



Johnson City MTPO

2050 Metropolitan Transportation Plan

Adopted December 13, 2022

Prepared by



KCI
TECHNOLOGIES

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List of Acronyms

AADT	Annual Average Daily Traffic
ADA	Americans with Disabilities Act (ADA) of 1990
ADT	Average Daily Traffic
ADHS	Appalachia Development Highway System
AVL	Automated Vehicle Locator System
BEA	Bureau of Economic Analysis Economic Areas
BIL	Bipartisan Infrastructure Law
BLOS	Bicycle Level of Service
BRR	Bridge Replacement and Rehabilitation
CAA	Clean Air Act
CBD	Central Business District
CIP	Capital Improvement Program
CMAQ	Congestion Mitigation and Air Quality Improvement Program
CO	Carbon Monoxide
CPTHSTP	Coordinated Public Transit Human Services Transportation Plan
E+C	Existing Plus Committed
EJ	Environmental Justice
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FAST Act	Fixing America's Surface Transportation Act
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
FY	Fiscal Year
GHG	Greenhouse Gas
GIS	Geographic Information System
HOV	High-Occupancy Vehicle Lanes
HPP	High Priority Projects
HSIP	Highway Safety Improvement Program
I	Interstate
IAC	Interagency Consultation
IIJA	Infrastructure Investment and Jobs Act
ITS	Intelligent Transportation Systems
JCT	Johnson City Transit
LOS	Level of Service
MAP-21	Moving Ahead for Progress in the 21st Century Act
MPA	Metropolitan Planning Area
MPH	Miles Per Hour
MPO	Metropolitan Planning Organization
MTP	Metropolitan Transportation Plan
MTPO	Metropolitan Transportation Planning Organization
MUTCD	Manual on Uniform Traffic Control Devices
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NET Trans	Northeast Tennessee Regional Public Transit System

NHFP	National Highway Freight Program
NHPP	National Highway Performance Program
NHS	National Highway System
NOx	Nitrogen Oxide
PDO	Property Damage Only
PLOS	Pedestrian Level of Service
PPP	Public Participation Plan
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SR	State Route
STBG	Surface Transportation Block Grant Program
STIP	State Transportation Improvement Program
STP	Surface Transportation Program
TAZ	Traffic Analysis Zone
TCA	Tennessee Code Annotated
TDM	Travel Demand Management
TDOSHS	Tennessee Department of Safety & Homeland Security
TDOT	Tennessee Department of Transportation
TA	Transportation Alternatives Program
TEA-21	Transportation Equity Act of the 21st Century of 1998
TERM	Transit Economic Requirements Model Scale
TIP	Transportation Improvement Program
TN	Tennessee
TSMO	Transportation System Management and Operations
UGB	Urban Growth Boundary
ULB	Useful Life Benchmark
US	United States
US DOT	United States Department of Transportation
USC	United States Code
V/C Ratio	Volume to Capacity Ratio
VHT	Vehicle Hours Traveled
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds

**RESOLUTION OF THE EXECUTIVE BOARD OF THE JOHNSON CITY METROPOLITAN TRANSPORTATION
PLANNING ORGANIZATION (MTPO)**

TO ADOPT THE JOHNSON CITY MTPO 2050 METROPOLITAN TRANSPORTATION PLAN

WHEREAS, the Johnson City MTPO is responsible for the transportation planning and coordination for the Johnson City Urbanized Area; and

WHEREAS, the Johnson City MTPO Executive Board has the authority to adopt plans and programs; and

WHEREAS, the development of a Metropolitan (Long-Range) Transportation Plan (MTP) was completed in accordance with Title 23 United States Code, Section 134, Metropolitan Transportation Planning; and

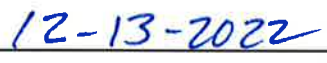
WHEREAS, various local, state, regional, and federal agencies, involved with transportation planning for the Johnson City Urbanized Area, have cooperatively developed the Johnson City MTPO 2050 MTP; and

WHEREAS, the MTP has completed the required 30-calendar day public review and comment period;

NOW, THEREFORE, BE IT RESOLVED that the Executive Board of the Johnson City MTPO does hereby adopt the Johnson City MTPO 2050 Metropolitan Transportation Plan.



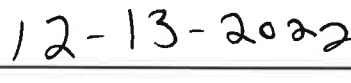
MTPO Executive Board, Chairman



Date



MTPO Executive Secretary



Date

INTRODUCTION



1.0 Introduction

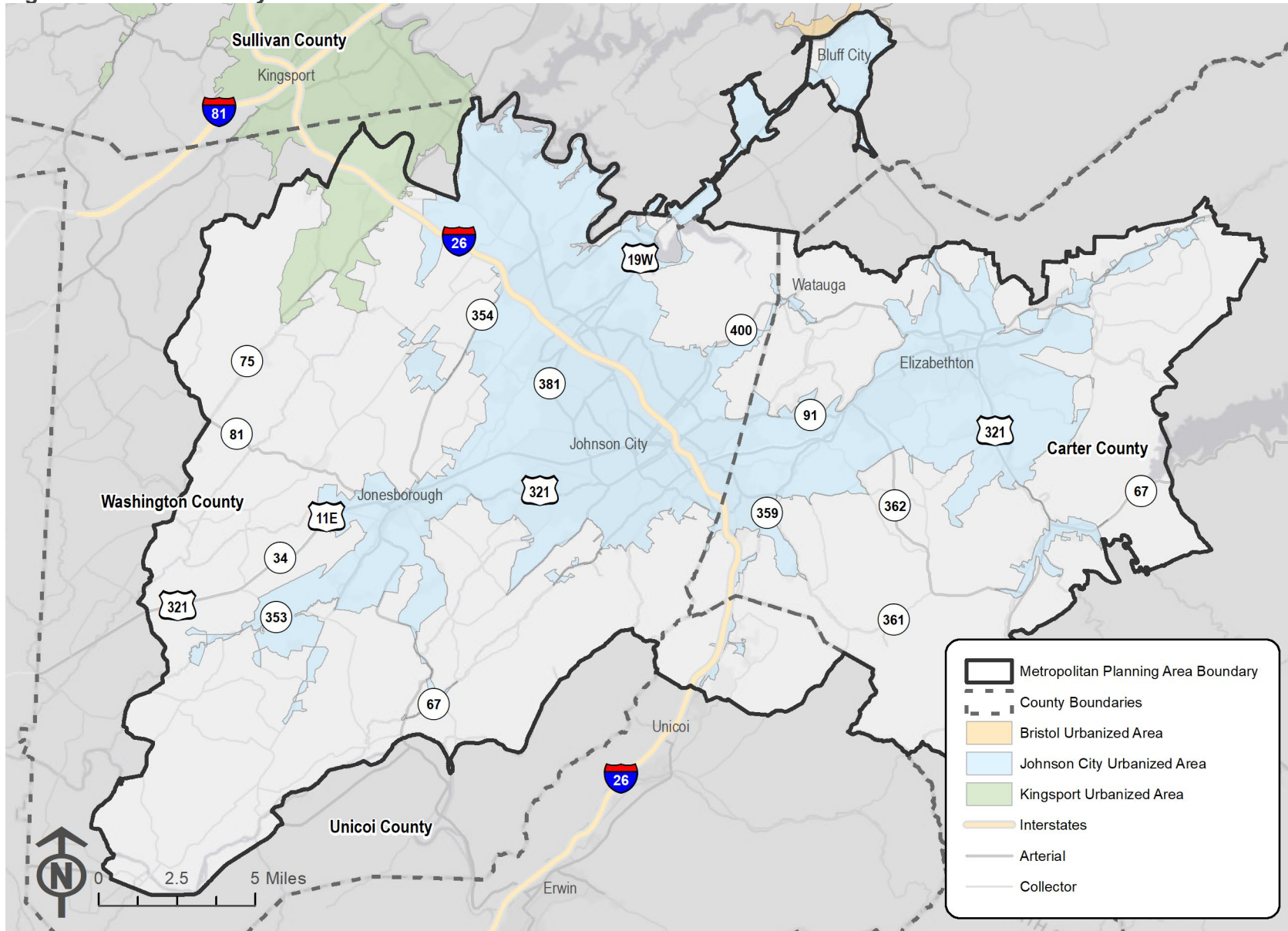
As a result of the 1980 U.S. Census, the Johnson City Metropolitan Transportation Planning Organization (MTPO) was established in 1982. The MTPO was created to comply with federal requirements that urbanized areas, such as Johnson City, provide a continuing, cooperative, and comprehensive approach to transportation planning for the region. At that time, the geographic limits of the urbanized area of Johnson City were much smaller, largely covering just the corporate limits of the City of Johnson City and a small portion of surrounding communities. Based on the 2010 U.S. Census, the Johnson City urbanized area includes a much larger geographic area including portions of Carter, Sullivan, Unicoi, and Washington counties and the municipalities of Bluff City, Elizabethton, Johnson City, Jonesborough, Watauga, and Unicoi.

An MPO is a policy-making organization focused on transportation that is composed of local government representatives, Federal and State officials, public transit providers, and other transportation officials, as well as local engineers and planners. Urbanized areas as defined by the U.S. Census Bureau with populations greater than 50,000 people are required to have an MPO to ensure that federal transportation funding is apportioned appropriately and aligned with planning processes that meet federal and regional goals. The Johnson City MTPO plans for and approves the use of transportation funds within its planning area for highway, transit, bicycle, and pedestrian projects. The MTPO's planning area includes the region's urbanized area and other areas that may become urbanized in the next 20 years (Figure 1-1).

The MPO coordinates the distribution of transportation funding through a planning process that is continuous, comprehensive, and cooperative, and includes engagement with regional partners and the public. As one of its core planning products, the MTPO develops the Metropolitan Transportation Plan (MTP) every five years. The MTP is a federally-required planning document that outlines transportation investments for the region over the next 25 years. Johnson City's 2050 MTP outlines the region's vision for transportation in the future, outlines key transportation needs, and establishes goals, objectives, and performance measures to meet those needs. The MTP is organized into the following main sections:

- Goals, Objectives, and Performance Measures
- Public and Stakeholder Engagement
- Existing Conditions and Trends
- Multimodal Transportation System and Performance
- Financial Analysis and Programming
- Project Impacts

Figure 1-1. Johnson City MTPO Area



GOALS, OBJECTIVES, AND PERFORMANCE MEASURES



2.0 Goals, Objectives, and Performance Measures

A performance-based planning approach allows states and MPOs to track progress toward meeting transportation planning goals and national priorities for multimodal transportation.

2.1 Federal Policy Context

In 2021, the Infrastructure Investment and Jobs Act, otherwise known as the Bipartisan Infrastructure Law (BIL), was passed to fund Federal highway and transit programs for fiscal years 2022 through 2026. The BIL reaffirms the transportation planning goals and performance management requirements outlined in the previous two transportation funding packages, Fixing America's Surface Transportation (FAST) Act and Moving Ahead for Progress in the 21st Century (MAP-21). The BIL makes no changes to the national planning goals outlined in 23 USC §150, which were first established in MAP-21 and address the following objectives:

- Safety – Achieve a significant reduction in traffic fatalities and serious injuries on all public roads;
- 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 (NHS);
- System Reliability – Improve the efficiency of the surface transportation system;
- Freight Movement and Economic Vitality – Improve the National Highway Freight Network, strengthening the ability of rural communities to access national and international trade markets, and supporting regional economic development;
- Environmental Sustainability – Enhance the performance of the transportation system while protecting and enhancing the natural environment; and
- 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.

The ten planning factors included in the FAST Act (23 CFR § 450.306) continue to be required for inclusion in the metropolitan transportation planning process under BIL. These planning factors are:

- Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency;
 - Increase the safety of the transportation system for motorized and nonmotorized users;
 - Increase the security of the transportation system for motorized and nonmotorized users;
 - Increase the accessibility and mobility options available to people and for freight;
 - 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;
 - Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight;
 - 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; and
- Enhance travel and tourism.

These national planning factors and goals provide the foundation for which desired statewide and regional outcomes are established.

2.2 Statewide Goals and Objectives

In 2015, the Tennessee Department of Transportation (TDOT) completed the 25-Year Long-Range Transportation Policy Plan (LRTP), which documents the state’s transportation policy and funding decisions and aligns with the national planning priorities established by the U.S. Department of Transportation (USDOT) and Federal Highway Administration (FHWA). In addition to a variety of policy recommendations, the LRTP outlines seven guiding principles to support transportation planning in the state, including:

- Preserve and manage the existing system;
- Support the state’s economy;
- Maximize safety and security;
- Provide for the efficient movement of people and freight;
- Build partnerships for sustainable and livable communities;
- Protect natural, cultural, and environmental resources; and
- Emphasize financial responsibility.

2.3 Metropolitan Transportation Planning Goals and Objectives

The 2050 MTP carries forward the goals and objectives that were included in the previous metropolitan transportation plan with minor revisions based on feedback and guidance from the Executive Board, stakeholders, and the public. These goals and objectives will help guide future transportation decisions in the region and establish a safe, connected, sustainable, and multimodal transportation system.

- Goal #1: Improve Safety and Security throughout the MTPO Area Transportation System
 - Reduce rates of crashes with serious injuries and fatalities
 - Reduce secondary traffic crashes
 - Establish initiatives (projects and programs) to improve the safety and security of vulnerable roadway users (e.g., pedestrians, cyclists, transit riders, and the young and old)
 - Encourage partnerships with other transportation and non-transportation agencies to enhance transportation safety and security
 - Increase the transportation system’s resilience to climate change and extreme weather
- Goal #2: Mitigate Traffic Congestion along Major Routes in the MTPO Area
 - Reduce travel delays between major areas of attractions in the MTPO study area
 - Seek cost-effective management solutions and new technologies as a means of addressing congestion, reducing transportation delay, improving travel time reliability, and improving system operations
 - Increase transit and other transportation demand management strategies
 - Enhance the flow of raw materials and manufactured products

- Goal #3: Promote Sustainable Economic Growth and Livability by Enhancing the MTPO Area Transportation System
 - Maintain what we have – take a “state of good repair” approach to our community’s transportation assets
 - Invest in the integration and connectivity of the transportation system, across and between modes, for people and freight, to support sustainable economic development and improve quality of life
 - Promote alternative forms of transportation (such as walking, biking, and transit)
 - Support transportation investments which minimize adverse impacts of surface transportation to historical, social, cultural, and natural environments, including stormwater impacts, and reduce transportation impacts on air-quality
- Goal #4: Enhance Regional Access to and from the MTPO Area
 - Maintain and improve access to regional areas outside of the MTPO study area
 - Support transportation investments and policies that work to create jobs and improve access to people, tourism, places, and goods while embracing access management and corridor management strategies that preserve the long-term functionality of a roadway’s capacity and safety
 - Strategically target transportation investments to areas supportive of and conducive to growth and redevelopment initiatives

Table 2-1 summarizes how the MTPO goals relate to the federal planning factors.

Table 2-1. MTP Goals and Federal Planning Factors

FAST Act Planning Factor	2050 MTP Goal
1. Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency.	4
2. Increase the safety of the transportation system for motorized and nonmotorized users.	1
3. Increase the security of the transportation system for motorized and nonmotorized users.	1
4. Increase the accessibility and mobility options available to people and for freight.	2, 3
5. 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.	1, 3
6. Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight.	3, 4
7. Promote efficient system management and operation.	2, 3, 4
8. Emphasize the preservation of the existing transportation system.	1, 3
9. Improve the resiliency of the transportation system and reduce or mitigate stormwater impacts of surface transportation.	1, 3
10. Enhance travel and tourism.	4

2.4 Performance Management

The Federal requirement for performance-based planning was first established in 2012 by MAP-21 and was further clarified within the FAST Act. The BIL continues the requirement of using quantifiable measures to support project evaluation, selection, and performance evaluation by State Departments of Transportation and MPOs. Twenty-three performance measures have been established to address topics of national concern, including safety, bridge and pavement condition, roadway and freight reliability, emissions reduction for pollutants, and transit safety measures. These measures, listed below, are used to ensure planning efforts and eventual project implementation support the attainment of national goals for the transportation system.

- Safety
 - Number of fatalities
 - Rate of fatalities per 100 million vehicle miles traveled (VMT)
 - Number of serious injuries
 - Rate of serious injuries per 100 million VMT
 - Number of non-motorized fatalities and non-motorized serious injuries
- Bridge and Pavement Conditions
 - Percentage of pavement of the Interstate System in good condition
 - Percentage of pavement of the Interstate System in poor condition
 - Percentage of pavement of the non-Interstate NHS in good condition
 - Percentage of pavement of the non-Interstate NHS in poor condition
 - Percentage of NHS bridges classified as in good condition
 - Percentage of NHS bridges classified as in poor condition
- Reliability
 - Percentage of person-miles traveled on the Interstate that are reliable
 - Percentage of person-miles traveled on the non-Interstate NHS that are reliable
 - Truck Travel Time Reliability (TTTR) Index
- Emissions Reduction
 - Total emission reductions for applicable criteria pollutants
- Transit Asset Management
 - Percentage of Rolling Stock revenue vehicles (by type) that exceed the useful life benchmark (ULB)
 - Percentage of non-revenue service vehicles (by type) that exceed the ULB
 - Percentage of facilities (by group) that are rated less than 3.0 on the Transit Economic Requirements Model (TERM) Scale
- Transit Safety
 - Total number of fatalities
 - Fatality rate per total vehicle revenue miles (VRM) by mode
 - Total number of injuries
 - Injury rate per total VRM by mode
 - Total number of safety events
 - Safety event rate per total VRM by mode
 - Total major mechanical failures
 - Mean distance between major mechanical failures by mode

In 2021, TDOT updated its LRTP to include a system performance report that establishes targets for each of these federally-required performance measures. The Johnson City MTPO

has chosen to adopt the performance targets established by TDOT to align with both federal and state performance management requirements. In doing so, the MTPO has agreed to prioritize projects and programs through this MTP that help the State meet or exceed its targets in the areas of system safety, infrastructure conditions, and system performance described below.

