ boundaries. Three TAZs in the vicinity of the proposed I-81/I-26 interchange area were split into multiple TAZs to better accommodate future planning analysis needs. Compared with the 190 internal TAZs in the 2012 model, the proposed 2015 TAZ structure includes 193 internal TAZs. **Figure 2-1** shows the proposed TAZ boundaries.

New TAZ IDs were assigned for the TAZ and highway node layers. IDs less than 600 are reserved for TAZ IDs, external station IDs, and internal and external centroids in highway node layer. The numbering scheme is as follows:

- IDs 1 through 500 are reserved for internal TAZs. IDs 1 through 193 are used for 193 TAZs in the proposed model. The remaining space from 194 to 500 is reserved for future expansion.
- IDs 501 through 600 are reserved for external stations. IDs 501 through 535 are used for 35 external stations. The remaining space from 536 to 600 is reserved for future external stations.

2.2 Districts

For future year demographic and employment forecasting and travel model validation purposes, the TAZs in the study area are grouped into 23 planning districts. **Figure 2-2** shows the planning district boundaries. In the highway assignment validation process, highway traffic predicted by the model can also be compared with the observed traffic counts at the district level to identify over or under estimation problems at particular districts.

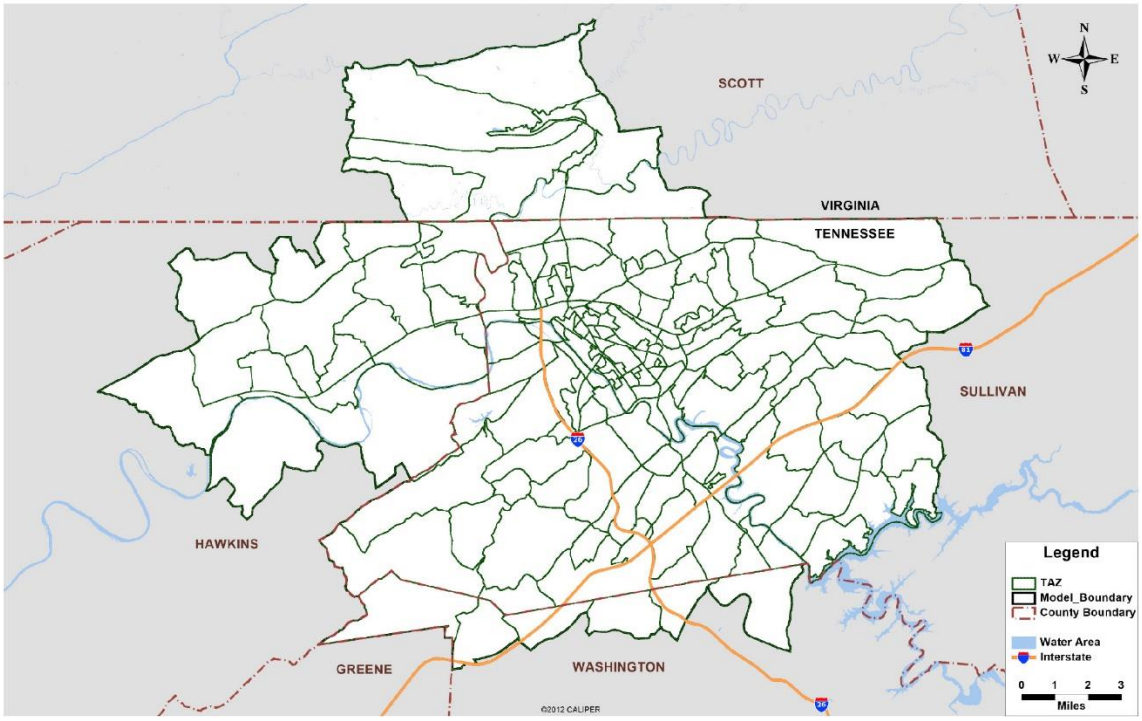


Figure 2-1 Traffic Analysis Zones

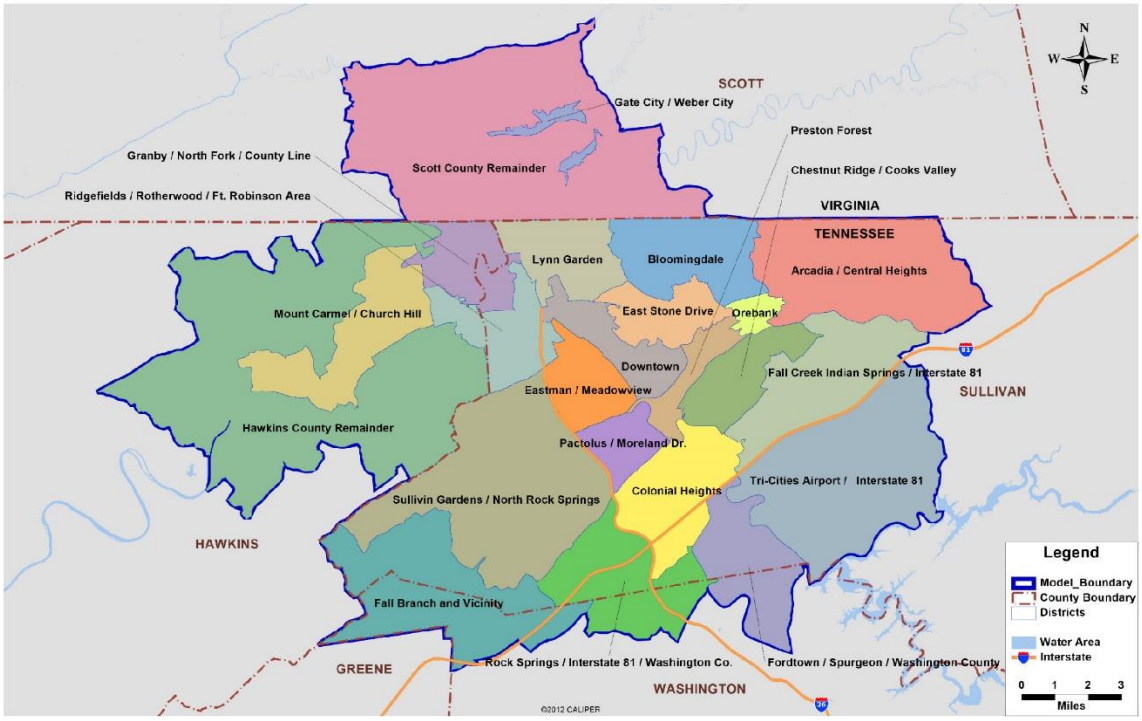


Figure 2-2 Planning Districts

2.3 Base Year Demographic and Employment Data

Given the unique multi-county and bi-state structure of the Kingsport MTPO, the process for allocating base year population to the traffic analysis zones (TAZs) within the MTPO area differed between the three counties located in Tennessee (Hawkins, Sullivan, and Washington counties) and the single county in Virginia (Scott County). The Woods & Poole 2015 Complete Economic and Demographic Data Source was used as county-level control totals for population within all four counties.

The process for determining the portion of each county's population that lies within the MTPO area for Tennessee counties began with an analysis of 2010 US Census data. Using this data at the block geography as well as Woods & Poole county-level estimates, the percentage of each county's population within the MTPO area was determined. Those proportions were held constant for each Tennessee county, and it was assumed that in 2015, the same percentage of each county's population resided in the MTPO area as in 2010. The 2015 population for each county in the MTPO area was then calculated using the 2015 Woods & Poole county population and those percentages.

For Scott County, data from the 2000 and 2010 US Census was used in the analysis. Within this 10-year time period, the portion of Scott County that lies within the MTPO area grew by approximately 0.79% each year. However, Woods & Poole county-level estimates show that Scott County as a whole decreased in population by an average of 0.45% each year. As such, based on the different levels of growth and decline shown between the two datasets, the difference between the two average annual growth rates, 0.35%, was used to determine the 2015 Scott County population in the MTPO area. This growth rate was applied to the 2010 US Census population for areas within the MTPO area to determine the portion of Scott County's 2015 population within the MTPO area.

The sub-allocation of population and household data for the base year was derived using 2010 US Census data at the block level and allocated to the corresponding TAZ.

The total number of households for base year 2015 inside the study area is 62,415, with a total population of 132,210. **Figure 2-3** shows the household density in units of number of households per acre.

To determine the base year employment within the MTPO area, 2015 InfoGroup data was purchased by the MTPO. This data was geocoded by address, cleaned, and allocated to the TAZs for 2015. The employment data was grouped to the following six categories by NAICS codes, as shown in **Table 2-1**.

Table 2-1 Employment Categories

Short Name in Model	Description	NAICS Code
Agr	Agricultural/mining/construction	11, 21, 23
Mfg	Manufacturing/transportation	22, 31-33, 42, 48-49
Retail	Retail	44-45
Office	Office	51, 52, 53, 54, 55, 56
Service	Service	61, 62, 71, 72, 81
Gov	Government	92, 99

Figure 2-4 is a color themed map showing the employment density in total number of employment per acre by TAZ.

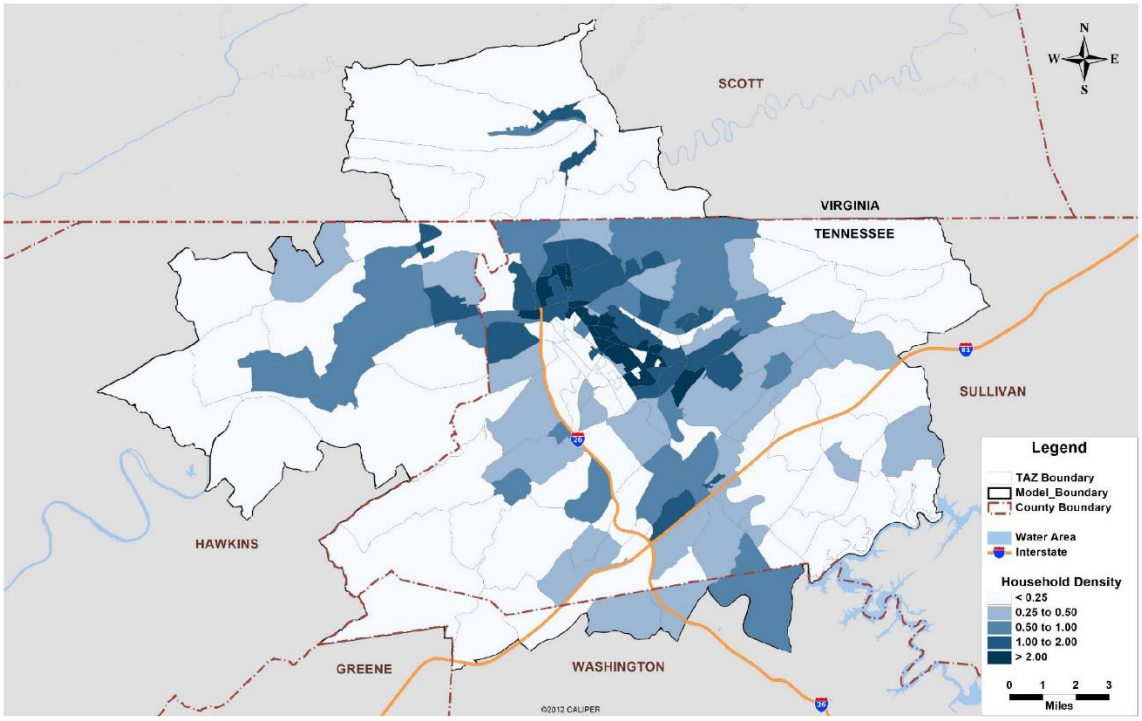


Figure 2-3 Household Density

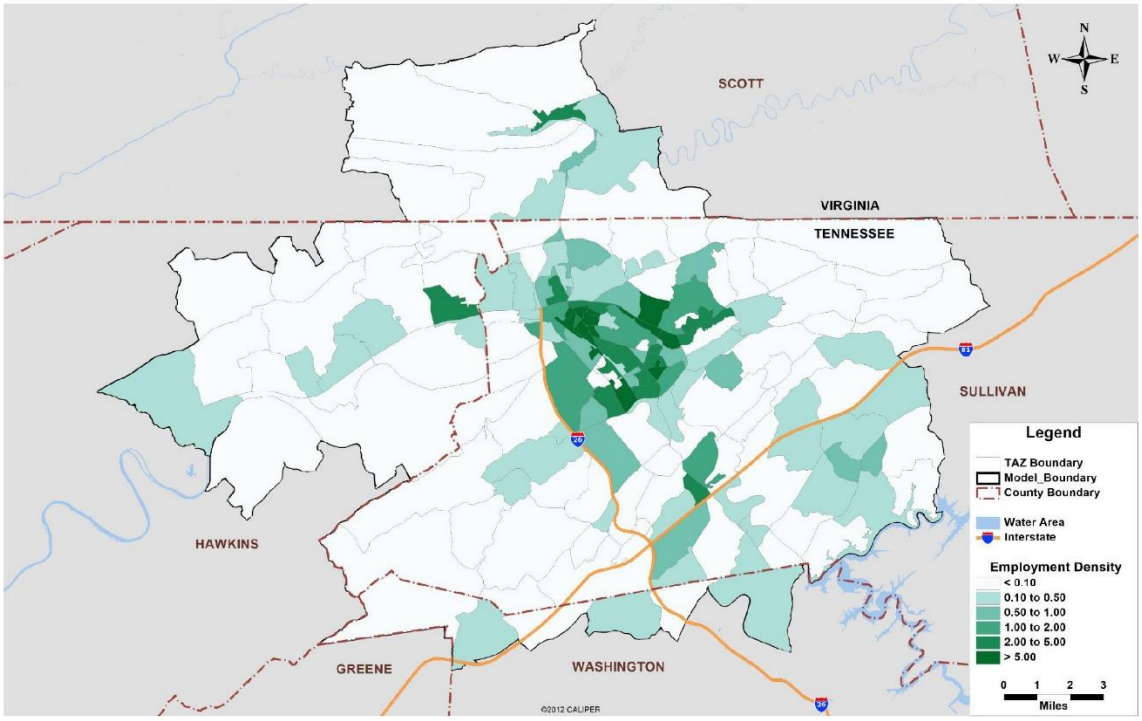


Figure 2-4 Employment Density

To cross-classify the total number of households for modeling purposes, the Census Transportation Planning Package 2010 (CTPP 2010) data set based on Census 2010 and American Community Survey (ACS) 2006-2010 5-year data were used. CTPP 2010 data was used to develop the following three cross-classification distributions for the Kingsport model:

- Household Size (number of persons) by vehicle ownership (number of vehicles owned per household),
- Household Size by number of children (age < 18) in household, and
- Number of workers in household by vehicle ownership.

Using the base year 2015 household control totals, the cross-classification distribution from the CTPP 2010 data was applied to each TAZ to obtain the number of households in each cross-classification bin. **Table 2-2** shows the percent distribution of households cross-classified by household size and vehicle ownership. **Table 2-3** shows the percent distribution of households cross-classified by household size and number of children. **Table 2-4** shows the percent distribution of households cross-classified by number of workers and vehicle ownership.

Table 2-2 Kingsport MTPO Household Size by Vehicle Ownership Cross-classification Distribution

Persons	Vehicles				Total
	0	1	2	3+	
1	4.3%	18.1%	4.4%	0.9%	27.7%
2	1.0%	7.2%	20.5%	9.1%	37.8%
3	0.2%	3.0%	7.0%	6.5%	16.6%
4+	0.4%	1.6%	7.1%	8.8%	17.9%
Total	5.9%	29.9%	39.0%	25.3%	100.0%

Table 2-3 Kingsport MTPO Household Size by Number of Children Cross-classification Distribution

Persons	Children			Total
	0	1	2+	
1	27.6%	0.0%	0.0%	27.6%
2	34.5%	3.4%	0.0%	37.9%
3	6.2%	8.7%	1.8%	16.6%
4+	1.5%	3.1%	13.3%	17.9%
Total	69.8%	15.1%	15.0%	100.0%

Table 2-4 Kingsport MTPO Number of Workers by Vehicle Ownership Cross-classification Distribution

Workers	Vehicles				Total
	0	1	2	3+	
0	5.0%	16.1%	10.7%	3.2%	35.0%
1	0.8%	12.4%	15.1%	7.2%	35.5%
2	0.1%	1.3%	12.5%	10.8%	24.7%
3+	0.0%	0.1%	0.7%	4.1%	4.8%
Total	5.9%	29.9%	38.9%	25.3%	100.0%

2.4 Base Year School Enrollment Data

K-12 school and college enrollment data was collected by the MTPO staff. MTPO staff recorded school enrollment data for base year 2015. The data was geocoded and totaled for each TAZ. **Figure 2-5 s**hows the school enrollment numbers by TAZ.

2.5 External Stations

There are a total of 35 external stations in the proposed 2015 model. **Figure 2-6** shows the external stations of the new model. Detailed external station data is presented separately in the external and truck model section of this memorandum.

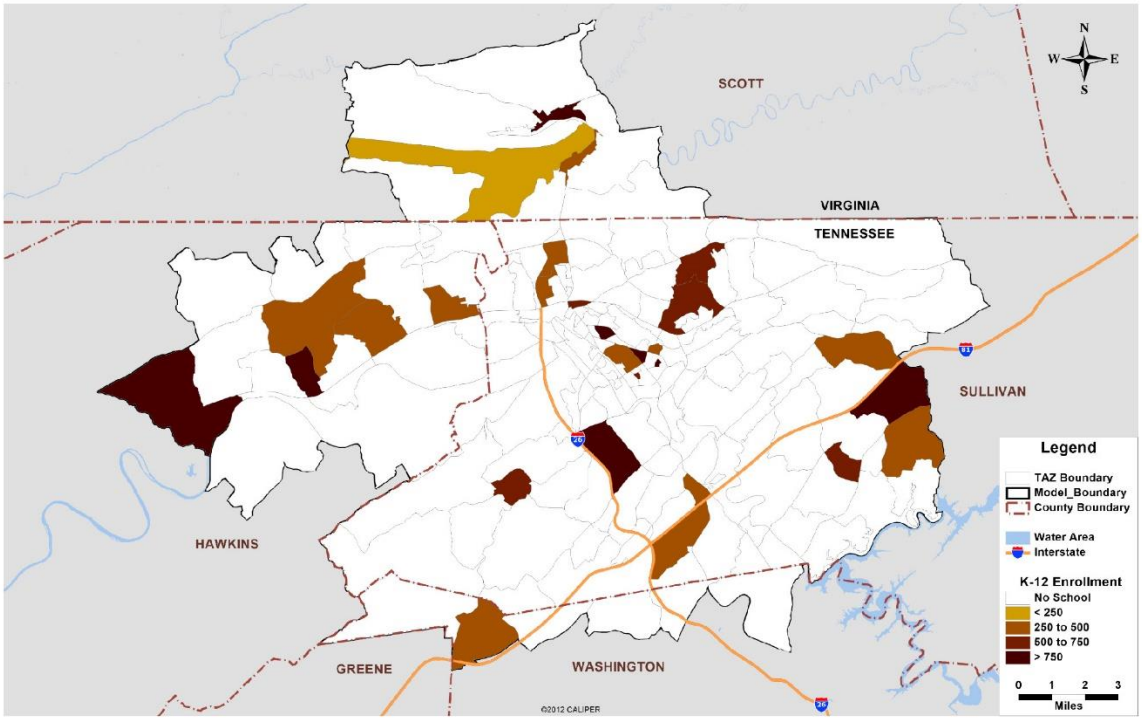


Figure 2-5 School Enrollment

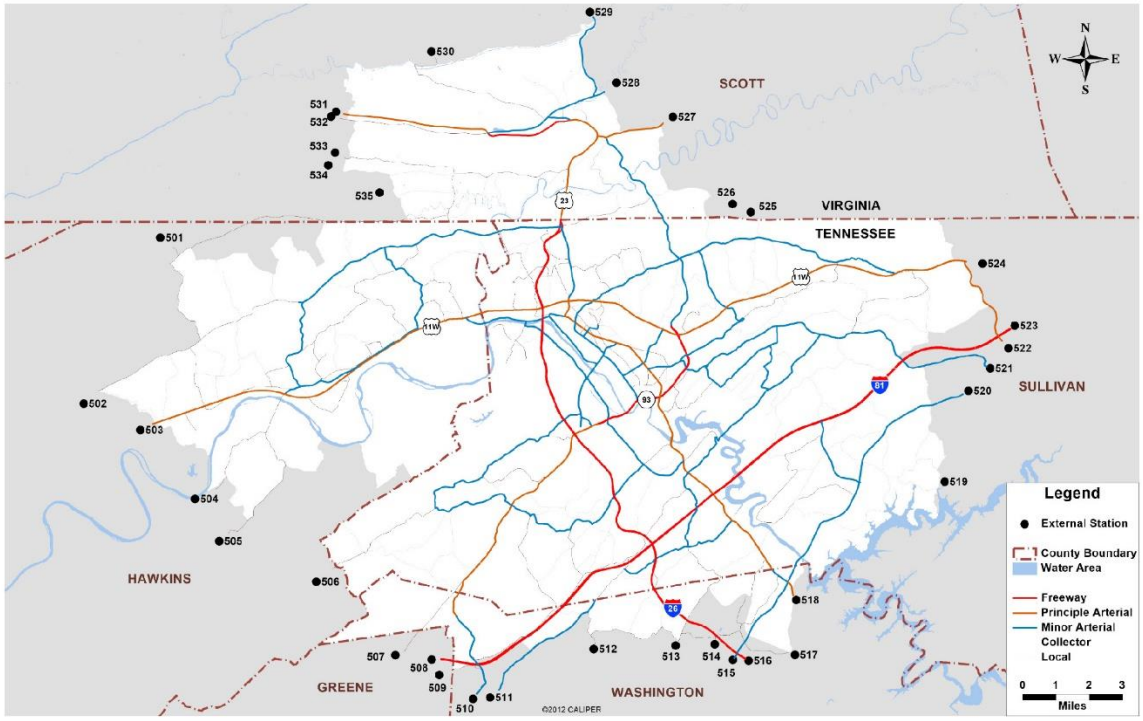


Figure 2-6 External Stations

3.0 HIGHWAY NETWORK DEVELOPMENT

To simulate travel within the Kingsport MTPO study area, the highway network was updated to represent the highway/street system. Development of the highway network involved identifying the network roads to be included, developing the TransCAD line network, collecting network attributes, and populating network data in TransCAD.

3.1 Master Network System

A single master network is used for the base year and all future year models. In TransCAD, the line layer is not the actual model network used by the travel demand modeling system. Rather, the model network is built from the line layer. This means the model network is developed as a selection set from the line layer. Having a selection set means that the base and future highway networks can use a different subset of the entire street network system.

An attribute named "In Network" in the line layer is used to identify the links to be included in the model's highway network building process. Active links in the base year network are identified by the "In Network" attributes in 2015. Any new highway to be constructed in a future year will be organized in the project lookup table. This lookup table will also include highway widening and other types of construction projects that have impact on highway capacity.

Using a master network and a project lookup table greatly simplifies the future year scenario management. The methodology related to future year projects and scenario management will be discussed in the next technical memorandum for future year model development.

3.2 Update the Highway Network

The highway network TransCAD line layer was developed using TDOT's TRIMS database and the existing 2009 model's line geography layer as a base. With the new study area boundary, all interstates, other freeways, arterials, and collector streets classified by TDOT and VDOT are included in the model network. In addition, a significant portion of local roads were added to the model highway network for improved connectivity.

As a part of the network development process, corrections and quality checks were made to the TransCAD network, including verifying and correcting roadway alignments, eliminating fragmented or redundant links, and modifying disconnected intersection nodes.

Table 3-1 shows the roadway functional classification based on the Federal Highway Administration (FHWA) classification system. **Figure 3.1** shows the base year highway network links by functional classification.

3.3 Centroid Connectors

Centroid connectors are idealized links representing traffic loading points for the TAZs. Centroid connectors are often attached to the network at mid-block, and their placement should be consistent with land use and local road density. TransCAD requires at least one connector per TAZ. Often, two or more connectors are coded for some TAZs.

Centroid connectors are typically placed along lower functionally classified roads such as collectors and arterials. They also might connect to principal arterials if the arterial has numerous local crossroads and a considerable amount of abutting development. In cases where many local roads serve a large residential area, it might be appropriate to connect TAZ connectors to local roads, which would then be added into the network. TAZ connectors should not be attached to limited access roads or ramps.

For the Kingsport model, centroid connectors were developed using aerial photography to identify the most appropriate loading locations. These locations were further reviewed and refined to better reflect loading conditions during traffic assignment model calibration and validation process.

Internal and external zone centroid connectors were coded with functional classifications 99 and 98, respectively. Centroid connectors are coded with very high capacities since methodologically, it is the roadway network that is providing the capacity restraint while the centroid connector is merely acting as an access point.

All internal centroid connectors were assigned with a fixed travel speed of 25 mph. Speed limits at each external station were used for external centroid connectors connecting external stations to the model highway network.

Table 3-1 Roadway Functional Classification

Functional Classification ID	Category	Description
01	Rural	Interstate
02	Rural	Other Principle Arterial
03	Rural	Ramps
06	Rural	Minor Arterial
07	Rural	Major Collector
08	Rural	Minor Collector
09	Rural	Local
11	Urban	Interstate
12	Urban	Other Freeway and Expressway
13	Urban	Ramps
14	Urban	Other Principle Arterial
16	Urban	Minor Arterial
17	Urban	Collector
19	Urban	Local
98	N/A	External Centriod Connector
99	N/A	Internal Centriod Connector

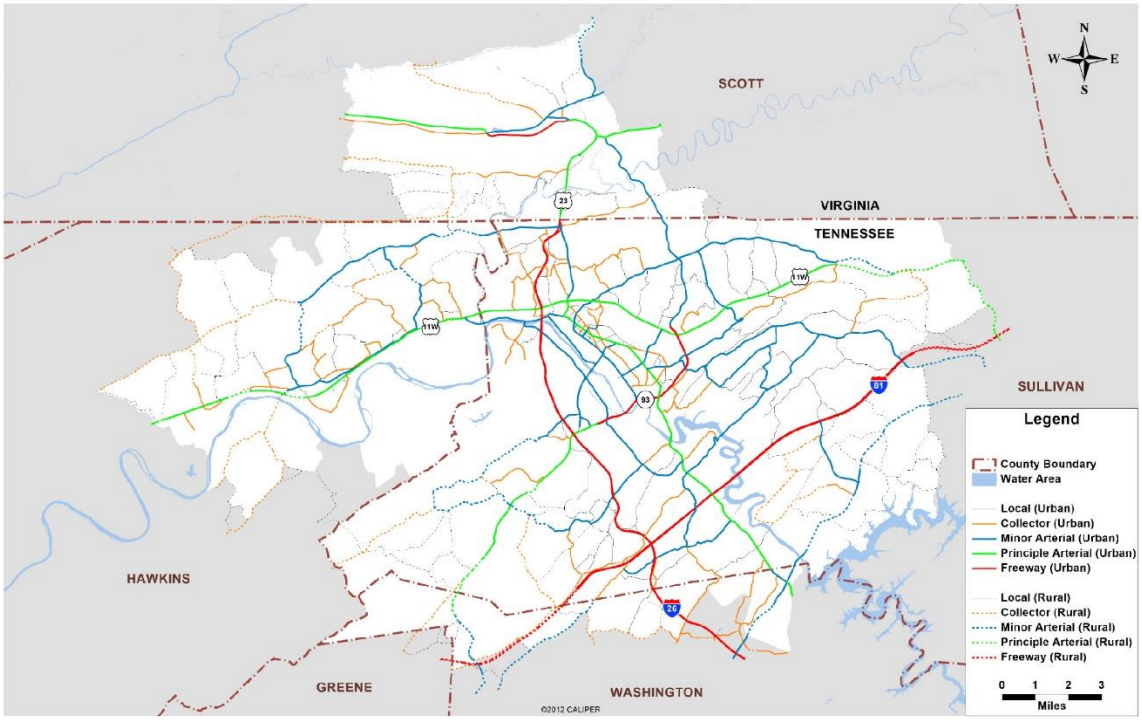


Figure 3-1 Kingsport Highway Network

3.4 Capacity Calculation

Using the collected base year link attributes, the roadway capacity in the Kingsport model is calculated using an equation which takes into account data such as functional classification, speed limit, lanes, median treatment, area type, average lane width, and average shoulder width. These equations are developed based on the Highway Capacity Manual (HCM) methodology. This method of capacity calculation has several benefits, including:

- Better representation of capacity based on roadway attributes
- Ability to load the model network with LOS D or E capacity
- Hourly capacities are calculated and utilized in the time-of-day model
- Ability to automatically recalculate capacities for future networks as improvements occur
- Ability to make adjustments to capacity equations throughout the process

The general form of the capacity equation is:

[3-1] $$SF = c \times N \times F_w \times F_{hv} \times F_p \times F_e \times F_d \times F_{clt} \times F_{park} \times (v/c)_i$$

Where:

SF = Maximum service flow for desired level of service

c = Capacity under ideal conditions (vehicles per hour per lane)

N = Number of lanes

F_w = Factor due to lane and shoulder width

F_{hv} = Factor due to percent heavy vehicles

F_p = Factor due to driver population

F_e = Factor due to driving environment

F_d = Factor due to directional distribution

F_{clt} = Factor for continuous left turn lane (for undivided sections)

F_{park} = Factor due to on − street parking

$(v/c)_i$ = Rate of service flow for levels of service D or E

The capacity equations **3-2** through **3-7** below represent the hourly link capacity calculation equations by roadway functional classification. All capacities are calculated by direction.

[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 = 2,200 (two lanes)
2,300 (three or more lanes)

N = Number of lanes, by direction

F_w =

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

F_{hv} = 0.88

F_p = 0.90 (Rural)
0.92 (Urban)

$(v/c)_i$ = 0.88 (LOS D)
1.00 (LOS E)

[3-3] Principal Arterial Capacity Equations (Functional classification = 2 or 14)

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

Where:

c =

Median Type	Rural	Urban
Divided	1,700	1,500
Undivided	1,500	1,300

N = Number of lanes, by direction

F_w =

Median Type	Lane Width	Shoulder Width		
		0-1'	2-4'	5'+
Divided	Narrow (<=10')	0.78	0.83	0.88
	Normal (>10')	0.90	0.95	1.00
Undivided	Narrow (<=10')	0.78	0.82	0.86
	Normal (>10')	0.92	0.96	1.00

F_{hv} = 0.90

F_p = 0.95

F_e =

Median Type	Rural	Urban
Divided	1.0	0.9
Undivided	0.9	0.8

F_{clt} = 1.08 (for sections with continuous left turn lane)

F_{park} = 0.95 (for sections with on – street parking)

$(v/c)_i$ = 0.84 (LOS D)
1.00 (LOS E)

[3-4] Minor Arterial Capacity Equations (Functional classification = 6 or 16)

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

Where:

c =

Median Type	Rural	Urban
Divided	1,600	1,400
Undivided	1,350	1,150

N = Number of lanes, by direction

F_w =

Median Type	Lane Width	Shoulder Width		
		0-1'	2-4'	5'+
Divided	Narrow (<=9')	0.77	0.83	0.88
	Normal (>9')	0.89	0.95	1.00
Undivided	Narrow (<=9')	0.81	0.86	0.93
	Normal (>9')	0.94	1.00	1.05

F_{hv} = 0.90

F_p = 0.98

F_e =

Median Type	Rural	Urban
Divided	1.0	0.9
Undivided	0.9	0.8

F_{clt} = 1.08 (for sections with continuous left turn lane)

F_{park} = 0.95 (for sections with on – street parking)

$(v/c)_i$ = 0.84 (LOS D)
1.00 (LOS E)

[3-5] Collector Road Capacity Equations (Functional classification = 7, 8, or 17)

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

Where:

c =

Median Type	Rural	Urban
Divided	1,350	1,150
Undivided	1,150	950

N = Number of lanes, by direction

F_w =

Median Type	Lane Width	Shoulder Width		
		0-1'	2-4'	5'+
Divided	Narrow (<=9')	0.81	0.86	0.93
	Normal (>9')	0.94	1.00	1.05
Undivided	Narrow (<=9')	0.81	0.85	0.90
	Normal (>9')	0.96	1.00	1.04

F_{hv} = 0.92

F_e =

Median Type	Rural	Urban
Divided	1.0	0.9
Undivided	0.9	0.8

F_{clt} = 1.08 (for sections with continuous left turn lane)

F_{park} = 0.95 (for sections with on − street parking)

$(v/c)_i$ = 0.83 (LOS D)
1.00 (LOS E)

[3-6] Ramp Capacity Equations (Functional classification = 3 or 13)

$$SF = c \times N \times (v/c)_i$$

Where:

c =

Ramp Type	c
Rural Ramp	1,200
Urban Ramp	1,100

N = Number of lanes, by direction

$(v/c)_i$ = 0.88 (LOS D)
1.00 (LOS E)

[3-7] Local Road Capacity Equations (Functional classification = 9 or 19)

$$SF = c \times N \times F_w \times F_{hv} \times F_e \times F_d \times F_{clt} \times F_{park} \times (v/c)_i$$

Where:

c =

Travel Lanes (by Direction)	Rural	Urban
Two-lane	900	800
Multi-lane	1,000	900

N = Number of lanes, by direction

F_w =

Travel Lanes (by Direction)	Lane Width	Shoulder Width		
		0-1'	2-4'	5'+
Two-lane	Narrow (<=9')	0.65	0.78	0.92
	Normal (>9')	0.85	1.00	1.10
Multi-lane	Narrow (<=9')	0.81	0.85	0.90
	Normal (>9')	0.96	1.00	1.04

F_{hv} = 0.97

F_e = 0.9 (Rural)
0.8 (Urban)

F_d =

Travel Lanes (by Direction)	Divided	Undivided
Two-lane	0.94	0.94
Multi-lane	1.16	1.00

F_{clt} = 1.08 (for sections with continuous left turn lane)

F_{park} = 0.95 (for sections with on − street parking)

$(v/c)_i$ = 0.83 (LOS D)
1.00 (LOS E)

4.0 INTERNAL TRIP GENERATION MODELS

Internal trip generation models were developed for the following six trip purposes:

- Home-based work (HBW),
- Home-based school (HBSC),
- Home-based shopping (HBSP),
- Home-based social-recreational (HBSR),
- Home-based other (HBO), and
- Non-home based (NHB).