System safety performance measures (Table 2-2) evaluate the safety of the transportation system for all modes and users and set performance targets for fatal and serious injury crashes (both vehicles and non-motorized crashes), as well as a fatality and serious injury rate per 100 million VMT. Data for each metric is collected and summarized as a 5-year rolling average between 2017 and 2021. These safety targets were established by TDOT on August 31, 2022; Johnson City MTPO established its targets on December 13, 2022.

Table 2-2. System Safety Measures and Targets

Performance Measures	5-Year Rolling Averages (2017-2021)	Target (2019-2023)
Number of Fatalities (Crashes per Year)	1,148.6	1,308.2
Number of Serious Injuries (Crashes per Year)	5,995.6	6,069.4
Fatality Rate per 100 million VMT	1.417	1.601
Serious Injury Rate per 100 million VMT	7.416	7.424
Non-Motorized Fatalities and Serious Injuries (Crashes per Year)	546.4	600.9

Infrastructure condition performance measures (Table 2-3) assess the physical condition of roadways and bridges along the National Highway System (NHS). Targets are set for both 2-year and 4-year periods, and they project changes to the facility's condition based on the age of the infrastructure, population changes, and congestion levels. Pavement conditions are established using the International Roughness Index (IRI), which considers cracking levels, faults, and ruts when classifying pavements, and the distress data, which includes metrics that define the deterioration of pavements such as cracking, rutting, or other pavement conditions. These targets were established by TDOT on May 20, 2018 and were updated on October 1, 2020; Johnson City MTPO established its targets on November 14, 2018 and updated them on February 24, 2021.

Table 2-3. Infrastructure Conditions Measures and Targets

Performance Measures	Baseline (2018)	2-Year Target (2018-2019)	Midpoint Performance (2018-2019)	4-Year Target (2018-2021)
Interstates in Good Condition (% of Pavements)	75.6%	---	71.5%	60.0%
Interstates in Poor Condition (% of Pavements)	0.14%	---	0.3%	1.0%
Non-Interstate NHS in Good Condition (% of Pavements)	44.8%	42.0%	41.6%	40.0%
Non-Interstate NHS in Poor Condition (% of Pavements)	3.24%	4.0%	4.0%	5.0%
NHS Bridges in Good Condition (% of Bridges)	39.5%	36.0%	35.1%	36.0%
Bridges in Poor Condition (% of Bridges)	4.9%	6.0%	4.1%	6.0%

System performance measures (Table 2-4) assess reliability of interstates and non-interstate portions of the NHS as an indicator of the overall health of the transportation system for personal vehicles and freight movement. This category of performance measures also includes air quality performance measures to assess the impact of transportation-related emissions. Because air quality performance metrics are only required to be reported for metropolitan planning areas in non-attainment, they were not included in the table below. Targets were established by TDOT on May 20, 2018; Johnson City MTPO established its targets on November 14, 2018.

Table 2-4. System Performance Measures and Targets

Performance Measures	Baseline (2018)	2-Year Target (2018-2019)	Midpoint Performance (2018-2019)	4-Year Target (2018-2021)	4-Year Target Adjustment
Reliable Interstate (% of Person-Miles Traveled)	87.7%	85.3%	88.2%	83.0%	None
Reliable Non-Interstate NHS Roads (% of Person-Miles Traveled)	---	---	89.4%	87.5%	None
Freight Reliability (Truck Travel Time Reliability (TTTR) Index)	1.35	1.35	1.35	1.33	1.37

On June 21, 2022, the Johnson City MTPO Executive Board adopted Transit Asset Management (TAM) targets for fiscal year 2023 to clarify useful life benchmarks (ULB) (Table 2-5), in addition to transit agency safety performance targets for Johnson City Transit (Table 2-6) and NET Trans (Table 2-7).

Table 2-5. Johnson City MTPO Transit Asset Management Performance Targets

Performance Measures	Baseline (Percent Past ULB – June 2022)	Target (Percent Past ULB – June 2023)
Rolling Stock: The percentage of revenue vehicles (by type) that exceed the useful life benchmark (ULB)	Bus - 0% Cutaway - 15% Minivan - 44% Vans - <25%	Bus - 0% Cutaway - <15% Minivan - 22% Vans - <25%
Equipment: The percentage of non-revenue service vehicles (by type) that exceed the ULB	Service Vehicles - 60%	Service Vehicles - <40%
Facilities: The percentage of facilities (by group) that are rated less than 3.0 on the Transit Economic Requirements Model (TERM) Scale	Maintenance - 0% Passenger - 0%	Maintenance - 0% Passenger - 0%

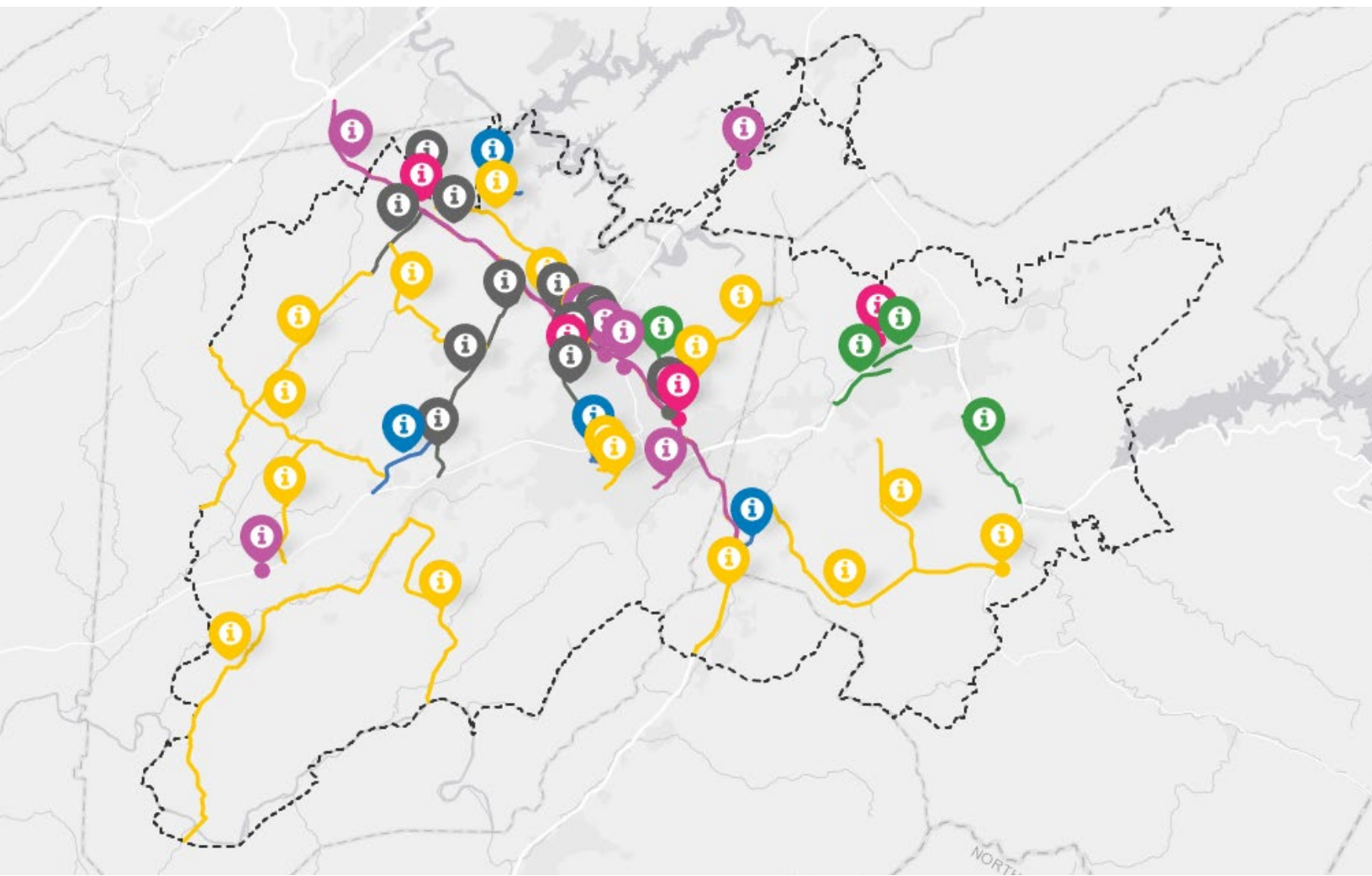
Table 2-6. Johnson City Transit Safety Performance Targets

Performance Measures	Target
Number of Fatalities	0
Rate of Fatalities per 100,000 Vehicle Revenue Miles	0
Number of Injuries	1
Rate of Injuries per 100,000 Vehicle Revenue Miles	0.000021
Number of Safety Events	2
Rate of Safety Events per 100,000 Vehicle Revenue Miles	0.33
Total Major Mechanical Failures	25
Miles Between Major Mechanical Failures	44,000

Table 2-7. NET Trans Transit Safety Performance Targets

Performance Measures	Target
Number of Fatalities	0
Rate of Fatalities per 100,000 Vehicle Revenue Miles	0
Number of Injuries	2
Rate of Injuries per 100,000 Vehicle Revenue Miles	0.08
Number of Safety Events	3
Rate of Safety Events per 100,000 Vehicle Revenue Miles	0.12
Total Major Mechanical Failures	15
Miles Between Major Mechanical Failures	163,748

PUBLIC AND STAKEHOLDER ENGAGEMENT



3.0 Public and Stakeholder Engagement

Public and stakeholder engagement was a critical component of the 2050 MTP update. Outreach was conducted throughout the planning process to the public, regional stakeholders, including technical representatives from local jurisdictions, and the MTPO's Executive Board. Detailed summaries of public and stakeholder feedback are included in Appendix A.

3.1 Engagement Approach

The outreach and engagement approach consisted of both virtual and in-person engagement opportunities, including virtual meetings, surveys, and in-person workshops. Due to the ongoing COVID-19 pandemic, virtual options were made available for all outreach opportunities to promote involvement while maintaining personal safety. When possible, in-person meetings were made available as well. Advertising efforts focused on sharing information before, during, and after outreach was conducted to promote upcoming events and varied opportunities for feedback. Targeted outreach included the development of a project webpage hosted by the Johnson City MTPO, press releases before each round of engagement, newspaper advertisements, boosted social media posts on Twitter and Facebook, use of the MetroQuest and Social Pinpoint engagement platforms, and email distribution lists that included over 1,800 business emails. Posters were also displayed at the Johnson City Transit Center.

3.2 Public Outreach

The first round of public engagement included virtual meetings and web-based surveys that were available from January to March 2022. Outreach at this stage focused on providing information on the purpose of the MTP update and gathering feedback on issues and opportunities related to the region's transportation system. The first survey was available online and was completed by 313 respondents. Respondents provided information about past and future development preferences, transportation priorities, and locations of transportation-related issues and opportunities through an interactive map. Key findings included:

- Perception that congestion on the region's roadways has worsened over time;
- Relative approval of the density of recent development;
- Desire for future development to be spread evenly throughout the region, while being focused near or next to existing development and transportation resources;
- Preference for prioritizing maintenance of existing roadways, reducing congestion and delay, and improving safety;
- Preference for project types that include bridge and pavement improvements, signal timing, and safety elements; and,
- Desire for improved sidewalk and trail connections to transit, as well as more investment in bicycle and pedestrian facilities in general.

The first two public meetings were held virtually on March 3, 2022, at 12:00 PM and 6:00 PM to explain the background and purpose of the MTP update and provide existing conditions information, including an overview of regional demographics, population and employment trends, roadway system conditions, environmental resources, safety statistics, active

transportation facilities, and transit system information. The presentation was recorded and posted on the project webpage.

The second round of public engagement included two open-house style in-person meetings on May 24, 2022, at 11:30 AM and 4:30 PM to gather feedback on the draft project recommendations. An interactive map on the Social Pinpoint platform allowed participants to comment on the draft recommendations in a virtual format that was visited by over 1,400 users.

Key feedback included:

- Widespread support for the ITS and safety projects, particularly adaptive signal control, ITS deployment along I-26, and projects addressing sight-distance issues and other geometric deficiencies;
- General support for the recommended widening of I-26 and Boones Creek Road;
- Strong opposition to the Okolona Road (SR 359) realignment due to property acquisition and environmental concerns; and,
- Strong support for the bicycle and pedestrian recommendations, particularly the Tweetsie Trail Extension and East Oakland Avenue pedestrian safety improvements.

Following the development of a draft MTP document, a third round of public outreach included an open-house style in-person meeting on November 30, 2022, at 4:00 PM to gather feedback on the draft of the MTP that was made available on the MTPO's website, the Johnson City Press, and multiple social media platforms. The third round of engagement garnered eight comments, and key feedback included:

- Support for additional bicycle, pedestrian, and transit facilities, particularly to serve as safe routes to school and to provide robust transportation options;
- Support for expanded transit routes and service hours; and,
- Support for roadway improvements between Kingsport and Johnson City.

3.3 Stakeholder Engagement

Coordination with regional stakeholders was ongoing throughout the development of the MTP and included consultation with local and regional planning agencies, county representatives, transit operators, school district representatives, TDOT, and FHWA. These stakeholders were chosen to provide feedback on critical topics, including economic development, freight, and tourism, as well as bicycle and pedestrian needs, transit, health, and equity. Stakeholders provided feedback on goals and objectives, locally prioritized projects, locations most likely to see future growth and development, and validated revenue and funding projections. All stakeholder meeting summaries can be found in Appendix A.

Stakeholder engagement also included four presentations to the MTPO's Executive Board, which provided status updates and allowed the Board to provide feedback at key phases of the planning process. The Board offered guidance on the MTP's goals and objectives, approved both the population and employment projections and the financial assumptions, and guided the project development and prioritization process.

EXISTING CONDITIONS AND TRENDS



4.0 Existing Conditions and Trends

The following sections detail existing conditions within the Johnson City Metropolitan Planning Area (MPA), which covers portions of Carter, Sullivan, Unicoi, and Washington Counties, to provide an overview of transportation issues and opportunities in the region.

4.1 Land Use, Growth, and Development

The Johnson City MTPO's land use and development patterns are influenced by local zoning ordinances and development regulations. Local decisions about how and where development occurs have wide-ranging effects on the region, from influencing where people live and work and how they travel, to impacts on the natural environment.

As the region continues to grow and change, land use decisions can be made to better coordinate new development with transportation planning efforts to best manage how the transportation system operates. For example, encouraging more compact, mixed-use development in existing communities can make bicycling, walking, and transit more viable alternatives to driving alone, while simultaneously reducing the impact of new development on the region's natural resources.

The Johnson City MTPO area covers over 350 square miles, with 45% of that area dedicated to agriculture, timber, and forest lands. Residential uses cover 28% of the region (only 3% of which is multi-family housing), commercial uses cover 3%, industrial uses cover 1%, and public/semi-public uses (which includes a small portion of the Administrative Boundary of the Cherokee National Forest, not actual land owned by the Cherokee National Forest) cover 9%. Five percent of the region's acreage is used for transportation purposes, 1% is river, and 8% is vacant.

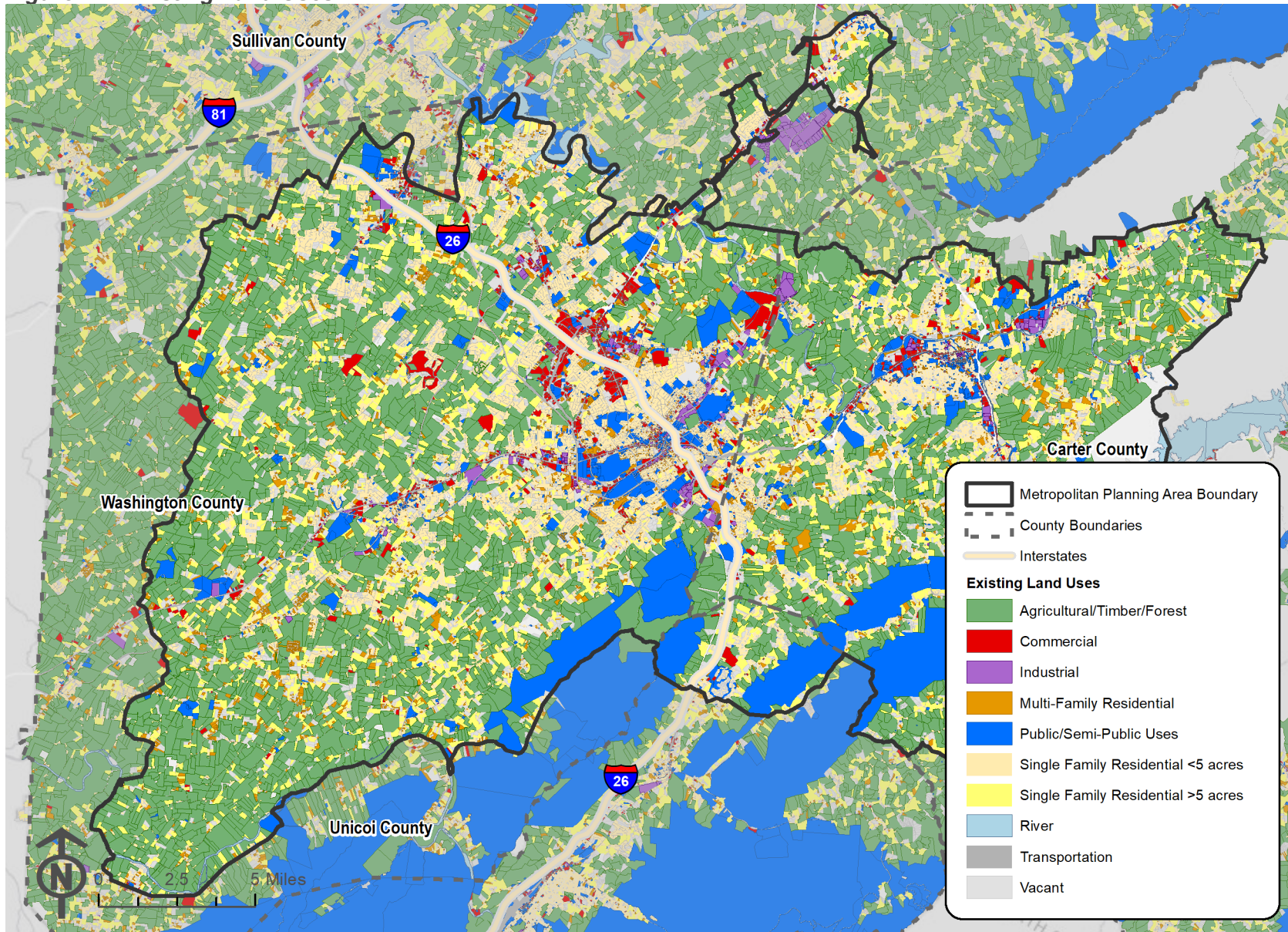
Figure 4-1 illustrates the existing land uses within the Johnson City MTPO area, and acreage totals are included in Table 4-1.

Table 4-1. Acreage by Land Use Type, inside MPA

Land Use Type	Acreage	Percentage
Agricultural/Timber/Forest	147,985	45%
Commercial	9273	3%
Industrial	2726	1%
Public	29,427	9%
Residential	90,452	28%
Other (i.e., Transportation, River, Vacant)	45,807	14%
Total	325,670	100%

Source: Tennessee Comptroller of the Treasury

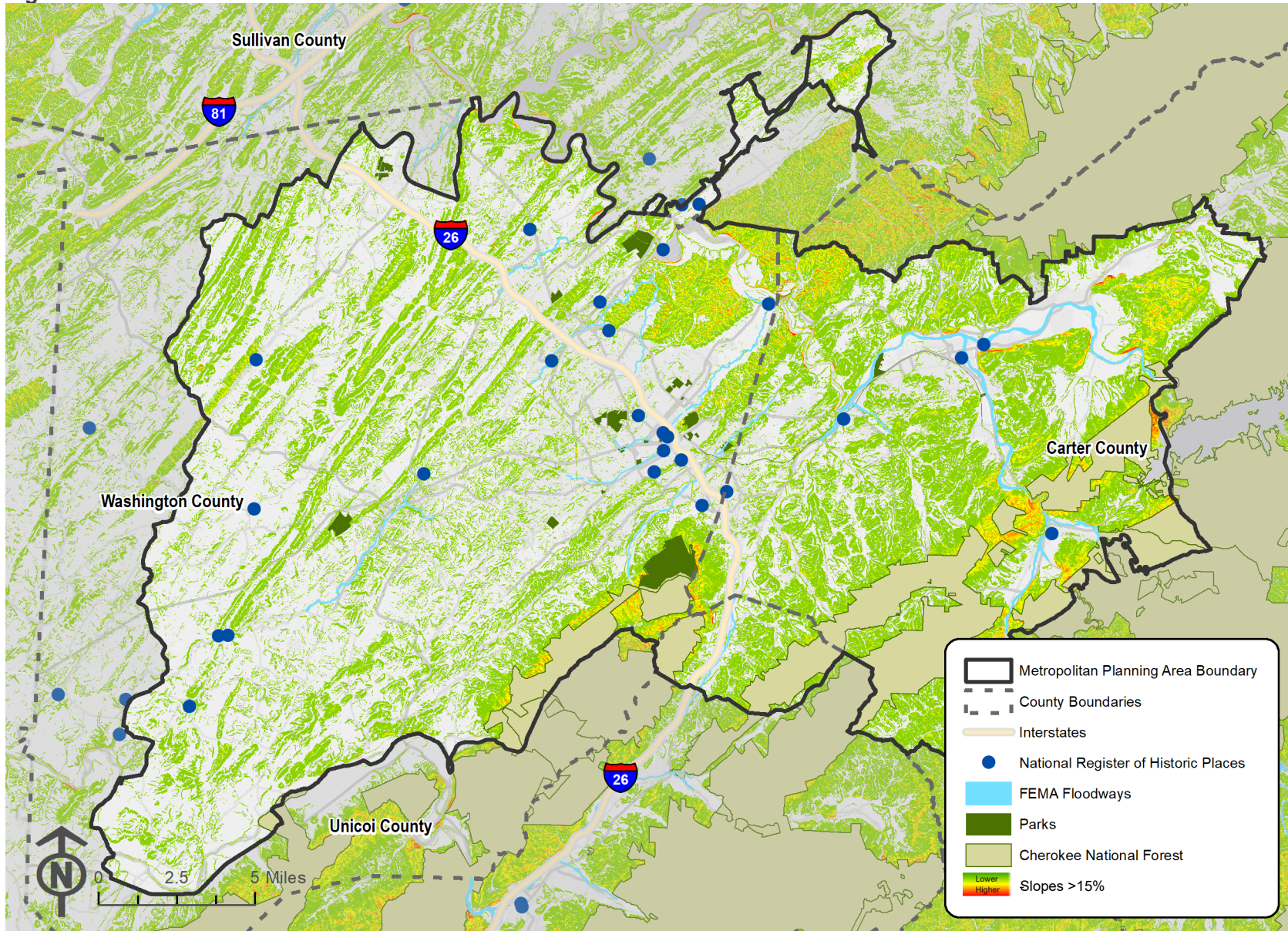
Figure 4-1. Existing Land Uses



4.2 Environmental Conditions

The Johnson City region is characterized by its rich natural resources, from its mountainous topography and fertile agricultural lands to the forested expanse of the Cherokee National Forest. Steep slopes of greater than 15% are a predominant environmental feature, which limits where development can occur. The region's karst topography also complicates development because the underlying limestone bedrock in most of the region is prone to developing sinkholes, caves, and depressions. Key environmental features are shown in Figure 4-2, including floodways, parks, sites listed on the National Register of Historic Places, and steep slopes.

Figure 4-2. Environmental Features

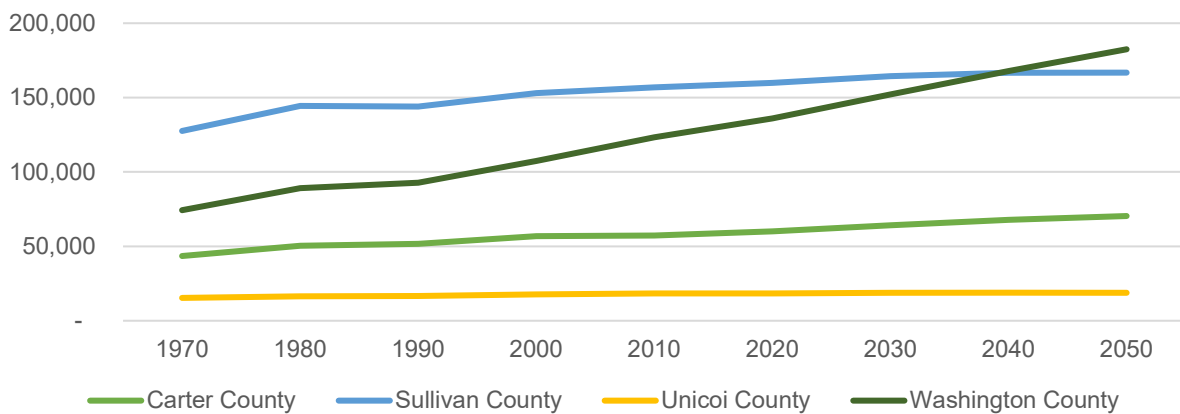


4.3 Existing and Future Population

The 4-county region surrounds the Johnson City MTPO area and includes all of Carter, Sullivan, Unicoi, and Washington Counties. Since 1970, the region has continued to see steady growth as shown in Figure 4-3. Population growth is expected to occur most rapidly in Washington County, which is projected to surpass Sullivan County as the most populous county in the region in 2040.

These county-level projections are sourced from the Woods & Poole data set, which was most recently purchased by TDOT in 2019. Although purchased in 2019, this national dataset sources historic decennial Census data and is used primarily for its future year projections. Detailed demographic data presented in this section is sourced from the 2019 edition of the U.S. Census Bureau’s American Community Survey (ACS) 5-Year Estimates as many of these variables are not yet available from the 2020 decennial Census. In general, 2020 U.S. Census data was analyzed for population analyses wherever possible and supplemented with 2019 ACS estimates where necessary.

Figure 4-3. Historic Population Growth in the Region



Source: Woods & Poole, 2019

As part of the larger region, the Johnson City MTPO area has a population of 171,269, according to the U.S. Census Bureau’s 2020 Census, which is a 7.2% percent increase since the 2010 Census. The Johnson City MTPO area is expected to see an additional 60,000 people by 2050, an increase of 35.4% that will mostly occur in Washington County as detailed in Table 4-2. Within the rest of the MTPO area, population growth is expected to plateau in both Unicoi and Sullivan counties and will increase by approximately 9,000 people in Carter County.

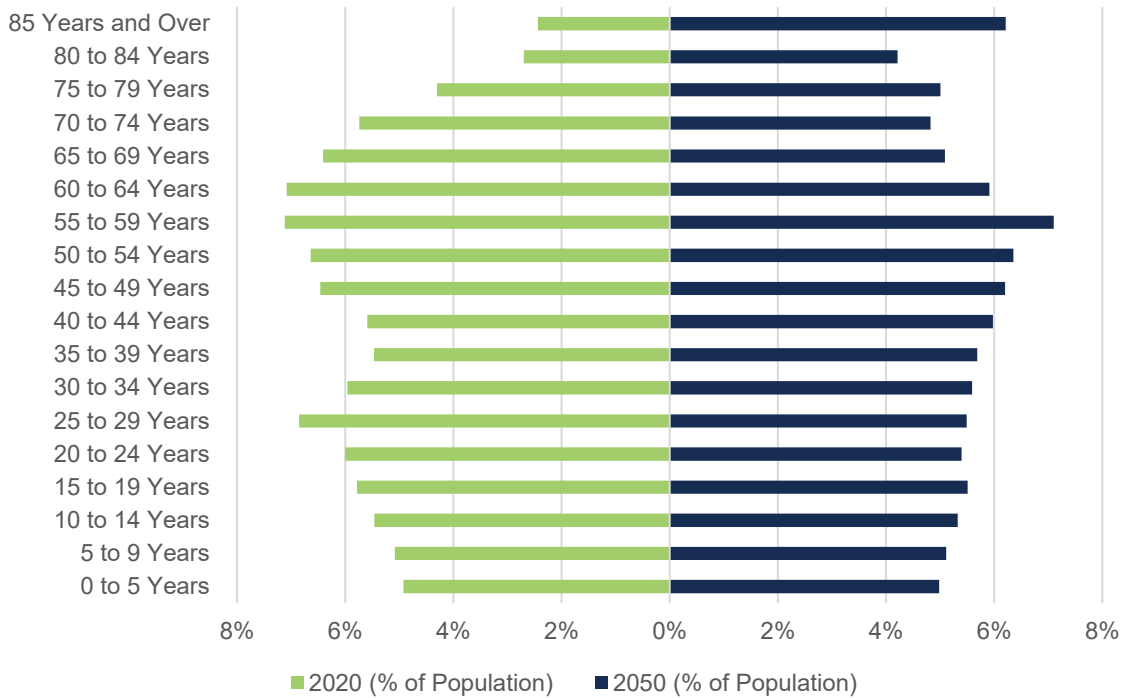
Table 4-2. Projected Population Growth Inside and Outside MPA

County	County Population 2020	Geography	Population 2020	Population 2050	Absolute Change 2020-2050	Percent Change 2020-2050
Carter	56,356	Inside MPA	46,201	55,283	9,082	19.7%
		Outside MPA	10,155	12,151	1,996	
Sullivan	158,163	Inside MPA	5,204	5,866	662	12.7%
		Outside MPA	6,013	6,778	765	
Unicoi	17,928	Inside MPA	1,865	1,980	115	6.2%
		Outside MPA	16,063	17,055	992	
Washington	133,001	Inside MPA	117,999	168,769	50,770	43.0%
		Outside MPA	15,002	21,457	6,455	
Total	365,448	Inside MPA	171,269	231,899	60,630	32.4%
		Outside MPA	47,233	57,441	10,208	

Figure 4-5 illustrates the population change between 2020 and 2050 in the Johnson City region by Traffic Analysis Zone (TAZ), which is a geography delineated for traffic-related analyses and consists of multiple census blocks.

Key demographic features, including age, access to vehicles, and income affect the types of transportation services that should be prioritized within the Johnson City MTPO area. The expected 3.8% increase in populations over the age of 65 (Figure 4-4) and the existing 6.5% of households in the region with no car (Table 4-3), for example, will require additional investment in walking, bicycling, and transit modes to provide mobility options for people who are unable or unwilling to drive. Regionally, approximately 13% of the region’s population is impoverished, which further underscores the need for increased investment in transit and active transportation.

Figure 4-4. Current and Projected Age Distribution in the Region



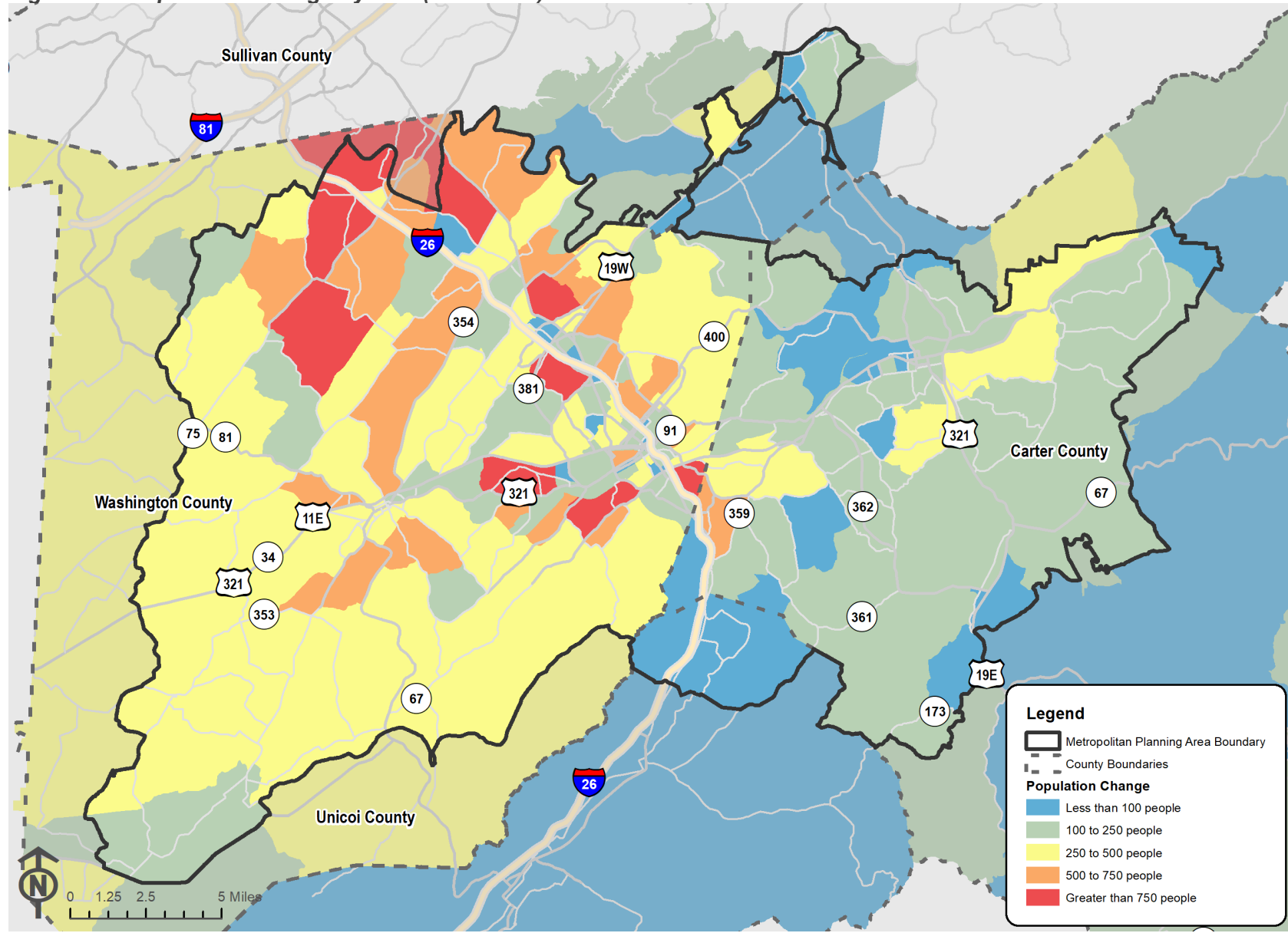
Source: Woods & Poole, 2019

Table 4-3. Poverty and Vehicle Access in the Region

County	Percent Zero-Auto Households	Percent Population in Poverty
Carter County	7.4%	16.8%
Sullivan County	6.3%	12.1%
Unicoi County	5.9%	13.4%
Washington County	6.3%	10.3%
Region Average	6.5%	13.0%

Source: American Community Survey, 2019

Figure 4-5. Population Change by TAZ (2020-2050)



4.4 Existing and Future Employment

In 2020, there were approximately 201,980 jobs in the 4-county region. Of these jobs, 71,032 were located within the Johnson City MTPO area, which is expected to see an increase of 18,200 jobs by 2050. Table 4-4 illustrates this projected employment increase. The 2020 estimates for employment were sourced from a TDOT purchase of the Infogroup dataset, which provided point-specific employment by category in the region as of February 2020. This snapshot of employment allowed for assessment of current jobs in the region prior to the COVID-19 pandemic.