4.1 Internal Person Trip Productions

Two-dimensional cross-classification trip production models were developed for each internal trip purpose. Production rates were developed using the National Household Travel Survey (NHTS) 2009 add-on data from TDOT and VDOT.

Trip production rates were estimated using a subset of the NHTS 2009 add-on data for sample households located in Metropolitan Statistic Areas (MSA) in Tennessee and Virginia that have population of less than 500,000. These MSAs are:

- Johnson City-Kingsport-Kingsport, TN-VA
- Jackson, TN
- Clarksville-Hopkinsville, TN-KY
- Chattanooga, TN-GA
- Danville, VA
- Roanoke, VA
- Lynchburg, VA
- Charlottesville, VA

A total of 3,135 household samples are included in the subset, with 319 households in Tennessee and 2,816 households in Virginia.

The following cross-classification categories are used:

- By vehicle availability – Zero, one, and two plus vehicles per household
- By children – Zero, one, two, and three plus school-aged children per household
- By worker – Zero, one, two, and three plus workers per household
- By household size – One, two, three, and four plus persons per household

The two-dimensional cross classification production models are as follows:

- HBW - By vehicle availability, then by number of workers
- HBSC - By household size, then by number of school aged children
- HBSP - By Vehicle availability, then by household size
- HBSR - By Vehicle availability, then by household size
- HBO - By Vehicle availability, then by household size
- NHB - By Vehicle availability, then by household size

The household cross-classification distribution was obtained from the Census Transportation Planning Package

(CTPP) 2010 data set. The total number of households in each TAZ from Census 2010 was distributed to each cross-classification bin by applying the distributions from the CTPP data.

Trip Production Rates

Table 4-1 through **Table 4-6** show the trip production rates for each trip purpose.

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**

Table 4-3 Trip Production Rates for Home-based Shopping (HBSP) Trips

Persons	Vehicles				Weighted Average
	0	1	2	3+	
1	0.293	0.813			**0.704**
2	1.481		1.514	1.589	**1.531**
3+	2.006			2.946	**2.456**
Weighted Average	**0.656**	**1.474**	**1.399**	**2.315**	**1.648**

Table 4-4 Trip Production Rates for Home-based Social-Recreational (HBSR) Trips

Persons	Vehicles				Weighted Average
	0	1	2	3+	
1	0.132	0.380			**0.328**
2	0.706				**0.706**
3	0.616		1.263	1.810	**1.399**
4+	1.046		1.891	3.711	**2.740**
Weighted Average	**0.356**	**0.528**	**1.004**	**1.844**	**1.093**

Table 4-5 Trip Production Rates for Home-based Other (HBO) Trips

Persons	Vehicles				Weighted Average
	0	1	2	3+	
1	0.097	0.389	0.417	0.792	**0.345**
2	1.093				**1.093**
3	0.903		1.301		**1.227**
4+	1.032		3.338		**3.224**
Weighted Average	**0.534**	**0.762**	**1.608**	**1.590**	**1.315**

Table 4-6 Trip Production Rates for Non-Home Based (NHB) Trips

Persons	Vehicles				Weighted Average
	0	1	2	3+	
1	0.138	1.125	1.144		**0.921**
2	2.480			2.730	**2.558**
3	4.628			4.798	**4.707**
4+	4.093		4.108	6.003	**5.034**
Weighted Average	**0.762**	**2.586**	**2.620**	**4.160**	**2.958**

Model Application and Validation Checks

The trip production models were applied using the year 2015 demographic data. **Table 4-7** compares the aggregate person trip rates per TAZ, person, households, and employee with these 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 4-7 Aggregate Trip Rates

Statistics	Kingsport Model	TN Guidelines	
		Low	High
Person Trips/TAZ	2,867	N/A	15,000
Person Trips/Person	4.2	3.3	4.0
Person Trips/HH	8.9	8.0	10.0
HBW Trips/Employee	1.53	1.20	1.55

Table 4-8 compares the person trip rates per household with the latest Chattanooga and Knoxville household travel surveys. Except for HBSR trips, the average trip rates per household are generally consistent with other surveys.

Table 4-8 Trip Production Rates (Person Trips / HH) by Trip Purpose

Trip Purpose	Kingsport Model (NHTS 2009 MSA<500K, TN/VA combined, 3,135 samples)	NHTS 2009 MSA<500K TN Only (319 samples)	NHTS 2009 MSA<500K VA Only (2,816 samples)	Chattanooga Survey	Knoxville Survey
HBW	1.26	1.23	1.30	1.19	1.24
HBSC	0.66	0.75	0.55	0.75	0.77
HBSP	1.65	1.73	1.55	1.57	1.04
HBSR	1.09	0.98	1.24	0.53	0.62
HBO	1.32	1.30	1.34	1.46	1.38
NHB	2.96	3.11	2.77	2.74	2.47
Total	**8.94**	**9.10**	**8.73**	**8.98**	**7.50**

Table 4-9 shows the percent of trips by trip purpose after applying the trip production models, and compares these with the values from the TN Guidelines and other household surveys. The results show general consistency with other surveys and fit within the range described in the TN Guidelines.

Table 4-9 Percent Trips by Trip Purpose Compared

Trip Purpose	Kingsport Model (NHTS 2009 MSA<500K TN/VA Combined)	TN Guidelines	Chattanooga 2010 Survey	Knoxville 2001/2008 Survey
HBW	15.1%	12% - 24%	14.4%	16.5%
HBSC	7.5%	5% - 8%	9.1%	10.2%
HBSP	18.2%	10% - 20%	19.1%	13.9%
HBSR	12.0%	9% - 12%	6.5%	8.2%
HBO	14.3%	14% - 28%	17.7%	18.4%
NHB	32.8%	20% - 33%	33.2%	32.9%
Total	**100%**	**100%**	**100%**	**100%**

4.2 Internal Person Trip Attractions

Trip attraction models were borrowed from the Chattanooga Model for the six internal trip purposes. A description of the model structure and rates is provided below.

Model Structure

Attraction models borrowed from Chattanooga were developed from the Chattanooga household survey data. All models are ordinary least squares regressions with no intercept and are of the following general form:

$$A_i = \sum_j c_j \times E_j$$

Where:

A_i = Trip Attractions for trip purpose i
c_j = Coefficient for independent variable j
E_j = Value of independent variable j

The independent variables include:

- Total Employment,
- Total Household,
- K-12 School Enrollment,
- College Enrollment, and
- One of the employment categories: Agriculture, Manufacturing, Retail, Office, Service, and Government.

Table 4-10 through **Table 4-15** show the trip production models for each trip purpose.

Table 4-10 Trip Attraction Rates for Home-based Work (HBW) Trips

Variable	Coefficient
Total Employment	0.953

Table 4-11 Trip Attraction Model for Home-based School (HBSC) Trips

Variable	Coefficient
K-12 School Enrollment	1.657
College Enrollment	0.557

Table 4-12 Trip Attraction Model for Home-based Shopping (HBSP) Trips

Variable	Coefficient
Retail	9.673

Table 4-13 Trip Attraction Model for Home-based Social-Recreational (HBSR) Trips

Variable	Coefficient
Retail	1.241
Service	0.263
Total Households	0.251

Table 4-14 Trip Attraction Model for Home-based Other (HBO) Trips

Variable	Coefficient
K-12 School Enrollment	1.700
Retail	1.155
Service	0.996
Total Households	0.177

Table 4-15 Trip Attraction Model for Non-home Based (NHB) Trips

Variable	Coefficient
Retail	8.348
Service	1.696
Total Households	0.906

4.3 Internal Person Trip Balancing

After applying the production and attraction models using the year 2015 demographic and employment data, the resulting total number of productions and attractions for each trip purpose are shown in **Table 4-16.**

Table 4-16 Trip Production and Attraction Totals, Year 2010

Trip Purpose	Productions	Attractions	% Difference
HBW	83,699	52,013	-37.9%
HBSC	41,367	36,144	-12.6%
HBSP	100,825	60,640	-39.9%
HBSR	66,668	28,930	-56.6%
HBO	79,115	70,255	-11.2%
NHB	181,750	144,249	-20.6%
Total	**553,424**	**392,231**	**-29.1%**

For NHB trips, the attraction vector is first scaled to the total productions. Then the production vector is set to equal the attraction vector because NHB trips are not produced from home zones. Unbalanced productions and attractions for other trip purposes are simply balanced to the production end.

5.0 TIME OF DAY MODEL

Four time-of-day periods are incorporated into the model stream from the trip distribution to assignment steps. The four time-of-day periods are AM peak, Midday, PM peak, and off-peak. Development of the time-of-day model included identifying peak travel time periods, developing peak period factors, and developing the percentage of trips by purpose during each time period by direction. Time-of-day factors were used to reflect peak period traffic behavior. Factors also are used for external station trips to convert the daily vehicle flows into traffic by direction by time period.

5.1 Determination of Peak Hour Periods

The peak hour periods were determined from the travel characteristics exhibited in the NHTS 2009 Household Travel Survey using samples from MSAs with population less than 500,000. Although different trip purposes have different peaking characteristics, the peak hour periods were determined based on peaking characteristics of internal auto trips since they were the majority of the trips using the highway facility.

For this time-of-day analysis, the trip summaries are based on the midpoint time of each trip. Although trips can be reviewed at the half-hour increment, traffic count data is only available consistently in hourly increments throughout the region. The peak periods selected would need to be in hourly increments in order for the assignment results to be validated using traffic counts. **Figure 5-1** shows a graphical display of the trip peaking characteristics by purpose. **Table 5-1** shows the distribution of the internal auto trips by hour for each trip purpose.

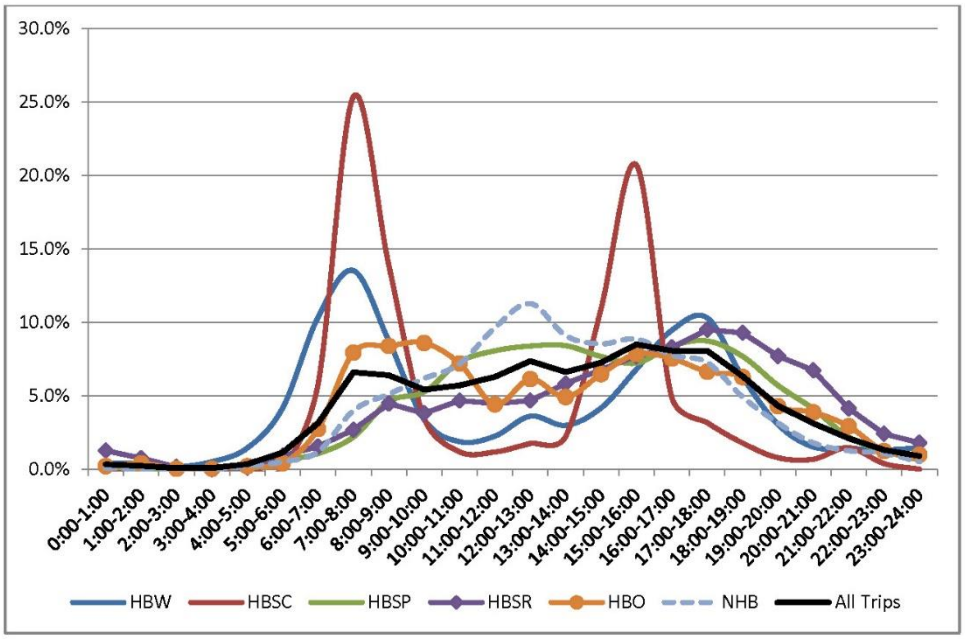


Figure 5-1 Auto Trips by Purpose by Time of Day

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

Time Period	Percent of Trips by Purpose						All Purposes
	HBW	HBSC	HBSP	HBSR	HBO	NHB	
0:00-1:00	0.4%	0.0%	0.2%	1.3%	0.2%	0.1%	0.4%
1:00-2:00	0.4%	0.0%	0.0%	0.8%	0.4%	0.0%	0.2%
2:00-3:00	0.2%	0.0%	0.0%	0.2%	0.0%	0.0%	0.1%
3:00-4:00	0.5%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%
4:00-5:00	1.5%	0.0%	0.0%	0.1%	0.2%	0.2%	0.4%
5:00-6:00	4.2%	0.1%	0.6%	0.9%	0.4%	0.5%	1.1%
6:00-7:00	10.4%	5.8%	1.1%	1.6%	2.8%	1.2%	3.1%
7:00-8:00	13.5%	25.3%	2.2%	2.7%	7.9%	4.0%	6.6%
8:00-9:00	8.8%	13.9%	4.6%	4.5%	8.4%	5.1%	6.4%
9:00-10:00	3.4%	3.5%	5.3%	3.8%	8.6%	6.2%	5.4%
10:00-11:00	1.9%	1.2%	7.3%	4.7%	7.2%	7.2%	5.7%
11:00-12:00	2.3%	1.2%	8.1%	4.5%	4.4%	9.7%	6.3%
12:00-13:00	3.6%	1.8%	8.4%	4.7%	6.1%	11.3%	7.4%
13:00-14:00	3.0%	2.2%	8.4%	5.8%	4.9%	9.1%	6.6%
14:00-15:00	4.2%	10.9%	7.7%	6.8%	6.5%	8.5%	7.3%
15:00-16:00	6.8%	20.7%	7.2%	7.7%	7.8%	8.9%	8.5%
16:00-17:00	9.5%	4.9%	8.4%	8.3%	7.5%	7.8%	8.1%
17:00-18:00	10.3%	3.2%	8.7%	9.5%	6.7%	7.3%	8.1%
18:00-19:00	6.3%	1.8%	7.7%	9.3%	6.3%	4.9%	6.3%
19:00-20:00	3.1%	0.8%	5.7%	7.7%	4.3%	3.2%	4.3%
20:00-21:00	1.5%	0.7%	4.1%	6.7%	3.9%	1.8%	3.1%
21:00-22:00	1.4%	1.5%	2.2%	4.2%	2.9%	1.3%	2.1%
22:00-23:00	1.3%	0.4%	1.3%	2.4%	1.3%	1.1%	1.3%
23:00-24:00	1.5%	0.0%	0.6%	1.8%	1.0%	0.5%	0.9%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 5-1 and **Figure 5-1** illustrate that the AM peak has a more pronounced, shorter peak, while the PM peak is spread over a longer time period. Home-based work and school trips exhibit significant peaking at both AM and PM peak hours. For other trip purposes, most trips occur in the Midday and PM periods.

Criteria used for selecting the peak periods in the Kingsport model include:

- Approximately 15% – 35% of the total daily trips should occur in each peak period
- Peak periods should capture the significant peak hours for HBW and HBSC trips
- Selected peak periods should allow for the capturing of peak spreading in the future, since the same time-of-day factors will be applied to the base year and future years
- Selected time-of-day periods are consistent with TDOT statewide model and TN Guildlines.

Based on the criteria above, 6 to 9 AM was selected for AM peak period, and 3 to 6 PM was selected for PM peak period. The AM and PM peak periods account for 16% and 25% of the daily auto trips, respectively. The midday period lasts from 9 AM to 3 PM. The night off-peak period lasts from 6 PM to 6 AM. Time range for each period is shown in **Table 5-2**.

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%

5.2 Model Application

The Kingsport Model applies time-of-day factors at multiple points in the process. For internal person trips, time-of-day factors are applied after trip generation to divide the trips by purpose into productions and attractions by time period. After the mode split step, a second set of directional factors are applied to convert the distributed productions and attractions into origins and destinations. Since the directionality of trips vary by time period, these factors are applied by each time period and trip purpose.

The process is similar for external trips (auto and truck) except that trips are already vehicular and do not have a mode-split component. **Figure 5-2** illustrates the time-of-day modeling process used in the Kingsport Model.

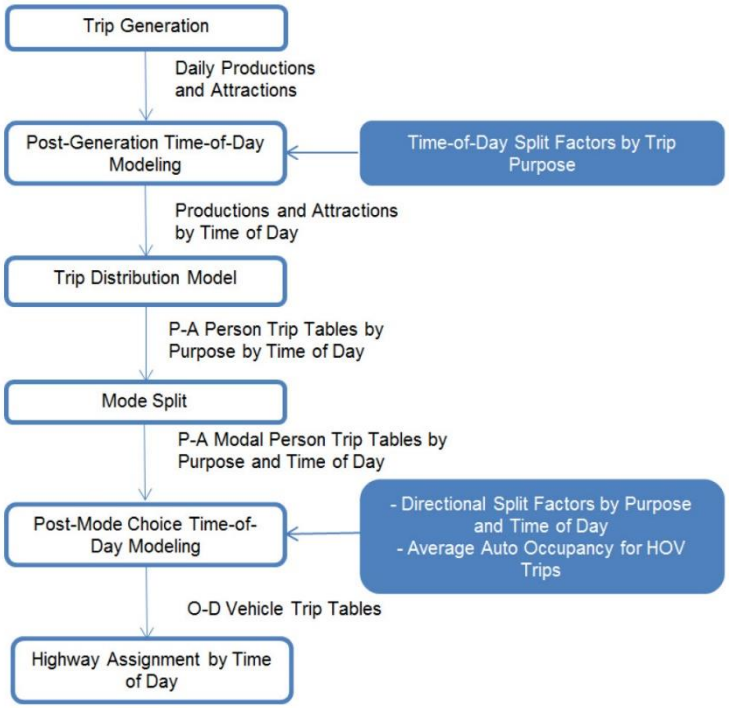


Figure 5-2 Time-of-day Model Application

5.3 Internal Person Trip Time-of-Day Factors

Internal person trip factors were developed for six trip purposes and four time periods based on the household travel survey.

Post-Trip Generation Trip Factors

Post-trip generation factors were applied after the trip generation step to split the daily productions and attractions into four time-of-day periods. **Table 5-3** shows the trip split factors for internal person trips. The initial values of these factors were calculated using the NHTS 2009 household survey. The final values were adjusted based on the assignment results compared with observed traffic counts.

Table 5-3 shows that 26% of the HBW trips occur in the AM peak period, and 28% occur in the PM peak since most people are going to and coming back from work in these times. HBSC trips exhibit similar behavior as HBW trips, but a higher percentage of these trips occur during the AM and PM peaks. HBSP, HBSR, and HBO trips are more spread out during MD, PM, and Off-peak periods, while most Non-Home Based trips occur during the midday and PM periods.

Table 5-3 Time-of-day Internal Person Trip Factor (Post-Trip Generation)

Trip Purpose	AM	MD	PM	OP	Daily
HBW	26.1%	19.9%	27.6%	26.4%	100.0%
HBSC	38.8%	21.9%	31.7%	7.6%	100.0%
HBSP	5.2%	43.3%	24.5%	27.0%	100.0%
HBSR	5.8%	29.6%	25.6%	39.0%	100.0%
HBO	14.8%	39.4%	22.0%	23.8%	100.0%
NHB	6.8%	51.6%	25.2%	16.4%	100.0%
Total	12.9%	38.7%	25.5%	22.9%	100.0%

Post-Mode Choice Trip Factors

Post-mode choice factors are trip directionality factors that are applied after the mode split step to separate the trips into departure and return trips. These factors are also derived from the NHTS 2009 household travel survey and shown in **Table 5-4**. Non-Home Based trips do not apply a directional factor since they do not have the home as an origin or destination point. NHB trips are distributed equally in both directions.

Table 5-4 Time-of-day Directional Trip Factors (Post-Mode Choice)

Trip Purpose	AM		MD		PM		OP	
	Departure	Return	Departure	Return	Departure	Return	Departure	Return
HBW	98.75%	1.25%	61.16%	38.84%	11.33%	88.67%	31.84%	68.16%
HBSC	98.16%	1.84%	28.38%	71.62%	10.96%	89.04%	29.21%	70.79%
HBSP	74.68%	25.32%	49.02%	50.98%	38.11%	61.89%	33.91%	66.09%
HBSR	74.34%	25.66%	61.46%	38.54%	50.04%	49.96%	35.51%	64.49%
HBO	80.55%	19.45%	59.11%	40.89%	42.49%	57.51%	33.28%	66.72%
NHB	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%
Total	**81.59%**	**18.41%**	**52.47%**	**47.53%**	**39.15%**	**60.85%**	**37.39%**	**62.61%**

After the mode choice model, the modal-person trip tables are still in production-attraction format. The directional factors in **Table 5-4** are applied to the trip tables to split the trips into departure and return trips by time-of-day period. For example, 100 home-based work trips choosing bus travel mode are produced from TAZ 101 and are attracted to TAZ 201 in the AM period. By applying the post-mode choice factors in **Table 5-4**, 99 of the 100 trips are departing from home to work, and only 1 of the 100 trips are returning from work to home. After applying the directional split factors, the resulting trip tables will be in origin-destination format and are ready to be assigned to the highway network.

6.0 INTERNAL TRIP DISTRIBUTION MODEL

Trip distribution, the second step in the traditional four-step modeling process, matches person trip ends (trip productions and trip attractions) estimated in the trip generation process to produce production-attraction person trip tables by purpose. To complete this process, trip distribution attempts to account for differences in attractiveness and accessibility of each possible zone-to-zone interchange in the model, reflecting each zone's land use and roadway network characteristics. The Kingsport model uses the most common type of trip distribution model, the gravity model, for all internal trip purposes. Trip distribution models were developed for the following six 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)

This section describes the gravity trip distribution model structure, its parameters, and the validation results.

6.1 Gravity Trip Distribution Model Structure

The gravity model formulation can be expressed as the equation below:

$$T_{i,j} = \frac{P_i \times A_j \times F_{i,j} \times K_{i,j}}{\sum_{j' \in Zones} A_{j'} \times F_{i,j'} \times K_{i,j'}}$$

where:

$T_{i,j}$	=	trips produced in zone i and attracted to zone j
P_i	=	total trips produced by zone i
A_j	=	total trips attracted by zone j
$F_{i,j}$	=	friction factor (function of impedance) between zones i and j
$K_{i,j}$	=	trip adjustment (K) factor between zones i and j

The gravity trip distribution model requires that friction factors and K-factors are estimated in a manner that matches the observed trip length frequency distribution and travel patterns as reflected in the household travel surveys. For the Kingsport model, the trip length distribution and travel pattern were derived from the CTPP 2010 Part 3 data for HBW trips only. Other internal trip purposes were then compared to the HBW average trip length and frequency distribution and were validated based on available guidelines.

Travel Impedances

In most urban areas with no significant transit services, travel impedance is based solely on highway travel time. Because the Kingsport model forecasts travel by four time-of-day periods, the travel impedances for distribution are based on congested travel times for each time-of-day period. The initial congested travel times in the Kingsport model are estimated by adjusting the posted speed limit with a congested speed adjustment factor for each time-of-day period. Due to very limited traffic counts with speed data in Kingsport, the adjustment factors were mainly borrowed from the Bristol MPO model that was developed from field measured speed data. The adjustment factors are presented in **Table 6-1** below.

Table 6-1 Congested Speed Adjustment Factors by Time-of-day

Time-of-day Period	Functional Classification	Area Type			
		CBD	Urban	Suburban	Rural
AM	Freeway	0.90	0.91	0.95	1.00
	Major Arterial (Posted Speed >= 45 mph)	0.90	0.95	0.97	1.00
	Major Arterial (Posted Speed < 45 mph)	0.98	1.00	1.00	1.00
	Minor Arterial (Posted Speed >= 45 mph)	0.90	0.95	0.97	1.00
	Minor Arterial (Posted Speed < 45 mph)	0.98	1.00	1.00	1.00
	Collector	0.80	0.85	0.90	0.98
	Local	0.70	1.00	1.00	1.00
MD	Freeway	0.90	0.90	0.95	1.00
	Major Arterial (Posted Speed >= 45 mph)	0.88	0.88	0.92	0.97
	Major Arterial (Posted Speed < 45 mph)	0.98	1.00	1.00	1.00
	Minor Arterial (Posted Speed >= 45 mph)	0.88	0.88	0.92	0.97
	Minor Arterial (Posted Speed < 45 mph)	0.98	1.00	1.00	1.00
	Collector	0.75	0.83	0.88	0.93
	Local	0.70	1.00	1.00	1.00
PM	Freeway	0.90	0.90	0.95	1.00
	Major Arterial (Posted Speed >= 45 mph)	0.88	0.88	0.93	0.98
	Major Arterial (Posted Speed < 45 mph)	0.92	0.95	1.00	1.00
	Minor Arterial (Posted Speed >= 45 mph)	0.88	0.88	0.93	0.98
	Minor Arterial (Posted Speed < 45 mph)	0.92	0.95	1.00	1.00
	Collector	0.80	0.83	0.89	0.95
	Local	0.70	1.00	1.00	1.00
OP	Freeway	1.00	1.02	1.03	1.05
	Major Arterial (Posted Speed >= 45 mph)	1.00	1.12	1.15	1.15
	Major Arterial (Posted Speed < 45 mph)	0.98	1.10	1.10	1.12
	Minor Arterial (Posted Speed >= 45 mph)	1.00	1.12	1.15	1.15
	Minor Arterial (Posted Speed < 45 mph)	0.98	1.10	1.10	1.12
	Collector	0.95	1.05	1.05	1.10
	Local	0.95	1.00	1.00	1.00

Feedback loops are implemented in the Kingsport Model. The initial congested travel times are input to provide a starting point for the model feedback loops to converge faster. At the end of each feedback iteration, congested travel time using the Method of Successive Averages (MSA) estimated by the model after traffic assignment are used to estimate travel impedances for the next iteration.

Intrazonal Travel Time

Intrazonal travel time refers to the average travel time for a trip that begins and ends at the same TAZ. Because the model network does not assign trips that are made within the same zone, intrazonal travel times cannot be computed by the network skimming process, and must be added separately to the skim matrix. For the Kingsport Model, the intrazonal travel time is calculated as half the average travel time to the four closest neighboring zones.

Terminal Time

Terminal time is the time associated with a person entering or exiting the modeled transportation network. Using a home-based work trip as an example, at the origin end, terminal time is the time leaving home and entering the car. At the destination, terminal time is the time to park the car and enter the office building. Typically, terminal time is larger in areas with higher land use density, and is smaller in less denser areas. For the Kingsport model, the following terminal times are used based on the area type of the zones:

- CBD = 5 minutes
- Urban = 3 minutes
- Suburban = 2 minutes
- Rural = 1 minute

Friction Factors

In gravity models, friction factors are used to represent the impedance between zones. Friction factors are typically inversely proportional to trip length. The friction factors for the Kingsport model are entered into the TransCAD modeling process as a gamma function equation. Each trip purpose has a unique set of friction factors that were developed through an iterative process to replicate the average trip length and trip distribution profile of the target data. The benefit of the gamma function is that it produces a smooth, continuous trip distribution curve that can be calibrated using mathematical functions. The gamma function is described below:

$$F_{i,j} = \mathrm{a} \times t_{i,j}^{b} \times e^{c \times t_{i,j}}$$

Where:

$F_{i,j}$ = Friction factor from zone i to zone j

a , b, c = Gamma function coefficients

$t_{i,j}$ = Travel time, or impedance from zone i to zone j

e = Base of the natural logarithms

6.2 Gravity Model Parameters

For each internal trip purpose, gamma function parameters were adjusted in an iterative process to produce reasonable average trip lengths based on the target trip length distribution. For the Kingsport Model, trip length distribution and travel pattern for work trips were derived from the CTPP 2010 Part 3 data. Other internal trip purposes were compared to the HBW average trip length and frequency distribution and were validated based on TN Guidelines. **Table 6-2** shows the final calibrated gamma function parameters for each internal trip purpose.

Table 6-2 Calibrated Gamma Function Parameters (Internal Trips)

Internal Trip Purpose	Gamma Function Parameters	
	b	c
HBW	0.015	0.15
HBSC	1.28	0.5
HBSP	1.46	0.42
HBSR	0.15	0.22
HBO	0.4	0.19
NHB	0.9	0.15

K Factors

The initial calibrated gravity model for work trips produced approximately 7.3% trips crossing the state line. Based on the initial estimated trip table, the assignment results show that the model estimated volume crossing the state line screen line is about 17% higher than the observed traffic counts. In comparison, the CTPP 2010 Journey-to-work trip table has only 3.5% trips crossing the state line. To match the travel pattern exhibited in the CTPP 2010 data set, K factors were introduced to the gravity model to reduce work trips crossing the state line. A K factor of 0.5 is used for home-based work trips to match the travel pattern in CTPP 2010 data set.

6.3 Model Validation

Because there is no existing database that can provide an accurate picture of trip interchanges at the TAZ level, the following aggregate measures are used to validate the trip distribution models:

- Average trip length,
- Percentage of intrazonal trips,
- Trip length distribution, and
- Production-Attraction trip interchanges at the county level.

Average Trip Lengths

Although the CTPP 2010 Journey-to-work data included estimated travel times, the estimated values were only aggregated to five to ten minute intervals. To get better estimates of average trip lengths and the distribution of trip lengths, travel times were directly obtained from the model network based on the production/attraction zones in the CTPP trip table. Travel time statistics were then calculated for work trips. **Table 6-3** shows the comparison between the results of the calibrated trip distribution model and the CTPP data for mean travel times by trip purpose. The comparison shows a reasonable match between model results and observed trip lengths for work trips. Average times for all trip purposes are within ranges in TN Guidelines.

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

Percentage of Intrazonal Trips

Another validation measure closely related to trip length distributions is the fraction of intrazonal trips. Intrazonal trips are made within the same zone and are not assigned to the model network. The percentage of intrazonal trips provides a measure for the amount of "very short" trips. **Table 6-4** shows the comparison between the calibrated trip distribution models, the CTPP data, and the TN Guidelines. Percent intrazonal trips for HBSP and NHB trips are slightly out of the range in TN Guidelines.

Table 6-4 Comparison of the Intrazonal Trip Percentage by Purpose

Trip Purpose	Percent Intrazonal Trips		
	Observed (CTPP 2010)	Model Predicted	TN Guidelines
HBW	6.7%	3.0%	1% - 4%
HBSC	-	10.8%	10% - 12%
HBSP	-	10.7%	3% - 9%
HBSR	-	8.7%	4% - 10%
HBO	-	6.8%	3% - 7%
NHB	-	10.3%	5% - 9%

Travel Time Frequency Distribution

The average trip length only provides the mean travel time. It is also very important to check the fraction of trips that are within a certain range of travel times. Using the CTPP 2010 data set, work trips can be grouped by travel time bins in one or two minute intervals, and a trip length distribution curve can be plotted. By comparing the trip length distribution curve from the model with the CTPP 2010 data, significant differences in travel time distribution can be revealed. Comparative plots for CTPP 2010 data and model predicted travel time frequency distribution curves for HBW trips are shown in **Figure 6-1**. No problems were indicated by this visual check.

The correlation between the observed and modeled trip length frequency tables for HBW trips is 97.1%. A correlation coefficient of 1.0 (100%) implies that the two frequency vectors are perfectly linearly correlated.

Another measure used to check the match of the distribution curves is the coincidence ratio. After overlaying the modeled and observed distribution curves, the coincidence ratio is calculated as the area under both curves divided by the area under at least one of the curves. It measures the percent of the area that "coincides" for the two curves. The coincidence ratio between the observed and predicted curves is 81%, which indicates a reasonable match.

Figure 6-2 through **Figure 6-6** show the travel time frequency distribution curves for other trip purposes.

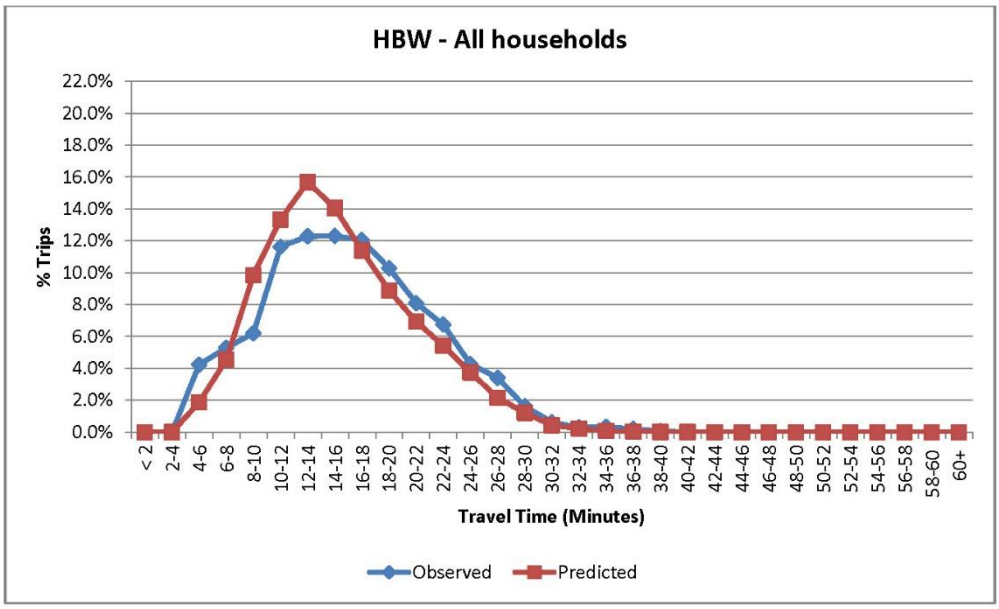


Figure 6-1 Observed and Predicted Trip Length Distribution for HBW Trips

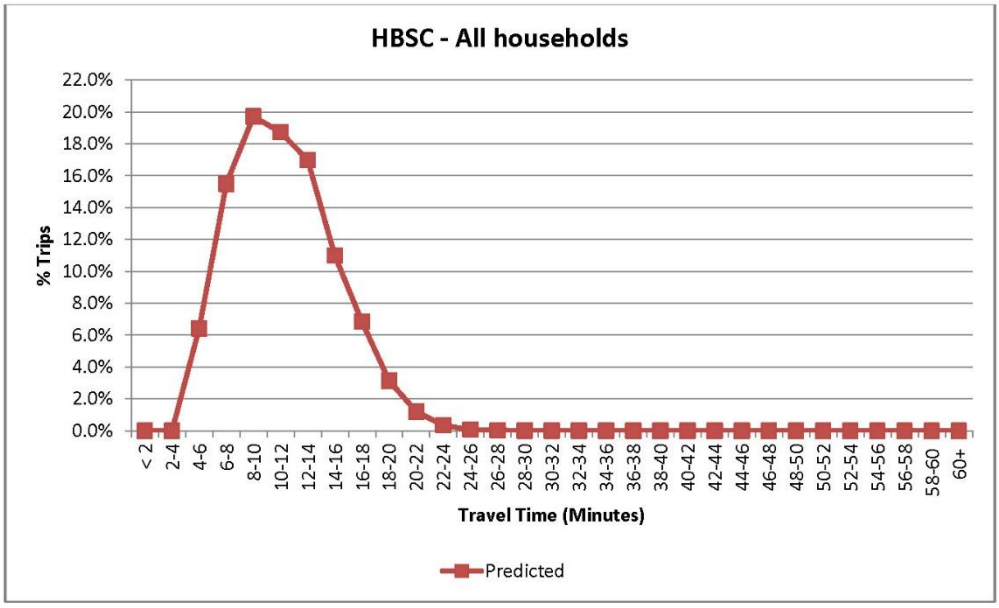


Figure 6-2 Predicted Trip Length Distribution for HBSC Trips

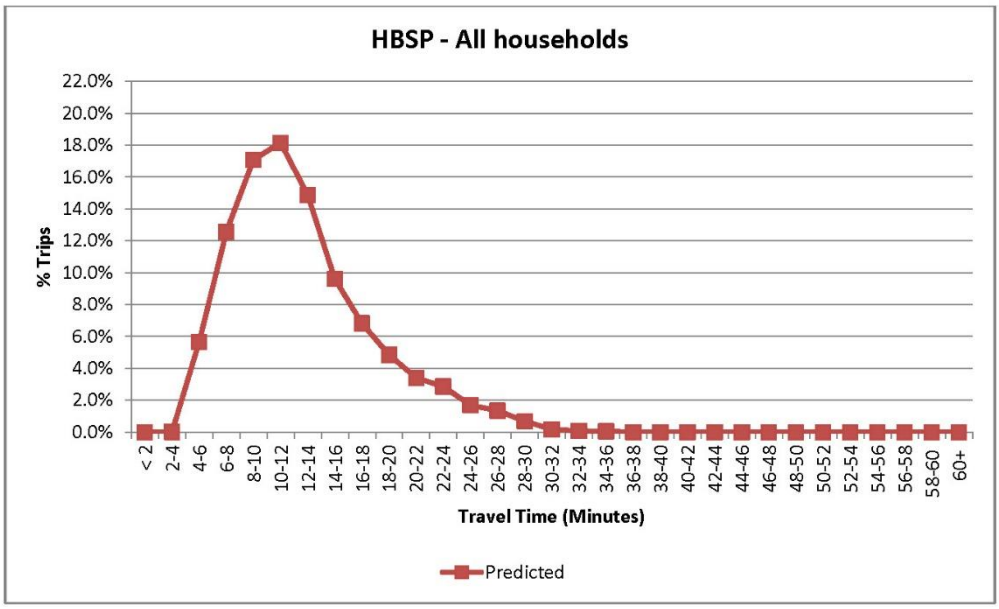


Figure 6-3 Predicted Trip Length Distribution for HBSP Trips

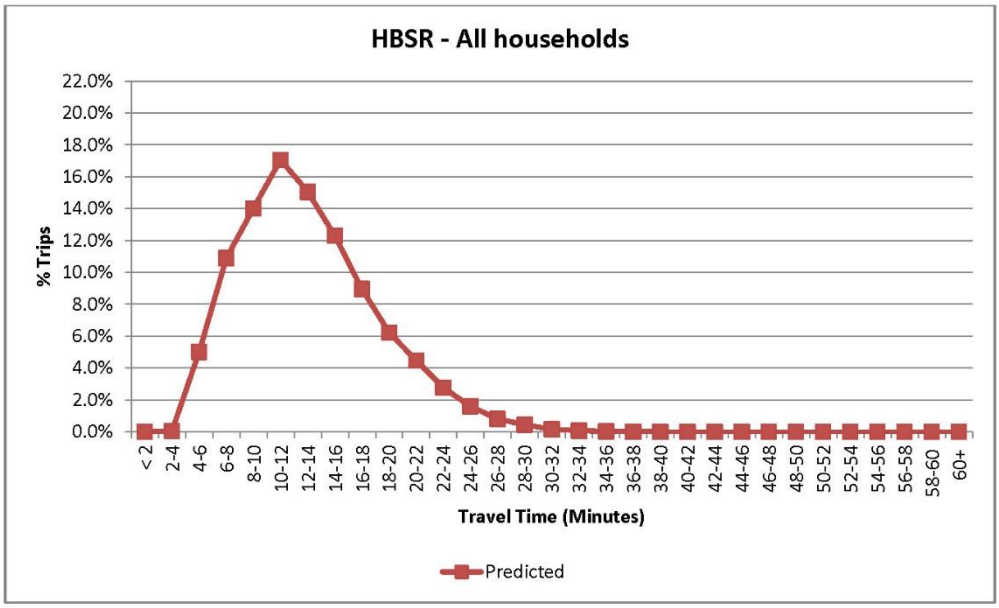


Figure 6-4 Predicted Trip Length Distribution for HBSR Trips

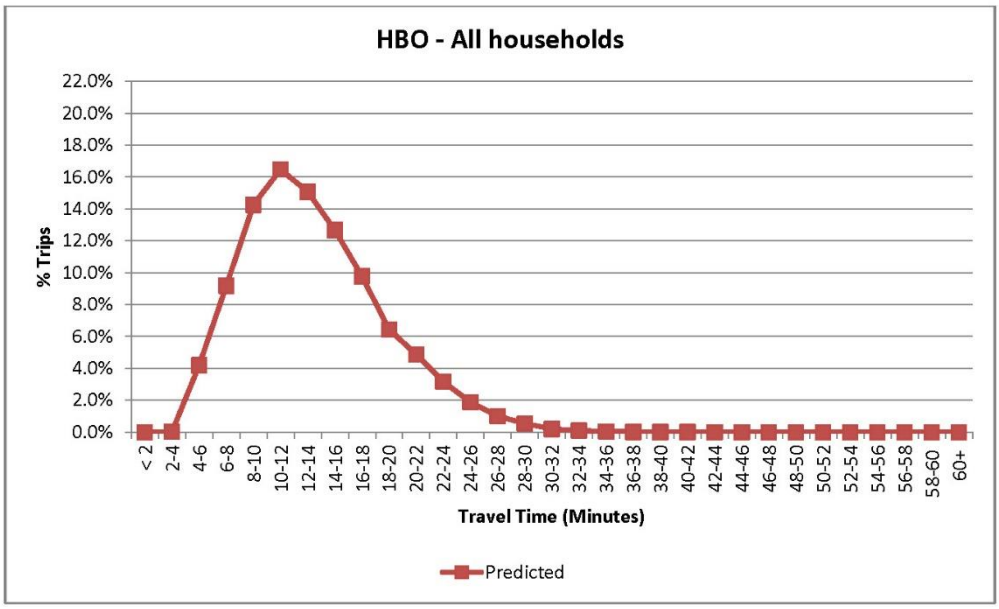


Figure 6-5 Predicted Trip Length Distribution for HBO Trips

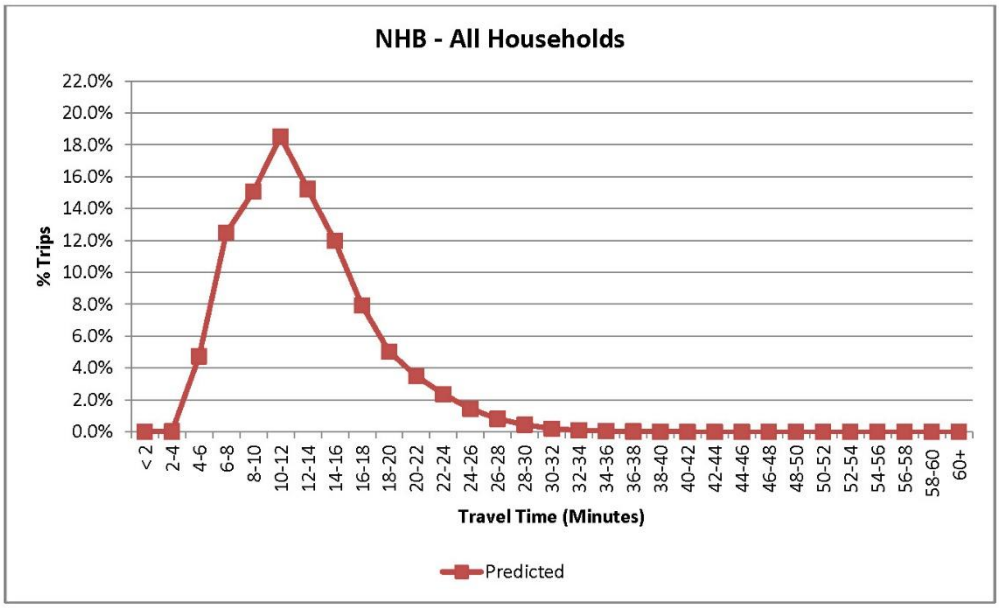


Figure 6-6 Predicted Trip Length Distribution for NHB Trips

Aggregate Trip Interchange Comparison at the County Level

The CTPP journey-to-work (JTW) trip interchanges aggregated at the county level are shown in **Table 6-5**. Total trips crossing the state line are approximately 3.5%.

Table 6-5 County to County Production-Attraction Interchanges (CTPP 2010 JTW)

Name	Hawkins	Sullivan	Washington	Scott	Total
Hawkins	4.7%	13.7%	0.0%	0.3%	18.8%
Sullivan	1.7%	71.3%	0.3%	0.3%	73.6%
Washington	0.2%	2.7%	0.8%	0.0%	3.7%
Scott	0.1%	2.8%	0.0%	1.0%	3.9%
Total	6.8%	90.6%	1.1%	1.6%	100.0%

The initial model predicted trip interchanges are shown in **Table 6-6**. Total trips crossing the state line are approximately 7.3%. As results of this discrepancy, the initial assignment results showed that the model estimated volume crossing the state line screen line is about 17% higher than the observed traffic counts. To match the travel pattern exhibited in the CTPP 2010 data set, a K factor of 0.5 was introduced to the gravity model to reduce trips crossing the state line. **Table 6-7** shows the aggregated trip interchanges after the K factor was introduced. After applying the K factor, model predicted work trips crossing the state line are approximately 4.7%, indicating a closer match with the CTPP dataset.

Table 6-6 County to County Production-Attraction Interchanges (Model Predicted, Before K Factor)

Name	Hawkins	Sullivan	Washington	Scott	Total
Hawkins	5.8%	11.9%	0.1%	0.8%	18.7%
Sullivan	2.0%	62.3%	1.4%	2.1%	67.8%
Washington	0.1%	6.2%	1.0%	0.1%	7.5%
Scott	0.3%	4.0%	0.0%	1.7%	6.0%
Total	8.3%	84.4%	2.6%	4.7%	100.0%

Table 6-7 County to County Production-Attraction Interchanges (Model Predicted, After K Factor)

Name	Hawkins	Sullivan	Washington	Scott	Total
Hawkins	5.9%	12.2%	0.1%	0.4%	18.7%
Sullivan	2.1%	63.4%	1.4%	1.0%	67.8%
Washington	0.1%	6.3%	1.0%	0.0%	7.5%
Scott	0.2%	2.5%	0.0%	3.3%	6.0%
Total	8.3%	84.4%	2.6%	4.7%	100.0%

7.0 MODE SPLIT MODEL

The development of a true utility-based mode choice model was not planned in this update due to the lack of a local survey, the high level of investment required to create a sound mode choice model, and the relatively low number of non-auto users. The existing 2012 model used a flat factor per trip purpose to convert person trips to auto trips. In this model update, an improved factoring process is used. For each trip purpose a set of conversion factors were developed based on the travel distance between production-attraction zone pairs. These factors were developed using the National Household Travel Survey (NHTS) 2009 Add-on data for small MSA areas with population less than 500,000 in Tennessee and Virginia. The auto mode shares by trip purpose are shown in **Table 7-1** below:

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

The factors can be read as fractions. For example, a HBW factor of 0.7 for trips less than half mile means 70% of these trips are automobile trips. As the trip distance increases, the share of non-auto trips decreases. This approach allows a slightly more realistic conversion, as travel distance is a statistically significant variable in most mode choice models.

Table 7-2 shows the auto mode share by trip purpose after these mode split factors are applied.

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%

8.0 EXTERNAL MODELS

As discussed in **Section 2.5**, a total of 35 external stations are included in the Kingsport Model. **Figure 2-6** shows the external station locations.

8.1 External Trip Splits and Time of day Factors

The number of base year vehicle trips at each external station was set equal to the average daily traffic (ADT) traffic count at the station. Using the observed vehicle classification, time-of-day, and other information, the ADTs at external stations are further divided by the following components, as shown in **Figure 8-1**:

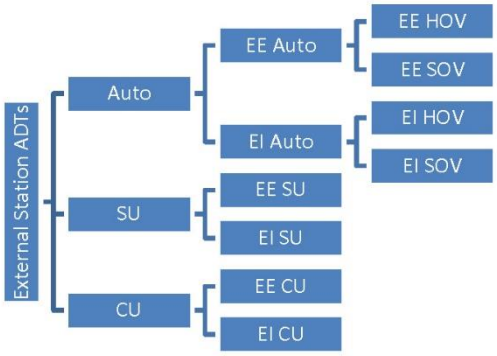


Figure 8-1 Split of External Travel Demand

Vehicle Classification Splits

Three vehicle classes are modeled and assigned to the highway network in model: Auto, Single-Unit Truck (SU), and Combination-Unit Truck (CU). ADTs at all external stations are split into these three vehicle classes. Auto, SU, and CU percentages were based on the vehicle classification counts conducted by the MTPO, Tennessee Department of Transportation (TDOT), and Virginia Department of Transportation (VDOT). For 12 stations, vehicle classification counts were available for 2015 or recent years. If no information was available, data from adjacent years or average values from other external stations with the same functional classification were used. **Table 8-1** shows the ADT and vehicle classification splits at each external station.

External-External (EE) and External-Internal (EI) Splits

The new Tennessee Statewide Travel Demand Model was the primary source of data used to determine the percent splits between EE and EI trips at each external station. A through trip matrix was developed with the Statewide Model that identified the total number of trips and the through trips for major external stations. This matrix was then used to calculate the percent EE trips for each external station by dividing the through trips by the total trips in the Statewide Model. Since autos and trucks (SU and CU) are modeled separately in the Statewide Model, the through trips were also determined separately for automobiles and trucks. EE and EI splits for low volume roads (local or collector roads with less than 1,000 daily traffic) were asserted based on typical values reported by the Statewide Model. EE and EI percentages are shown in **Table 8-2**.

Time-of-day Splits

Time-of-day trip factors for external stations were developed using 24-hour traffic counts collected from TDOT, VDOT, and the MTPO. Like the internal person trips, these factors are applied after trip generation to split the external trips into four time-of-day periods. Since only limited time-of-day data is available for a particular vehicle type, the time-of-day factors are applied equally to all vehicle types (Auto, SU trucks, and CU trucks). **Table 8-3** shows the external time-of-day trip factors at each external station. As described in **Section 5.3**, the AM peak period is form 6:00 AM – 9:00 AM, the midday peak period is from 9:00 AM – 3:00 PM, the PM peak period from 3:00 PM – 6:00 PM, and the night off peak is from 6:00 PM – 6:00 AM.

Table 8-1 External Station ADT and Vehicle Classification Splits

ID	Name	State	Func. Class	ADT	ADT Data Source	% Auto	% SU	% CU	Data Source*
501	Caney Valley Road	TN	8	345	TDOT	99.0%	1.0%	0.0%	Estimated
502	Carters Valley Road	TN	8	1,189	TDOT	99.0%	1.0%	0.0%	Estimated
503	Highway11W	TN	14	11,249	TDOT	94.5%	1.7%	3.8%	TDOT
504	Millers Bluff Road	TN	8	720	Est.	98.9%	0.7%	0.4%	Estimated
505	Goshen Valley Road	TN	8	278	TDOT	99.0%	1.0%	0.0%	Estimated
506	Beech Creek Road	TN	7	312	TDOT	99.0%	1.0%	0.0%	Estimated
507	Horton Highway	TN	8	677	TDOT	99.0%	1.0%	0.0%	Estimated
508	I-81	TN	1	26,170	TDOT	60.8%	5.4%	33.8%	Estimated
509	Jearoldstown Road	TN	8	1,000	Est.	97.2%	1.3%	1.5%	Estimated
510	Highway 93	TN	6	3,526	TDOT	97.2%	1.3%	1.5%	TDOT
511	Fordtown Road	TN	6	893	TDOT	97.0%	1.5%	1.5%	Estimated
512	Harmony Road	TN	8	2,000	Est.	99.0%	1.0%	0.1%	Estimated
513	Ford Creek Road	TN	17	500	Est.	98.5%	1.1%	0.4%	Estimated
514	Gray Station Road	TN	17	3,000	Est.	98.5%	1.1%	0.4%	Estimated
515	Suncrest Drive	TN	16	12,167	TDOT	97.0%	1.5%	1.5%	Estimated
516	I-26	TN	11	56,158	TDOT	91.4%	2.4%	6.3%	Estimated
517	Old Gray Station Road	TN	17	4,380	TDOT	99.0%	1.0%	0.0%	Estimated
518	Kingsport Highway	TN	14	12,049	TDOT	97.0%	1.5%	1.5%	Estimated
519	Muddy Creek Road	TN	9	2,024	TDOT	99.0%	1.0%	0.0%	Estimated
520	Highway 75	TN	6	5,350	TDOT	97.0%	1.4%	1.6%	TDOT
521	Highway 126	TN	6	3,326	TDOT	97.0%	1.5%	1.5%	Estimated
522	Highway 394	TN	2	16,882	TDOT	96.5%	2.3%	1.3%	TDOT
523	I-81	TN	1	31,126	TDOT	68.2%	3.4%	28.4%	Estimated
524	Highway 11W	TN	2	10,509	TDOT	97.6%	0.8%	1.6%	TDOT
525	Esterville Rd	VA	19	30	VDOT	99.0%	1.0%	0.0%	Estimated
526	East Carter's Valley Rd	VA	9	360	VDOT	99.0%	1.0%	0.0%	Estimated
527	Kingsport Highway	VA	2	2,800	VDOT	97.9%	1.5%	0.6%	VDOT
528	Nicklesville Highway	VA	16	3,900	VDOT	97.5%	1.6%	0.9%	VDOT
529	Veteran's Memorial Highway	VA	6	1,900	VDOT	97.9%	1.5%	0.7%	VDOT
530	Manville Road	VA	8	250	VDOT	98.0%	1.6%	0.4%	VDOT
531	Daniel Boone Heritage Highway	VA	2	13,000	VDOT	93.0%	1.7%	5.3%	VDOT
532	Daniel Boone Trail	VA	7	380	VDOT	97.9%	1.8%	0.3%	VDOT
533	Yoma Road	VA	8	580	VDOT	98.0%	1.9%	0.1%	VDOT
534	State Route 635	VA	9	80	VDOT	99.0%	1.0%	0.0%	Estimated
535	State Route 632	VA	9	220	VDOT	99.0%	1.0%	0.0%	Estimated

*** Estimated** – Station specific data is not available. Values from nearby counts on the same road, or average values from other external stations with the same functional classification are used.

Table 8-2 External Station EE/EI Splits

ID	Name	% EE Auto	% EE SU	% EE CU	Data Source*
501	Caney Valley Road	8%	30%	30%	TN Statewide Model
502	Carters Valley Road	1%	1%	1%	TN Statewide Model
503	Highway11W	9%	39%	39%	TN Statewide Model
504	Millers Bluff Road	15%	50%	50%	TN Statewide Model
505	Goshen Valley Road	1%	4%	4%	TN Statewide Model
506	Beech Creek Road	8%	7%	7%	TN Statewide Model
507	Horton Highway	8%	51%	51%	TN Statewide Model
508	I-81	59%	89%	89%	TN Statewide Model
509	Jearoldstown Road	0%	0%	0%	TN Statewide Model
510	Highway 93	42%	49%	49%	TN Statewide Model
511	Fordtown Road	0%	0%	0%	TN Statewide Model
512	Harmony Road	0%	0%	0%	TN Statewide Model
513	Ford Creek Road	0%	0%	0%	TN Statewide Model
514	Gray Station Road	0%	0%	0%	Estimated
515	Suncrest Drive	47%	68%	68%	TN Statewide Model
516	I-26	31%	43%	43%	TN Statewide Model
517	Old Gray Station Road	0%	21%	21%	TN Statewide Model
518	Kingsport Highway	24%	13%	13%	TN Statewide Model
519	Muddy Creek Road	0%	11%	11%	TN Statewide Model
520	Highway 75	28%	58%	58%	TN Statewide Model
521	Highway 126	0%	4%	4%	TN Statewide Model
522	Highway 394	21%	43%	43%	TN Statewide Model
523	I-81	47%	83%	83%	TN Statewide Model
524	Highway 11W	5%	11%	11%	TN Statewide Model
525	Esterville Rd	0%	0%	0%	TN Statewide Model
526	East Carter's Valley Rd	0%	0%	0%	TN Statewide Model
527	Kingsport Highway	23%	82%	82%	TN Statewide Model
528	Nicklesville Highway	0%	0%	0%	TN Statewide Model
529	Veteran's Memorial Highway	0%	0%	0%	Estimated
530	Manville Road	0%	0%	0%	Estimated
531	Daniel Boone Heritage Highway	14%	35%	35%	TN Statewide Model
532	Daniel Boone Trail	0%	0%	0%	Estimated
533	Yoma Road	0%	0%	0%	Estimated
534	State Route 635	0%	0%	0%	Estimated
535	State Route 632	0%	0%	0%	Estimated

*** Estimated** – Station specific data is not available. Values from nearby counts on the same road, or average values from other external stations with the same functional classification are used.

Table 8-3 External Station Time-of-day Factors

ID	Name	State	Func. Class	AM	MD	PM	OP	Data Source*
501	Caney Valley Road	TN	8	15%	34%	20%	31%	TDOT
502	Carters Valley Road	TN	8	15%	31%	23%	32%	TDOT
503	Highway11W	TN	14	17%	34%	23%	27%	TDOT
504	Millers Bluff Road	TN	8	13%	32%	22%	33%	Estimated
505	Goshen Valley Road	TN	8	13%	33%	27%	27%	TDOT
506	Beech Creek Road	TN	7	14%	31%	24%	30%	TDOT
507	Horton Highway	TN	8	17%	32%	25%	26%	TDOT
508	I-81	TN	1	13%	36%	20%	31%	Estimated
509	Jearoldstown Road	TN	8	20%	31%	25%	24%	Estimated
510	Highway 93	TN	6	20%	31%	25%	24%	TDOT
511	Fordtown Road	TN	6	18%	34%	23%	25%	TDOT
512	Harmony Road	TN	8	24%	23%	26%	27%	Estimated
513	Ford Creek Road	TN	17	14%	30%	27%	29%	Estimated
514	Gray Station Road	TN	17	14%	30%	27%	29%	Estimated
515	Suncrest Drive	TN	16	17%	34%	23%	26%	TDOT
516	I-26	TN	11	19%	34%	24%	23%	Estimated
517	Old Gray Station Road	TN	17	13%	34%	30%	23%	TDOT
518	Kingsport Highway	TN	14	16%	34%	25%	24%	TDOT
519	Muddy Creek Road	TN	9	15%	32%	25%	28%	TDOT
520	Highway 75	TN	6	17%	35%	24%	24%	TDOT
521	Highway 126	TN	6	16%	35%	26%	23%	TDOT
522	Highway 394	TN	2	18%	34%	24%	24%	TDOT
523	I-81	TN	1	13%	36%	20%	31%	Estimated
524	Highway 11W	TN	2	17%	36%	25%	23%	TDOT
525	Esterville Rd	VA	19	15%	32%	25%	28%	Estimated
526	East Carter's Valley Rd	VA	9	15%	32%	25%	28%	Estimated
527	Kingsport Highway	VA	2	18%	34%	24%	24%	Estimated
528	Nicklesville Highway	VA	16	17%	34%	23%	26%	Estimated
529	Veteran's Memorial Highway	VA	6	18%	34%	23%	25%	Estimated
530	Manville Road	VA	8	15%	32%	25%	28%	Estimated
531	Daniel Boone Heritage Highway	VA	2	18%	34%	24%	24%	Estimated
532	Daniel Boone Trail	VA	7	15%	32%	25%	28%	Estimated
533	Yoma Road	VA	8	15%	32%	25%	28%	Estimated
534	State Route 635	VA	9	15%	32%	25%	28%	Estimated
535	State Route 632	VA	9	15%	32%	25%	28%	Estimated

*** Estimated** – Station specific data is not available. Values from nearby counts on the same road, or average values from other external stations with the same functional classification are used.

8.2 External Auto Trip Generation and Balancing

As shown in **Figure 8-1**, after applying the trip split factors to external station ADTs, external trips can be sub-divided into the following groups:

- EE (through) trips (Auto, SU, and CU)
- EI trips (Auto, SU, and CU)

External-External (Through) Auto Trips

Through auto trips were directly modeled as half in-bound and half out-bound trips. At each external station, for each time of day period:

$$EE\ IB/OB\ Trips_{auto} = ADT \times Percent_{auto} \times Percent_{tod} \times Percent_{EE\ Auto} \div 2$$

External-Internal (EI) Auto Trips

EI auto trips are assumed to be produced at external stations and attracted to internal zones. Total auto trips produced at each external station are:

$$EI\ Trip\ Production_{\ Auto} = ADT \times Percent_{Auto} \times Percent_{tod} \times Percent_{EI\ Auto}$$

EI auto attractions were derived at the TAZ level based on various employment categories and total number of households. Linear regression models based on employment and number of households in each internal zone were developed for EI auto trip attractions. The linear regression coefficients were estimated using the 2010 base year trip table from the Statewide Model. The number of EI trips attracted to internal zones is given by the formula:

$$A_{EI\ Auto} = \sum_j c_j \times E_j$$

Where:

$A_{EI\ Auto}$ = Trip Attractions for EI Auto Trips
c_j = Coefficient for independent variable j
E_j = Value of independent variable j

Estimated EI Auto trip attraction rates are summarized in **Table 8-4**. The resulting total number of productions and attractions for EI Auto trips is shown in **Table 8-5**. When balancing the productions and attractions, EI Auto trip productions were held constant at the external station locations since there is a higher level of certainty with the volumes at these locations than the attractions being derived at the TAZ level.

Table 8-4 EI Auto Trip Attraction Model Coefficients (c_i)

Variable	Coefficients	t Value (Linear Regression)
Employment (Office)	3.022	2.77
College Enrollment	0.840	2.89
Total Number of Households	1.566	5.53

Table 8-5 Trip Production and Attraction Totals for EI Auto Trips

Trip Purpose	Productions	Attractions	% Difference
EI Auto	146,629	130,600	-10.9%

8.3 External Auto Trip Distribution

External trips are distributed using a gravity model. Gravity models were developed for EE and EI Auto trips respectively.

K Factor Matrix for EE Auto Trips

To obtain desired interchanges for EE trips, K-factors are applied to adjust the gravity distribution algorithm. The Statewide Model was used to derive a target through trip matrix for EE Auto trips. All other OD interchanges not included in the Statewide model were manually assigned to the target trip table based on the characteristics of the network and the proportional demand at each external station. This target trip table was then used to calibrate the K-factor matrix and the friction factor parameters for EE Auto gravity model.

Friction Factors

For EE Auto trips, K-factor matrix and gamma function parameters were estimated together from the target matrix to produce matching distribution between external stations.

For EI Auto trips, gamma function parameters were adjusted in an iterative process to produce reasonable average trip lengths for EI Auto trips based on the size of the region. The calibrated average trip length for EI Auto trips is approximately 16.7 minutes in travel time, which is approximately 66% of the average length for EE Auto trips. **Table 4-6** shows the calibrated gamma function parameters for each external auto trip type.

Table 8-6 Calibrated Gamma Function Parameters (EE and EI Auto Trips)

External Trip Type	Gamma Function Parameters	
	B	c
EI Auto	0.500	0.330
EE Auto	0.399	0.020

9.0 TRUCK MODELS

In the Kingsport model, truck travel was estimated for three vehicle classification types: four-tire commercial vehicles (Light Truck), single unit trucks with six or more tires (SU), and combination trucks (CU). Total truck trips using the highway network can be divided into three types: External-External (EE), External–Internal(EI), and Internal trips, as shown in **Figure 9-1**.

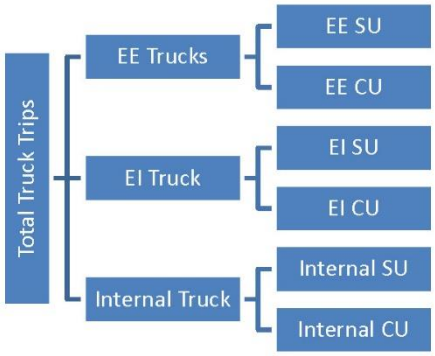


Figure 9-1 Truck Trips Simulated in Kingsport Model

Truck models for the Kingsport Model were developed using the methodology outlined in Chapter 4 of the **Quick Response Freight Manual II**, FHWA, 2007 (QRFM).

9.1 External-External (EE) Truck Trip Generation

Through truck trips were directly modeled as half in-bound and half out-bound trips at each external stations for each time of day period:

$$EE\ IB/OB\ Trips_{SU\ or\ CU} = ADT \times Percent_{SU\ or\ CU} \times Percent_{tod} \times Percent_{EE\ SU\ or\ CU} \div 2$$

9.2 External-Internal Truck Trip Generation

EI truck trips are assumed to be produced at external stations and attracted to internal zones. Truck trips produced at each external station are:

$$EI\ Trip\ Production_{\ SU\ or\ CU} = ADT \times Percent_{SU\ or\ CU} \times Percent_{tod} \times Percent_{EI\ SU\ or\ CU}$$

EI attractions were derived at the TAZ level based on various employment categories and total number of households. Linear regression models based on employment and number of households in each internal zone was developed for EI truck trip attractions.

Linear regression coefficients for EI CU trucks were estimated using the 2012 American Transportation Research Institute (ATRI) trip tables provided by TDOT. Using the QRFM employment by TAZ as explanatory variables, the number of EI trips attracted to internal zones is given by the formula:

$$A_{EI\ (SU\ or\ CU)} = \sum_j c_j \times E_j$$

Where:

$A_{EI\ (SU\ or\ CU)}$ = Trip Attractions for EI SU or CU Truck Trips

c_j = Coefficient for independent variable j

E_j = Value of independent variable j

Because the ATRI data set is predominately reported by heavy trucks, the linear regression process was conducted at the model district levels for CU Trucks only. QRFM employment numbers were first aggregated to the planning districts. All EI truck trips in the ATRI truck table were used as the observed variable to estimate the linear regression coefficients for the EI CU trucks. Estimated EI CU Truck trip attraction rates are summarized in **Table 9-1**.

Table 9-1 EI CU Truck Trip Attraction Model Coefficients (c_j)

QRFM Employment Category	Coefficients	t Value (Linear Regression)
Manufacturing, Transportation/ Communications/Utilities, and Wholesale	0.092	6.41
Retail	0.231	3.87
Office	0.171	3.24
Total Households	0.034	3.34

The QRFM default SU truck trip rates were used by the Kingsport model as attraction rates. The QRFM default trip rates are based on surveys from Phoenix, Arizona region, as shown in **Table 9-2**.

Table 9-2 EI SU Truck Trip Attraction Model Coefficients (c_j)

QRFM Employment Category	QRFM Default SU Rates
Agriculture, Mining, and Construction	0.289
Manufacturing, Transportation/ Communications/Utilities, and Wholesale	0.242
Retail	0.253
Office and Services	0.068
Total Households	0.099

When balancing the productions and attractions, EI Truck trip productions were held constant at the external station locations since there is a higher level of certainty with the volumes at these locations than the attractions being derived at the TAZ level.

9.3 Internal Truck Trip Generation

Internal truck trip generation is based on the linear regression models by various employment categories and number of households as defined in the QRFM procedures:

$$Internal\ Truck\ Trips_{Class\ i} = \sum_j c_j \times E_j$$

Where:

$Class_i$ = Light Truck, SU, and CU trucks
c_j = Coefficient for independent variable j
E_j = Value of independent variable j

Similar to EI truck trips, CU truck rates were estimated using the ATRI data set at the planning district levels. QRFM employment categories were used as explanatory variables. All internal truck trips in the ATRI truck table were used as the observed variable to estimate the linear regression coefficients for internal CU trucks. A scaling factor was applied to these rates during the assignment calibration process. Estimated internal CU Truck trip attraction rates and the final scaled rates are summarized in **Table 9-3**.

Table 9-3 Internal CU Truck Trip Generation Rates (c_j)

QRFM Employment Category	Estimated CU Rates from ATRI	t Value (Linear Regression)	Scaling Factor for Model
Manufacturing, Transportation/ Communications/Utilities, and Wholesale	0.064	1.08	0.6
Retail	0.696	2.83	0.6
Total Households	0.198	4.40	0.6

Attraction rates for Light and SU trucks were obtained by scaling the QRFM default truck trip rates during the assignment calibration process comparing with the observed classification counts. The default trip rates and the scaling factors are shown in **Table 9-4**.

Table 9-4 Adjusted Light and SU Truck Trip Rates (c_j)

QRFM Employment Category	QRFM Default SU Truck Rates	SU Scaling Factor for Model	QRFM Default Light Truck Rates	Light Truck Scaling Factor for Model
Agriculture, Mining, and Construction	0.289	0.6	1.110	1
Manufacturing, Transportation/ Communications/Utilities, and Wholesale	0.242	0.6	0.938	1
Retail	0.253	0.6	0.888	1
Office and Services	0.068	0.6	0.437	1
Total Households	0.099	0.6	0.251	1

Production and attractions for internal truck trips are 50/50 splits after the total demand is estimated. **Table 9-5** shows the total truck trips by trip type.