Table 4-4. Projected Employment by County and MPA

	2020		2050		Change (2020 to 2050)	
	County	MPA	County	MPA	County	MPA
Carter County	18,026	12,654	21,099	14,803	3,073 (17.1%)	2,149 (17.0%)
Sullivan County	93,030	1,566	105,643	1,782	12,613 (13.6%)	216 (13.8%)
Unicoi County	6,742	58	7,101	61	359 (5.3%)	3 (5.2%)
Washington County	84,182	56,754	105,516	72,586	21,334 (25.3%)	15,832 (27.9%)
Total	201,980	71,032	239,359	89,232	37,379 (18.5%)	18,200 (25.6%)

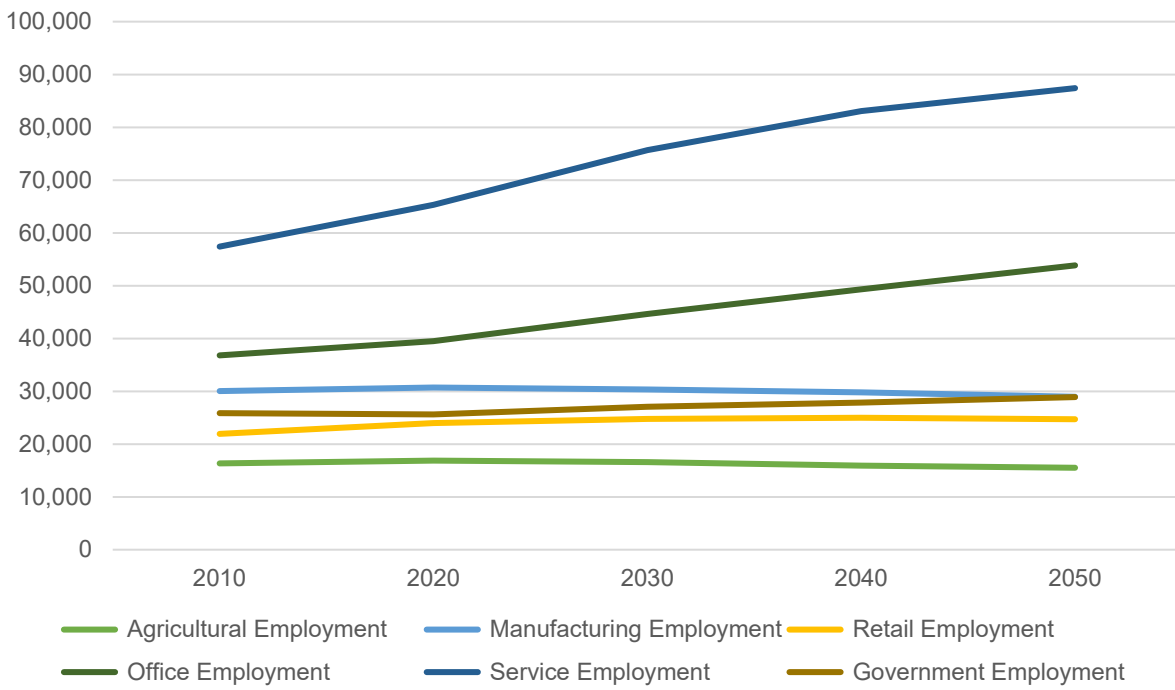
Source: Woods & Poole, 2019, InfoUSA 2020

For the purposes of modeling travel, jobs in the Johnson City region are grouped into six categories:

- Agricultural – farming, forestry, fishing, mining, construction
- Government – Federal civilian, Federal military, state/local government
- Manufacturing – Utilities, manufacturing, wholesale trade, transportation, warehousing
- Office – information, finance, insurance, real estate, leasing, professional and technical services, management, administration, waste services
- Retail – retail trade
- Service – educational, health care, social assistance, arts, entertainment, recreation, accommodation, food services, other services (except public administration)

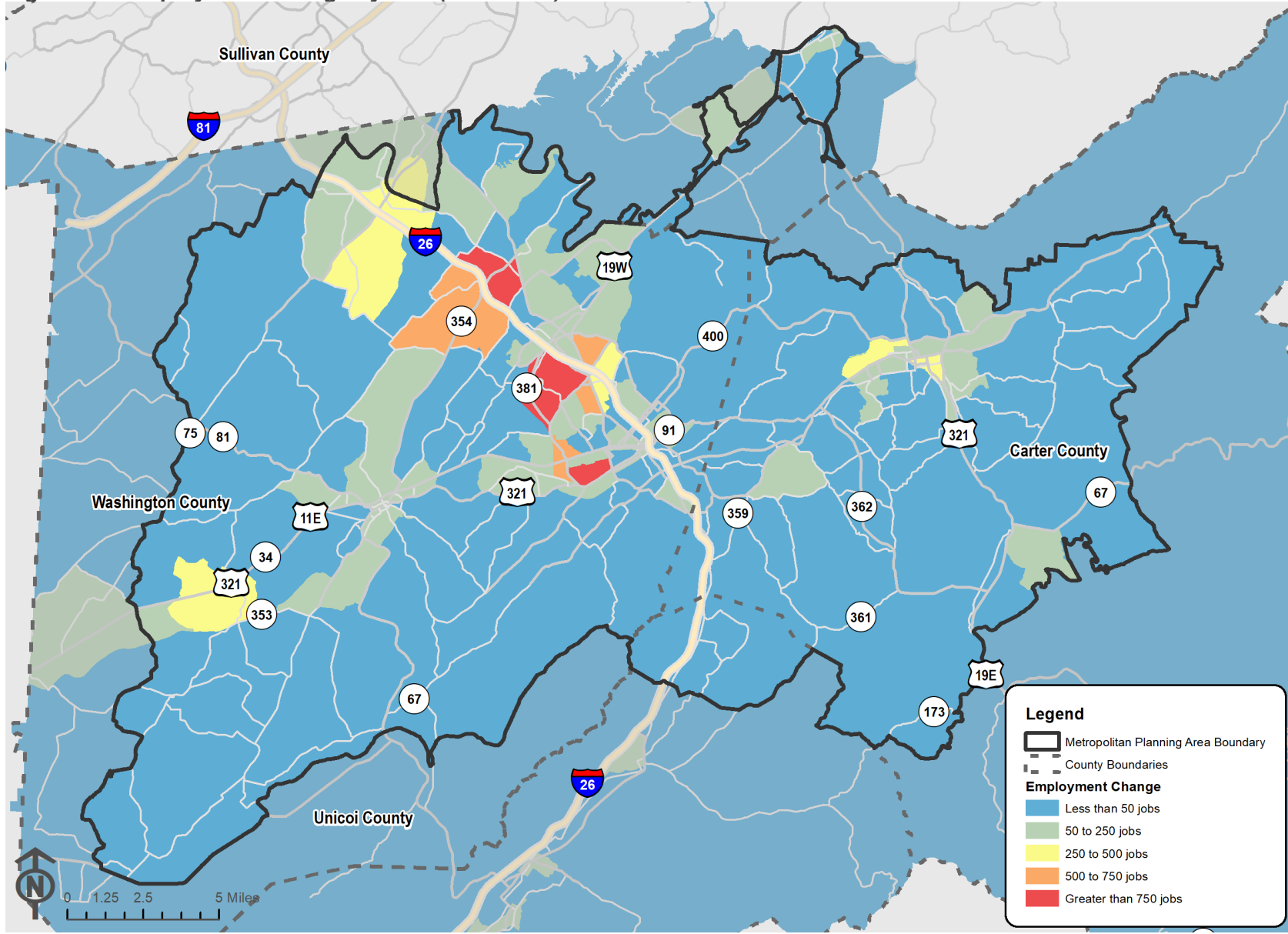
Figure 4-6 illustrates projected employment trends by sector in the 4-county region that contains the Johnson City MTPO area. This data is sourced from the Woods & Poole dataset, which projects employment changes at a county-level across the country. Consistent with national trends, job losses are expected for the agricultural and manufacturing sectors, while employment in the retail, office, government, and service sectors is expected to increase. Figure 4-7 highlights the total change in employment across all sectors by TAZ over the planning horizon.

Figure 4-6. Historic and Future Employment Trends by Sector in the Region



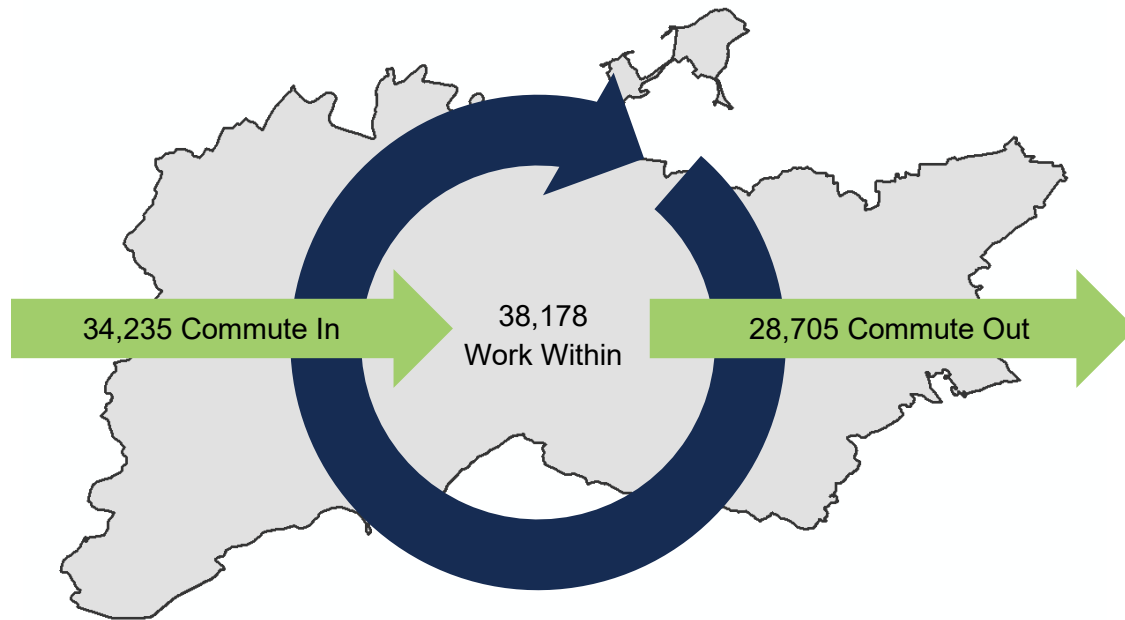
Source: Woods & Poole, 2019

Figure 4-7. Employment Change by TAZ (2020-2050)



The region's commuting patterns reflect the interconnectedness of the Johnson City MTPO region. According to U.S. Census data, in 2019, of the approximately 72,000 workers employed in the MTPO area, more than 34,000 people commute into the MTPO area each day for work, and an additional 28,000 people commute outside of the MTPO area each day to access their jobs (Figure 4-8). More than 38,000 workers both live and work within the MTPO area.

Figure 4-8. Commuting Patterns (2019)



Source: U.S. Census OnTheMap, 2019

While the majority of workers are employed in their county of residence, a significant number of workers travel to neighboring counties to access their jobs. Approximately 107,000 workers commute within the larger 4-county region each day. The county-to-county commuting patterns across the region are shown in Table 4-5. With a third of residents commuting across county lines for work, this data highlights the need for a regional approach to transportation.

Table 4-5. Commuting Trip Origins and Destinations (2019)

Home Location	Work Location							
	Carter County		Sullivan County		Unicoi County		Washington County	
Carter County	5,839	36%	3,010	18%	454	3%	7,120	43%
Sullivan County	1,418	3%	33,790	73%	326	1%	10,712	23%
Unicoi County	344	7%	632	13%	2,036	41%	1,902	39%
Washington County	1,987	5%	9,511	24%	1,094	3%	27,031	68%
Total County Employment	9,588		46,943		3,910		46,765	

Source: U.S. Census OnTheMap, 2019

MULTIMODAL SYSTEM AND PERFORMANCE



5.0 Multimodal System and Performance

The multimodal transportation system in the Johnson City MTPo area includes highways and local streets, railroads, transit, sidewalks, bikeways, and trails, all of which are used to move people and goods where they need to go, both locally and regionally. A connected transportation system that is accessible to all helps support the region’s economic health and desirability as a place to live and do business.

5.1 Roadway Network

There are 1,610 miles of roadways within the Johnson City MTPo area, including 19 miles of interstate (I-26), 186 miles of arterial roads, 295 miles of collector roads, and 1,110 miles of local roads. Each roadway is classified by its function, which reflects the level of accessibility and mobility it provides. For example, interstates allow high speed travel and regional connectivity, with minimal local access points, while arterials and collectors distribute relatively high volumes of vehicles between destinations. Local roads, in contrast, tend to have lower speeds and more access to individual properties and businesses. Table 5-1 organizes the mileage of each type of roadway within the MTPo area.

Table 5-1. Roadway Functional Classification

	Functional Classification	Miles of Roadway
Rural	Interstate	1.4
	Other Principal Arterials	3.0
	Minor Arterials	22.7
	Major Collector	53.8
	Minor Collector	89.6
	Local	371.8
	Total Rural Roadways	542.3
Urban	Interstate	17.5
	Other Principal Arterials	56.3
	Minor Arterials	103.9
	Major Collectors	113.5
	Minor Collectors	38.03
	Local	738.2
	Total Urban Roadways	1,067.4
Total Inside Johnson City MTPo Area		1,610.0

Source: TDOT

Traffic and Congestion

Traffic volume data are collected for major roadways by TDOT, including Annual Average Daily Traffic (AADT), roadway congestion, and safety metrics. This data is used to understand facility use, plan road maintenance, identify roadway segments with safety issues, and determine operational and capital improvements to address congestion.

Data on roadway congestion is purchased by TDOT and is developed using anonymized GPS data from smartphones, watches, and other GPS-enabled technologies in vehicles. This data was used to identify congested locations in the MTPO area during the AM and PM peak periods by analyzing vehicle speeds gathered over 15-minute increments throughout weekdays during January 2022. Figure 5-1 and Figure 5-2 display the severity of congestion during the AM peak (from 7 to 9 AM) and the PM peak (from 4 to 6 PM), respectively. These maps show percentages that compare how fast vehicles travel compared to the posted speed limit. Lower speed percentages highlight areas that are experiencing more congestion and delay compared to free flow speeds.

This data can also be used to identify specific locations where vehicles experience excessive delay based on vehicular speeds. Also known as bottlenecks, these locations may cause slower vehicle speeds due to a variety of factors such as geometric deficiencies, over-capacity facilities, construction, poor weather, traffic incidents, and others. In total, there were 135 bottlenecks that occurred within the Johnson City MTPO area during January 2022. Table 5-2 lists the top five worst bottlenecks based on the combined impact of their duration (i.e., the average amount of time per day that congestion is identified as originating in each location), length, and frequency, and Figure 5-3 shows their locations in the MTPO area.

Table 5-2. Top Bottleneck Impacts

Rank	Location	Average Duration	Average Length	Number of Occurrences per Month
1	North Roan Street at Bristol Highway (US 11E)	4 h 6 m	0.17 miles	543
2	Suncrest Drive (SR 75) at I-26	2 h 49 m	0.24 miles	348
3	Broad Street (US 321) with Veterans Memorial Parkway (US 19E)	1 h 57 m	0.19 miles	281
4	North Roan Street at Bristol Highway (US 11E/US 19W)	12 m	4.59 miles	11
5	I-26 East at State of Franklin (Exit 19)	2 m	2.84 miles	4

Source: INRIX, 2022

In addition to functional classification, roads are also assigned a “Level of Service”, or LOS. LOS is used to generally describe a road’s traffic conditions and how well it serves to move vehicles, by comparing traffic volumes and roadway capacity. While LOS ignores other modes of travel, such as walking and bicycling, it can be a useful indicator of existing and expected traffic conditions.

A road’s capacity is generally determined by its speed and number of lanes, and each road is assigned a letter grade between A and F, where LOS A denotes roads with free flow conditions and LOS F represents roads where demand far exceeds capacity. In more developed urbanized

areas, LOS E is generally considered an acceptable level of congestion. Figure 5-4 illustrates the LOS on the region's roadways across an average day under existing conditions. In 2020, approximately 99% of roadway miles in the MTPO area operate at LOS E or better. Primary exceptions include portions of North State of Franklin Road and Oakland Avenue in Johnson City.

To assess future transportation needs, the regional travel demand model is used to project the changes in roadway LOS after accounting for growth in population and employment in the region. A common practice is to examine how well the future transportation system operates if no more improvements were made to the current roadway facilities beyond those projects that have committed funding. This scenario is termed an existing plus committed (E+C) model scenario and allows for the prioritization of improvements based on future growth in the region. For planning purposes, committed projects in the E+C model scenario include those projects that are likely to be complete by 2050 based on current funding obligations in the MTPO's Transportation Improvement Program (TIP). A complete list of these projects is included in Table 5-3. Without additional improvements beyond these projects, the LOS on many of the region's roadways is expected to deteriorate slightly as shown in Figure 5-5. Specifically, the percentage of streets operating at LOS D or better is projected to fall from 99% to 97% by 2050.