Table 9-5 Total Truck Trips by Category and Type

Truck Category	Type	Trips	Percent within Truck Category
Light Truck	Internal	25,533	100%
SU Truck	Internal	7,088	65%
	EI	2,245	20%
	EE	1,650	15%
CU Truck	Internal	5,272	27%
	EI	5,848	29%
	EE	8,772	44%

9.4 Time-of-Day Splits for Internal Truck Trips

Time-of-day split factors for internal truck trips were developed from the traffic counts. All traffic counts collected within the region with both vehicle classification and time-of-day information were used to develop the time-of-day period splits for Auto, SU, and CU classes. Because the traffic counts cannot distinguish light trucks with autos, auto time-of-day distribution was used for light trucks. **Table 9-6** shows the time-of-day splits of truck trips by category.

Table 9-6 Time of Day Factors for Truck Trips

Time Period	Time Range	Light Truck %	SU %	CU %
AM	6 AM - 9 AM	15.6%	17.9%	13.1%
Midday (MD)	9 AM - 3 PM	34.8%	37.7%	36.3%
PM	3 PM - 6 PM	24.1%	23.1%	24.5%
Off-peak (OP)	6 PM - 6 AM	25.5%	21.3%	26.2%
Total		100%	100%	100%

9.5 Truck Trip Distribution

Truck trips are distributed using gravity models. Gravity models were developed and calibrated for each of the following truck types:

- Internal Light Trucks
- Internal SU trucks
- EI SU Trucks
- EE SU Trucks
- Internal CU Trucks
- EI CU Trucks
- EE CU trucks

Friction Factors and K Factors

For EE trips, K-factor matrix and gamma function parameters were estimated together from the target matrix developed from the Statewide Model to produce matching distribution between external stations.

For internal and EI truck trips, no K factors were used. Gamma functions were used for truck trip friction factors. Gamma function parameters were adjusted in an iterative process to produce reasonable average trip length for truck trips based on the size of the region and the trip lengths for internal trip purposes. **Table 9-7** shows the calibrated gamma function parameters for each external trip type.

Table 9-7 Calibrated Gamma Function Parameters (Truck Trips)

External Trip Type	Gamma Function Parameters	
	b	c
Internal Light Truck	0.01	0.085
Internal SU	0.01	0.05
EI SU	1.65	0.75
EE SU	-5.7962	0.5090
Internal CU	0.01	0.015
EI CU	0.25	0.25
EE CU	-5.7962	0.5090

Table 9-8 shows the average trip length for each truck trip type. For comparison, the average trip length for internal home-based work trip is approximately 15.4 minutes, and average trip length for EI auto trips is approximately 17.1 minutes.

Table 9-8 Truck Average Trip Length

Truck Trip Type	Average Trip Length (min.)
Internal Light Truck	15.7
Internal SU	17.0
EI SU	18.3
EE SU	19.4
Internal CU	18.9
EI CU	19.9
EE CU	20.5

9.6 Directional Splits for Truck Trips

All internal truck trips are distributed in production-attraction (PA) format. After the gravity model, the 50/50 splits were applied to all internal trucks to convert the trip matrix from PA to OD format, similar to the non-home based (NHB) internal trip purpose.

EI SU and CU trucks were also in PA format after the gravity model. The production end is at the external stations and attractions are at each internal TAZ. 50% in-bound and out-bound factors at each external stations are applied to the PA vector to split the total number of trips to in-bound (from external station to internal TAZs) and out-bound (from internal TAZs to external station). After this process, the EI truck trip tables are ready to be assigned to the highway network.

10.0 DIRECTIONAL SPLITS AND PERSON TRIP TO VEHICLE TRIP CONVERSION

After mode split, all internal trips are in a Production zone to Attraction zone (PA) format. To assign the trips to the network, trip tables must be converted to an Origin-Destination (OD) format. In addition, person trips that shared rides must be converted to vehicular trips by applying vehicle occupancy factors. This section discusses the methodology used to convert the trips from PA to OD format, and to convert person trips to vehicular trips for shared ride trips.

10.1 PA to OD (Directional Splits)

For all internal trip purposes, person trips using the automobile mode predicted by the mode split model are the total number of trips produced from home zone and attracted to the attraction zones. To convert these trips from PA to OD format, departure and return rates by trip purpose and time-of-day period must be known. Using the home-based work trip purpose as an example, trips from home to work in the AM have the trip origin as home and destination as the work place. Similarly, trips returning home from work in the AM have the trip origin as work place and destination as home. These departure and return rates can be applied to the PA trip tables as directional splits to convert them to an OD format. The directional split factors were developed by trip purpose and time-of-day period using the NHTS 2009 Tennessee and Virginia Add-on data. **Table 10-1** shows the directional splits by time-of-day period and trip purpose.

Table 10-1 Time-of-day Directional Splits (Post-Mode Split)

Trip Purpose	AM		MD		PM		OP	
	Departure	Return	Departure	Return	Departure	Return	Departure	Return
Home-based Work	98.75%	1.25%	61.16%	38.84%	11.33%	88.67%	31.84%	68.16%
Home-based School	98.16%	1.84%	28.38%	71.62%	10.96%	89.04%	29.21%	70.79%
Home-based Shopping	74.68%	25.32%	49.02%	50.98%	38.11%	61.89%	33.91%	66.09%
Home-based Social Recreational	74.34%	25.66%	61.46%	38.54%	50.04%	49.96%	35.51%	64.49%
Home-based Other	80.55%	19.45%	59.11%	40.89%	42.49%	57.51%	33.28%	66.72%
Non-home Based	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%
Total	**81.59%**	**18.41%**	**52.47%**	**47.53%**	**39.15%**	**60.85%**	**37.39%**	**62.61%**

Note that non-home based trips do not have the home end as an origin or destination point. They are assumed to be equally distributed in both directions and a 50/50 split is applied.

Directional splits for external and truck trips were discussed in **Section 8 and 9**.

10.2 Person Trip to Vehicular Trip Conversion

The mode split model predicts the number of person trips using automobile mode. The auto mode consists of auto trips with one or more passengers. Auto occupancy factors by trip purpose and time-of-day were applied to convert the person trips to auto trips. These factors were developed using the NHTS 2009 dataset. **Table 10-2** shows the average auto occupancy factors.

Table 10-2 Average Auto Occupancy for Auto Trips

Trip Purpose	AM	MD	PM	OP
Home-based Work	1.08	1.10	1.06	1.09
Home-based School	1.89	1.47	2.01	1.61
Home-based Shopping	1.31	1.40	1.49	1.61
Home-based Social Recreational	1.38	1.53	1.67	1.61
Home-based Other	1.73	1.68	1.67	1.71
Non-home Based	1.28	1.47	1.57	1.63

Using home-based school in the AM peak period as an example, average auto occupancy is 1.89 persons per auto. To apply the factors, the auto person trips for home-based school purpose in the AM are divided by 1.89 to get the number of auto vehicle trips.

External and truck trips are vehicular trips from trip generation step. No conversion is needed for external and truck trips.

After converting all trip tables to origin-destination format and vehicular trips, they are aggregated and assigned to the highway network. Assignment methodologies are discussed in the following sections.

11.0 HIGHWAY ASSIGNMENT METHODOLOGY

Highway assignment has two steps: a multimodal multi-class (MMA) all-or-nothing preload assignment, and a MMA User Equilibrium (UE) assignment. The initial all-or-nothing assignment is used to "preload" through trips and large commercial vehicle trips. These trips are less sensitive to travel time and do not reroute trips based on congestion as often as trips such as an internal home-based-work auto trip. An MMA assignment is a generalized cost assignment that lets you assign trips by individual modes or user classes to the network simultaneously. This setup offers several advantages, including the flexibility to model High-Occupancy Vehicle (HOV) lanes, passenger car equivalencies for trucks, and exclusion of no-truck routes for trucks only.

The two steps of assignments (preload and equilibrium) are applied for each of the four time periods (AM, midday, PM, and off-peak), which yields a total of eight assignment routines for the Kingsport model. Volume-delay functions used for the assignment are based on time and period capacity and are modified versions of the Bureau of Public Road (BPR) curves. The volume-delay curves have varied coefficients for different roadway functional classification and link speed.

11.1 MMA All-or-Nothing Preload Assignment

The first step of the highway assignment procedure is to "preload" through trips. The preload assignment uses an all-or-nothing method, which assigns trips between origin-destination pairs based on the shortest path established by the free-flow travel time. This assignment procedure is intended to reflect the insensitivity congestion has on external trips, especially long-haul truck trips, since they are typically much less likely to divert to another roadway than other types of trips, either due to lack of knowledge about the area, perceived inconvenience, or restrictions against heavy trucks.

The following trip tables are loaded during the preload assignment procedure for each time period:

- External automobile
- External single-unit (SU) trucks
- External combination-unit (CU) trucks

External trips includes external-external (EE, through trips) and external-internal (EI) trips. Since there is no reflection of delay in the choice of path for these trips, no volume-delay function is required and only one assignment iteration is required.

11.2 MMA User Equilibrium Assignment

The second step of the highway assignment procedure is to load all remaining trips not considered in the preload assignment. Preloaded trips are addressed in the assignment procedures as background traffic that reduces capacity but does not divert to another route. The remaining trips are loaded using an MMA user-equilibrium assignment, which assigns trips between origin-destination pairs in an iterative fashion that accounts for link congestion on route choice. The user-equilibrium assignment procedure computes the link travel time, assigns link traffic based on shortest path, and then recalculates the link travel time. This step is repeated until the user equilibrium conditions are met: all used paths for each O-D pair are minimal and equal; and any unused path for a given O-D pair has a greater travel time than any used paths for that O-D pair. In TransCAD's implementation, the convergence of user equilibrium is measured by the "relative gap," which is an estimate of the "distance" between current solution and the user equilibrium solution. The relative gap is defined as follows:

$$\text{Relative gap} = \frac{\sum_{\forall links} x_i^{UE\,t} - \sum_{\forall links} x_i^{AON\,t}}{\sum_{\forall links} x_i^{UE\,t}}$$

Where:

x_i^{UE} = Current flow on link i

x_i^{AON} = All-or-nothing flow on link i

x_i^{UEt} = Current travel time on link i

The traffic assignment will stop when the current iteration relative gap is below a user specified threshold or the maximum number of iterations is reached.

For UE assignment, internal light trucks are combined with internal auto trips, and are assigned to the network as automobile trips.

Volume-Delay Function

The Kingsport model uses the Bureau of Public Roads (BPR) formula as the volume-delay function to relate travel time to the volume/capacity ratio. The BPR formula is shown below,

$$T_N = T_0 * \left[1 + 0.15\left(\frac{V}{C}\right)^4\right]$$

Where:

T_N = Congested link travel time
T_0 = Initial link travel time under free-flow conditions
V = Assigned traffic volume
C = Capacity

In the equation, the coefficient 0.15 is known as the *alpha* value and the exponent of 4 is known as the *beta* value. Different functionally classified roads are known to have different alpha and beta values. The values of 0.15 and 4 are recognized as the most generic. The alpha and beta settings are based on the type of facility and its posted speed. Settings are automatically applied in the GISDK code and have been developed based on the coefficients presented in **NCHRP Report 716**. **Table 11-1** lists the alpha and beta settings, by functional classification, for the Kingsport model.

Table 11-1 Alpha and Beta Settings by Speed and Functional classification

Roadway Functional Classification	Free Flow Speed >= 70 mph		Free Flow Speed >= 55 and <70 mph		Free Flow Speed <55 mph	
	Alpha	Beta	Alpha	Beta	Alpha	Beta
Freeways	0.88	9.8	0.83	5.5	0.56	3.6
Multilane Highways	1.0	5.4	0.83	2.7	0.71	2.1
2-lane Roads	0.71	2.1	0.71	2.1	0.71	2.1
Centroid Connectors	1.0	5.4	1.0	5.4	1.0	5.4

Link Capacity

The hourly capacities of roadways in the Kingsport model are calculated using the capacity equations presented in **Section 3.4**. The capacity calculation is fully integrated into the model process. Roadway improvements in future year scenarios are automatically accounted for in future year model runs.

Since the model is based on four multi-hour time periods, a conversion factor must be used to create a time period capacity for each of the four time periods. The capacity factors below are based on the hourly traffic count data and the Kingsport household travel survey. The initial values of the time-of-day capacity factor were based on the following equation:

$$\text{Capacity Factor} = \frac{\text{Total Time Period Volume}}{\text{Peak Hour Time Period Volume} \times \text{Number of Hours in Time Period}}$$

The time-of-day capacity factors were adjusted based on the highway assignment results during the model calibration process. Final factor values are shown in **Table 11-2** below.

Table 11-2 Hourly to Time-of-day Period Capacity Factors

Time Period	Time Range	Period Length	Capacity Factor
AM	6 AM - 9 AM	3 Hours	1.6
Midday (MD)	9 AM - 3 PM	6 Hours	2.7
PM	3 PM - 6 PM	3 Hours	1.6
Off-peak (OP)	6 PM - 6 AM	12 Hours	4.1

Free Flow Speed

Free flow travel time is calculated from free flow speed and is the input data of the volume-delay function. Free flow speeds are calculated by applying a factor to the posted speed. The free flow speed factors were adjusted in the highway assignment calibration process. **Table 11-3** shows the free flow speed adjustment factors by roadway functional classification and by area type.

Table 11-3 Free Flow Speed Adjustment Factors

Functional Classification	Area Type			
	CBD	Urban	Suburban	Rural
Freeway	1.00	1.02	1.03	1.05
Major Arterial (Posted Speed >= 45 mph)	1.00	1.15	1.17	1.20
Major Arterial (Posted Speed < 45 mph)	0.98	1.08	1.10	1.12
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

During the assignment calibration process, several roadway segments were over-assigned comparing with the observed traffic counts. Free flow speed on these roadway segments were manually adjusted to the posted speed to discourage travel on these roadway segments. **Table 11-4** shows the roadway segments.

Table 11-4 Free Flow Speed Adjustment Factors (Segment Specific)

Roadway Name	Segment Termini	Free Flow Speed Adjustment Factor
I-26	Suncrest Drive to I-81	1.0
South Wilcox Drive	Highway 93 to East Center Street	1.0
Highway 126	Highway 93 to I-81	1.0

Passenger Car Equivalency (PCE) Factors

Table 11-5 shows the PCE factors for the assignment process. The same PCEs are used for both preload and user equilibrium assignment steps.

Table 11-5 Passenger Car Equivalency Factors for Assignment

Assignment Class	Passenger Car Equivalency
Auto	1.0
SU	1.5
CU	2.0

User Equilibrium Assignment Convergence Criteria

The standard user equilibrium algorithm is used for the UE assignment model. The maximum number of iterations is set to 100, and convergence is set to 0.0001.

To give the MPO maximum flexibility using and maintaining the model, all model parameters are stored in tables in the model's input folder, and can be adjusted without modifying and recompiling the GISDK code.

12.0 FEEDBACK METHODOLOGY

The objective of the feedback process is to execute the travel model system in an integrated manner so that the time outputs from the traffic assignment model are reasonably consistent with the inputs assumed at the trip distribution and mode choice steps. The trip distribution, mode choice, and trip assignment steps are repeated until a sufficient convergence — output times being close to input times — is achieved. In the Kingsport model, the Method of Successive Averages (MSA) feedback loop procedure is implemented.

In the MSA method, output volumes from trip assignment from previous iterations are weighted together to produce the current iteration's link volumes. Adjusted congested times are then calculated based on the normal volume-delay relationship. This adjusted congested time is then fed back to the skimming procedures.

The adjusted volume is calculated based on the following equation:

$$MSAFlow_n = MSAFlow_{n-1} + \frac{1}{n}(Flow_n - MSAFlow_{n-1})$$

Where:

n = current MSA iteration number
$MSAFlow_n$ = calculated MSA flow at iteration n
$Flow_n$ = resulting flow directly from trip assignment

The MSA flow and link cost created from the MMA assignment procedure is then "fed back" into the skimming procedure of the next MSA feedback iteration. The benefits of this process are that it can be applied with relatively ease of programming and convergence is assured.

Convergence Criteria

At the end of each feedback iteration, the MMA User Equilibrium Assignment Procedure can return a calculated Root Mean Square Error (RMSE) statistic that compares volumes from the current feedback iteration to volumes from the last feedback iteration. The equation used to calculate RMSE is shown below:

$$RMSE_n = \sqrt{\frac{\sum_{i=1}^{L}(x_i^n - x_i^{n-1})^2}{L-1}}$$

Where:

i = link i
L = total number of links
n = feedback iteration number
$RMSE_n$ = Root Mean Square Error for feedback iteration n
x_i^n = volume on link i, iteration n

The convergence is then checked against the predefined RMS Error threshold. If the convergence criteria are not met, the MSA flows and travel times are fed back to the next iteration. This iterative process continues until one of the following conditions is true:

- $RMSE_n < RMSE$ threshold
- Current iteration n > maximum iteration allowed

The convergence criteria used for the Kingsport model are:

- $RMSE$ threshold = 10
- Maximum iteration = 10

These thresholds were determined through sensitivity tests during the calibration process. Using these criteria, the model usually converges in four to five iterations. On a typical desktop computer, one iteration of the model run takes approximately 5 minutes. Tighter convergence criteria can be used, but improvement to the model results is marginal after 4 iterations. Both parameters can be easily changed in the model interface if tighter convergence is desired.

13.0 HIGHWAY ASSIGNMENT RESULTS AND VALIDATION

As the starting point of the model calibration effort, the initial highway assignment were made using the trip tables produced by the upstream models that were already calibrated and validated individually. The steps of model calibration involved the following calibration strategies:

- Review and eliminate highway network coding errors
- Adjust centroid connector locations based on adjacent network link loading
- Add turn penalties to eliminate illegal moves within the highway network
- Adjust Quick Response Freight Manual (QRFM) truck trip rates
- Adjust gravity model friction factors/average trip lengths
- Review VMT target based on HPMS data and traffic count data system-wide
- Revise free-flow speed factors by functional classification
- Adjust peak period capacity factors (Hourly to time-of-day period)
- Review capacity equations and volume delay function parameters by functional classification
- Adjust gravity models based on county level travel patterns

Final adjusted time-of-day factors, free flow speed factors, and gravity model parameters were presented in previous sections of this memorandum. This section presents the final highway assignment validation results after the model calibration and validation steps above. The highway assignment results were validated at varying levels of aggregation, based on the requirements from the TN Guidelines.

13.1 Vehicle Miles of Travel (VMT)

The HPMS data within the model study area in Tennessee were directly calculated using HPMS link data provided by TDOT. The HPMS data from Virginia are only available at the county level. To establish VMT validation targets for the Kingsport MTPO region, the HPMS data for Scott County were interpolated to the partial county area within the model boundary by miles of the roadway by functional classification. VMTs for local roads cannot be directly interpolated because not all the local roads were included in the model. The percentage of VMT on local roads in HPMS data was used to estimate the local road VMTs in each county within the model boundary. **Table 13-1** shows the VMT targets by county and by roadway functional classification.

Table 13-1 VMT Validation Targets

Functional Class	Model Study Area in TN	Scott, VA	Town of Gate City, VA	Town of Weber City, VA	MPO Total
Freeway	1,048,230	13,444	5,979	0	1,067,653
Major Arterial	889,320	97,581	16,189	44,326	1,047,416
Minor Arterial	706,612	19,638	24,219	175	750,643
Collector	196,299	14,695	3,827	1,051	215,872
Local	497,920	25,901	6,920	2,110	532,851
Total (No Local)	2,840,461	145,358	50,214	45,553	3,081,584
Total (With Local)	3,338,380	171,259	57,134	47,662	3,614,435

Regional, household, and per capita VMT were computed and compared to HPMS data and other suggested ranges. Since the model does not include all local roads, model VMT for local roads was estimated by applying the same local VMT percentage from the HPMS data. **Table 13-2** compares the model VMT per person and per household with the HPMS data and TN Guidelines.

Table 13-2 VMT per Person and Household

	Model	HPMS	TN Guidelines
VMT per Person	28	27	24 - 32
VMT per Household	60	58	60 - 75

Region wide, the current model produces a VMT per capita of 28 and VMT per household of 60. These model results are within reasonable ranges provided by TN Guidelines. The HPMS VMTs are low compared with the range provided by TN Guidelines.

VMT is categorized by functional classification and compared with suggested percent differences, shown in **Table 13-3**. Overall, the model was 3% higher than the total VMT target. **Table 13-4** shows the VMT comparison for model study area in the State of Tennessee only.

Table 13-3 Percent Difference Targets for VMT by Functional Classification (Entire Model Area)

Roadway Functional Classification	VMT		VMT Distribution		% Difference	
	Observed (HPMS Data)	Model Estimated	Observed (HPMS Data)	Model Estimated	Model Compared to Observed	TN Guidelines
Freeways	1,067,653	1,040,230	34.6%	32.7%	-2.6%	7.0%
Principal Arterials	1,047,416	1,117,706	34.0%	35.2%	6.7%	15.0%
Minor Arterials	750,643	772,107	24.4%	24.3%	2.9%	15.0%
Collectors	215,872	247,153	7.0%	7.8%	14.5%	25.0%
Total	3,081,584	3,177,196	100.0%	100.0%	3.1%	**5.0%**

Table 13-4 Percent Difference Targets for VMT by Functional Classification (TN Only)

Roadway Functional Classification	VMT		VMT Distribution		% Difference	
	Observed (HPMS Data)	Model Estimated	Observed (HPMS Data)	Model Estimated	Model Compared to Observed	TN Guidelines
Freeways	1,048,230	1,003,670	148.3%	137.3%	-4.3%	7.0%
Principal Arterials	889,320	954,851	125.9%	130.6%	7.4%	15.0%
Minor Arterials	706,612	730,996	100.0%	100.0%	3.5%	15.0%
Collectors	196,299	212,424	27.8%	29.1%	8.2%	25.0%
Total	2,840,461	2,901,942	402.0%	397.0%	2.2%	5.0%

13.2 Daily Traffic Volumes Compared to Counts

The coefficient of determination (R^2) is a useful measure to compare system-wide observed traffic counts with estimated volumes. The TN Guidelines suggest that the R^2 value be greater than 0.88 at the system level. The base year model has an R^2 value of 0.9, which is on target. Figure 13-1 is a scatter plot of observed and model-assigned volumes.

The current root mean square error (%RMSE) is 30.3%, which is well below the acceptable RMSE value of 45% suggested by the TN Guidelines.

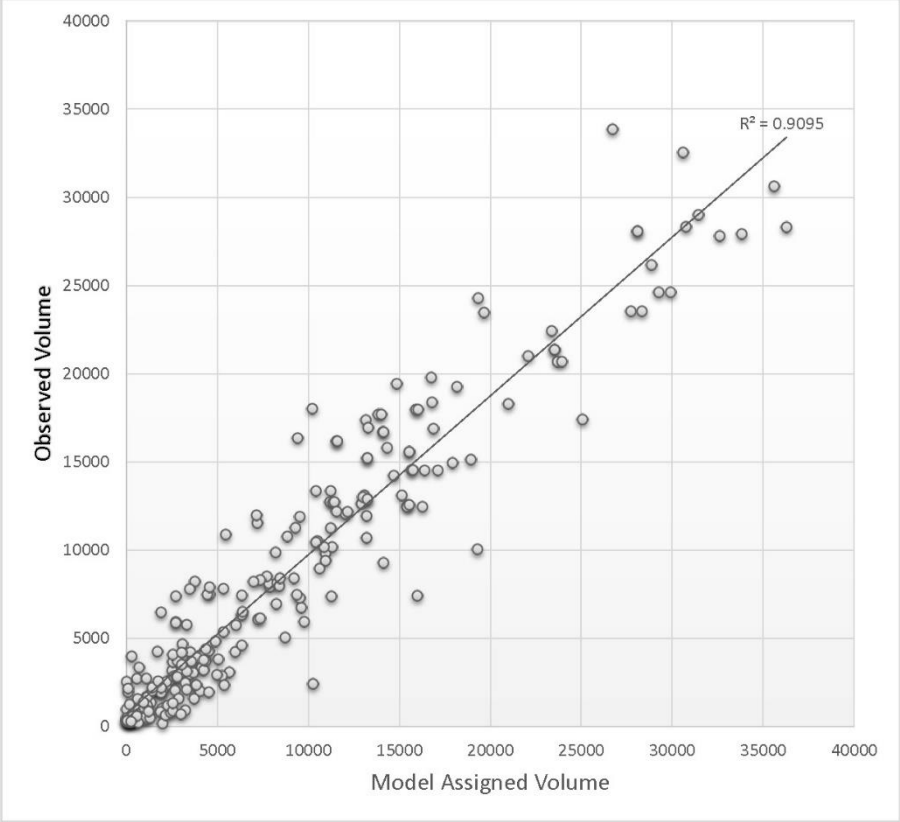


Figure 13-1 Scatter Plot of Model Assigned vs. Observed Link Traffic Volume

Table 13-5 compares the daily volumes with targets by functional classification. **Table 13-6** 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.

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 13-6 Percent Difference Volume Targets by Daily Volume Groupings

Volume Group	Volume Per Day		Number of Traffic Count Locations	% Difference	
	Observed (Traffic Counts)	Model Estimated		Model Compared to Observed	TN Guidelines (FHWA Targets)
<1,000	23,186	37,373	40	61%	200%
1,000-2,500	67,049	84,437	38	26%	100%
2,500-5,000	149,743	141,402	43	-6%	50%
5,000-10,000	282,011	285,315	38	1%	25%
10,000-25,000	630,553	602,520	44	-4%	20%
25,000-50,000	830,921	858,376	43	3%	15%
>50,000	56,158	56,158	2	0%	10%

Table 13-7 shows the %RMSE values by functional classification. All RMSE errors are below the target values provided by TN Guidelines.

Table 13-7 Root Mean Square Error (RMSE) by Functional Classification

Roadway Functional Classification	Number of Traffic Count Locations	% RMSE	
		Model Compared to Observed	TN Guidelines (Small Region)
Freeways	42	16.7%	20%
Principal Arterials	33	21.8%	30%
Minor Arterials	88	38.8%	40%
Collectors	85	60.6%	70%
Total	**248**	30.3%	**45%**

Table 13-8 shows the %RMSE values by volume groups. Both measures are below the target values provided by TN Guidelines in all categories.

Table 13-8 Root Mean Square Error (RMSE) by Volume Group

Volume Group	Number of Traffic Count Locations	% RMSE	
		Model Compared to Observed	TN Guidelines (Targets)
< 5000	121	68%	100%
5000 - 10000	38	38%	45%
10000 - 15000	23	26%	35%
15000 - 20000	13	25%	30%
20000 - 30000	28	17%	27%
30000 - 50000	23	17%	25%
50000 - 60000	2	0%	20%
> 60000	0	0%	19%
Total	248	30%	45%

13.3 Screen Line and Cut Line Volumes

As a part of the model calibration and validation process, six screen lines were developed for the Kingsport model to gauge how well the model replicates traffic between different areas within the MPO area. **Figure 13-2** shows the screen line locations.

Table 13-9 shows the percent errors at screen lines. All screen line and cut line fell within the desired targets.

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%

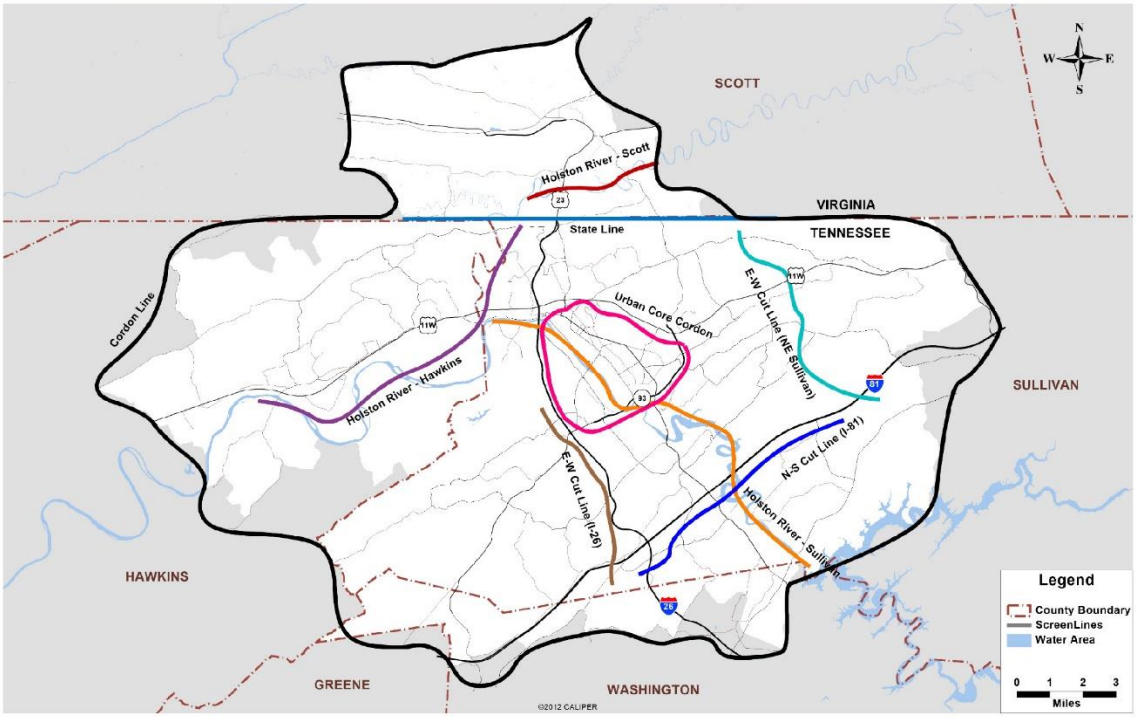


Figure 13-2 Screen Line Locations

13.4 Time-of-Day Period Measures

Table 13-10 compares the target counts with model assigned volumes for each time-of-day period. The daily total statistics reported here are different than the statistics reported in **Table 13-5** as only 83% of the traffic counts have time-of-day information. Overall, the % differences for all time-of-day periods are less than 5% compared with observed data. The time of day distribution from the model also closely matches the observed data. The results show that the model performs reasonably well in each time-of-day period at a system-wide level.

Table 13-10 Time-of-day Comparison

Time of Day Period	Volume (VPD)		Number of Traffic Count Locations	% Difference	Time-of-day Distribution	
	Observed (Traffic Counts)	Model Estimated			Observed (Traffic Counts)	Model Estimated
AM	220,212	223,331	205	1.4%	15.1%	15.1%
MD	525,112	531,032	205	1.1%	35.9%	35.9%
PM	351,596	359,995	205	2.4%	24.1%	24.4%
OP	364,667	363,014	205	-0.5%	25.0%	24.6%
Total (Time-of-day Counts only)	1,461,587	1,477,372	205	1.1%	100.0%	100.0%

Table 13-11 and **Table 13-12** show the percent of links within the range of count for AM and PM peak periods.

Table 13-10 Percent of Links within a Specified Percent of Count by Functional Classification - (AM Peak Period)

Roadway Functional Classification	Number of Traffic Count Locations	Error Range (+/-)	Percent Count within Range (AM)	TN Guidelines (Targets)
Freeway	8	20%	44%	75%
Freeway	8	10%	19%	50%
Major Arterial	28	30%	79%	75%
Major Arterial	28	15%	36%	50%
Minor Arterial	82	40%	65%	75%
Minor Arterial	82	20%	40%	50%

Table 13-11 Percent of Links within a Specified Percent of Count by Functional Classification - (PM Peak Period)

Roadway Functional Classification	Number of Traffic Count Locations	Error Range (+/-)	Percent Count within Range (PM)	TN Guidelines (Targets)
Freeway	8	20%	63%	75%
Freeway	8	10%	31%	50%
Major Arterial	28	30%	79%	75%
Major Arterial	28	15%	54%	50%
Minor Arterial	82	40%	71%	75%
Minor Arterial	82	20%	48%	50%

Table 13-11 and **Table 13-12** can be read as "75% of the freeway links need to be within 20% of counts, 50% of the freeway links need to be within 10% of counts". For freeways, only 4 count locations have time of day data available. Errors for major arterial roads are within the acceptable target. For minor arterial roads, both AM and PM peak periods are slightly out of range.

13.5 Truck Traffic Reasonableness Check

Table 13-13 and **Table 13-14** compare the model and observed SU and CU truck volumes respectively by functional classification. These measures were calculated using only the count locations where vehicle classification information is available. Region wide, total trucks are roughly within 20% of the error margin. Although large variances are observed by facility type, the results are reasonable for QRFM based truck models.

Table 13-12 Volume-to-Count Percent Difference by Functional Classification for SU Trucks

Roadway Functional Classification	Truck Volume (VPD)		Number of Traffic Count Locations	Difference	
	Observed (Traffic Counts)	Model Estimated		Value	%
Freeways	4,330	6,319	12	1,989	46.9%
Principal Arterials	3,814	4,771	12	957	25.1%
Minor Arterials	8,355	6,385	48	-1,970	-23.6%
Collectors	1,967	1,799	38	-168	-8.5%
Total	18,466	19,274	110	808	4.4%

Table 13-13 Volume-to-Count Percent Difference by Functional Classification for CU Trucks

Roadway Functional Classification	Truck Volume (VPD)		Number of Traffic Count Locations	Difference	
	Observed (Traffic Counts)	Model Estimated		Value	%
Freeways	16,382	17,956	12	1,574	9.6%
Principal Arterials	6,404	7,515	12	1,111	17.4%
Minor Arterials	7,503	6,388	48	-1,115	-14.9%
Collectors	2,359	1,918	38	-441	-18.7%
Total	32,648	33,777	110	1,129	3.5%

Technical Memorandum #3

KINGSPORT TRAVEL DEMAND MODEL UPDATE

FUTURE YEAR MODELS

Developed for

KINGSPORT METROPOLITAN TRANSPORTATION PLANNING ORGANIZATION

Developed by

Kimley»Horn

In association with:

RPM Transportation Consultants

September 26, 2016

TABLE OF CONTENTS

1.0 INTRODUCTION

RPM Transportation Consultants (RPM) and Kimley-Horn and Associates, Inc. (Kimley-Horn) are updating the Kingsport Travel Demand Model with a validated base year of 2015 for the Kingsport Metropolitan Transportation Planning Organization (MTPO). In March 2016, a study design was conducted as the first step of this model development effort. The effort was documented in **Technical Memorandum #1 – Study Design**. The study design document outlines the proposed model development approach at sub-task levels. Based on the approach outlined in the study design document, various components of the Kingsport Travel Demand Model were updated. **Technical Memorandum #2 – Base Year Model** described the development process and the validation results of the base year 2015 model.

The purpose of this memorandum is to document the development of the future year models. **Section 2** discusses the future year demographic and employment data forecasts. **Section 3** presents the future year model data and model structure for horizon year 2040 and interim year 2025. **Section 4** shows the highway assignment results for the scenario with 2040 land use data and the Existing and Committed (E+C) network.

2.0 DEMOGRAPHIC AND EMPLOYMENT FORECASTS FOR FUTURE YEARS

Future year data is the foundation upon which any successful travel demand forecasts are modeled. This section describes the process for allocating population and employment growth for model interim year 2025 and horizon year 2040.

2.1 Demographic Data

The same forecasting methodology and allocation processes used for the base year 2015 are applied for the horizon year of 2040. Given the unique multi-county and bi-state structure of the Kingsport MTPO, the process for allocating base year population to the traffic analysis zones (TAZs) within the MTPO area differed between the three counties located in Tennessee (Hawkins, Sullivan, and Washington counties) and the single county in Virginia (Scott County). The Woods & Poole Data was used as county-level control totals for population within all four counties, as shown in **Table 2-1**.

Table 2-1 County Level Population Control Totals

Counties	Year 2015	Year 2025	Year 2040
Hawkins	57,811	63,524	71,800
Scott	22,617	22,637	22,243
Sullivan	157,366	162,260	166,706
Washington	128,307	143,918	167,766
Total	**366,101**	**392,339**	**428,515**

The process for determining the portion of each county's population that lies within the MTPO area for Tennessee counties began with an analysis of 2010 US Census data. Using this data at the block geography as well as Woods & Poole county-level estimates, the percentage of each county's population within the MTPO area was determined. Those proportions were held constant for each Tennessee county, and it was assumed that in future years, the same percentage of each county's population resided in the MTPO area as in 2010. The 2015 and future year population for each county in the MTPO area was then calculated using the Woods & Poole county population and those percentages. The results are shown in **Table 2-2**.

Table 2-2 County Population Within the MTPO Area

Counties	Year 2010	Year 2015	Year 2025	Year 2040
Hawkins	23,248	23,632	27,315	30,874
Scott	8,300	8,446	9,136	10,253
Sullivan	90,993	91,289	95,733	98,357
Washington	8,501	8,845	10,794	12,582
Total	**131,042**	**132,212**	**142,978**	**152,066**

For Scott County, data from the 2000 and 2010 US Census was used in the analysis. Within this 10-year time period, the portion of Scott County that lies within the MTPO area grew by approximately 0.79% each year. However, Woods & Poole county-level estimates show that Scott County as a whole decreased in population by an average of 0.45% each year. As such, based on the different levels of growth and decline shown between the two datasets, the difference between the two average annual growth rates, 0.35%, was used to determine the Scott County population in the MTPO area. This growth rate was applied to the 2010 US Census population for areas within the MTPO area to determine the portion of Scott County's 2015 and future year population within the MTPO area.

For future horizon years (2025 and 2040), population growth was sub-allocated based on stakeholder input received on February 9, 2016, as well as an examination of growth between 2000 to 2010 growth (by Census Block Group for the complete MTPO area). In addition to these variables, land availability and suitability were considered (looking at currently zoned residential, commercial, industrial and agricultural lands as well as lands classified as vacant by TAZ). Each of these factors were balanced to the control totals for population (for each county and each horizon year – 2025 and 2040).

Using the household control totals at the TAZ level, the cross-classification distribution from the base year was applied at the TAZ level to obtain the number of households in each cross-classification bin for each future year. The base year demographic cross-classification distribution is from the Census Transportation Planning Package 2010 (CTPP 2010) data set. The number of households were cross-classified to the following three categories:

- Household Size (number of persons) by vehicle ownership (number of vehicles owned per household),
- Household Size by number of children (age < 18) in household, and
- Number of workers in household by vehicle ownership.

Table 2-3 shows the forecasts of the total number of households for each future year and the percent growth from the base year of 2015.

Table 2-3 Future Year Population and Total Number of Households

Year	Population	No. of Households	% Growth (from 2015)
2015	132,210	62,415	-
2025	140,154	66,117	5.9%
2040	151,983	71,587	14.7%

Figure 2-1 shows the year 2040 household density in units of number of households (HH) per acre. **Figure 2-2** shows the percent growth and the total number of households from the model base year 2015 to horizon year 2040 for the 23 planning districts.

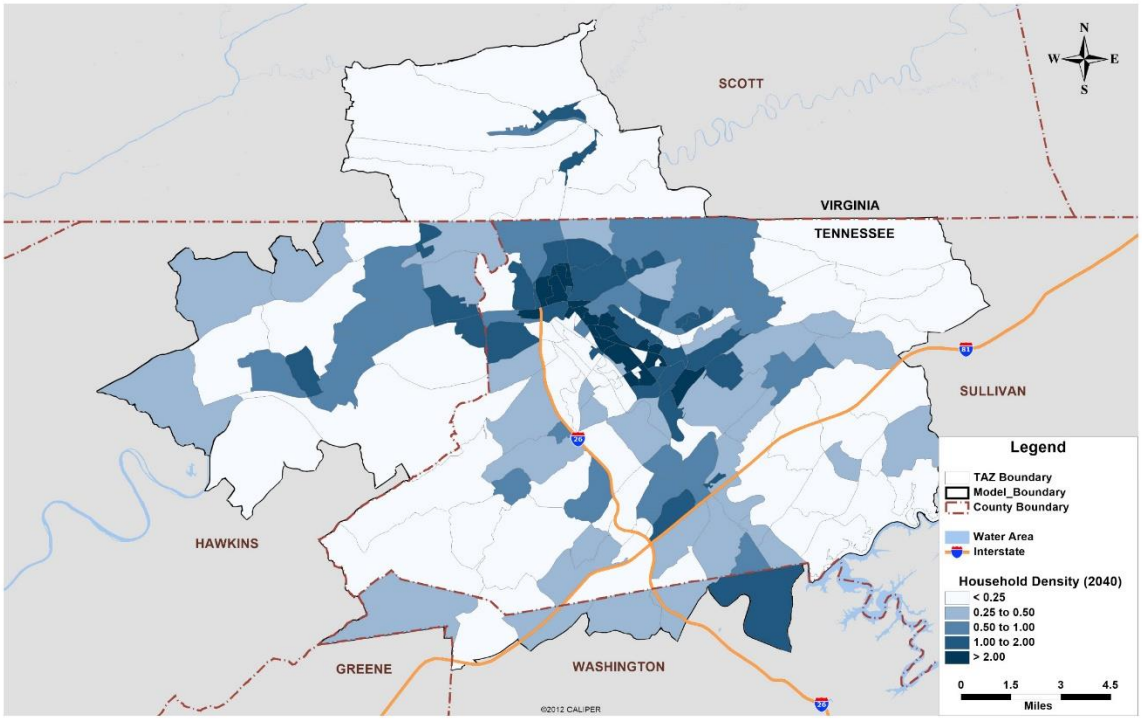


Figure 2-1 2040 Household Density (HH Per Acre)

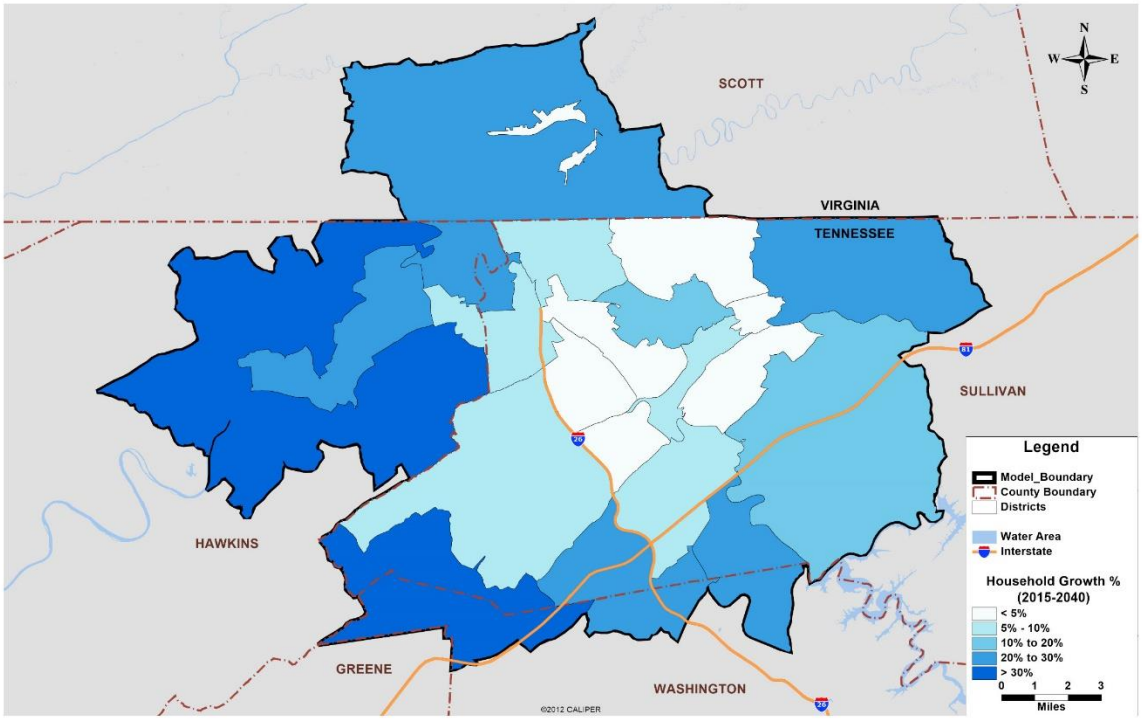


Figure 2-2 2040 Household Growth by Planning Districts

2.2 Employment Data

Based on the 2015 employment, county-specific growth rates established from the Woods & Poole data were used to project employment within the MTPO area. Additionally, Woods & Poole data was used to determine the relative share of employment by employment classification for future years. For future horizon years (2025 and 2040), employment growth was sub-allocated based on stakeholder input received on February 9, 2016, as well as an examination of growth between 2000 to 2010 growth. In addition to these variables, land availability and suitability were considered by looking at currently zoned residential, commercial, industrial and agricultural lands as well as lands classified as vacant by TAZ. Each of these factors were balanced to the control totals for employment for each county as well as for each job classification – agricultural, manufacturing, retail, office, service, and government employment – and by horizon year 2025 and 2040.

Table 2-5 summarizes the forecasts of the total employment for each future year and the percent growth from the base year of 2015.

Table 2-5 Future Year Total Employment

Year	Total Employment	% Growth (from 2015)
2015	54,580	-
2025	60,185	10.3%
2040	68,590	25.7%

Figure 2-3 shows the employment density in total employment per acre by TAZ for year 2040. **Figure 2-4** shows the percent growth in total employment from the model base year 2015 to horizon year 2040 for the 23 planning districts.

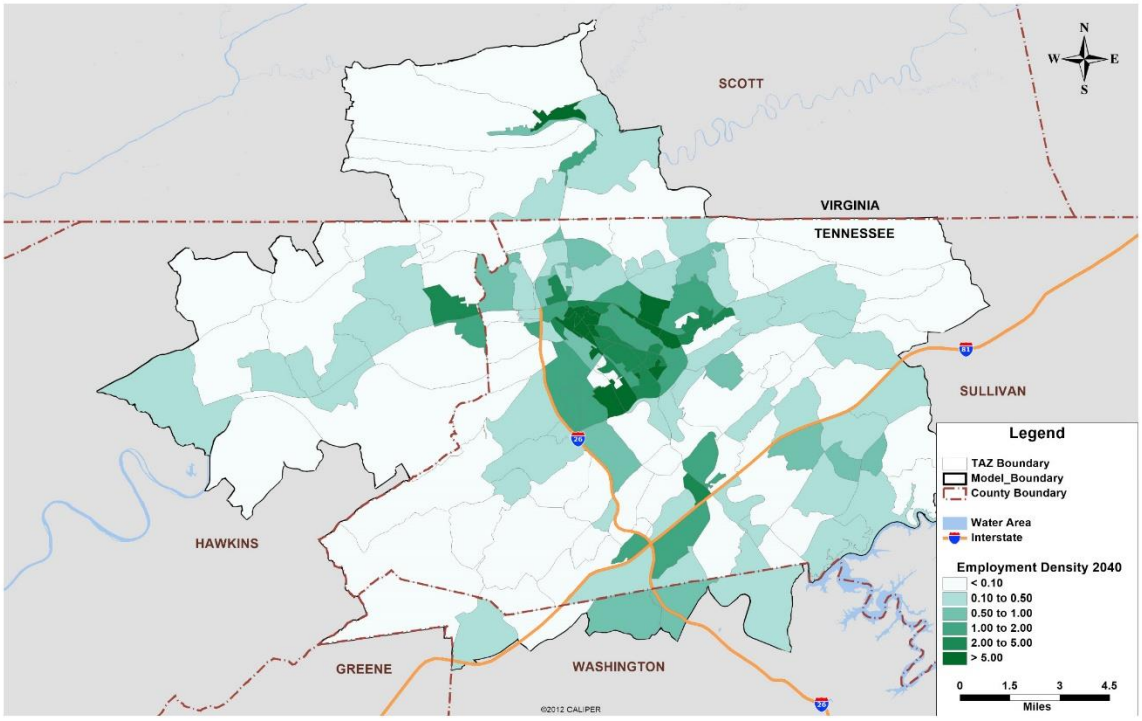


Figure 2-3 2040 Employment Density (Employment Per Acre)

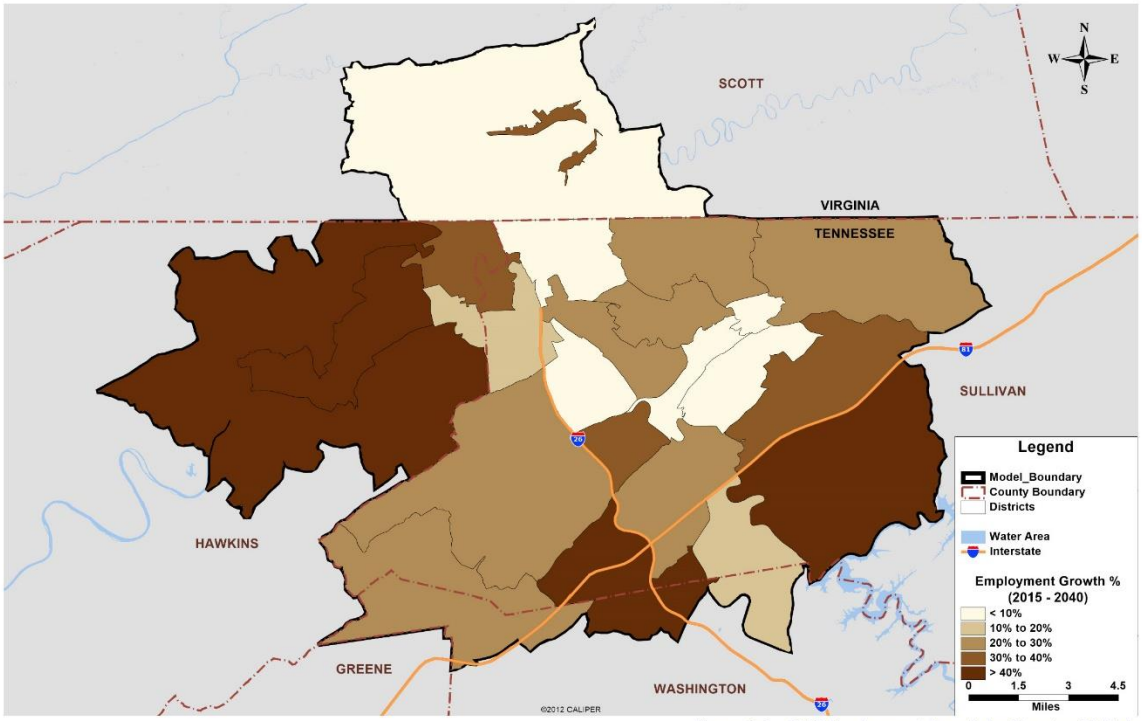


Figure 2-4 2040 Employment Growth by Planning Districts

2.3 School and College Enrollment

School and college enrollment forecasts are based on current per capita measures in each TAZ, and increased according to projected population growth. When possible, projected growth rates provided by individual school districts have been considered in the forecasted student and college enrollments. **Table 2-3** summarizes the forecasts of the school enrollment for each future year and the percent growth from the base year of 2015.

Table 2-3 Future Year School Enrollment

Year	K-12 School Enrollment	K-12 School % Growth (from 2015)	College Enrollment	College % Growth (from 2015)
2015	18,714	-	10,300	-
2025	19,281	3.0%	10,815	5.0%
2040	20,130	7.6%	11,588	12.5%

3.0 EXTERNAL TRIP FORECASTS

While internal trips are estimated by the model based on trip rates and the forecasted housing and employment, external trips must be forecasted manually. External trips are treated as model input. All growth rates developed for external stations are exponential growth rates. The following information was developed and used for forecasting external station trips.

- Annual growth rates at external stations from the Tennessee Statewide Model
- Annual growth rates based on historic traffic counts from 1995 to 2015 collected from TDOT and VDOT
- Average historic growth rates at external stations by roadway functional classification.

If historic counts at an external station were available, two annual growth rates were calculated: 1995-2015 representing a long-term trend, and 2005-2015 representing a shorter-term trend. The two growth rates were averaged, and the growth rates by functional classification were calculated. A 0.5% growth rate was used for low volume collector and local roads without sufficient historic data. In addition, if links are modeled in the Tennessee Statewide Model, annual growth rates were calculated and referenced when determining the growth rate. **Table 3-1** lists the forecasted future year Average Daily Traffic (ADT) at external stations.

The number of future year vehicle trips at each external station was set equal to the forecasted ADT at the station. The external trips were applied in the model using the same methodology described in **Technical Memorandum #2 – Base Year Model**. The following input data in the base year model were assumed to hold true for future years:

- Vehicle classification splits (Auto, SU truck, and CU truck)
- EE/EI splits
- Time-of-day splits
- In-bound and out-bound splits
- K-factors used for the EE gravity models.

Table 3-1 Future Year External Station ADTs

ID	Name	State	Func. Class	2015 ADT	Growth Rate	2025 ADT	2040 ADT
501	Caney Valley Road	TN	8	345	0.50%	363	391
502	Carters Valley Road	TN	8	1,189	0.97%	1,309	1,514
503	Highway11W	TN	14	11,249	1.68%	13,288	17,061
504	Millers Bluff Road	TN	8	720	0.50%	757	816
505	Goshen Valley Road	TN	8	278	0.50%	292	315
506	Beech Creek Road	TN	7	312	0.50%	328	353
507	Horton Highway	TN	8	677	0.50%	712	767
508	I-81	TN	1	26,170	0.99%	28,879	33,478
509	Jearoldstown Road	TN	8	1,000	0.50%	1,051	1,133
510	Highway 93	TN	6	3,526	1.63%	4,145	5,282
511	Fordtown Road	TN	6	893	0.50%	939	1,012
512	Harmony Road	TN	8	2,000	0.50%	2,102	2,266
513	Ford Creek Road	TN	17	500	0.50%	526	566
514	Gray Station Road	TN	17	3,000	0.50%	3,153	3,398
515	Suncrest Drive	TN	16	12,167	1.81%	14,558	19,052
516	I-26	TN	11	56,158	0.70%	60,215	66,857
517	Old Gray Station Road	TN	17	4,380	3.00%	5,886	9,171
518	Kingsport Highway	TN	14	12,049	2.00%	14,688	19,768
519	Muddy Creek Road	TN	9	2,024	0.93%	2,220	2,551
520	Highway 75	TN	6	5,350	1.65%	6,301	8,054
521	Highway 126	TN	6	3,326	0.52%	3,503	3,786
522	Highway 394	TN	2	16,882	1.34%	19,286	23,548
523	I-81	TN	1	31,126	0.57%	32,946	35,879
524	Highway 11W	TN	2	10,509	0.92%	11,517	13,213
525	Esterville Rd	VA	19	30	0.50%	32	34
526	East Carter's Valley Rd	VA	9	360	0.50%	378	408
527	Kingsport Highway	VA	2	2,800	0.75%	3,017	3,375
528	Nicklesville Highway	VA	16	3,900	0.75%	4,203	4,701
529	Veteran's Memorial Highway	VA	6	1,900	0.50%	1,997	2,152
530	Manville Road	VA	8	250	0.50%	263	283
531	Daniel Boone Heritage Highway	VA	2	13,000	0.24%	13,315	13,803
532	Daniel Boone Trail	VA	7	380	0.50%	399	430
533	Yoma Road	VA	8	580	0.50%	610	657
534	State Route 635	VA	9	80	0.50%	84	91
535	State Route 632	VA	9	220	0.50%	231	249

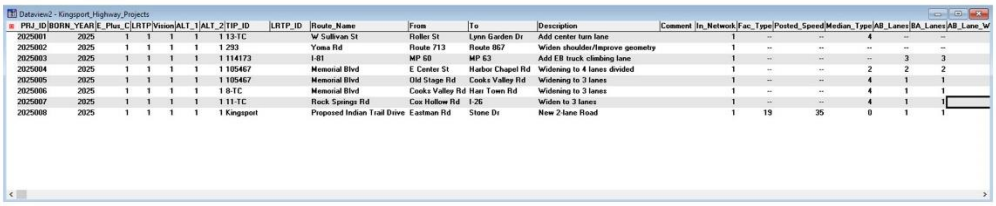
4.0 FUTURE YEAR HIGHWAY NETWORK DEVELOPMENT

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

4.1 Master Network and Project Table Methodology

In the Kingsport model, a single master network is used for the base year and all future year models. In TransCAD, the line layer is not the actual model network used by the travel demand modeling system. Rather, the model network is built from the line layer. This means the model network is developed as a selection set from the line layer. Having a selection set means that highway, transit, and walk networks can use a different subset of the entire street network system. An attribute named "In Network" in the line layer is used to identify the links to be included in the model's highway network building process.

All future year highway projects were stored in a project table. **Figure 4-1** shows a screen shot of the project table with the existing plus committed projects and their attributes. For facilities on new location, links were developed for future year roads and added to the master network database as new links. Attributes for the new facilities in the future year were added to the project table. For widening projects, the number of lanes and other improvements such as signalization will be identified in the project table. Similarly, other types of projects such as changing speed limit, changing functional classification, and adding or removing on-street parking can be modeled using this approach.



Dataview2 - Kingsport_Highway_Projects

PRJ_ID	BORN_YEAR	E_Plus_C	LRTP	Vision	ALT_1	ALT_2	TIP_ID	LRTP_ID	Route_Name	From	To	Description	Comment	In_Network	Fac_Type	Posted_Speed	Median_Type	AB_Lanes	BA_Lanes	AB_Lane_W
2025001	2025	1	1	1	1	1	13-TC		W Sullivan St	Roller St	Lynn Garden Dr	Add center turn lane		1	--	--	4	--	--	
2025002	2025	1	1	1	1	1	293		Yoma Rd	Route 713	Route 867	Widen shoulder/Improve geometry		1	--	--	--	--	--	
2025003	2025	1	1	1	1	1	114173		I-81	MP 60	MP 63	Add EB truck climbing lane		1	--	--	--	3	3	
2025004	2025	1	1	1	1	1	105467		Memorial Blvd	E Center St	Harbor Chapel Rd	Widening to 4 lanes divided		1	--	--	2	2	2	
2025005	2025	1	1	1	1	1	105467		Memorial Blvd	Old Stage Rd	Cooks Valley Rd	Widening to 3 lanes		1	--	--	4	1	1	
2025006	2025	1	1	1	1	1	8-TC		Memorial Blvd	Cooks Valley Rd	Harr Town Rd	Widening to 3 lanes		1	--	--	4	1	1	
2025007	2025	1	1	1	1	1	11-TC		Rock Springs Rd	Cox Hollow Rd	I-26	Widen to 3 lanes		1	--	--	4	1	1	
2025008	2025	1	1	1	1	1	Kingsport		Proposed Indian Trail Drive	Eastman Rd	Stone Dr	New 2-lane Road		1	19	35	0	1	1	

Figure 4-1 Project Table

The project table also identifies the years and scenarios in which the project is expected to be built. During the model initialization step, based on the analysis year and network alternative selected in the current scenario, the model will go through the projects in the project table and only incorporate the active projects based on their born year and associated network alternatives.

This methodology allows a single database to handle all potential projects in the highway network in a compact format. One project can be easily included in multiple scenarios, and can be switched on and off with a simple click. It significantly reduces model maintenance burden and potential errors or inconsistencies for project coding.

To facilitate project coding, a "Future Year Project" toolbox was developed for the Kingsport model. **Figure 4-2** shows the project editor interface of this tool. The benefits of using this toolbox to code the project include querying links to see all the associated projects, modifying or deleting a project, and adding a new project with intuitive workflow. Details on how to use the "Future Year Project" toolbox will be provided in the Model User's Manual.

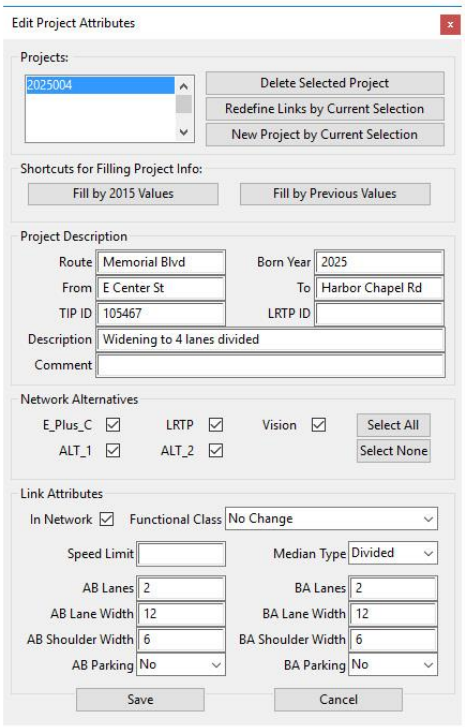


Figure 4-2 Project Editing Tool Box

4.2 Existing Plus Committed Network

The Existing Plus Committed (E+C) highway network was developed using the master network and project table methodology described above. The E+C network alternative includes the improvements that were completed between 2015 and 2016, and projects that are to be completed by 2025. **Table 4-1** shows the projects included in the E+C network alternative.

Table 4-1 Existing and Committed Projects

ID	Location	Name	From	To	Description
1	Scott Co.	Moccasin Gap Bypass	Intersection of SR-224, US-23, & US-58 (RTE 58)		Modify intersection to accommodate the Moccasin Gap Bypass
2	Sullivan Co.	State Route 75	State Route 36	State Route 357	Widen from 2 lanes to 5 lanes
3	Sullivan Co.	Gibson Mill	Gibson St	Watauga St	Widen from 2 to 3 lanes
4	Sullivan Co.	West Sullivan Street	Church Circle Drive	Roller Lane	Widen from 2 to 3 lanes
5	Sullivan Co.	West Sullivan Street	Roller Lane	Lynn Garden Drive	Widen from 2 to 3 lanes
6	Scott Co.	Route 614 (Yuma Road)	Route 713	Route 867	Widen shoulders and straighten curves
7	Sullivan Co.	I-81	Mile post 60	Exit 63 interchange	Add one eastbound truck climbing lane
8	Sullivan Co.	State Route 126 (Memorial Blvd)	East Center Street	Harbor Chapel Road	Widen from 2/4 lanes to 4-lane divided
9	Sullivan Co.	State Route 126 (Memorial Blvd)	Old Stage Road	Cooks Valley Road	Widen from 2 to 3 lanes
10	Sullivan Co.	State Route 126 (Memorial Blvd)	Cooks Valley Road	Harr Town Road	Widen from 2 to 3 lanes
11	Sullivan Co.	Rock Springs Rd	I-26	Cox Hollow Road	Widen from 2 to 3 lanes
12	Sullivan Co.	Indian Trail Drive	Reedy Creek Road	Stone Drive	New 2-lane road

5.0 YEAR 2040 E+C MODEL RESULTS

A full model run was conducted using the future year 2040 demographic and employment forecasts and the E+C network alternative. This section summarizes the highway assignment results from the 2040 E+C scenario.

For highway assignment results, the 2040 Vehicle Miles of Travel (VMT) are summarized by roadway functional classification and districts, and compared with the base year 2015 results. Model predicted traffic volumes crossing screen lines and cut lines are compared with the base year 2015 results.

VMT Region Wide

Table 5-1 shows a comparison of the base year 2015 and 2040 average VMT per capita and per household estimated by the model. **Table 5-2** compares the 2040 VMTs by functional classification with 2015. The 2040 model predicted VMT per capita of 32.5 and VMT per household of 69.1. Overall, the regional VMT increased by 20.2% from 2015 to 2040.

Table 5-1 2040 VMT per Person and Household

	2015 Model	2040 Model
VMT per Person	31.1	32.5
VMT per Household	65.9	69.1

Table 5-2 2040 Model Predicted VMT Compared with 2015 by Functional Classification

Roadway Functional Classification	Model Estimated VMT		% Difference	VMT Distribution	
	2015	2040		2015	2040
Freeways	1,286,759	1,503,441	16.8%	36.8%	35.7%
Principal Arterials	1,124,005	1,366,270	21.6%	32.1%	32.5%
Minor Arterials	828,757	994,247	20.0%	23.7%	23.6%
Collectors	259,674	342,320	31.8%	7.4%	8.1%
Total	**3,499,195**	**4,206,277**	**20.2%**	**100.0%**	**100.0%**

VMT by Districts

Table 5-3 shows a summary of the year 2040 model VMT at a district level using the 23 planning districts defined in the model validation process.

Estimated Traffic at Screen Lines/Cut Lines

Table 5-4 shows the year 2040 predicted traffic volumes at the screen lines and cut lines. The location of the screen and cut lines is shown in **Figure 5-1**.

Table 5-3 District VMT Results Comparison

District Name	VMT		% Difference
	2015	2040	
Gate City / Weber City	109,060	118,069	8.3%
Scott County Remainder	168,596	188,709	11.9%
Mount Carmel / Church Hill	152,050	191,041	25.6%
Hawkins County Remainder	94,139	129,063	37.1%
Granby / North Fork / County Line	56,366	70,055	24.3%
Ridgefields / Rotherwood / Ft. Robinson Area	166,964	197,318	18.2%
Lynn Garden	128,970	147,022	14.0%
Downtown	213,350	238,860	12.0%
East Stone Drive	185,263	212,852	14.9%
Bloomingdale	84,411	98,871	17.1%
Orebank	31,039	38,899	25.3%
Arcadia / Central Heights	206,276	280,489	36.0%
Preston Forest	101,906	110,970	8.9%
Chestnut Ridge / Cooks Valley	49,211	54,950	11.7%
Fall Creek Indian Springs / Interstate 81	117,133	130,494	11.4%
Tri-Cities Airport / Interstate 81	157,004	193,245	23.1%
Fordtown / Spurgeon / Washington County	102,880	139,281	35.4%
Colonial Heights	271,493	329,363	21.3%
Rock Springs / Interstate 81 / Washington Co.	296,006	369,952	25.0%
Pactolus / Moreland Dr.	76,886	88,675	15.3%
Fall Branch and Vicinity	93,954	122,513	30.4%
Sullivin Gardens / North Rock Springs	171,188	191,895	12.1%
Eastman / Meadowview	146,192	167,139	14.3%

Table 5-4 Estimated Traffic Volume at Screen Lines / Cut Lines

Screen Line / Cut Line Name	Model Predicted Volume Per Day		% Difference
	2015	2040	
State Line	36,314	40,154	10.6%
Holston River - Scott	29,522	30,877	4.6%
Holston River - Hawkins	56,175	68,988	22.8%
Holston River - Sullivan	134,327	154,621	15.1%
Urban Core Cordon	212,626	233,872	10.0%
E-W Cut Line (I-26)	62,923	72,668	15.5%
N-S Cut Line (I-81)	91,200	109,948	20.6%
E-W Cut Line (NE Sullivan)	68,803	83,536	21.4%
Cordon Line	229,331	296,415	29.3%

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

The level of service (LOS) for roadways was developed based on the 2040 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 $\geq$ 1.0
- LOS E: 0.85 $\leq$ V/C Ratio < 1.0
- LOS D: 0.7 $\leq$ V/C Ratio < 0.85
- LOS C or Better: V/C Ratio < 0.7

For comparison purposes, the LOS map based on the 2015 base year model is shown in **Figure 5-2**. **Figure 5-3** shows the level of service based on the 2040 E+C model run.