Figure 5-1. AM Peak Period Congestion (2022)

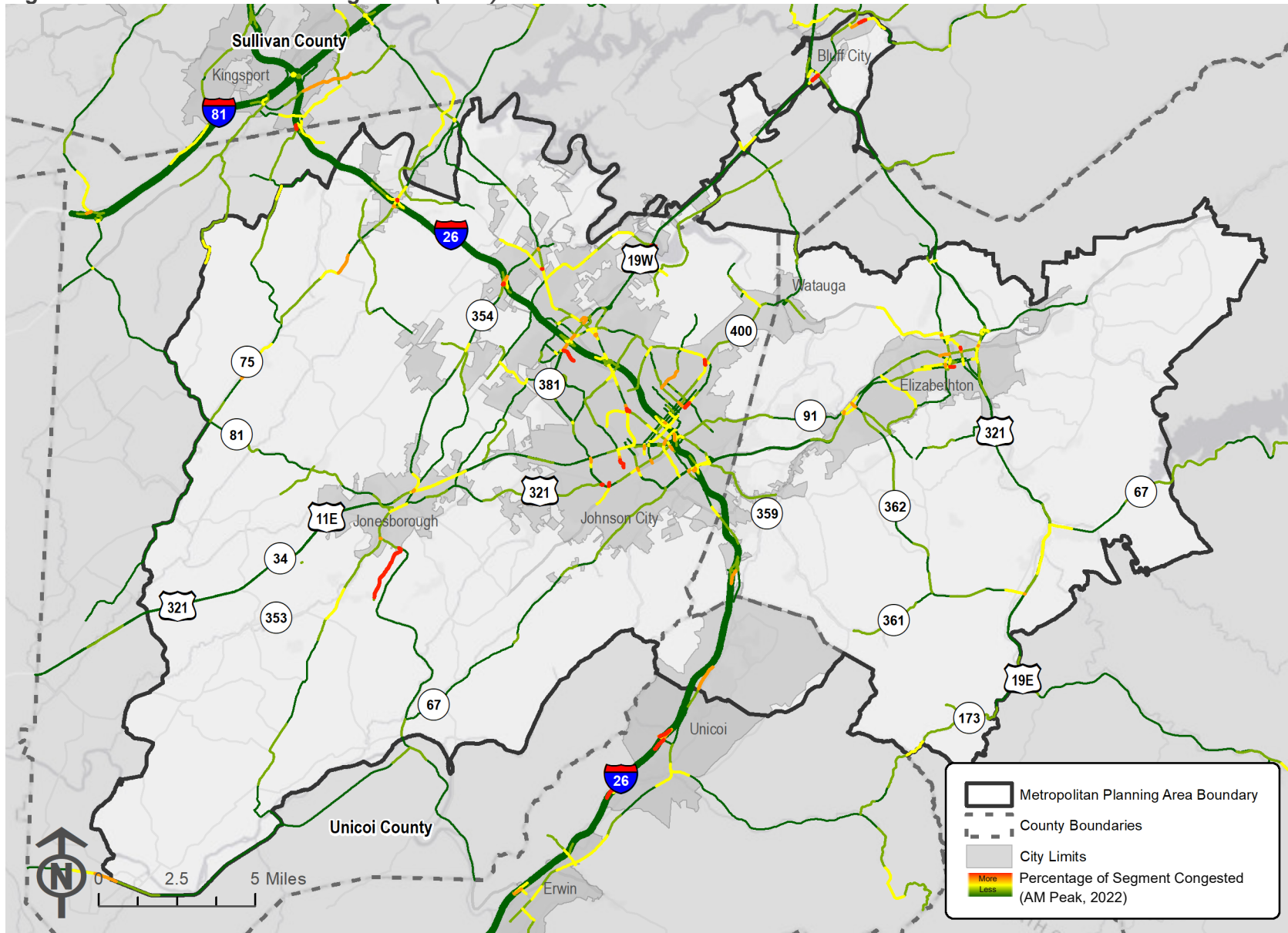


Figure 5-2. PM Peak Period Congestion (2022)

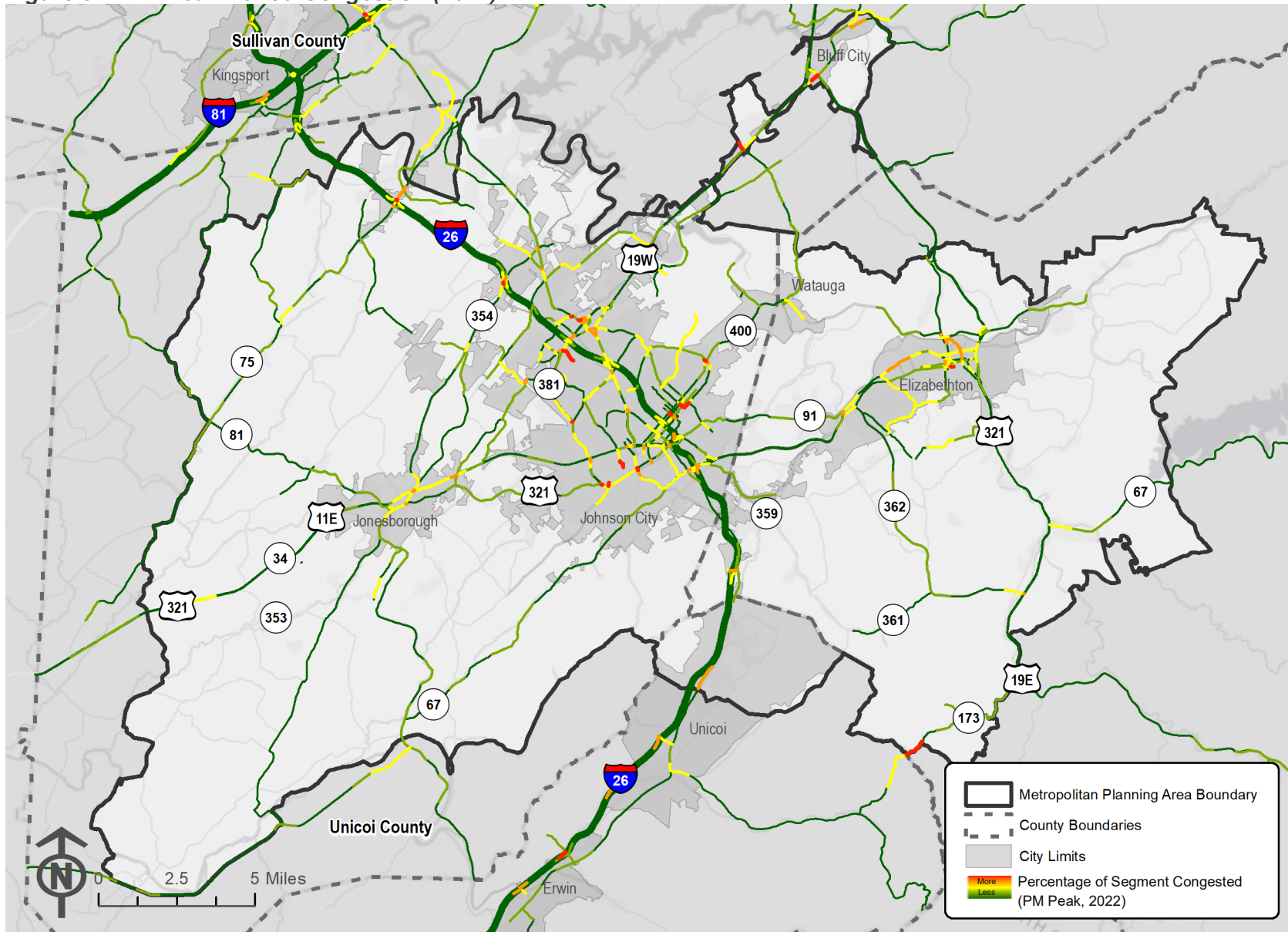


Figure 5-3. Top Bottleneck Locations (2022)

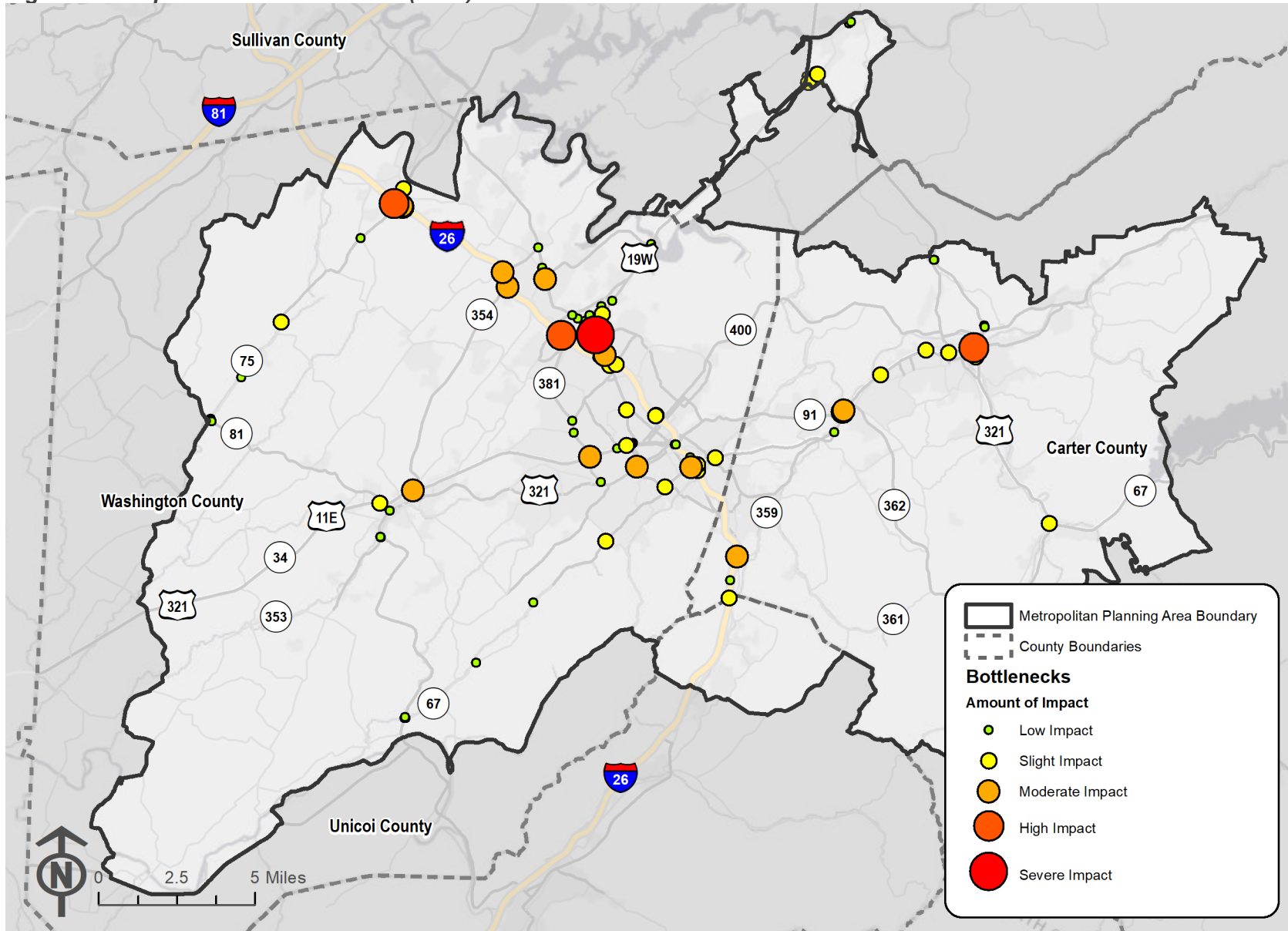


Figure 5-4. Existing Daily Level of Service (2020)

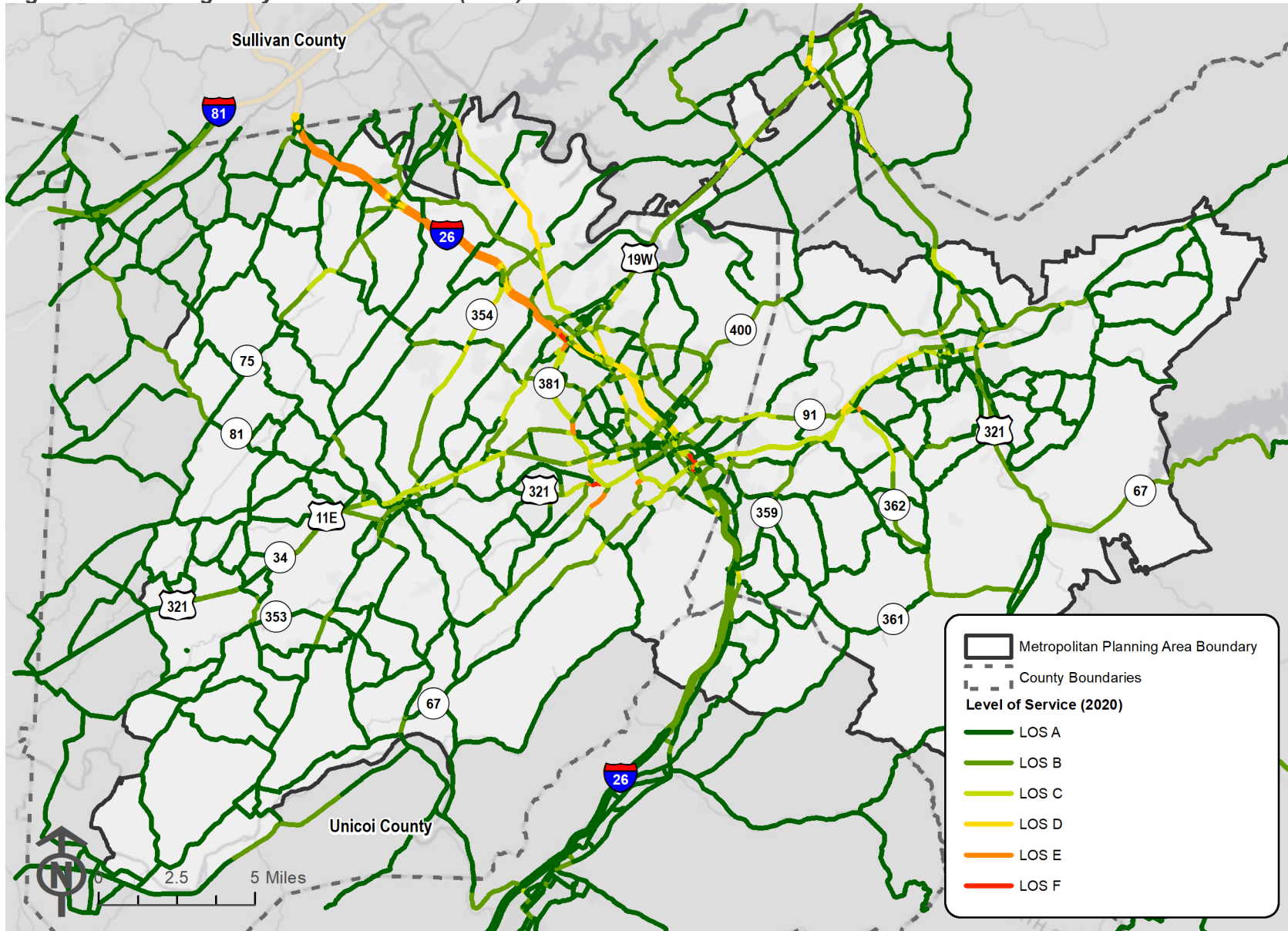


Table 5-3. E+C Projects

Lead Agency	Project/Route	From/To	Type	Description	Project Status
TDOT	Boones Creek Road (SR 354)	I-26 to Christian Church Road	Widen	Widen existing 2 lane roadway to 4 lanes	Completed
TDOT	Boones Creek Road (SR 354) and Bugaboo Springs Road Improvements	Boones Creek Road (SR 354) at Bugaboo Springs Road	Intersection Improvement	Intersection Improvement	Completed
TDOT	Bristol Highway (SR 34) at Industrial Park Road Traffic Signal Upgrade	Intersection of Bristol Highway (SR 34) and Industrial Park Road	Intersection Improvement	Upgrade traffic signals	Completed
TDOT	Elk Avenue Bridge Repair	Elk Avenue Bridge over Doe River	Bridge Rehabilitation	Repair and rehab the bridge due to deterioration	Completed
Johnson City	Christian Church Road	Boones Station Road to Boones Creek Road (SR 354)	Roadway Widening	Widen to 3 lanes, curb & sidewalk	Under Development; estimated \$3,200,000 cost
Washington County	Claude Simmons Road	West Market Street (US 11E) to Knob Creek Road	Safety	Spot safety improvements, signage, guardrail, striping, Safety Edge	Under Development
Washington County	Conklin Road	Old SR 34, Bacon Branch Road to Horace Dillow Road	Safety	Spot safety improvements, signage, guardrail, striping, Safety Edge	Under Development
TDOT	East Jackson Boulevard (SR 34/US 11E) and Boones Creek Road (SR 354) in Jonesborough	Intersection of East Jackson Boulevard (SR 34/US 11E) and Boones Creek Road (SR 354)	Intersection Improvement	Intersection Improvement	Completed

Lead Agency	Project/Route	From/To	Type	Description	Project Status
TDOT	East Jackson Boulevard (SR 34/US 11E) Improvements	East Jackson Boulevard (SR 34/US 11E) from Jonesborough City Limits to Claude Simmons Road	Reconstruction	Install turn lanes	Completed
Johnson City	Fiber Optic Network Expansion	Throughout Johnson City	ITS Improvements	Extend fiber optic network to include fiber optic cable, conduit, and possibly overhead installation throughout Johnson City	Under Development
Johnson City	Greenline Road	Intersection of Peoples Street and Greenline Road	Intersection Improvement	Intersection Improvement	Completed
Washington County	Greenwood Drive	Bill Jones Road to Lone Oak Road	Safety	Spot safety improvements, signage, guardrail, striping, Safety Edge	Under Development
TDOT	I-26 Exit 24 at University Parkway (SR 67)	Exit 24 on I-26 at University Parkway (SR 67)	Interchange Improvement	Ramp Modification	Completed
TDOT	I-26, Exit 17 at Boones Creek Road (SR 354)	Exit 17 on I-26 at Boones Creek Road (SR 354)	Interchange Improvement	Interchange modification	Completed