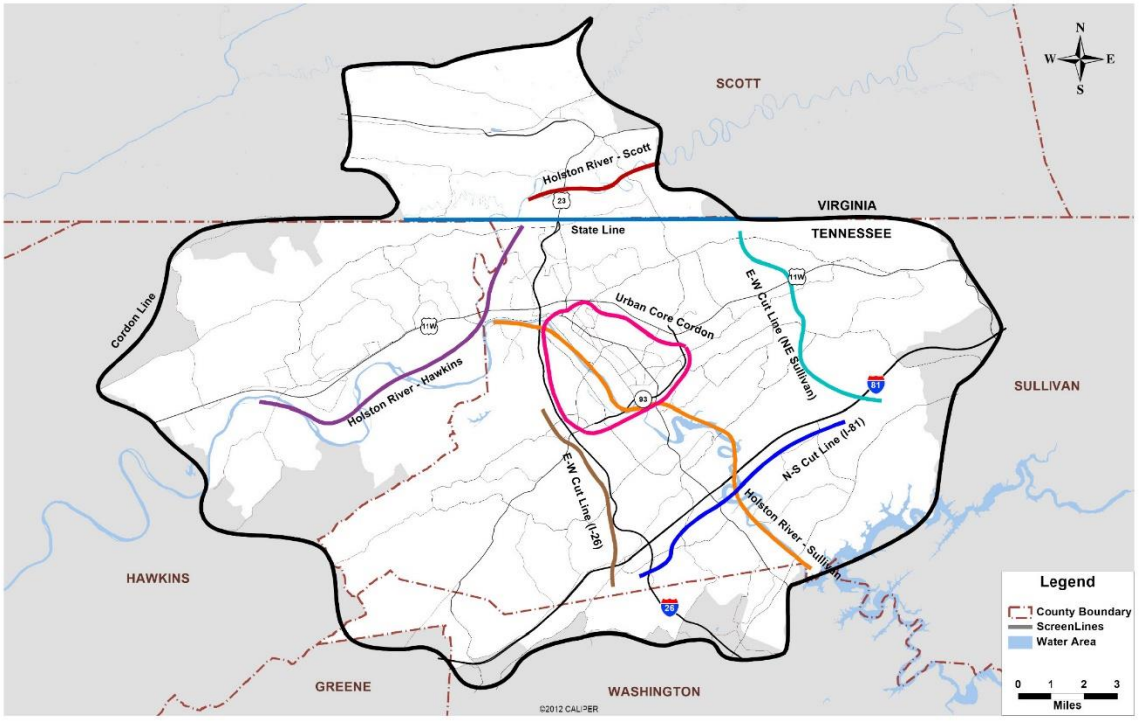


Figure 5-1 Screen Line / Cut Line Locations

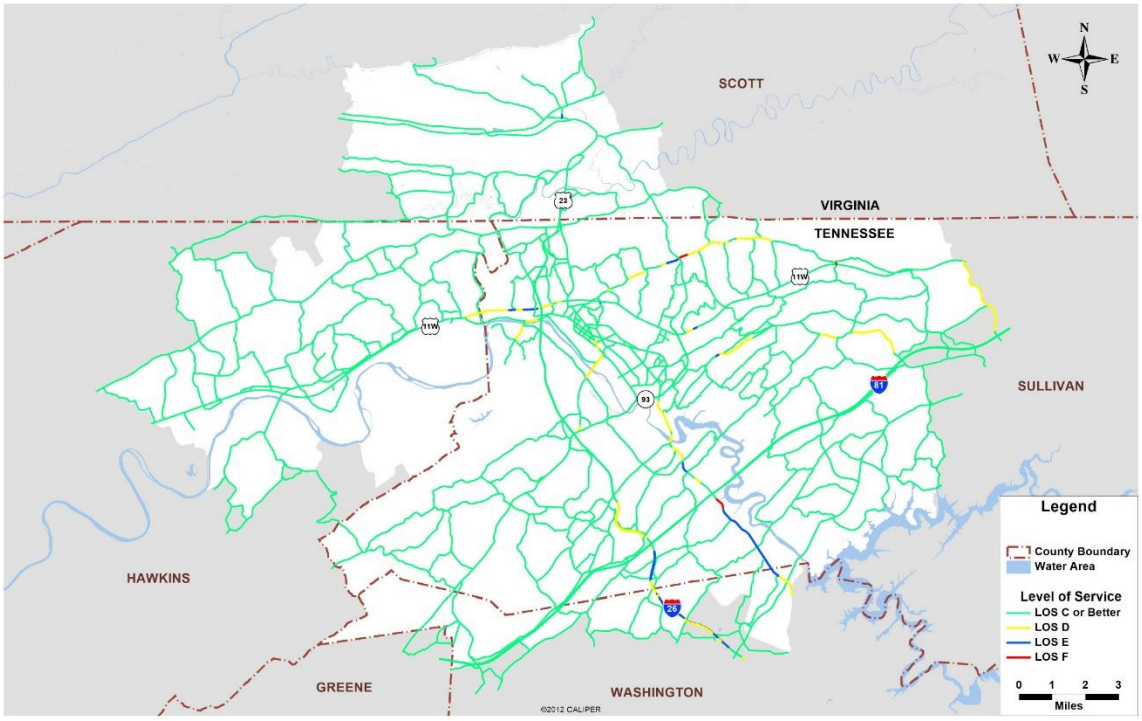


Figure 5-2 2015 Highway Network Level of Service

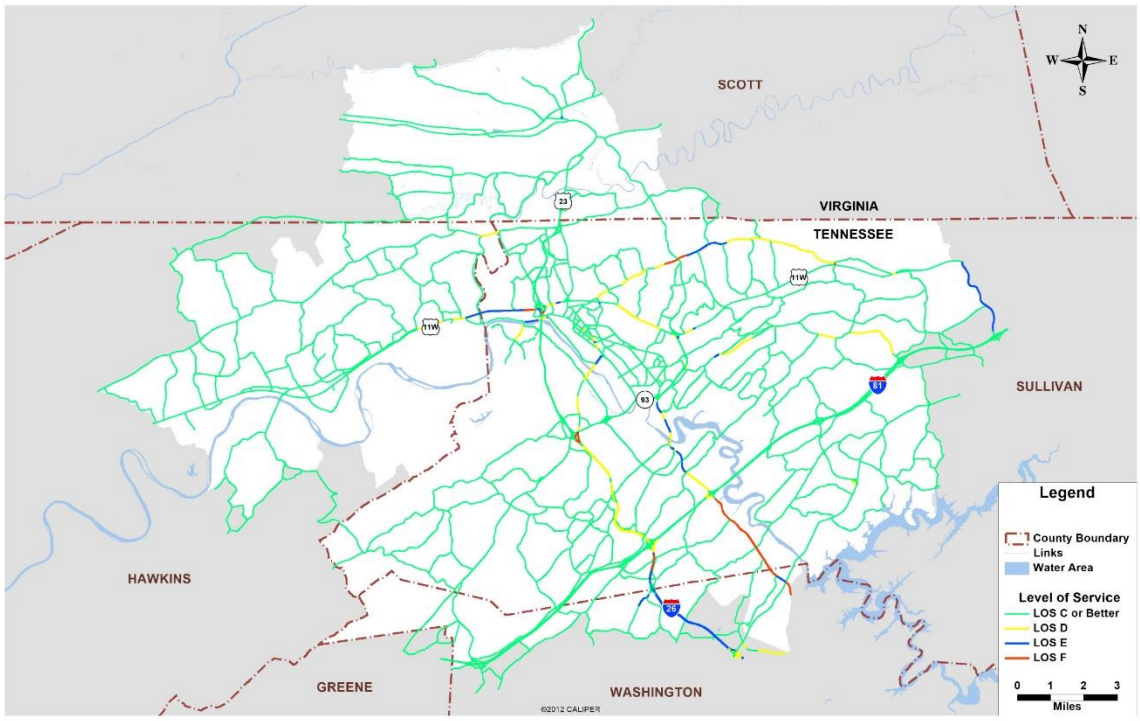


Figure 5-3 2040 Highway Network Level of Service

APPENDIX II

Scored Candidate Projects Considered in the 2040 LRTP (Horizon Years 2025, 2040, & Vision Plan)

ID	ROUTE	FROM ROAD	TO ROAD	DESCRIPTION	In Model	Total Project Score	Safety	Efficiency	Accessibility	Active Transportation	Environmental	Economic	Horizon Year
L54	Clinchfield Street	Main Street	Stone Drive (US-11)	Coordinate signal system to improve traffic flow		**71**	18	10	4	15	6	18	2025
L62	Stone Drive (US-1)	Gibson Mill Road	Deneen Lane	Coordinate signal system		**69**	18	13	4	12	10	12	2025
L22	Stone Drive (US-11)	John B. Dennis (SR-93)	Cleek Road	Improve intersections and coordinate signal timings		**65**	12	18	4	6	9	16	2025
L12	Fort Henry Drive (SR-36)	Moreland Dr/ Hemlock Rd	Interstate 81	Improve intersections, coordinate signal timings, and evaluate driveway cuts		**61**	15	15	2	6	9	14	2025
L20	Stone Dr West (US-11)	Kaywood Ave (City of Mt Carmel)	Granby Rd	Install signal system with advanced warning signals to improve safety at intersections		**57**	13	13	5	6	1	19	2025
L53	Bloomingdale Pike	John B. Dennis (SR-93)	Packinghouse Road	Improve shoulders and geometry with spot safety improvements		**54**	13	9	2	13	5	12	2025
L1	Fort Henry Drive (SR-36) *(Improve Act)*	Interstate 81 (I-81)	Airport Road (SR-75)	Widen existing 2 lane road to 4 lanes to match Washington County portion	X	**54**	14	13	5	6	4	12	Improve
L36	Fort Henry Drive (SR-36)	Moreland Drive	Interstate 81	Frontage road to improve traffic along Fort Henry Drive		**54**	15	12	3	6	4	14	Illustrative
L35	East Sullivan Street	Church Circle	Main Street	Widen to 2/3 lanes with multimodal and aesthetic improvements	X	**53**	14	11	3	12	1	12	2025
L33	BAE Frontage Road	Old Armory	Hammond Avenue	Develop in conjunction with economic development along Netherland Inn Road		**53**	12	13	5	3	4	16	Illustrative
L70	Interstate 81 *(Improve Act)*	Interstate 26 Interchange (Exit 57)	Virginia State Line	ITS expansion		**53**	12	15	4	2	6	14	Improve
L11	Fort Henry Drive (SR-36)	John B Dennis (SR-93)	Moreland Dr/ Hemlock Rd	Improve intersections and coordinate signal timings; install median where non-existent		**52**	14	14	2	3	9	10	2025
L15	Carters Valley Rd East (VA SR-704)	Lynn Garden Dr (SR-36)	Wadlow Gap Rd (SR-224)	Improve shoulders and geometry with spot safety improvements		**49**	12	8	3	9	5	12	2025
L47	Stone Drive (US-11)	John B. Dennis (SR-93)	New Beasonwell Road	Widen from 4/5 to 6 lanes	X	**49**	12	13	4	6	4	10	2040
L17	Tranbarger Dr	Lynn Garden Dr (SR-36)	Virgil Ave	Improve shoulders and geometry with spot safety improvements with additional safety improvements		**48**	14	6	3	13	5	7	2025

ID	ROUTE	FROM ROAD	TO ROAD	DESCRIPTION	In Model	Total Project Score	Safety	Efficiency	Accessibility	Active Transportation	Environmental	Economic	Horizon Year
L65	Interstate 26	John B. Dennis (SR-93)	I-26 Exit 6 (SR 347 Rock Springs Road)	Add eastbound truck climbing lane	X	**48**	12	13	4	1	4	14	2025
L30	Fall Creek Road	Colonial Heights Road	Memorial Blvd (SR-126)	Improve shoulders and geometry with spot safety improvements		**47**	10	11	3	6	1	16	2040
L60	Lincoln Street	John B. Dennis (SR-93)	Wilcox Drive (SR-126)	Coordinate signal system		**47**	5	12	3	8	9	10	2025
L25	Stone Drive (US-11)	Hammond Ave	East Avenue	Widen from 4 to 6 lanes	X	**46**	4	13	5	4	5	15	Illustrative
L51	Wilcox Drive (SR-126)	John B. Dennis (SR-93)	Industry Drive	Replace center turn lane with raised landscaped median, providing left turn lanes where needed	X	**46**	13	10	3	9	3	8	2040
L31	Hemlock Road	Fort Henry Drive (SR-36)	Fall Creek Road	Improve shoulders and geometry with spot safety improvements, add multiuse path on north side of roadway to link to park		**45**	14	11	2	6	4	8	2040
L10	Bloomingdale Pike	Stone Drive West (US-11)	Orbin Drive	Widen from 2 to 3 lanes to include center turn lane with paved shoulders and other safety and geometric spot safety improvements	X	**44**	17	3	3	8	5	8	2040
L58	John B. Dennis (SR 93)	Stone Drive (US-11)	Bloomingdale Pike	Implement access management		**43**	12	3	4	4	10	10	2025
P1	Center Street	Sullivan Street	Fairview Avenue	Reconfigure turning movements with roundabout		**43**	4	8	3	10	10	8	2040
L49	West Sullivan Street	Roller Street	Lynn Garden Drive	Widen from 2 to 3 lanes	X	**43**	6	5	3	12	4	13	2025
L50	Sullivan Garden Parkway (SR 93)	Lonestar Road	Derby Drive	Widen from 2 to 4 lanes	X	**43**	8	12	2	6	4	11	Illustrative
L32	Cherokee Street Viaduct	MLK Extension	Main Street	Construct vehicular and non-motorized bridge over railroad tracks	X	**42**	3	2	6	10	5	16	2040
P22	Stone Drive (US11) *(Improve Act)*	Bridge over North Fork Holston River		Bridge replacement/rehabilitation		**42**	6	13	3	6	4	10	Improve
L24	Interstate 81	Fort Henry Drive (SR-36)	Tri-Cities Crossing (MM 56)	Widen from 4 to 6 lanes	X	**41**	4	13	4	2	4	14	Illustrative
L63	Wadlow Gap Road (SR-224)	Near North Fork Holston River		Straighten horizontal curves near North Fork Holston River bridge		**41**	4	3	3	11	10	10	2025
L43	Jared Drive	Sluice Bridge	Wilcox Drive (SR-126)	New 2-lane roadway linking Moreland Drive and Wilcox Drive at Jan Way	X	**41**	5	11	6	4	3	12	2025

ID	ROUTE	FROM ROAD	TO ROAD	DESCRIPTION	In Model	Total Project Score	Safety	Efficiency	Accessibility	Active Transportation	Environmental	Economic	Horizon Year
P21	Stone Drive (US-11) *(Improve Act)*	Bridge over North Fork Holston River		Bridge replacement/rehabilitation		**41**	6	13	3	6	3	10	Improve
L14	Gravely Road	Lynn Garden Drive (SR-36)	Shipps Spring Road	Improve shoulders and geometry with spot safety improvements		**40**	6	3	3	15	5	8	2025
L4	Eastern Star Road	Mitchell Rd	Fordtown Road	Widen from 2 to 3 lanes as economic development occurs	**X**	**40**	6	8	3	6	5	12	2040
L56	Fort Henry Drive (SR-36)	Lebanon Road	Wendover Drive	Improve vertical geometry		**40**	14	10	2	1	5	8	Illustrative
L66	Stone Drive (US-11)	Deneen Lane	East Avenue	Widen from 4 to 6 lanes	**X**	**40**	6	13	4	4	3	10	Illustrative
L21	May Ave	Bell Ridge Drive	Lynn Garden	Improve shoulders and geometry with spot safety improvements		**39**	8	6	2	12	5	6	2025
L52	Airport Parkway (SR 357)	Interstate 81	Airport Road (SR 75)	Improve median breaks and add left turn lanes at various intersections		**39**	8	8	3	3	5	12	2025
L55	Fordtown Road	Eastern Star Road	Lebanon Road	Install left turn lanes at key intersections through industrial park		**39**	5	11	3	3	5	12	2040
L59	Lewis Lane	Rearden Lane	Ripley Street	Improve shoulders and geometry with spot safety improvements		**39**	5	6	4	13	5	6	2025
L34	Cox Hollow Road	Snapps Ferry	Interstate 81 MM 56	Widen from 2 to 3 lanes as economic development occurs	**X**	**38**	5	11	4	7	5	6	2040
P10	Industry Drive	At CSX railroad overpass		Replace/widen railroad overpass approximately .25 miles east of Kingsport City garage with possibility to convert to at-grade crossing		**38**	4	8	2	6	4	14	2040
P8	Lebanon Road	Kendricks Creek Road	Grove Drive	Replace signalized intersection with roundabout		**38**	4	3	3	6	10	12	2040
L19	Lebanon Road	Intersection at Fort Henry Rd (SR-36)	Colonial Heights Road	Improve sight distance and extend left turn lanes		**37**	11	8	2	1	5	10	2025
L37	Gibson Mill Road	Stone Drive (US-11)	Bloomingdale Pike	Widen from 2 to 3 lanes as part of Gibson Mill Road improvements	**X**	**37**	9	5	4	8	5	6	2025
L40	Interstate 26	MM 8	MM 10	Widen from 4 to 6 lanes	**X**	**37**	0	13	4	1	5	14	Illustrative
P12	Lynn Garden Drive	Stone Drive (US-11)		Improve interchange ramps to alleviate weaving issues		**37**	4	8	3	8	5	9	2025
L13	Fairview Ave	Stone Drive (US-11)	Virgil Avenue	Improve shoulders and geometry with spot safety improvements		**36**	9	3	3	10	5	6	2025

ID	ROUTE	FROM ROAD	TO ROAD	DESCRIPTION	In Model	Total Project Score	Safety	Efficiency	Accessibility	Active Transportation	Environmental	Economic	Horizon Year
L29	Airport Parkway (SR-357)	Fall Creek Road	Interstate 81	Extend SR-357 northbound with limited access 2-lane cross section with wide shoulders	X	**36**	3	4	8	3	4	14	2040
P27	Industry Drive *(Improve Act)*	Bridge over Reedy Creek		Bridge replacement/rehabilitation		**36**	6	8	3	6	3	10	Improve
L16	Bell Ridge Road / Drive	May Ave	Harrison Ave	Improve shoulders and geometry with spot safety improvements		**35**	8	3	2	11	5	6	2025
L3	Tri-Cities Crossing	Kendricks Creek Road	Fordtown Road	Widen from 2 to 3 lanes with improved left turns as economic development occurs	X	**35**	5	9	4	7	4	6	2040
P14	Hammond Avenue	Near Main Street		Replace railroad overpass to improve traffic flow and emergency services		**35**	0	7	3	6	5	14	2040
P23	Fordtown Road *(Improve Act)*	Bridge over CSX Railroad		Bridge replacement/rehabilitation		**35**	6	7	3	6	5	8	Improve
L9	Lincoln St/MLK Jr Drive Connector	Lincoln St/MLK Jr Drive	Industry Drive (SR-355)	Extend Lincoln St/MLK JR Drive to Industry Drive	X	**34**	0	2	7	4	3	18	2040
L7	Netherland Inn Road	Center St (SR-36)	Ridgefields Road	Widen from 2 to 3 lanes	X	**34**	9	5	3	6	1	10	2040
L48	Stone Drive (US-11) / Center Street Connector	Stone Drive (US-11) near Interstate 26 ramp	Center Street	New 3-lane roadway using Riverside Drive and Interstate 26 ramp	X	**34**	3	2	7	8	4	10	2040
L46	Stone Drive (US-11)	John B. Dennis (SR-93)		Extend left turn lanes on Stone Drive under John B. Dennis interchange		**33**	6	2	4	6	5	10	2025
L61	Reservoir Road	Saratoga Road	Hood Road	Improve shoulders and geometry with spot safety improvements		**33**	5	3	3	8	4	10	2025
P3	John B. Dennis (SR-93)	Lincoln Street		Extend length of interchange ramps		**33**	5	9	2	4	5	8	2025
L18	Summerville Road	Fort Henry Drive (SR-36)	New Summerville Road	Improve shoulders and geometry with spot safety improvements		**32**	8	6	2	6	4	6	2040
L28	Airport Parkway (SR-357)	Stone Drive East (US-11)	Fall Creek Road	Extend SR-357 northbound with limited access 2-lane cross section with wide shoulders	X	**32**	3	4	6	1	4	14	Illustrative
P28	John B. Dennis (SR-93) *(Improve Act)*	Bridge over CSX Railroad		Bridge replacement/rehabilitation		**32**	6	3	2	8	5	8	Improve
P20	Fort Henry Drive (SR-36) Bridge *(Improve Act)*	Wesley Road	Rock Springs Road	Replace northbound bridge over the South Fork Holston River for safety		**31**	6	8	2	3	4	8	Improve
P4	John B. Dennis (SR-93)	Fort Henry Drive (SR-36)		Extend length of interchange ramps		**30**	4	5	2	6	5	8	2025

ID	ROUTE	FROM ROAD	TO ROAD	DESCRIPTION	In Model	Total Project Score	Safety	Efficiency	Accessibility	Active Transportation	Environmental	Economic	Horizon Year
P5	John B. Dennis (SR-93)	Stone Drive (US-11)		Extend length of interchange ramps		**30**	4	3	4	4	5	10	2025
P7	John B. Dennis (SR-93)	Orebank Road		Construct new interchange exit ramp northbound	X	**30**	5	6	2	4	5	8	2025
P24	Old Blair Gap Road *(Improve Act)*	Bridge over Walker Fort Creek		Bridge replacement/rehabilitation		**30**	8	8	2	1	5	6	Improve
L5	Fort Henry Drive (SR-36)	Holston River Bridge	Hemlock Road	Safety improvements, install median, add center turn lane (consider widening bridge over railroad tracks and widening lanes near railroad bridge)		**29**	4	8	2	3	4	8	2025
L57	Fort Henry Drive (SR-36) Bridge *(Improve Act)*	Wesley Road	Rock Springs Road	Replace southbound bridge over the South Fork Holston River for safety		**29**	4	9	2	1	4	9	Improve
L6	Mitchell Rd Connector	Fordtown Road	Eastern Star Rd Road	Construct new 3 lane roadway to link Fordtown Rd to Eastern Star at I-26 Interchange	X	**28**	0	2	8	1	5	12	Illustrative
L64	Moccasin Gap Bypass	Route 71	Wadlow Gap Road	Contruct new 2-lane divided highway with connection to Filter Plant Road	X	**28**	0	4	8	6	4	6	Illustrative
P13	John B. Dennis (SR-93)	Moreland Drive		Improve interchange ramps on south side		**28**	6	3	2	4	5	8	2025
P11	John B. Dennis (SR-93)			Realign intersections at Indian Path Medical Center and Kroger to improve safety		**27**	3	2	4	3	5	10	2025
L45	Netherland Inn Road / Stone Drive Connector	Union Street	Netherland Inn Road	Realign and reconstruct Union Street to improve access to Netherland Inn Road and economic redevelopment areas	X	**26**	4	3	6	3	0	10	Illustrative
P2	Interstate 81	Buttermilk Road		Construct new interchange	X	**26**	0	8	2	1	5	10	Illustrative
L23	Wilcox Drive (SR-126)	John B Dennis (SR-93)	Moreland Drive	Extend 4-lane roadway as economic development occurs	X	**26**	3	2	7	4	4	6	2025
L42	Jack White Drive	Idel Hour Road		Extend west to connect to Stone Drive at Idel Hour Road	X	**26**	3	4	7	1	3	8	Illustrative
P16	Rock Springs Road	Railroad Tunnel		Replace / widen railroad tunnel		**26**	4	1	2	9	4	6	2040
P15	Wadlow Gap Road (SR-224)	North Fork Holston River		Replace bridge over North Fork Holston River		**23**	0	3	3	2	5	10	2025
P9	Interstate 26	Interstate 81		Add capacity at intersections including study of frontage roads along interstates		**23**	0	2	3	1	5	12	2040

ID	ROUTE	FROM ROAD	TO ROAD	DESCRIPTION	In Model	Total Project Score	Safety	Efficiency	Accessibility	Active Transportation	Environmental	Economic	Horizon Year
L39	Indian Trail Drive North	Stone Drive (US-11)	John B. Dennis (SR-93)	Re-alignment and new connection to John B. Dennis (SR-93)		**21**	3	2	4	1	5	6	2040
L41	I-81 Buttermilk Road Connection	Buttermilk Road	Fall Creek Road	New 2-lane connector to link proposed interchange at Buttermilk Road	**X**	**21**	0	2	7	1	1	10	Illustrative
L26	Moreland Drive - Lebanon Road Connector	Near Shady Side Drive	Kendricks Creek Road	New 3-lane bypass away from Fort Henry Drive	**X**	**20**	0	2	6	1	3	8	2040
L38	Huntington Hills Connector	Birchwood Road	Burke Road	New 2-lane roadway to provide additional access	**X**	**20**	0	2	6	3	5	4	2040
P25	Reedy Creek Lane *(Improve Act)*	Bridge over Reedy Creek		Bridge replacement/rehabilitation		**19**	6	2	3	2	4	2	Improve
P26	Meadow Brooke Lane *(Improve Act)*	Bridge over Reedy Creek		Bridge replacement/rehabilitation		**17**	3	2	2	4	4	2	Improve

Priority	Total # Points	Measure	Upper Thresholds	Points Given
Safety (25 points)	10	Number of auto crashes	50	2
			100	4
			150	6
			200	8
			> 200	10
	10	Number of bike/ped crashes	0	0
			2	5
			> 2	10
	3	Existing Crash Rate	1	1
			5	2
			> 5	3
	2	Low-volume, narrow streets	Yes	2
			No	0
Operational Efficiency (20 points)	5	LOS improved between 2015 and 2040 E+C	-10%	5
			0%	2
			> 0%	0
	5	LOS improved between 2040 E+C and 2040 vision run	5%	0
			20%	2
			> 20%	5
	5	Traffic signal projects	Yes	5
			No	0
	2	Creates parallel facility/system redundancy	Yes	2
			No	0
	3	Difference between 2015 and 2040 vision AADT	1000	1
			2500	2
			> 2500	3
Accessibility (10 points)	3	Population growth surrounding project 2015-2040	100	1
			500	2
			> 500	3
	3	Employment growth surrounding project 2015-2040	100	1
			500	2
			> 500	3
	4	Improves connectivity of system	Yes	4
			No	0
Active Transportation (15 points)	5	Qualitative non-motorized demand near project	Low	1
			Medium	3
			High	5
	5	Number of above average EJ populations touched by project (65+, low income, disabled)	1	1
			2	3
			3	5
	5	PLOS or BLOS of D or worse	0	0
			1	2
			2	5
Environmental (10 points)	5	Number of challenging areas the project touches (floodplains, historical areas, steep slopes, and parks)	0	5
			1	4
			2	3
			3	1
			4	0
	5	Projects improves capacity without widening or adding new facility	Yes	5
			No	0
Economic (20 points)	4	Percent of trucks in 2040 E+C	2%	1
			5%	2
			> 5%	4
	4	Within 1/2 mile of freight-dependent industries	Yes	4
			No	0
	4	Number of ATRI truck trip origins and destinations	400	2
			> 400	4
	4	Percent of accessible workforce with associates degree or higher	15%	1
			30%	2
			> 30%	4
	4	Improves access to identified tourist destinations	Yes	4
			No	0

Appendix III

Title VI and Environmental Justice Assessment

The specific civil rights concerns with transportation projects revolve around Title VI of the Civil Rights Act and Environmental Justice requirements (E.O.12898 *Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations*). US DOT's policy is to ensure compliance with 42 U.S.C. 2000 "No person in the United States shall, on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under a program or activity receiving federal financial assistance from the Department of Transportation." E.O. 12898 requires each agency (including the US DOT) to "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations". US DOT issued its Order on Environmental Justice (DOT Order 5610.2) in response to clarify Title VI responsibilities. Adverse impacts related to transportation projects include:

- Bodily impairment, infirmity, illness, or death.
- Air, noise, and water pollution; and soil contamination.
- Destruction or disruption of man-made or natural resources.
- Destruction or diminution of aesthetic values.
- Destruction or disruption of community cohesion or a community's economic vitality.
- Destruction or disruption of the availability of public and private facilities and services.
- Vibration.
- Adverse employment effects.
- Displacement of persons, businesses, farms, or nonprofit organizations.
- Increased traffic congestion, isolation, exclusion, or separation of minority or low-income individuals within a given community or from the broader community.
- The denial of, reduction in, or significant delay in the receipt of benefits of DOT programs, policies, or activities.

The DOT Order ensures that there will be greater public involvement opportunities and access to information on transportation activities affecting the human health and the environment. A requirement of the E.O. 12898 and the DOT Order concerns Limited English Proficiency (LEP) people. Discrimination against people who are Limited English Proficient was determined to be a form of national origin discrimination forbidden by Title VI of the Civil Rights Act.

Metropolitan planning organizations are required to consider three fundamental environmental justice principles:

1. To avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including interrelated social and economic effects, on minority populations and low-income populations.
2. To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process.
3. To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority populations and low-income populations.

Metropolitan planning organizations are required to consider environmental justice early in the planning process and (1) determine benefits to and potential negative impacts on minority populations and low-income populations from proposed investments or actions; (2) quantify expected effects (total, positive and negative) and disproportionately high and adverse effects on minority populations and low-income populations; and (3) determine the appropriate course of action, whether avoidance, minimization, or mitigation. (This is a discussion of environmental justice and planning, but the requirements apply across the whole range of transportation activities including contracting for services, and require the recipients, i.e. the MTPO, the Cities of Kingsport, Mount Carmel, Church Hill, Weber City, and Gate City, and Sullivan, Hawkins, Washington, and Scott Counties to do things such as monitor minority participation in contracts and maintain a complaint system for addressing Title VI complaints, etc.).

The following sections provide an assessment of potential impacts to the low-income population groups and minority population groups within the Kingsport Metropolitan Transportation Planning Organization (MTPO) area based on implementation of the transportation projects within the 2040 Long Range Transportation Plan (LRTP). The analysis was done using the MTPO's geographic information system (GIS) and US Census Block Group data. The 5- Year Estimate (2009-2013) US Census American Community Survey (ACS) Population and Housing Characteristics data were used for this assessment with data being used at the US Census Block Group level. A senior population analysis (persons over the age of 65) was also undertaken given the size of this population group in the MTPO area and their vulnerability over time to transportation decisions (i.e. availability of income to transportation costs, mobility limitations, etc.).

Minority Population

According to the 2009-2013 ACS data, 5 percent of the Kingsport MTPO region's residents are considered to be minorities (non-white). As shown in Table 1, the region's minority population is comparable to those of Sullivan, Hawkins, Washington, and Scott counties in the MTPO area. When compared with the share of minority population for Virginia and Tennessee, the MTPO's share of minority population is considerably smaller.

Table 2 illustrates the minority population breakdown of the MTPO area and the concentrations of minority populations within the counties of the MTPO. It should be noted that the populations shown in this table are based on ACS estimates and therefore may not align with the existing population in 2015 detailed in the LRTP document.

Table 1: Kingsport MTPO Area Minority Population

	Total Population	Minority (Non-White)	Percent Minority
Kingsport MTPO	**121,364**	**6,550**	**5.4%**
Sullivan County	89,482	5,304	5.9%
Hawkins County	19,677	908	4.6%
Washington County	4,566	143	3.1%
Scott County	7,639	195	2.6%
State of Virginia	8,256,630	2,561,483	31.0%
State of Tennessee	6,499,615	1,439,721	22.2%

Source: ACS 5-Year Estimate, US Census, 2014

Table 2: Kingsport MTPO Area Ethnicity Population

	White	Black	Asian	Other	Hispanic Origin
Sullivan County*	148,357	3,031	915	4,449	2,600
Hawkins County*	54,455	791	208	1,141	750
Washington County*	115,466	4,944	1,709	3,198	3,968
Scott County*	22,137	171	60	202	267

Source: ACS 5-Year Estimate, US Census, 2014

*Total county populations were used for these categories

In the following subsections, the positive and negative effects of the 2040 LRTP's highway, transit, and bicycle/pedestrian improvements on concentrations of minority populations are discussed by type of improvement. The highway projects (both funded and unfunded) in the 2040 LRTP include roadway widening projects, new roadways, reconstruction of roadways, signal improvements, and intersection improvements. In some cases sidewalks and/or bicycle facilities may be included as part of a highway project and are noted in the analysis. Additionally, expansion in transit services and routes in areas with concentrations of minority, senior, and low-income populations will have positive impacts on the transportation system in these areas.

HIGHWAY IMPROVEMENTS

There are a total of 60 Census Block Groups within the Kingsport MTPO area that will be directly affected by the 2040 LRTP highway transportation improvement projects. Of the total MTPO Population estimated by the ACS data (121,364 people) the share within the affected Census Block Groups is 74% and the share of the total MTPO minority population (6,550 people) is 75%. Within the 60 Census Block Groups, a total of 89,649 people reside, of which 6% are minority, as seen in Table 3.

Table 3: Characteristics of All Census Block Groups with Highway Improvements

Within	Number of Block Groups	Number of People	Total Block Group Population (%)	Total MTPO Population	Total MTPO Population (%)
Non-Minority	60	84,720	94%	114,814	74%
Minority	60	4,929	6%	6,550	75%
All	60	89,649	100%	121,364	74%

Source: ACS 5-Year Estimate, US Census, 2014

The next step was to look at the Census Block Groups within the affected area (the 60 Block Group area) in which the share of minority population is higher than the MTPO region's percentage of minority population (5%). Of the 60 Block Group affected area, 19 Block Groups have over 5% minority population (See Table 4 and Figure 1).

For the purposes of this EJ analysis, those individual Block Groups where the share of minority population is double that of the MTPO area (or 10% minority or higher) are considered to potentially contain an environmental justice population and are referred to as "communities of concern". Eleven Census Block Groups are part of the "communities of concern". A total of 2,584 minority people reside in those 11 Block Groups, representing about 39% of the total number of minority people in the MTPO area (6,550 people). These 11 Block Groups represent 11% of the MTPO region's total population (121,364 people). All 11 Block Groups are located in Sullivan County.

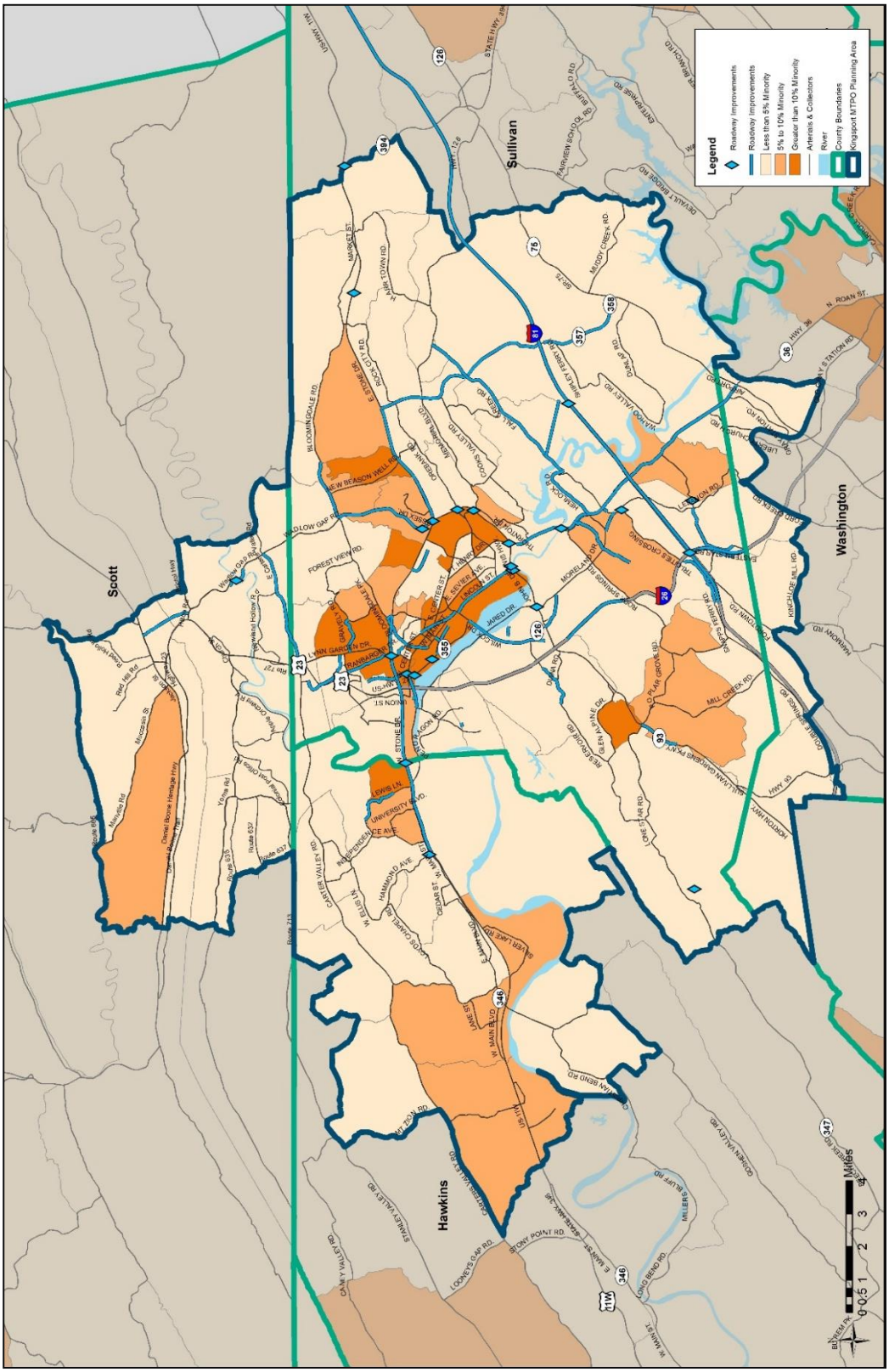
Table 4: Minority Census Block Groups with Highway Improvements

Within	Number of Block Groups	Number Minority Population	Total MTPO Minority Population
Minority – At Least Regional Average (5% to 10%)	12	1,313	20%
Minority – Double Average (10% or Greater) – "Communities of Concern"	11	2,584	39%

Source: ACS 5-Year Estimate, US Census, 2014

A more detailed review, including positive and negative impacts of the projects in the communities of concern was conducted. The projects' affects include improving traffic congestion, adding transportation options by including bicycle and pedestrian modes, improving access to transit, and possibly affecting right-of-way due to new roadways, roadway widening, or reconstruction.

Figure 1
Highway Improvements in Minority Population Areas



The cost feasible highway projects in the 2040 LRTP that would fall within the minority population of at least 5% were identified. Eighty-four improvements fall into this category consisting of new roadways and roadway widenings; roadway reconstructions and realignments; bridge replacements and rehabilitations; interchange ramp improvements; signal and intersection improvements; and safety-related projects. The signal and intersection improvements should improve the traffic flow in the areas. Also, the safety improvements should improve the transportation network so these projects would have a positive impact on the population. The improvements to bridges and interchanges are primarily related to safety, not capacity. That leaves the road widening and new construction projects which may adversely affect the population and require mitigation steps be taken. These 30 projects are listed in Table 5 with project descriptions and funding year.

Additionally, as part of the 2040 LRTP, the candidate projects, both cost feasible and illustrative, were evaluated to determine where bicycle and pedestrian accommodations may be appropriate. In reviewing the affected projects as part of this analysis, it was determined pedestrian accommodations may be provided on 47 projects and bicycle accommodations on 29 projects. However, all transportation projects should consider bicycle and pedestrian accommodations in the design phase as part of the US DOT Policy on Accommodations, the City of Kingsport's Complete Streets Policy, and the Region's desire to increase active transportation solutions.

Table 5: Highway Improvements within Block Groups containing Greater than 5% Minority

2040 LRTP Id	Roadway	From	To	Length (Miles)	Type of Improvement	Current Number of Lanes	Future Number of Lanes	Horizon Year
L29	Airport Parkway (SR 357)	Fall Creek Road	Interstate 81	2.1	New Roadway	-	2	2040
L28	Airport Parkway (SR 357)	Stone Drive East (US 11)	Fall Creek Road	2.5	New Roadway	-	2	2025
L33	BAE Frontage Road	Old Armory	Hammond Avenue	1.7	New Roadway	-	2	Illustrative
L10	Bloomingdale Pk	Stone Dr West (US 11)	Orbin Dr	0.2	Roadway Widening	2	3	2040
L32	Cherokee Street Viaduct	MLK Extension	Main Street	0.2	New Roadway	-	2	2040
L34	Cox Hollow Road	Snapps Ferry	Interstate 81 MM 56	0.6	Roadway Widening	2	3	2040
L35	East Sullivan Street	Church Circle	Wilcox Drive (SR 126)	1.0	Roadway Widening	2	3	2025
L4	Eastern Star Rd	Mitchell Rd	Fordtown Rd	0.7	Roadway Widening	2	3	2040
L1	Fort Henry Drive (SR 36)	Interstate 81	Airport Road (SR 75)	3.5	Roadway Widening	2	4	2025 (IMPROVE)
L36	Fort Henry Drive (SR 36)	Moreland Drive	Interstate 81	1.4	New Roadway	-	2	Illustrative
L37	Gibson Mill Road	Stone Drive (US 11)	Bloomingdale Pike	0.1	Roadway Widening	2	3	2025
L38	Huntington Hills Connector	Birchwood Road	Burke Road	0.1	New Roadway	-	2	2040
L41	I-81 Buttermilk Road Connection	Buttermilk Road	Fall Creek Road	1.4	New Roadway	-	2	Illustrative
L40	Interstate 26	MM 8	MM 10	1.4	Roadway Widening	4	6	Illustrative
L24	Interstate 81	Fort Henry Dr (SR 36)	Tri-Cities Crossing (MM 56)	4.0	Roadway Widening	4	6	Illustrative
L42	Jack White Drive	Idel Hour Road	Stone Drive (US 11)	0.7	New Roadway	-	2	Illustrative
L43	Jared Drive	Sluice Bridge	Wilcox Drive (SR 126)	0.2	New Roadway	-	2	2025
L9	Lincoln St/MLK Jr Dr Connector	Lincoln St/MLK Jr Dr	Industry Dr (SR 355)	0.8	New Roadway	-	2	2040
L6	Mitchell Rd Connector	Fordtown Rd	Eastern Star Rd	0.6	New Roadway	-	3	Illustrative
L26	Moreland Drive - Lebanon Road Connector	Near Shady Side Dr	Kendricks Creek Road	0.5	New Roadway	-	3	2040
L7	Netherland Inn Road	Center St (SR 36)	Ridgefields Rd	0.7	Roadway Widening	2	3	2040
L45	Netherland Inn Road / Stone Drive Connector	Union Street	Netherland Inn Road	0.1	New Roadway	-	2	Illustrative
L25	Stone Drive (US 11)	Hammond Ave	East Avenue	1.2	Roadway Widening	4	6	Illustrative
L66	Stone Drive (US 11)	Deneen Lane	East Avenue	1.0	Roadway Widening	4	6	Illustrative
L48	Stone Drive (US 11) / Center Street Connector	Stone Drive (US 11)	Center Street	0.1	New Roadway	-	3	2040
L47	Stone Drive (US11)	John B. Dennis (SR 93)	New Beasonwell Road	1.7	Roadway Widening	4	6	2040
L50	Sullivan Garden Parkway (SR 93)	Lonestar Road	Derby Drive	1.0	Roadway Widening	2	4	Illustrative
L3	Tri-Cities Crossing	Kendricks Creek Rd	Fordtown Road	1.0	Roadway Widening	2	3	2040
L49	West Sullivan Street	Roller Street	Lynn Garden Drive	0.3	Roadway Widening	2	3	2025
L23	Wilcox Drive (SR 126)	John B Dennis (SR 93)	Moreland Drive	0.9	New Roadway	-	4	2025

TRANSIT IMPROVEMENTS

For the purposes of the EJ analysis minority population assessment, the MTPO reviewed areas that are currently served by the Kingsport Area Transit Service's (KATS) fixed-route bus service. The routes are shown in Figure 2. KATS provides service in an area comprised of 31 Census Block Groups. According to the 2009-2013 5-Year ACS estimates, approximately 39,912 people reside in the service area, representing 33% of the total MTPO population (121,364 people) (see Table 6). In that service area, 10% of the residents are minority people; the minority residents in this area represent 67% of the region's total minority population (6,550 people). By comparison, the percentage of non-minority people in the 30 Block Group service area represents 31% of the region's total non-minority population (114,814 people).

Table 6: Characteristics of Census Block Groups with Existing Transit Service

Within	Number of Block Groups	Number People	Percent of Total Census Block Group Population	Total MPTO population	Percent of MTPO Population
Non-Minority	31	35,765	90%	114,814	31%
Minority	31	4,417	10%	6,550	67%
All	31	39,912	100%	121,364	33%

Source: ACS 5-Year Estimate, US Census, 2014

The next step was to look specifically at those Census Block Groups in which the share of minority population was equal to or greater than the MTPO region's percentage of minority population (5%) and that are served by the KATS system. A total of 19 Block Groups have minority populations of at least 5% and are served by the KATS system (See Table 7 and Figure 2). Approximately 55% of the region's total minority population resides in those 19 Block Groups.

Table 7: Minority Census Block Groups with Existing Transit Service

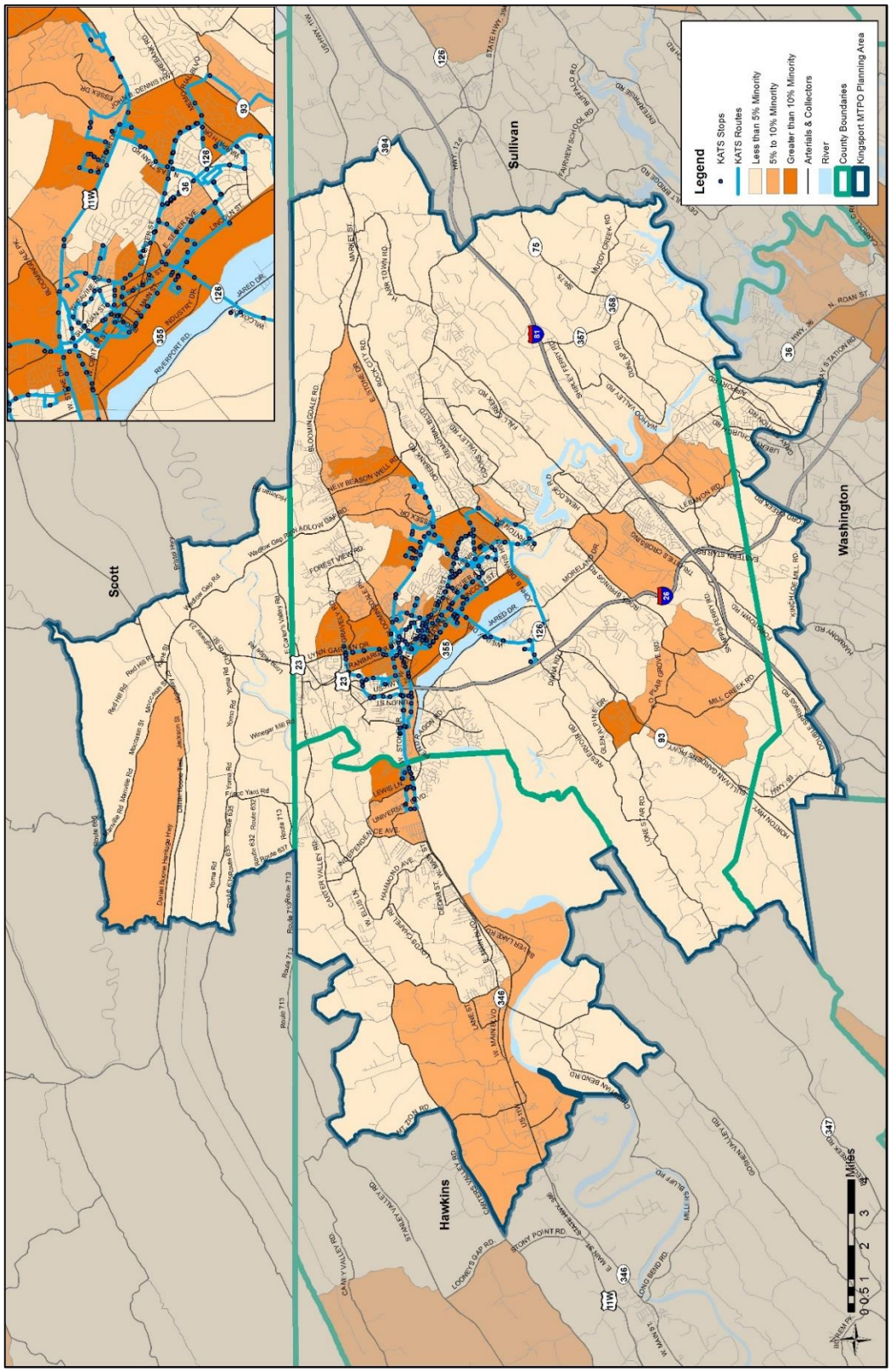
Within	Number of Block Groups	Number Minority People	Total MTPO Minority Population
Minority – At Least Regional Average (5% to 10%)	9	982	15%
Minority – Double Average (10% or Greater) – "Communities of Concern"	10	2,621	40%

Source: ACS 5-Year Estimate, US Census, 2014

As discussed in the previous section "communities of concern" consist of those Block Groups where the minority population is double that of the MTPO area (at least 10 percent minority). For the existing transit service affected area, 10 Census Block Groups have double the MTPO average share of minority people; these 10 Block Groups represent about 40% of the MTPO region's total minority population. These Block Groups are located primarily in and around downtown Kingsport.

The 2040 LRTP contains a list of projects to enhance the existing transit services. Planned public transportation improvements over the 25-year plan horizon are geared toward system expansion including more routes, extended service hours, more bus shelters, and following a normal vehicle replacement schedule. The transit projects are expected to enhance the service for the 19 Census Block Group area.

Figure 2
Existing System Transit Improvements in Minority Population Areas



Low-Income Population

According to the 2009-2013 ACS data, approximately 17% of the households located within the MTPO region reported incomes below the federal poverty level (referred to as "low-income" in this analysis). As shown in Table 8, the region's low-income population is about 2% lower than that of Scott County, about 4% higher than Hawkins County, 6% higher than Washington County, and 1% lower than Sullivan County.

Table 8: Kingsport MTPO Area Low-Income Population

	Total Households	Low-Income Households	Percent Low-Income
Kingsport MTPO	52,091	8,861	17%
Sullivan County*	38,405	6,932	18%
Hawkins County*	8,313	1,079	13%
Washington County*	2,078	228	11%
Scott County*	3,295	622	19%

Source: ACS 5-Year Estimate, US Census, 2014
*Numbers represent only Census Block groups located within MTPO area

In the following sections, the effects of the 2040 LRTP's highway improvements and the transit system on low-income populations are discussed by type of improvement.

HIGHWAY IMRPOVEMENTS

As mentioned previously, 60 Census Block Groups would be directly affected by the 2040 LRTP roadway transportation improvement projects, shown on Figure 3. Within those Census Block Groups, there are a total of 38,102 household, of which 17% (6,663 households) are reported to be low-income (see Table 9).

Table 9: Census Block Groups with Highway Improvements

Within	Number of Block Groups	Number Households	Percent of Total Census Block Group Households	Total MTPO Households	Total MTPO Households (%)
Not Low-Income	60	31,439	83%	43,230	73%
Low-Income	60	6,663	17%	8,861	75%
All	60	38,102	100%	52,091	73%

Source: ACS 5-Year Estimate, US Census, 2014

The next step was to look at the Census Block Groups within the affected area (the 60 Block Group area) in which the share of low-income households is higher than the MTPO region's percentage of low-income households (17%). Of the 60 Block Group affected area, 33 Block Groups have a 17% or higher low-income households (See Table 10 and Figure 3).

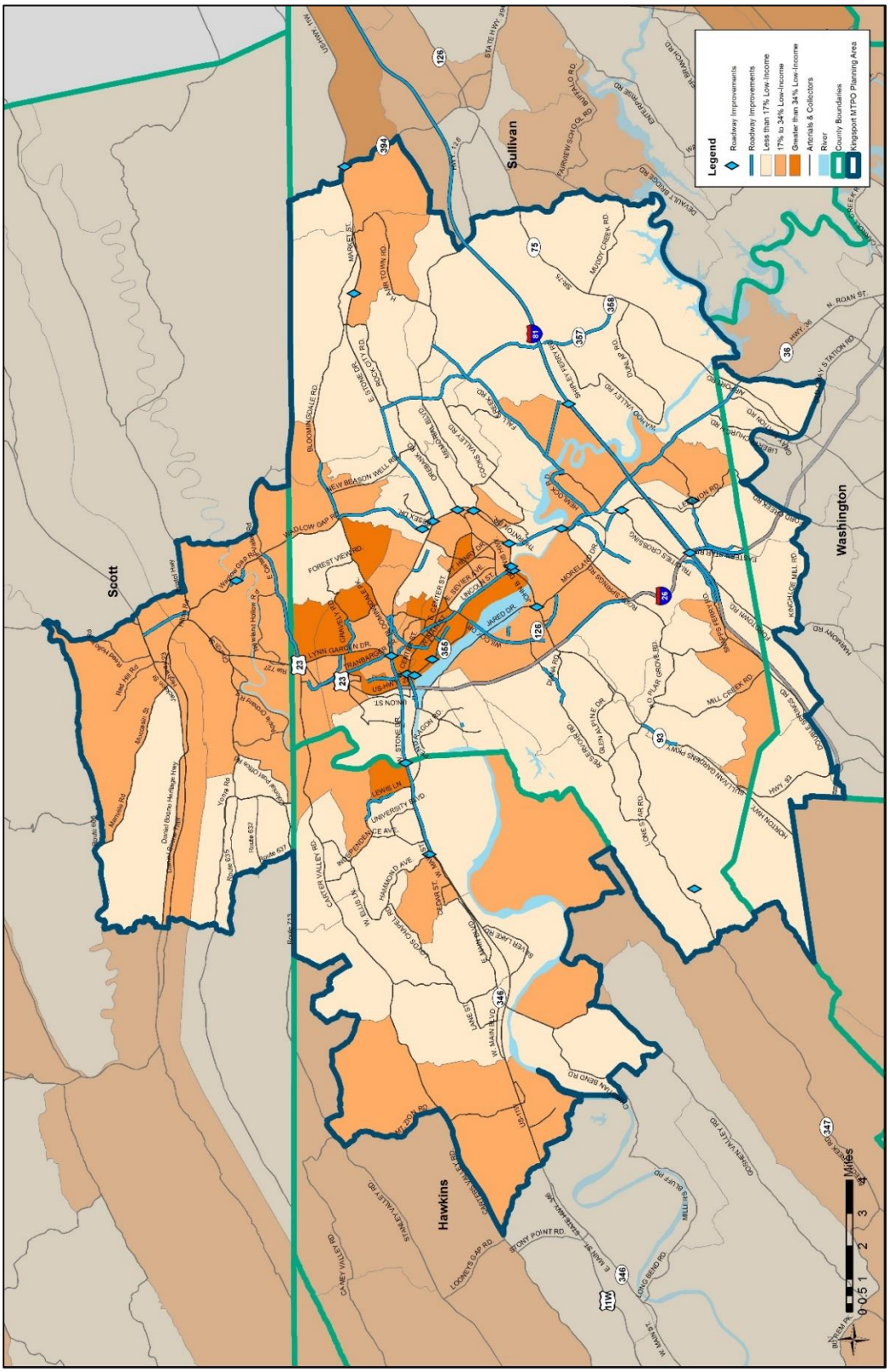
Nine Census Block Groups contain concentrations of low-income households that are at least double the regional average, or at least 34%. These Census Block Groups, identified as "communities of concern" are dispersed throughout the MTPO area and contain 19% of the total low-income households (8,861 households) in the entire MTPO area.

Table 10: Low-Income Census Block Groups with Highway Improvements

Within	Number of Block Groups	Number Low-Income Households	Total MTPO Low-Income Households %
Low-Income – (17% - 34%)	24	3,041	34%
Low-Income – Double (34% and Greater) – "Communities of Concern"	9	1,674	19%

Source: ACS 5-Year Estimate, US Census, 2014

Figure 3
Highway Improvements in Low-Income Population Areas (Below Poverty)



To determine both the positive and negative impacts on the low-income population in the affected area the highway projects were evaluated. Fifty-five highway projects fall in Census Block Group areas with over 17% low-income households consisting of new roadways and roadway widenings; roadway reconstructions and realignments; bridge replacements and rehabilitations; interchange ramp improvements; signal and intersection improvements; and safety-related projects. Positive effects by the signal and intersection improvement projects expected to be seen include improved traffic flow in the area. In addition, the safety improvements should have positive effects on the population. The 18 roadway widening and new roadway projects which may have a negative impact on the population are listed in Table 11.

As part of the 2040 LRTP, the proposed projects, both cost feasible and illustrative, were evaluated to determine where bicycle and pedestrian accommodations may be appropriate. In reviewing the affected projects as part of this analysis, it was determined pedestrian accommodations may be provided on 47 projects and bicycle accommodations on 29 projects. However, all transportation projects should consider bicycle and pedestrian accommodations in the design phase as part of the US DOT Policy on Accommodations, the City of Kingsport's Complete Streets Policy, and the Region's desire to increase active transportation solutions.

Table 11: Highway Improvements within Block Groups containing Greater than 17% Low-Income Households

2040 LRTP Id	Roadway	From	To	Length (Miles)	Type of Improvement	Current Number of Lanes	Future Number of Lanes	Horizon Year
L10	Bloomingdale Pk	Stone Dr West (US 11W	Orbin Dr	0.24	Roadway Widening	2	3	2040
L32	Cherokee Street Viaduct	MLK Extension	Main Street	0.16	New Roadway	-	2	2040
L34	Cox Hollow Road	Snapps Ferry	Interstate 81 MM 56	0.57	Roadway Widening	2	3	2040
L35	East Sullivan Street	Church Circle	Wilcox Drive (SR 126)	1.00	Roadway Widening	2	3	2025
L1	Fort Henry Drive (SR 36)	Interstate 81	Airport Road (SR 75)	3.54	Roadway Widening	2	4	2025 (IMPROVE)
L37	Gibson Mill Road	Stone Drive (US 11)	Bloomingdale Pike	0.14	Roadway Widening	2	3	2025
L41	I-81 Buttermilk Road Connection	Buttermilk Road	Fall Creek Road	1.40	New Roadway	-	2	Illustrative
L24	Interstate 81	Fort Henry Dr (SR 36)	Tri-Cities Crossings (MM 56)	4.02	Roadway Widening	4	6	Illustrative
L43	Jared Drive	Sluice Bridge	Wilcox Drive (SR 126)	0.24	New Roadway	-	2	2025
L9	Lincoln St/MLK Jr Dr Connector	Lincoln St/MLK Jr Dr	Industry Dr (SR 355)	0.76	New Roadway	-	2	2040
L7	Netherland Inn Road	Center St (SR 36)	Ridgefields Rd	0.73	Roadway Widening	2	3	2040
L25	Stone Drive (US 11)	Hammond Ave	East Avenue	1.16	Roadway Widening	4	6	Illustrative
L66	Stone Drive (US 11)	Deneen Lane	East Avenue	1.01	Roadway Widening	4	6	Illustrative
L48	Stone Drive (US 11) / Center Street Connector	Stone Drive (US 11)	Center Street	0.11	New Roadway	-	3	2040
L47	Stone Drive (US11)	John B. Dennis (SR 93)	New Beasonwell Road	1.70	Roadway Widening	4	6	2040
L3	Tri-Cities Crossing	Kendricks Creek Rd	Fordtown Road	0.98	Roadway Widening	2	3	2040
L49	West Sullivan Street	Roller Street	Lynn Garden Drive	0.25	Roadway Widening	2	3	2025
L23	Wilcox Drive (SR 126)	John B Dennis (SR 93)	Moreland Drive	0.88	New Roadway	-	4	2025

TRANSIT IMPROVEMENTS

As mentioned previously, the KAT's current fixed-route bus service is provided to 31 Census Block Groups. In that service area, approximately 39,912 people reside in approximately 18,118 households (see Table 12). Also in that service area, 24% of the resident households are considered low-income. For comparison, the percentage of low-income households in the transit service area represents approximately 48% of the region's total low-income households (52,091).

Table 12: Characteristics of Census Block Groups with Existing Transit Service

Within	Number of Census Blocks	Number of Households	Percent of Total Census Block Group Households	Total MTPO Households	Percent of MTPO Households
Non-Low Income	31	13,852	76%	43,230	22%
Low-Income	31	4,266	24%	8,861	48%
All	31	18,118	100%	52,091	35%

Source: ACS 5-Year Estimate, US Census, 2014

The next step was to look specifically at those Census Block Groups in the existing transit service area in which the share of low-income population is equal to or greater than the region's percentage of low-income population (17%). Twenty-one of the Census Block Groups served by transit have low-income populations of at least 17% (See Table 13 and Figure 4). These twenty-one Census Block Groups serve about 86% of the total MTPO low-income population (4,266 households).

Table 13: Low-Income Census Block Groups with Existing Transit Service

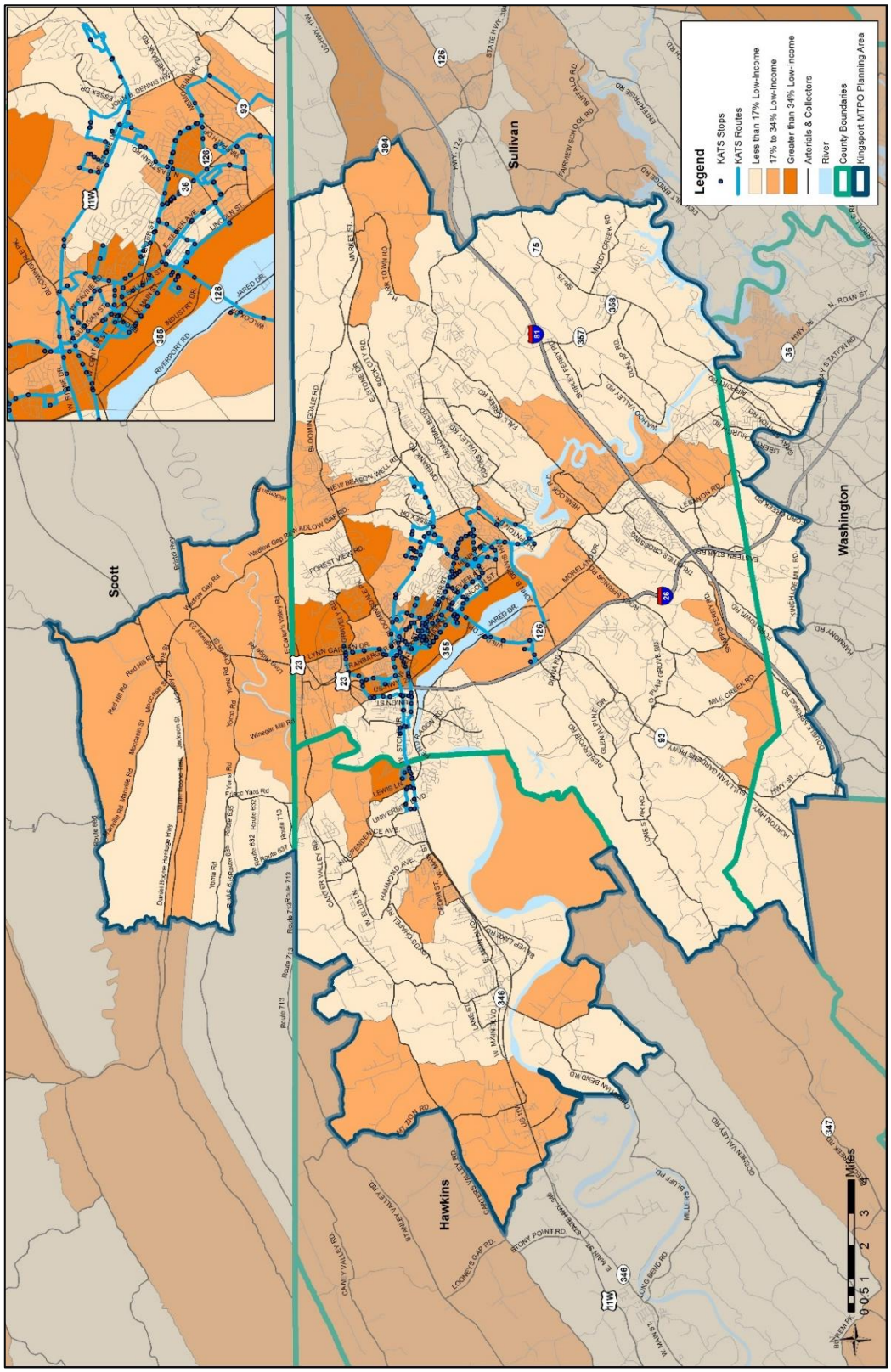
Within	Number of Census Block Groups	Number Low-Income Households	Total MTPO Low-Income Households %
Low-Income – (17% - 34%)	13	1,793	42%
Low-Income – Double (Greater than 34%) Communities of Concern	9	1,888	44%

Source: ACS 5-Year Estimate, US Census, 2014

There are nine Census Block Groups that have low-income populations that meet or exceed 34%; thus, these Census Block Groups which are provided transit service are considered to be "communities of concern" for low-income populations. These Census Block Groups are mostly located in the Kingsport city limits.

The 2040 LRTP contains a list of projects to enhance the existing transit services. Planned public transportation improvements over the 25-year plan horizon are geared toward system expansion including more routes, extended service hours, more bus shelters, and following a normal vehicle replacement schedule. The transit projects are expected to enhance the service for the 21 Census Block Group area.

Figure 4
Existing Transit System Improvements in Low-Income Areas of Concern



Senior Population (Over 65)

According to the 2009-2013 ACS 5-Year estimates, nearly 19% of the population of the MTPO region is 65 years of age or older (referred to as "senior" in this analysis). As shown in Table 14, the region's senior population is lower than that of Sullivan, Washington, and Scott Counties and slightly higher than that of Hawkins Counties.

Table 14: Kingsport MTPO Area Senior Population

	Total Population	Senior Population	Percent Senior Population
Kingsport MTPO	**121,364**	**23,646**	**19%**
Sullivan County	89,482	17,751	20%
Hawkins County	19,677	3,298	17%
Washington County	4,566	946	21%
Scott County	7,639	1,651	20%

Source: ACS 5-Year Estimate, US Census, 2014

In the following sections, the effects of the 2040 LRTP's highway and transit improvements on senior populations are discussed by type of improvement.

HIGHWAY IMPROVEMENTS

As mentioned previously, 60 Census Block Groups will be directly affected by the LRTP's proposed highway improvement projects, shown on Figure 5. Within those Census Block Groups, a total of 89,649 people reside, of which 19% (17,100 people) are reported to be in the senior population (see Table 15). The share of the senior population within the affected Census Block Groups (19%) is similar to the overall share of senior population within the MTPO area (17%).

Table 15: Census Block Groups with Highway Improvements

Within	Number of Block Groups	Number People	Percent of Total Census Block Group Population	Total MTPO Population	Percent of Total MTPO Population
Non-Senior Population	60	72,549	81%	97,718	74%
Senior Population	60	17,100	19%	23,646	72%
All	60	89,649	100%	121,364	74%

Source: ACS 5-Year Estimate, US Census, 2014

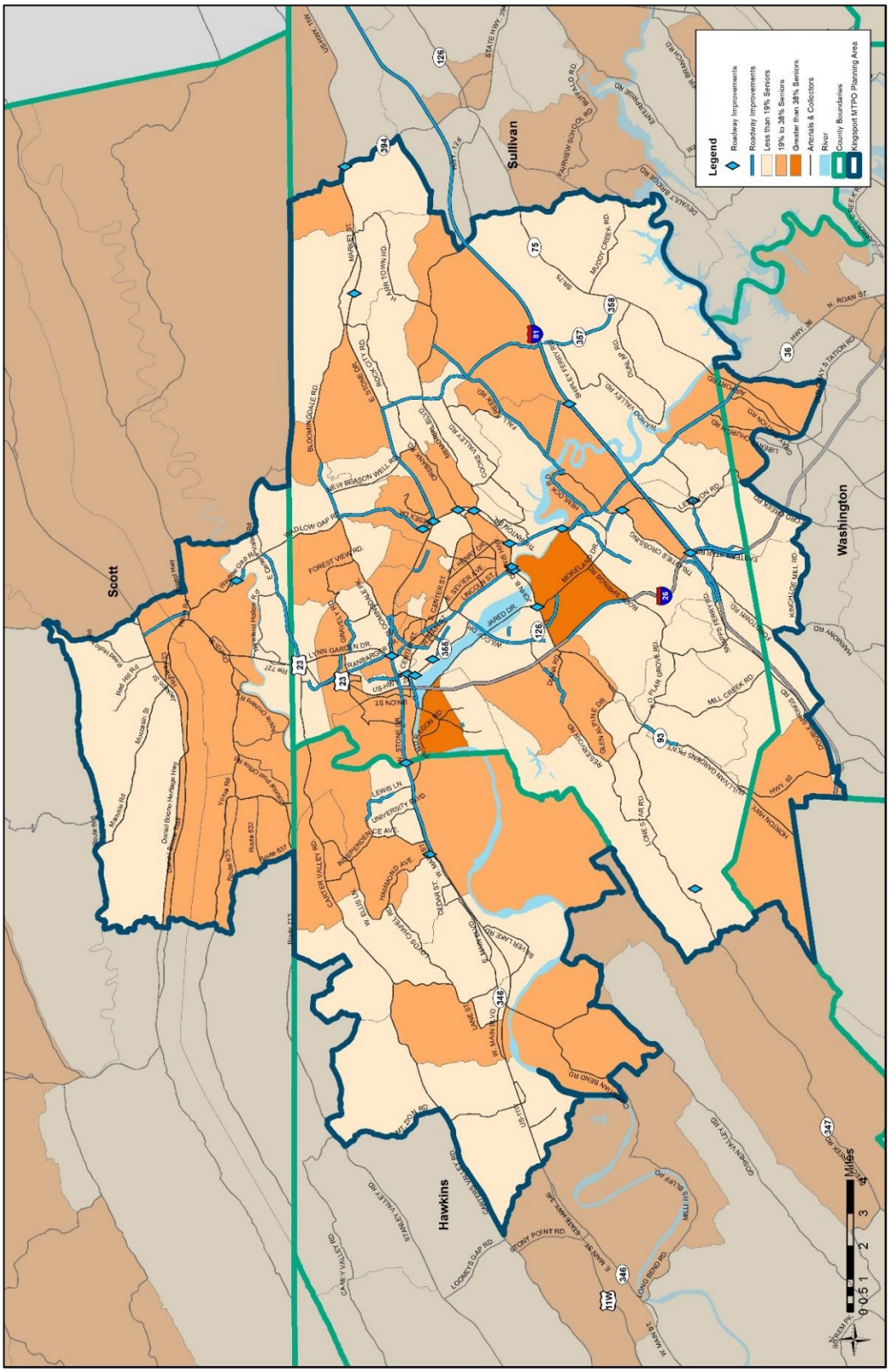
Evaluation of the Census Block Groups within the affected area (the 60 Block Group area) in which the share of senior population is compared to the MTPO region's percentage of senior population was conducted. Of the 60 Block Group affected area, 26 block groups have at least 19% senior population (See Table 16 and Figure 5). Three Census Block Groups contain concentrations of senior populations that are at least double the regional average, (or at least 38%) and therefore are communities of concern. One Census Block Group is located within the Kingsport City boundary and the other one is located in Scott County. The three Census Block Groups contain seven percent of the total senior population (22,524 people) in the entire MTPO area.