Lead Agency	Project/Route	From/To	Type	Description	Project Status
Johnson City	Knob Creek Road at State of Franklin Road (SR 381) Intersection and Approaches Improvements	Intersection Knob Creek Road at State of Franklin Road (SR 381), including intersections of Knob Creek & Peoples Street/Med-Tech Pkwy, & Knob Creek & Fitness Way	Intersection Improvement	Add turn lanes at Knob Creek & Med Tech, Knob Creek & Fitness Way, Knob Creek & Peoples with realignment on Peoples Street	Under Development; estimated \$750,000 for construction
TDOT	Knob Creek Road Extension - Section 1	West of Mizpah Hills Drive to Marketplace Boulevard	Reconstruction	Construct a new 5 lane (overpass crossing CSX RR)	Under Development; currently in right-of-way with additional \$35M left for construction, which TDOT will fund and manage
TDOT	Knob Creek Road Extension - Section 2 (IA)	North of Mizpah Hills Drive to Boones Creek Road (SR 354)	Reconstruction	New alignment, sidewalks and multiuse trail 2/3 lane	Under Development; currently in preliminary engineering with additional \$41.4M left for right-of-way and construction
Elizabethton	Linear Path and Tweetsie Trail Connector	Hattie Avenue, from Cedar Avenue to South Riverside Drive	Bicycle/Pedestrian	Two 5-foot paths connecting Linear Path at South Riverside Drive to the Tweetsie Trail at Cedar Avenue.	Under Development; estimated \$360,000 cost

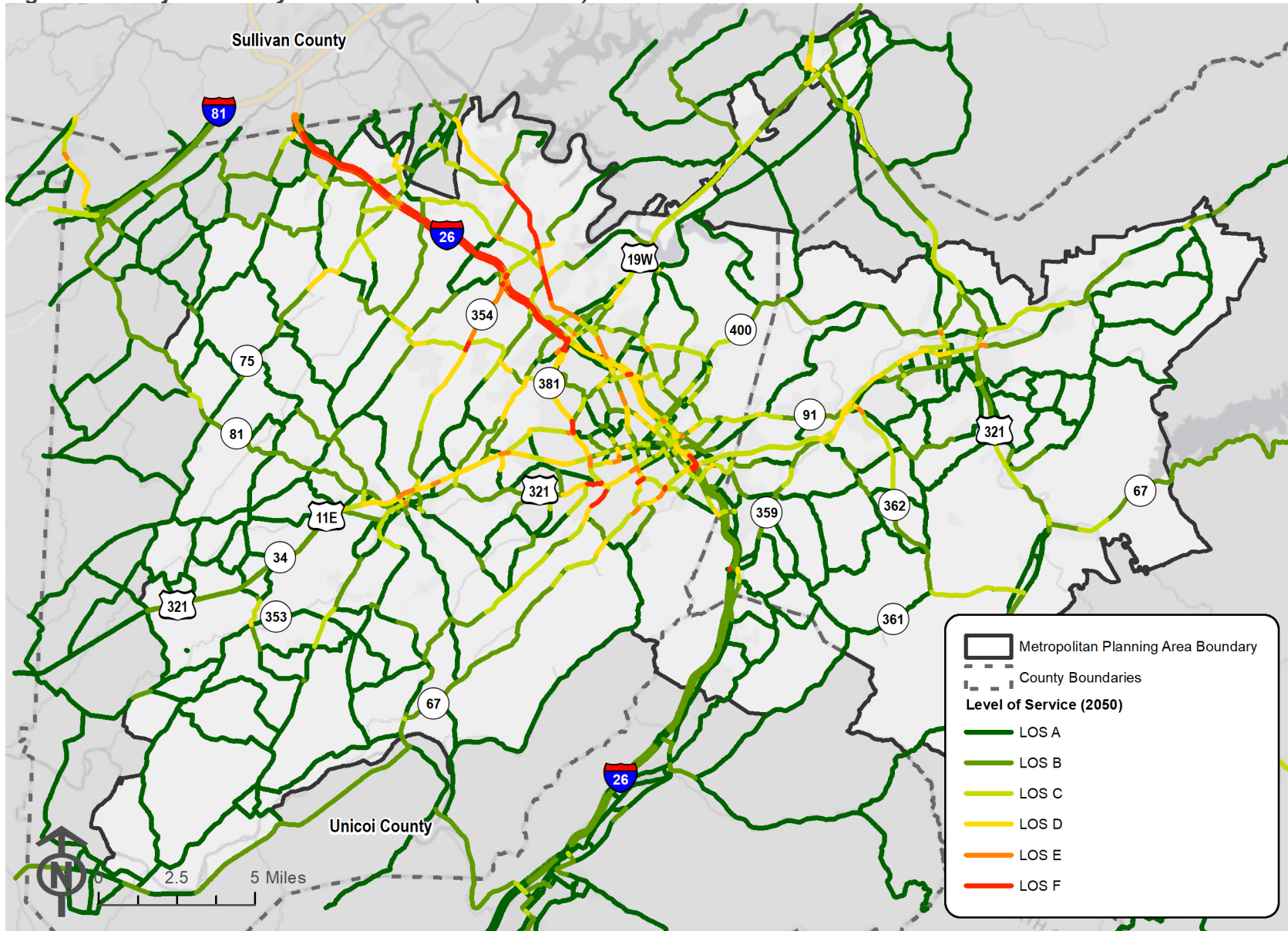
Lead Agency	Project/Route	From/To	Type	Description	Project Status
Jonesborough	New Traffic Signal at East Jackson Boulevard (SR 34) and Tiger Way	Intersection of East Jackson Boulevard (SR 34) at Tiger Way - Jonesborough	Traffic Signal	New traffic signal	In preliminary engineering phase
TDOT	Okolona Road (SR 359)	Milligan Highway (SR 359) to South Roan Street	Safety / Geometric Spot Improvement	Safety/geometric improvements (including paved shoulders, improvements at select locations/intersections as determined through the project development process	Not Started
Johnson City	Old Gray Station Road - Section 2	Bobby Hicks Highway (SR 75) to just north of Buckingham Road	Widen	Upgrade Traffic Signal at Bobby Hicks Highway (SR 75), widen to 3 lanes with turning lanes to intersection with Glen Mize Way; from Glen Mize Way to Boones Creek Road (SR 354) - improved 2 lanes with turn lanes	Under Development
Elizabethton	Overmountain Drive Extension	Overmountain Drive near the intersection of Militia Court	New Construction	Extend Overmountain Drive to the hospital access road	Under Development; estimated \$670,000 cost
Elizabethton	Overmountain Drive Roundabout in Elizabethton	Overmountain Drive Entrance to Walmart	Intersection Improvement	Install a roundabout to replace 3-way stop on Overmountain Drive	Under Development

Lead Agency	Project/Route	From/To	Type	Description	Project Status
Elizabethton	Riverfront Linear Walking Path - Phases IV & V	Phase V trail begins at the termination point of the existing trail along Race Street and ends at the termination point of the existing trail along West Riverside Drive. Phase IV trail begins at the termination point of the existing trail behind Lowe's adjacent to Overmountain Drive and ends at Sycamore Shoals State Park.	Bicycle/ Pedestrian	Linear walking path	Under Development; currently in preliminary engineering with additional \$630,000 left for construction
TDOT	Signalization Improvements for Elizabethton at Two Intersections	Elk Ave (SR 67) and Milligan Highway and Mill Street	Intersection Improvement	Upgrade and install traffic signals	Completed
TDOT	SR 91 Extension	Veterans Memorial Parkway (SR 37/US 19E) to West Elk Avenue (US 321)	Reconstruction	Add center turn lane along the 4-lane undivided portion of West Elk Avenue from Holly Lane to North Roan Street and reconfigure intersection of North Roan	Project is under construction, to be completed on or before June, 2023

Lead Agency	Project/Route	From/To	Type	Description	Project Status
Johnson City	State of Franklin Road (SR 381)	Intersection with Indian Ridge Road and Skyline Drive	Intersection Improvement	Add turn lanes, bridge rehabilitation	Completed
Elizabethton	Traffic Management Center - Elizabethton	Engineering Offices - Elizabethton	ITS Improvements	Software, computer system to control traffic signals and fiber.	Under Development
TDOT	Traffic Signal for North Roan Street (SR 36) at Mountainview Road	North Roan Street (SR 36) at Mountainview Road	Intersection Improvement	Install traffic signals	Completed
TDOT	Traffic Signal for State of Franklin Road (SR 381) and Harris Drive	Intersection of State of Franklin Road (SR 381) and Harris Drive	Intersection Improvement	Install traffic signals	Completed
Johnson City	Traffic Signal in Gray	Bob Fitz Road or Gray Station Road at Bobby Hicks Highway (SR 75) (only one location)	New Traffic Signal	Install new traffic signal at one of the locations	Under Development
TDOT	Traffic Signal Upgrade at Broad Street and Veterans Memorial Parkway	Intersection of Broad Street (SR 67/91/US 321) and Veterans Memorial Parkway (SR 37/US 19E)	Intersection Improvement	Upgrade traffic signal to improve safety and congestion	Under Construction; to be completed on or before June 2023
TDOT	Veterans Memorial Parkway (SR 37 /US 19E) and Gap Creek Road (SR 361) Intersection Improvements	Veterans Memorial Parkway (SR 37/US 19E) and Gap Creek Road (SR 361)	Safety / Bridge Improvements	Install traffic signal, signage, widen bridge	Under Development

Lead Agency	Project/Route	From/To	Type	Description	Project Status
TDOT	West Main Street (SR 81) at Persimmon Ridge Road Improvements	West Main Street (SR 81) at Persimmon Ridge Road	Intersection Improvement	Intersection Improvement	Completed
Johnson City	West Mountainview Road Improvements	West Mountainview Road, near Knob Creek Road to West Oakland Avenue	Roadway Widening	Widen roadway and add turn lanes	Under Development; estimated \$1,000,000 for construction
Johnson City	West Oakland Avenue Improvements	West Oakland Avenue, from West Mountainview Road to Hanover Road	Roadway Widening	Widen roadway and add turn lanes	Under Development; estimated \$1,150,000

Figure 5-5. Projected Daily Level of Service (2050 E+C)



Roadway Safety

Between 2016 and 2020, there were 27,006 crashes in the Johnson City MTPo area. As shown in Figure 5-6, these crashes are largely concentrated in the more densely populated areas within the region with more than 74% of crashes having occurred within city jurisdiction boundaries in this period. Approximately 53% of crashes occurred within the Johnson City limits. In addition, concentrations of crashes can be observed in Elizabethton and at various interchanges along the I-26 corridor.

Of the 27,006 crashes, 429 resulted in a serious injury and 90 resulted in a fatality. Fatal and serious injury crashes were concentrated along SR 91/US 321 in Elizabethton, along West State of Franklin Road in Johnson City, and at US 19E and US 321 in Hampton (Figure 5-7). Of the fatal and serious injury crashes, more than half (53.4%) were crashes that did not involve a collision with another vehicle. These crashes can be caused by a variety of factors, from human errors such as speeding and distracted driving, to roadway design deficiencies, such as shoulder widths and horizontal and vertical curvature.

Figure 5-8 illustrates the crash rates for roadway segments within the Johnson City MTPo area. These rates normalize the number of crashes that occur by each roadway segment's traffic volumes and segment length. Crash rates are highest in the downtown cores of the region's cities, in particular along Forrest Drive in Jonesborough, West Maple Street in Johnson City, and East Mill Street in Elizabethton.

There were a number of safety issues identified through the public and stakeholder engagement process as well as previous planning efforts including, but not limited to, geometric and design issues along parts of I-26, SR 91, Old State Route 34 (SR 353), Leesburg Road, and safety issues caused by congestion at the I-26 interchanges.

Figure 5-6. All Vehicular Crashes (2016-2020)

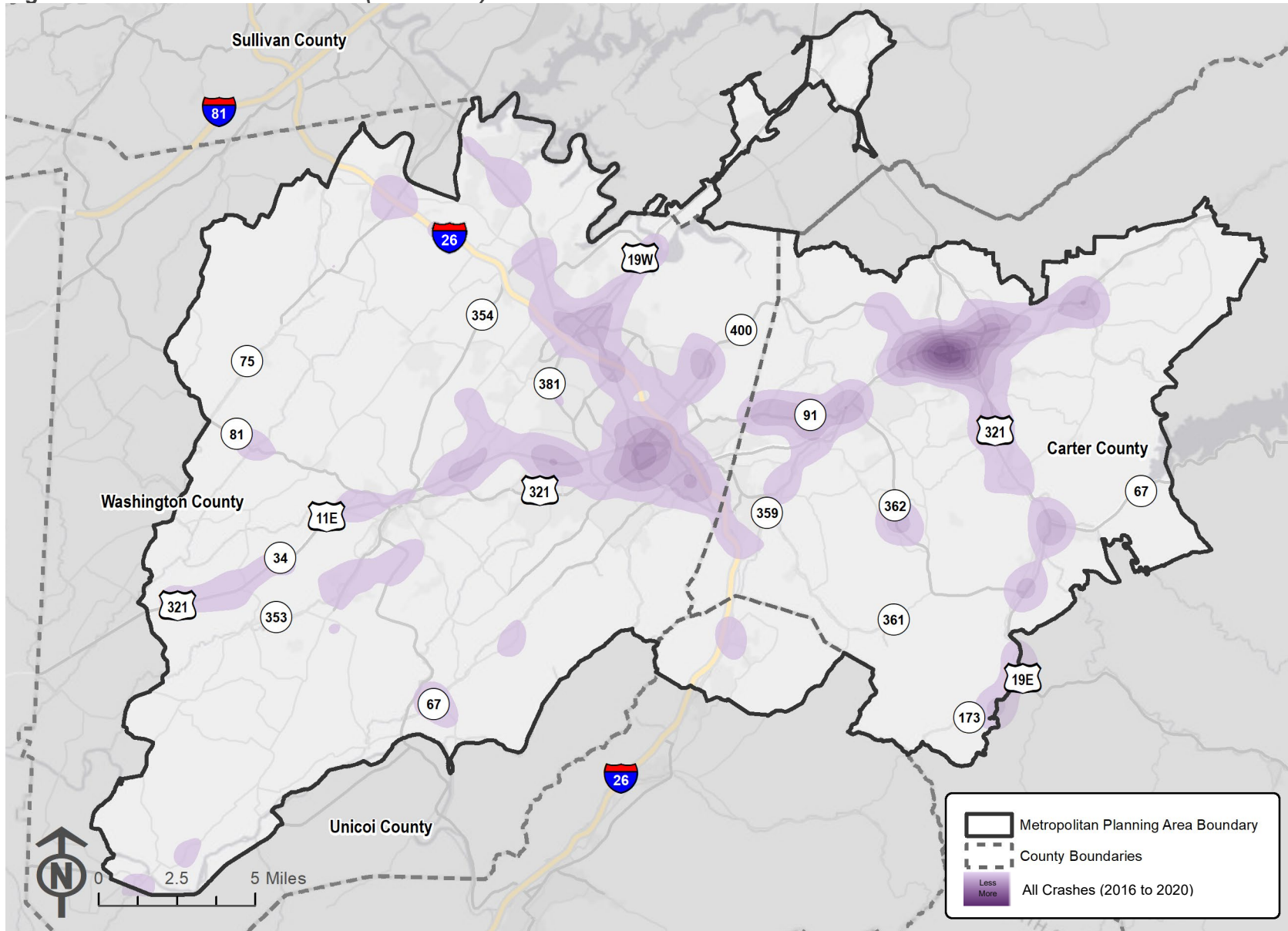


Figure 5-7. Fatal and Serious Injury Crashes (2016-2020)