Table 16: Senior Census Block Groups with Highway Improvements

Within	Number of Block Groups	Number Senior People	Total MTPO Senior Population (%)
Senior Population – (19% - 38%)	25	9,699	41%
Senior Population – Double (38% and up)	1	342	1%

Source: ACS 5-Year Estimate, US Census, 2014

Figure 5
Highway Improvements in Senior Population Areas (Over 65)



Fifty-six highway projects are within Census Block Group areas that have a senior population over 19% consisting of new roadways and roadway widenings; roadway reconstructions and realignments; bridge replacements and rehabilitations; interchange ramp improvements; signal and intersection improvements; and safety-related projects. The 21 new roadways and roadway widening projects are listed in Table 17.

As part of the 2040 LRTP, candidate projects, both cost feasible and illustrative, were evaluated to determine where bicycle and pedestrian accommodations may be appropriate. It was determined pedestrian accommodations may be provided on 47 projects and bicycle accommodations on 29 projects. However, all transportation projects should consider bicycle and pedestrian accommodations in the design phase as part of the US DOT Policy on Accommodations, the City of Kingsport's Complete Streets Policy, and the Region's desire to increase active transportation solutions.

Table 17: Cost Feasible Highway Improvements within Block Groups containing Greater than 19% Senior Population

2040 LRTP Id	Roadway	From	To	Length (Miles)	Type of Improvement	Current Number of Lanes	Future Number of Lanes	Horizon Year
L29	Airport Parkway (SR 357)	Fall Creek Road	Interstate 81	2.1	New Roadway	-	2	2025
L28	Airport Parkway (SR 357)	Stone Drive East (US 11)	Fall Creek Road	2.5	New Roadway	-	2	Illustrative
L33	BAE Frontage Road	Old Armory	Hammond Avenue	1.7	New Roadway	-	2	Illustrative
L10	Bloomingdale Pk	Stone Dr West (US 11)	Orbin Dr	0.2	Roadway Widening	2	3	2040
L32	Cherokee Street Viaduct	MLK Extension	Main Street	0.2	New Roadway	-	2	2040
L35	East Sullivan Street	Church Circle	Wilcox Drive (SR 126)	1.0	Roadway Widening	2	3	2025
L1	Fort Henry Drive (SR 36)	Interstate 81	Airport Road (SR 75)	3.5	Roadway Widening	2	4	2025 (IMPROVE)
L36	Fort Henry Drive (SR 36)	Moreland Drive	Interstate 81	1.4	New Roadway	-	2	2025
L37	Gibson Mill Road	Stone Drive (US 11)	Bloomingdale Pike	0.1	Roadway Widening	2	3	2025
L41	I-81 Buttermilk Road Connection	Buttermilk Road	Fall Creek Road	1.4	New Roadway	-	2	Illustrative
L39	Indian Trail Drive North	Stone Drive (US 11)	John B. Dennis (SR 93)	0.1	New Roadway	-	2	2040
L24	Interstate 81	Fort Henry Dr (SR 36)	Tri-Cities Crossing (MM 56)	4.0	Roadway Widening	4	6	Illustrative
L42	Jack White Drive	Idel Hour Road	Stone Drive (US 11)	0.7	New Roadway	-	2	Illustrative
L64	Moccasin Gap Bypass	Route 71	Wadlow Gap Road	1.2	New Roadway	-	2	Illustrative
L7	Netherland Inn Road	Center St (SR 36)	Ridgefields Rd	0.7	Roadway Widening	2	3	2040
L45	Netherland Inn Road / Stone Drive Connector	Union Street	Netherland Inn Road	0.1	New Roadway	-	2	2040
L25	Stone Drive (US 11)	Hammond Ave	East Avenue	1.2	Roadway Widening	4	6	Illustrative
L66	Stone Drive (US 11)	Deneen Lane	East Avenue	1.0	Roadway Widening	4	6	Illustrative
L47	Stone Drive (US11)	John B. Dennis (SR 93)	New Beasonwell Road	1.7	Roadway Widening	4	6	2040
L49	West Sullivan Street	Roller Street	Lynn Garden Drive	0.3	Roadway Widening	2	-	2025
L23	Wilcox Drive (SR 126)	John B Dennis (SR 93)	Moreland Drive	0.9	New Roadway	-	4	2025

TRANSIT IMPROVEMENTS

As mentioned previously, the KAT's current fixed-route bus service provides service in an area that comprises 31 Census Block Groups. In that service area, approximately 39,912 people reside (see Table 18) of which 22% of the residents fall into the senior population. The existing fixed-route transit service is focused in the Downtown Kingsport area.

Table 18: Characteristics of Census Block Groups with Existing Transit Service

Within	Number of Census Block Groups	Number of People	Percent of Total Census Block Group Population	Total MTPO Population	Percent of Region Total
Non-Senior Population	31	31,300	72%	97,718	32%
Senior Population	31	8,612	22%	23,646	36%
All	31	39,912	100%	121,364	33%

Source: ACS 5-Year Estimate, US Census, 2014

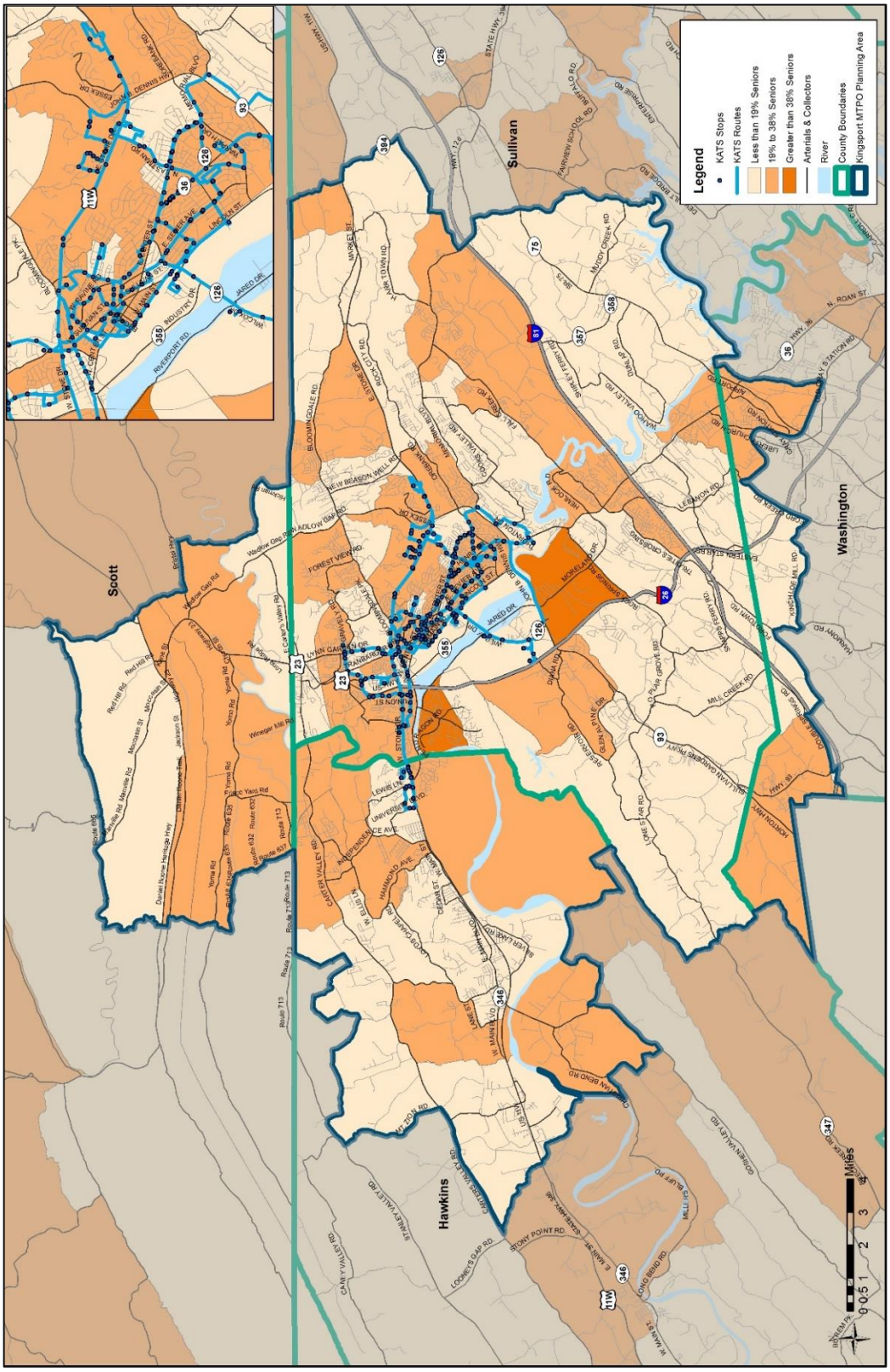
The next step was to look specifically at those Census Block Groups in the existing transit service area in which the share of senior population is equal to or greater than the region's percentage of senior population (19%). Nineteen Census Block Groups have senior populations of at least 19% (See Table 19 and Figure 6). Of the 19 Census Block Groups identified, 18 have a senior population ranging between 19 and 38%. The remaining Census Block Group has a senior population of 38% or more; this is the only Census Block Group considered as a community of concern for the senior population. This Census Block Group is located within the Kingsport city limits.

Table 19: Senior Population Census Block Groups with Existing Transit Service

Within	Number of Census Block Groups	Number Senior People	Percent of Total MTPO Senior People
Senior population – (19% - 38%)	18	6,410	74%
Senior population – Double (38%) Communities of Concern	1	342	4%

Source: ACS 5-Year Estimate, US Census, 2014

Figure 6
Existing Transit System Improvements in Senior Areas of Concern



Summary of Burdens

Segments of the population that live adjacent to roadway construction projects may endure short-term construction-related impacts related to visual changes, noise, and traffic patterns. Although some of the roadway widening and new construction projects proposed in the 2040 Kingsport LRTP will be adjacent to or through areas with minority, low-income, or senior populations the projects will not disproportionately affect them. Also, some of the projects will include pedestrian and bicycle facilities, which will benefit minority, low-income, and senior populations. The safety and traffic management projects in the area should improve the flow of traffic through the communities of concern.

Lastly, to ensure that all people are considered and involved in the ultimate outcomes of the 2040 LRTP (and corresponding transportation improvements), efforts by the MTPO, its member jurisdictions, and VDOT and TDOT, during the project development process should consider special outreach efforts for areas identified as communities of concern to help mitigate any adverse impacts and/or burdens from transportation improvements.

Appendix IV

Environmental Review

INTRODUCTION

The FAST Act calls for greater environmental consideration in the development of long range transportation plans. The Kingsport MTPO, as part of the 2040 LRTP, has developed an initial understanding of environmental conditions, which can be used to assist in the project development process once a project has moved from the planning stage of this document to the programming stage (e.g. the TIP) for ultimate project implementation.

The Environmental Assessment section includes a discussion of potential environmental impacts and avoidance and mitigation activities at the policy/strategy level based on environmental regulatory framework. The Kingsport MTPO compared projects in the 2040 Long Range Transportation Plan with available local, state and federal, maps and inventories of historic and natural resources. This discussion assesses the identified environmentally sensitive areas and provides mitigation strategies that could be considered to reduce potential impacts related to transportation improvement projects.

The MTPO will implement the following policies to reflect the region's consideration of environmental factors included in the 2040 Long Range Transportation Plan:

- An appropriate level of review will occur to assess potential environmental, historic and cultural resource impacts in likely areas for mitigation activities in transportation planning;
- Potential impacts to environmentally sensitive areas will be considered before transportation projects are planned, funded and designed; and
- Consultation will occur with federal, state, tribal and local land use management, natural resources, wildlife, environmental protection, conservation and historic preservation agencies in developing the LRTP.

PROJECT REVIEW

Based on available information, the MTPO utilized its Geographic Information System (GIS) to map locations of known wetlands, flood zones, historic sites, and historic districts within the MTPO planning boundary. By identifying sensitive areas in advance, this effort will help to improve avoidance measures and natural resource mitigation activities to provide greater benefits to the environment regionally.

The LRTP project list includes a series of transportation improvements projects that have been identified as potentially impacting sensitive areas. These projects' scopes vary and include signalization, major reconstruction, minor reconstruction, bridge replacements and rehabilitations, new corridors and intersection improvements. The maps on the following pages show where improvement projects may impact the environmentally sensitive areas.

It is important to note, that while the physical footprint of a transportation improvement may not intersect with a known resource, it is possible that unrelated activities of that improvement may have an indirect effect on these sensitive areas. It is also important to note that until a project has gone through a full environmental study, the exact location of the transportation project is not known. The LRTP identifies transportation improvement locations for general planning purposes only.

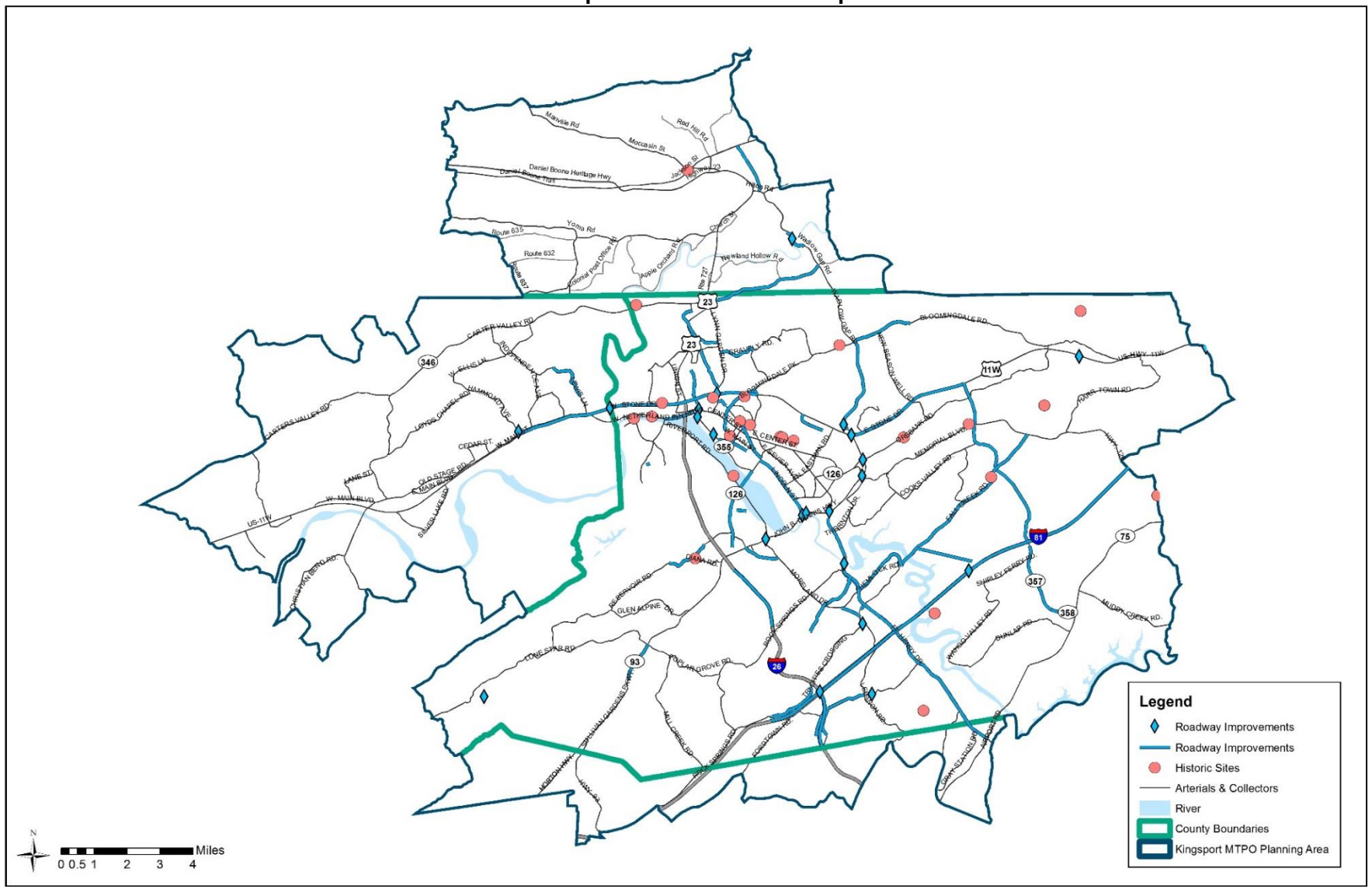
(a) Historic Lands Analysis

Historic site/district avoidance, minimization and mitigation are considered as part of the decision making process for transportation projects. Historic sites and districts have been identified and inventoried within the Kingsport MTPO boundary and are illustrated in the map below. Numerous laws and regulations call for preservation and/or enhancement of cultural resources through various local, state and federal agencies. Federal agencies are responsible for historical review process coordination between state and tribal agencies and officials on various transportation projects. The MTPO coordinates with these various agencies as part of its Long Range Planning process. In order to identify areas where the MTPO's planned projects may impact Kingsport's historic districts, a spatial analysis was undertaken, using the MTPO's geographic information system (GIS).

Figure 1 illustrates the location of historic properties in relation to the planned improvements in the Long Range Transportation Plan.

From this review, 35 projects from the 2040 LRTP were identified for which further study should be done in consultation with the appropriate local, state and federal agencies in the future (i.e. as the project proceeds into the project development process).

Figure 1
Historic Properties & 2040 LRTP Improvements



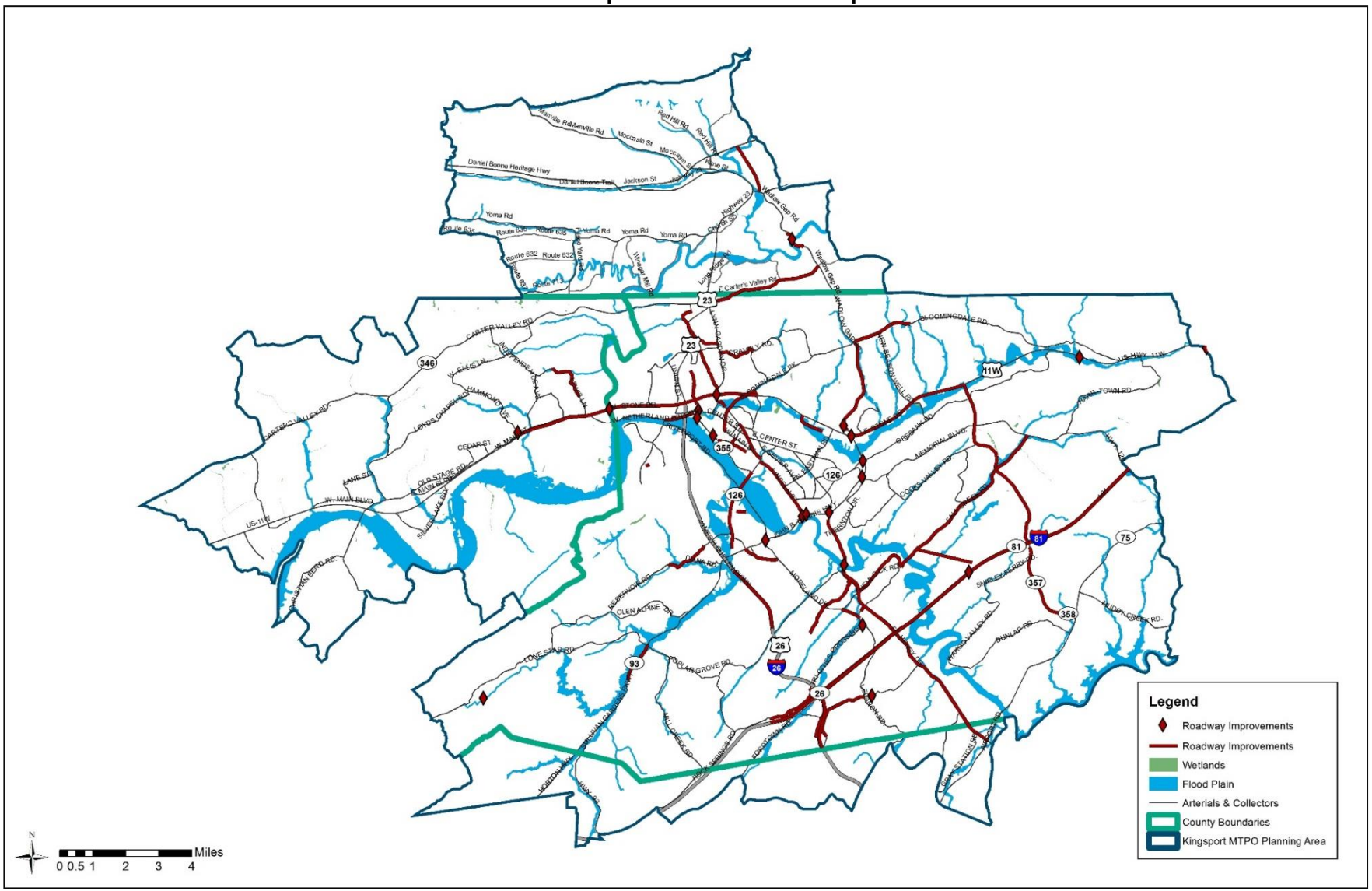
(b) Wetlands and Floodplains Analysis

As transportation projects are developed, it is important to be aware of their potential impacts on the physical environment. Two areas of environmental concern are wetlands and floodplains. Wetlands can be described as lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on the surface. A floodplain is a low plain adjacent to a river that is formed mainly of river sediment and is subject to flooding.

Figure 2 illustrates the location of wetland and floodplain areas in relation to the planned improvements in the Long Range Transportation Plan.

From this review 46 projects were identified from the 2040 LRTP for which further study should be done in consultation with the appropriate local, state and federal agencies in the future (i.e. as the project proceeds into the project development process).

Figure 2
Wetlands and Floodplains & 2040 LRTP Improvements



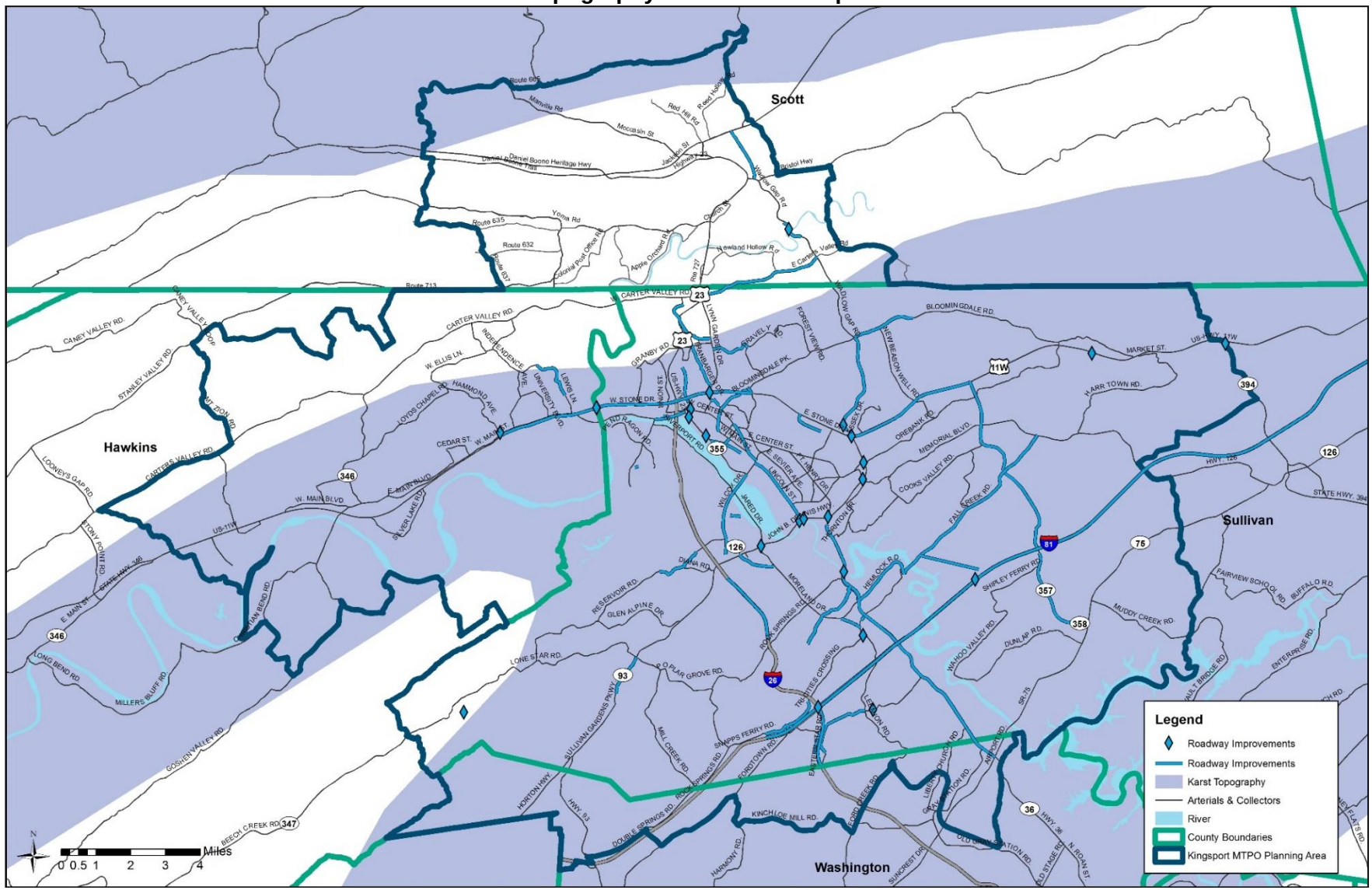
(c) Topography and Karst Analysis

The East Tennessee landscape consists of varied topography that reflects the lithology and geologic structure of the area. Karst makes up a large part of the East Tennessee landscape and is very problematic in locating, designing, and constructing highways. Karst topography is the name give to an area underlain by rocks such as limestone and is characterized by caves, sinkholes, and depressions. The karst system identified in the map below represents possible areas were fissures, tubes, and caves over 1,000 ft (300 m) long; 50 ft (15 m) to over 250 ft (75 m) vertical extent; in moderately to steeply dipping beds of carbonate rock may exist. Potential karst system problems include sinkholes, caves and caverns, collapse incidents, and groundwater contamination. Innovative and cost-effective remedial concepts for solving karst related geotechnical problems include avoidance, using lined ditches and graded rock pads, and other bridging- and drainage-related concepts. Stringent land use and building codes for karst areas are required to ensure the success of karst-related remedial design concepts proposed for highways.

Figure 3 illustrates the location of karst topography areas in relation to the planned improvements in the Long Range Transportation Plan.

From this review nearly all projects from the 2040 LRTP (81 out of 87) were identified for which further study should be done in consultation with the appropriate local, state and federal agencies in the future (i.e. as the project proceeds into the project development process).

Figure 3
Karst Topography & 2040 LRTP Improvements



ENVIRONMENTAL MITIGATION STRATEGIES

As previously discussed, the FAST Act continues the SAFETEA-LU intention to enhance the consideration of environmental issues and impacts within the transportation planning process. As such, metropolitan and statewide transportation plans must include a discussion of types of potential environmental mitigation activities as part of their plans. The following strategies will be utilized by the MTPO to address and consider environmental impacts relative to the decisions of the MTPO early in the planning process:

- Embrace the principles of Context Sensitive Solutions (CSS) as a means of developing transportation facilities that fit its physical setting and preserves scenic, aesthetic, historic, and environmental resources, while maintaining safety and mobility.

- Continue to utilize the Region's GIS to identify environmental features (both physical and social) early in the planning process as a means of avoidance and/or to establish early corrective action plans prior to project construction.

- Partner with local, state, and federal resource agencies early in the planning process to identify potential issues relative to projects under consideration in the MTPO's plans and programs to develop appropriate solutions prior to actually beginning the project development process.

- Minimize the construction of transportation investments that would impact wetlands.

- Construct greenways as a means of preserving environmentally sensitive lands from inappropriate development.

Environmental impacts cannot always be avoided. Mitigation is the attempt to offset potential adverse effects of human activity on the environment. Mitigation, as listed below, is one of the last steps in the avoidance and minimization process. The mitigation areas and activities will be consistent with legal and regulatory agencies pertaining to human and natural environments. Steps to take in the project development process include the following in relation to environmental impacts:

- Avoid Impacts - The first strategic step in the environmental process is to avoid negative impacts altogether.
- Minimize impacts – If impacts cannot be avoided, they should be minimized by limiting the degree or magnitude of the proposed activity or project.
- Mitigate Impacts – Typical approaches to mitigation include:
  - Rectifying impacts – Repair, rehabilitate, or restore the impacted resource.
  - Reducing or eliminating impacts – Preservation and maintenance operations during the life of the proposed activity or project should seek to reduce or eliminate environmental impacts over time.
  - Compensating for impacts – A substitute or replacement resource or environmental function of equivalent or greater value could be implemented.

The MTPO will continue to work with the agencies, as defined in the MTPO's Public Participation Plan and Consultation process as projects proceed in the project development process, as appropriate. The MTPO recognizes that not every project will require the same level of mitigation;

different projects may utilize more mitigation while others require very little. All impacts on environmentally sensitive areas will be analyzed on a project by project basis to examine what mitigation strategies are appropriate.

The following mitigation activities will be considered on a project by project basis. For major construction projects, such as new roadways, or for projects that may have a region-wide environmental impact, a context sensitive solution process should be considered in which considerable public participation and alternative design solutions are used to lessen the impact of the project. The table below details mitigation activities that could be considered to deal with the primary areas of concern.

Table 1
Potential Mitigation Activities

Environmental Concern	Potential Mitigation Activities
Water Quality and Hydrology	Avoidance, Minimization, Mitigation; Maintain meanders in streams; minimize concrete channelization of streams; reduce use of riprap on river banks opting instead for natural vegetation; wetland mitigation banking; implementation of green infrastructure; bridge sensitive areas; improve stormwater management; compensation (could include preservation, creation, restoration, in lieu fees, riparian buffers); use of reduced-salt or reduced-sand road treatment mixtures in sensitive areas; use of best practices regarding herbicide use
Threatened and Endangered Species, Natural Areas	Avoidance, Minimization, Mitigation; reduction of habitat fragmentation; habitat banking; Smart Growth Concepts; wildlife fencing; maintenance of vegetation along infrastructure rights-of-way; use of native trees, shrubs, and warm season grasses for stabilization of disturbed areas; maintenance of important wildlife movement corridors, possible provision of wildlife crossings; Memoranda of Agreements for species management
Noise	Avoidance, Minimization, Mitigation; Truck restrictions such as the use of engine brakes; noise barriers; construction schedule considerations; speed control; pavement material considerations; roadway design (Context Sensitive Design)
Air Quality and Climate Change	Minimization, Mitigation, Adaptation; Establishing a low-carbon fuel standard (lcfs); Setting regional targets for per capita GHG Green House Gas (GHG) reductions from passenger vehicles; facility energy code standards; reduce and minimize impacts of exposed soils; minimization of idling, both passenger and commercial vehicles through congestion reduction and on-board technologies for freight transport
Neighborhoods, Communities, Homes & Businesses	Minimization, Mitigation; Context Sensitive Design; transit-oriented development (TOD); Smart Growth concepts; noise abatement; ensuring environmental justice; avoidance, minimization of agricultural lands; construction schedule coordination with farm operators; reimbursements to farm operators for loss of income; traffic calming design considerations
Cultural Resources	Avoidance, Minimization, Mitigation: Design considerations, design exceptions, and variances that avoid or minimize impacts to historic properties should be considered first. If avoidance or minimization isn't possible mitigation measures should be considered in cooperation with the appropriate resource agencies and depend on the type of resource being impacted.
Parks and Recreation Areas	Avoidance, Minimization, Mitigation; design considerations; replacement of impacted facilities
Underground Storage Tanks & Contaminated Sites	Avoidance, Minimization, Mitigation; design exceptions and variances; environmental compliance monitoring

PROCESS

The list below includes agencies to be consulted with during the development of the Long Range Transportation Plan.

Federal Agencies:

- Environmental Protection Agency (EPA)
- National Park Service (NPS)
- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- U.S. Forest Service

State Agencies & Local Agencies:

- Tennessee Department of Economic and Community Development
- Tennessee Department of Environmental and Conservation
- Tennessee State Historic Preservation Officer
- Tennessee Wildlife Resource Agency
- VA Department of Environmental Quality
- VA Department of Conservation & Recreation
- VA Marine Resources Commission
- VA Department of Game & Inland
- VA Department of Forestry