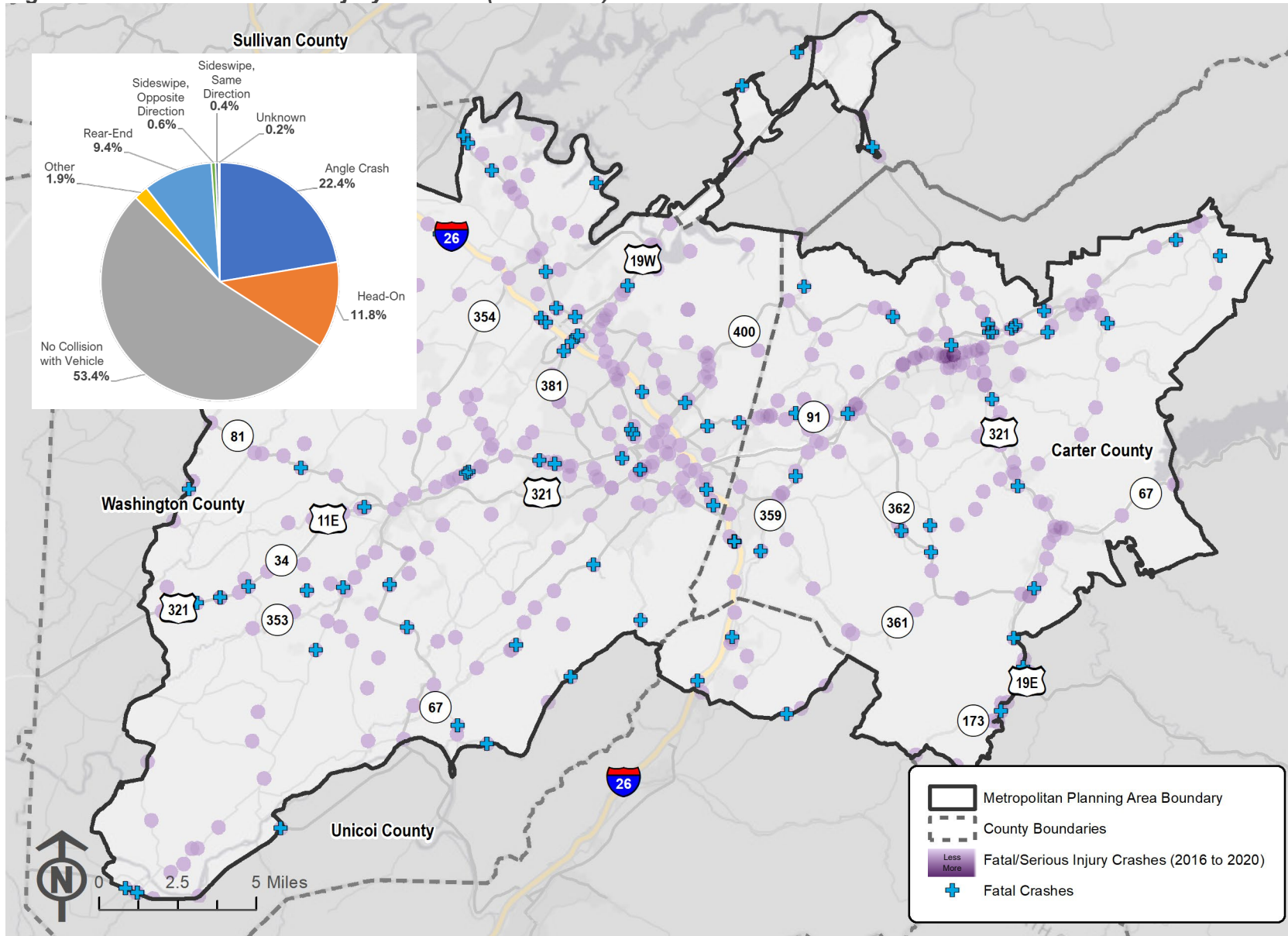
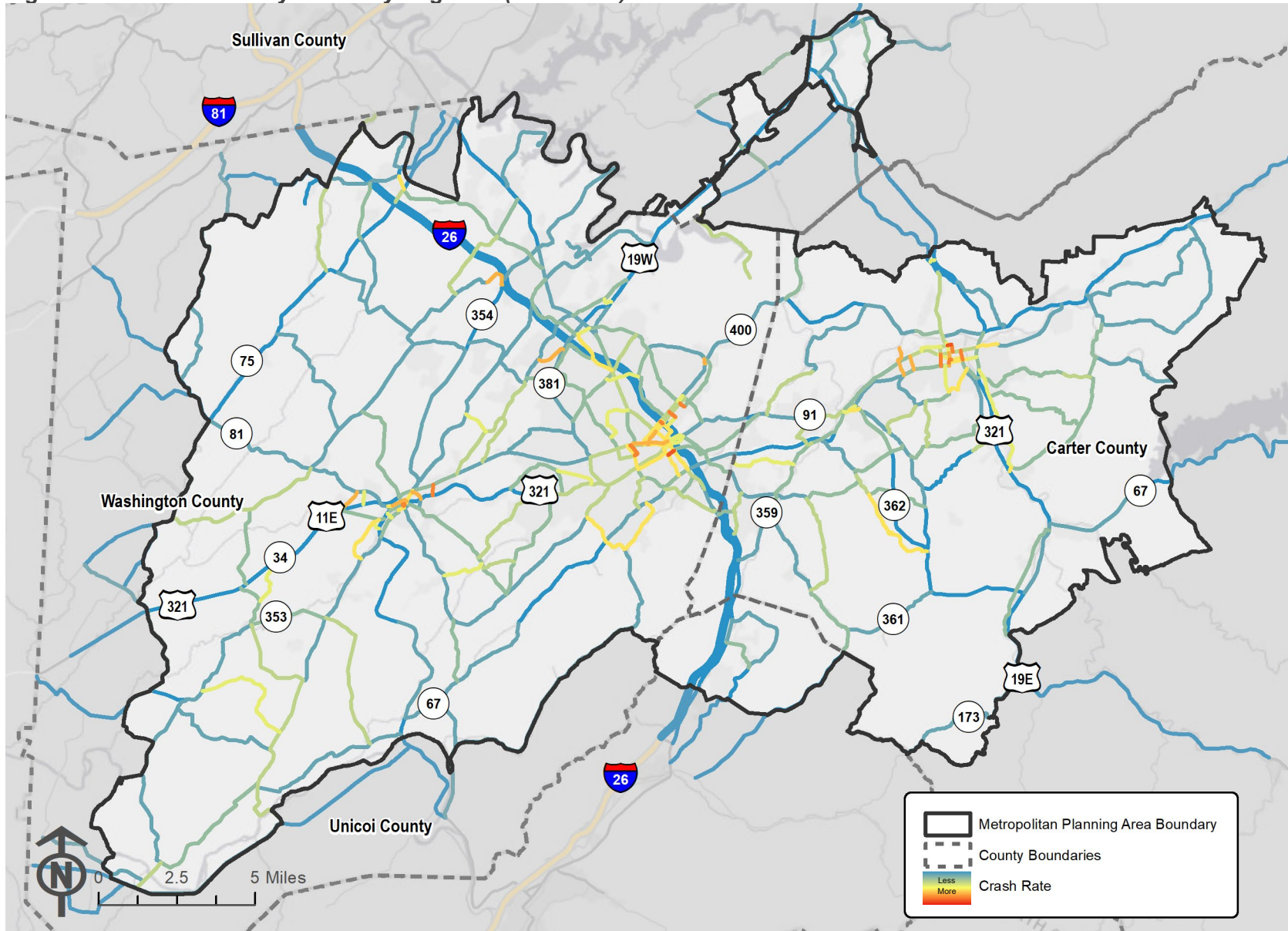


Figure 5-8. Crash Rates by Roadway Segment (2016-2020)



Safety priority areas are outlined in Tennessee’s Strategic Highway Safety Plan (SHSP), which was last updated in 2020 by TDOT as a partnership between the Tennessee Department of Safety and Homeland Security (TDOSHS), FHWA, and the Federal Motor Carrier Safety Administration (FMCSA). The SHSP identifies statewide crash trends and suggests strategies to address safety issues that are related to federal safety performance measures. There are 16 contributing factors outlined in the SHSP as key influences of fatal crashes, including speeding, impaired driving, distraction, and other overlapping and interrelated behaviors. These factors are listed in Table 5-4 for the fatal crashes within Carter, Sullivan, Unicoi and Washington Counties between 2016 and 2020.

The SHSP outlines six emphasis areas to reduce the number of crashes that result in serious injuries or fatalities, including: data collection and analysis, driver behavior, infrastructure improvements, vulnerable roadway users, operational improvements, and motor carrier safety. These emphasis areas are used to establish mitigation strategies, such as educational and advocacy initiatives targeting aggressive and impaired driving, conducting road safety audits to prioritize road segments with disproportionate levels of roadway departure related crashes, and TDOT-led spot safety studies to address a variety of safety issues. Please note that a single crash can have multiple contributing factors, so the totals for each column will not be the same as the total number of fatal crashes.

Table 5-4. Contributing Factors of Fatal Crashes, 2016-2020

Contributing Factors	2016	2017	2018	2019	2020	Total
All Fatal Crashes	30	35	42	49	36	192
Impaired Driving	13	12	17	21	12	75
Large Trucks	0	2	9	2	5	18
Speeding/Aggressive Driving	5	10	13	10	9	47
Roadway Departure	17	25	30	28	23	123
Intersection Related	5	4	12	6	7	34
Motorcyclist	7	7	11	8	3	36
Pedestrian	1	4	2	6	5	18
Bicyclist	0	0	0	1	0	1
Unrestrained Occupants	8	5	6	7	7	33
Seniors (65+)	11	13	9	14	14	61
Young Drivers (15-20)	7	7	5	7	5	31
Inattentive, Distracted, and/or Drowsy Drivers	3	2	2	3	3	13
Work Zone	0	0	0	0	0	0

Source: Fatality Analysis Reporting System (FARS)

Since the last MTP update, the Johnson City MTPO has focused on finishing major projects in the region through partnerships with the Tennessee Department of Transportation and its member jurisdictions, including:

- Completing a new diverging diamond interchange at State Route 354/Boones Creek Road and Exit 17 on I-26, which included multiuse paths for people walking and bicycling in the area;
- State Route 91 Improvements in Elizabethton, which began construction in 2022; and,
- The Knob Creek Section 1 project (TDOT PIN 102620.00; currently in the ROW phase), which will connect to a newly created State Route. This project also includes multiuse paths, which will expand the existing bicycle and pedestrian network in the MTPO region.

With the completion of these projects and future projects moving into the construction phase, the MTPO will continue to focus on safety for all users of the transportation system. As a start to this process, the Federal Highway Administration selected Washington County as a pilot project technical safety assistance that resulted in the creation of a report titled, *Federal Highway Administration Local Road Technical Assistance Corridor Safety Analyses and Recommendations*. The draft report was completed in October 2022, and the MTPO will assist Washington County to pursue funding opportunities, particularly the new grant opportunities in the BIL, to implement the recommendations in this report. The MTPO is currently reviewing the draft document and plans on using it as a guide for other jurisdictions in the MTPO area.

Since the development of the previous MTP, TDOT has provided all MPOs in Tennessee with access to the “AASHTOWare Safety” web-based software program. This new tool allows MTPO staff access to analyze crash data in an effective manner. The software will the MTPO to:

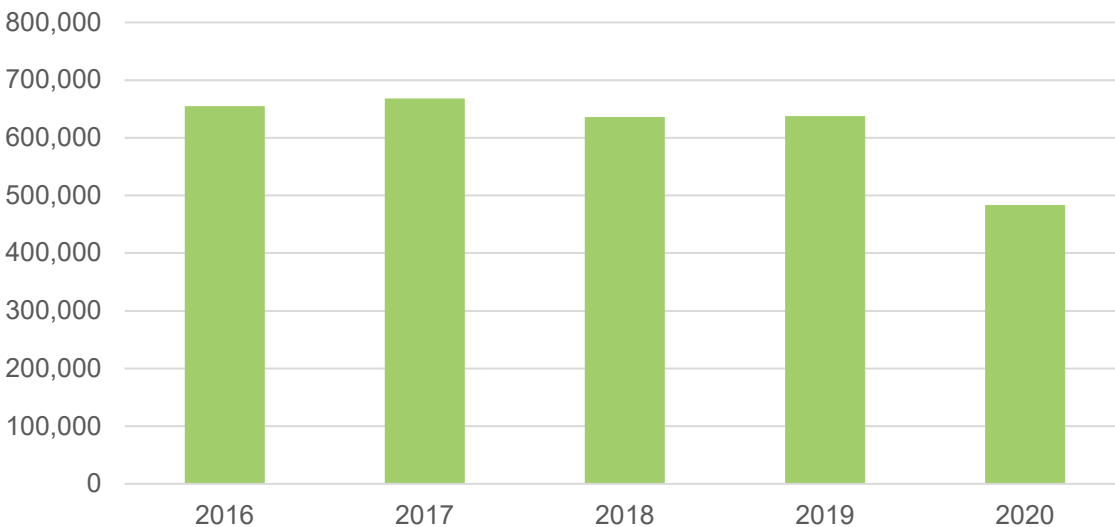
- Query crash data for any roadway or intersection across the state;
- Export raw crash data for more in-depth analyses;
- Generate custom reports, charts, and spreadsheets;
- Explore crash data in a spatial, map-based interface;
- Filter crashes based on crash location, as well as various crash, and roadway attributes; and,
- Explore crash data dashboards for particular areas of interest, including specific emphasis areas (e.g., pedestrian and bicycle crashes, hit-and-run crashes, etc.).

To further support safety improvements in the region, Johnson City MTPO staff will continue to identify select roads for TDOT’s safety audit program. The MTPO will use this information to pursue “Safe Streets for All” grant opportunities through the BIL. Additionally, as outlined in Section 5.3 of the MTP, all jurisdictions in the MTPO consider complete streets in the design of any new and improved roadways.

5.2 Public Transportation

Two transit providers operate within the Johnson City MTPO area. Johnson City Transit (JCT) provides fixed route and demand response services within the Johnson City corporate limits. JCT also provides fixed route shuttle service on the East Tennessee State University Campus (called Bucshot), paratransit, and a Job Access program. JCT's buses cover 15 fixed routes with headways that range from 60 to 90 minutes (Figure 5-10). JCT operates Monday through Friday from 6:15 AM to 6:15 PM and on Saturday from 8:15 AM to 5:15 PM. Northeast Tennessee Regional Public Transit System (NET Trans) provides on-demand transit services to Carter, Greene, Hancock, Hawkins, Johnson, Sullivan, Unicoi, and Washington Counties. NET Trans operates Monday through Friday from 6:00 AM to 6:00 PM and offers limited weekend service for eligible riders. Between 2016 and 2019, JCT and NET Trans recorded an average of 649,147 annual unlinked trips. The COVID-19 pandemic dramatically affected annual ridership numbers and caused a 24% decline in ridership in 2020. Figure 5-9 illustrates transit ridership trends between 2016-2020.

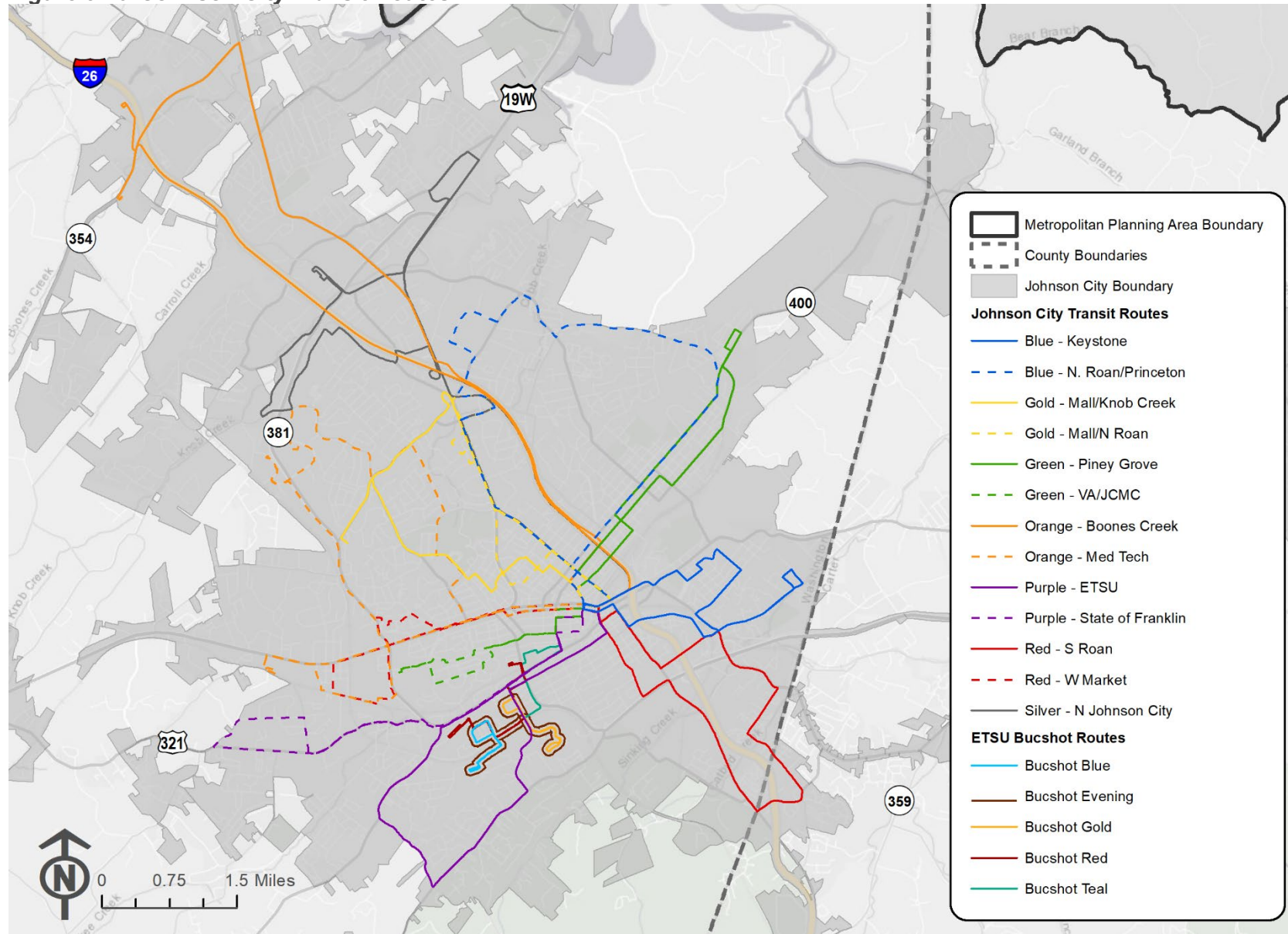
Figure 5-9. Transit Ridership Trends



Source: Federal Transit Administration NTD Agency Profiles

The Johnson City Urbanized Area Coordinated Public Transit-Human Services Transportation Plan was updated and adopted in 2022. This plan outlines the state of the transit system in the region and provides recommendations to address the unmet transportation needs of individuals with disabilities, older adults, and people with low incomes. Recommendations included in the plan are varied and include prioritized strategies such as developing a mobility management program for JCT and NET Trans, more robust fleet planning, driver recruitment, pursuing additional funding to expand critical transit services and programs, implementing electronic fare payment systems, and more. Due to funding levels, the MTPO anticipates the same levels of service to be maintained for the next five years. The MTPO will, along with JCT and NETTRANS, look for funding for new opportunities in the Johnson City MTPO area. The MTPO also understands the funding for any new opportunities must be above and beyond the current levels of funding to allow for service expansion.

Figure 5-10. Johnson City Transit Routes



5.3 Walkways and Bikeways

Facilities for people walking and bicycling within the Johnson City MTPO area are limited primarily to downtown Johnson City, downtown Elizabethton, and Jonesborough. Walkways and bikeways located in other parts of the region are largely disconnected from one another, and the existing facilities do not form a true network to support active transportation. The Tweetsie Trail, a gravel trail connecting Johnson City and Elizabethton, is an exception, providing a low-stress resource for recreation, and the Lost State of Franklin Trail connects Persimmon Ridge Park with downtown Jonesborough. Figure 5-11 illustrates the extent of the current system, which contains 9 miles of bikeways, 319 centerline miles of sidewalks, and 67 miles of trails.

Facility Accessibility

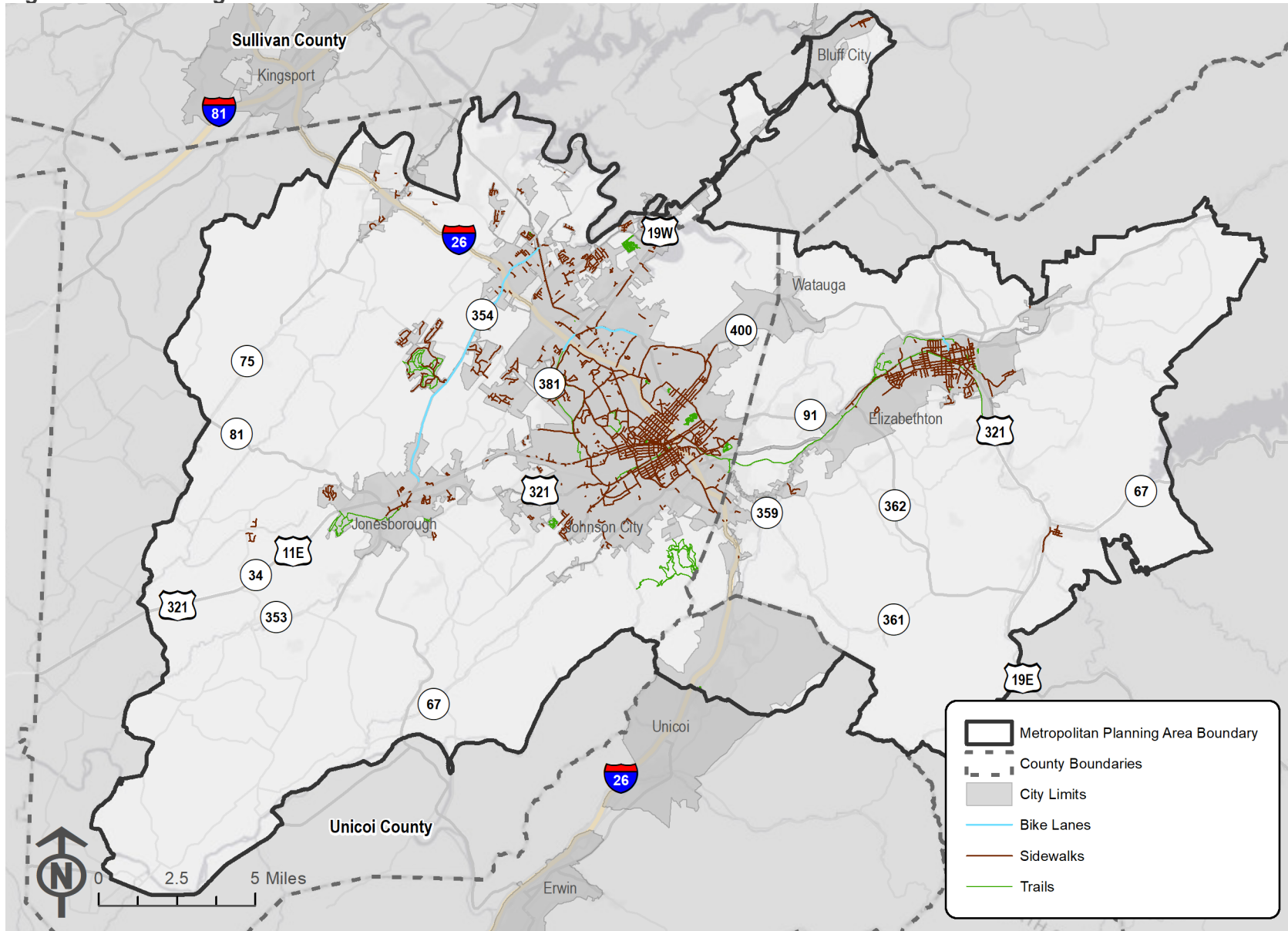
The Americans with Disabilities Act (ADA) requires public agencies with 50 or more employees to develop and implement an ADA transition plan that details the actions required to become fully compliant with the ADA. These plans often include inventories of active transportation facilities, including sidewalk, trails, buses, traffic signals, and their level of accessibility for people with disabilities. Table 5-5 summarizes the status of ADA transition plans for local governments in the Johnson City region and whether or not these plans include an assessment of pedestrian facility accessibility.

Table 5-5. ADA Transition Plans

Local Jurisdiction	ADA Transition Plan Available?	Includes Assessment of Pedestrian Facilities
Johnson City	Yes	Yes
Bluff City	Not Required	--
Elizabethton	Awaiting Final Draft	--
Jonesborough	Yes	No
Unicoi	Not Required	--
Carter County	Yes	No
Sullivan County	Yes	Yes
Washington County	Yes	No
Unicoi County	No	--

While the MTPO has considered funding a regional bicycle and pedestrian plan, the member jurisdictions to date have opted to do their individual plans and their own projects. In some cases, the jurisdictions have opted not to use federal funds to have these projects completed. The MTPO will continue to have this option available for its members and work with them to coordinate their local projects to improve regional connectivity. For example, while Carter County is pursuing non-federal funding directly with the Governor of Tennessee to extend the Tweetsie Trail, the MTPO has included this project in the MTP, and the project would be eligible for Transportation Alternative Program funding at the federal level if desired in the future.

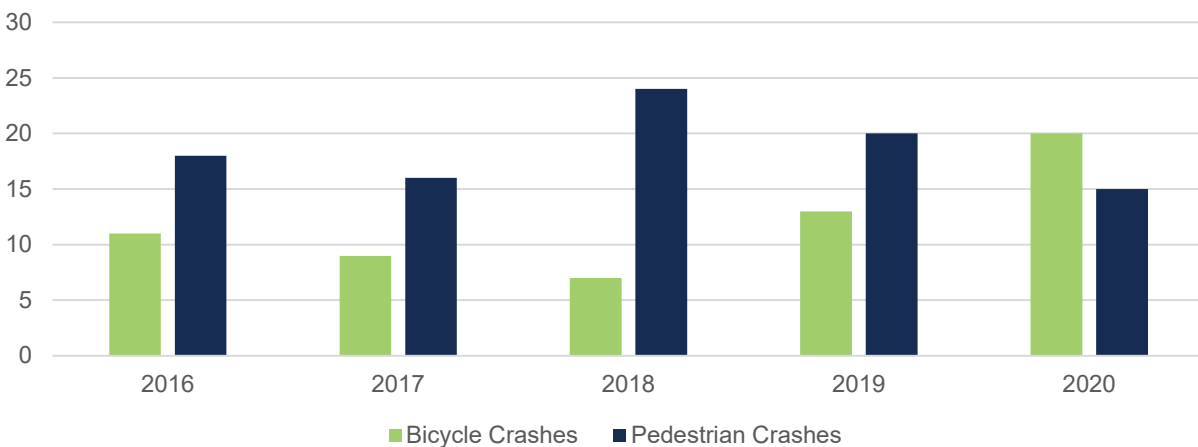
Figure 5-11. Existing Non-Motorized Network



Bicycle and Pedestrian Safety

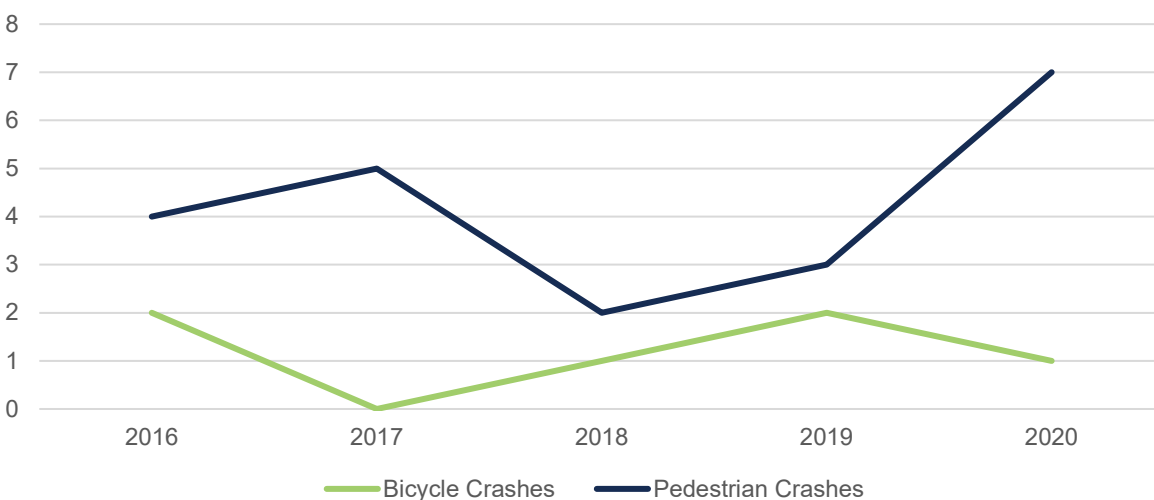
People walking and bicycling are at greater risk of injury and death if they are involved in a collision with a vehicle, compared to people traveling by motor vehicle. Understanding where crashes have occurred in the Johnson City MTPO area allows limited resources to be applied to locations of greatest concern. Of the 27,006 vehicular crashes that occurred in the Johnson City MTPO area between 2016 and 2020, 102 involved a pedestrian and 69 involved a bicyclist. Of the 153 non-motorized crashes that have occurred since 2016, 21 resulted in a serious injury and six resulted in a fatality. Figure 5-12 and Figure 5-13 illustrate regional trends in non-motorized crashes and severity of those crashes within the MTPO area.

Figure 5-12. Bicycle and Pedestrian Crash Trends



Source: TDOT

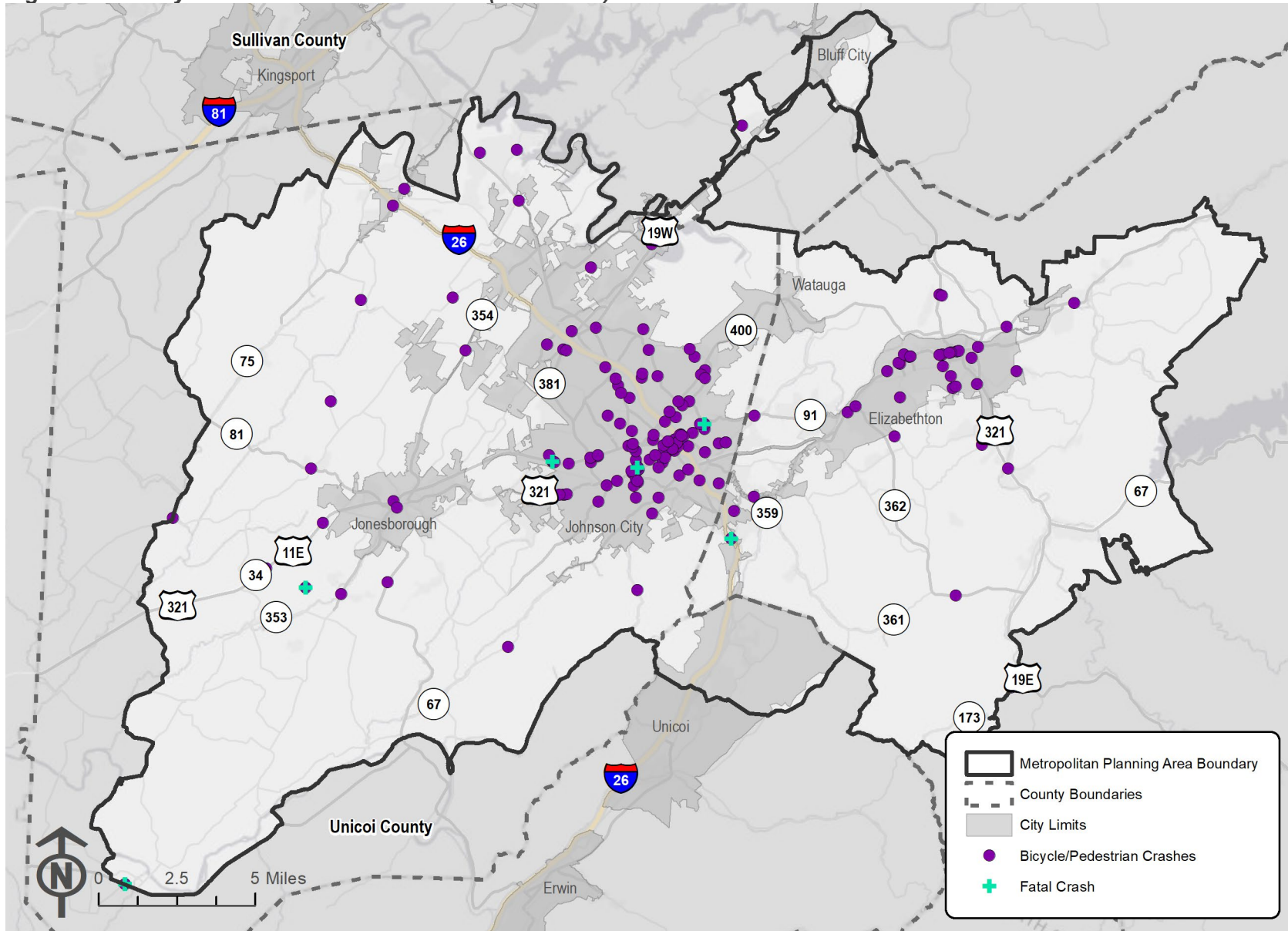
Figure 5-13. Fatal and Serious Injury Bicycle and Pedestrian Crash Trends



Source: TDOT ETRIMS

Figure 5-14 depicts the locations of bicycle and pedestrian crashes in the MTPO area, including the locations of serious injury and fatal crashes involving bicyclists and pedestrians.

Figure 5-14. Bicycle and Pedestrian Crashes (2016-2020)



Complete Streets

To further support the safety and mobility of transportation users in the region, the Johnson City MTPO encourages its member jurisdictions to consider Complete Streets design supporting safe streets for all users. Several resources are available to aid with this endeavor, including the following (but not limited to):

- TDOT's Multimodal Access Policy, which establishes support for Complete Streets design for transportation facility;
- National Association of City Transportation Officials' *Urban Street Design*, which serves as a guide for the development of complete, safe streets;
- Institute of Transportation Engineers' various resources and guides to accommodate active transportation, including safe pedestrian and bicycle facilities at interchanges; and
- *Designing Walkable Urban Throughfares: A Context Sensitive Approach*.

Current and past efforts by Johnson City MTPO member jurisdictions include working with the TDOT Strategic Transportation Investments Division to include safe pedestrian and bicycle access during initial field reviews of proposed projects, namely the Knob Creek Extension – Section 2 project and the West Market Street Bridge Rehabilitation project.

Listed below are examples of recent projects by local jurisdictions that have incorporated Complete Streets design:

- Johnson City has completed two Complete Street projects, including the reduction of travel lanes to allow for the addition of a multimodal path along Legion Street from East Main Street to Alabama Street to provide access to the trailhead of the Tweetsie Trail. Within downtown Johnson City, Buffalo Street was redesigned by reducing travel lanes, channelizing the road by adding raised medians, and providing for safe on-street parking. This new design allowed for safer pedestrian movement and safe channelized turning movements for vehicles.
- The City of Johnson City is currently redeveloping the West Walnut Street corridor with local bond funding. This street provides a connection between downtown Johnson City and East Tennessee State University. The new, pedestrian-friendly roadway will include sidewalks on both sides, on-street parking and a bike lane. The design of the roadway will include traffic calming measures such as raised intersections and slight curves.
- The City of Johnson City also plans to improve crosswalks throughout downtown Johnson City to further increase pedestrian safety by adding lighting at crosswalks and upgrading curb ramps.
- Along the Tweetsie Trail, the City of Elizabethton upgraded critical intersections with signalized pedestrian/bicycle crossings where the trail crossed major roadways.
- Carter County is pursuing state funding to extend the Tweetsie Trail from its current end point on Hatcher Lane, which will provide access to walk or bike from the community of Hampton (and Hampton High School) to downtown Elizabethton. The extension will require a bridge to be built over the Doe River.
- The Town of Jonesborough is purchasing right-of-way for the addition of sidewalks on East Main Street to connect their downtown area with the new Senior Center and new

Lincoln Park. A large community donation has made the construction of these sidewalks possible.

- Bluff City has recently received a TDOT Multimodal Access grant that includes construction of a sidewalk that will provide a pedestrian link between Bluff City Park and City Hall along Bluff City Highway and the installation of four crosswalks located at key points along the route that will facilitate safe cross-street pedestrian movements.

The Johnson City MTPO encourages the use of Complete Streets through education, assisting in the coordination with state and local partners on project development, and serving as a resource for its member jurisdictions. Furthermore, the Johnson City MTPO realizes that each member jurisdiction has unique needs when it comes to project development that include Complete Streets. By serving as a resource to its members, the Johnson City MTPO encourages local jurisdictions to decide what is best for their community.

5.4 Freight Transportation System

Freight transportation is an essential element of the Johnson City region's economy and includes highway, rail, and air modes. TRANSEARCH data from 2019 was analyzed to understand the movement of freight in the region, including tonnage and commodity values of imports and exports from Carter, Sullivan, Unicoi, and Washington Counties.

Highway

Within the MTPO area, there are over 1,600 miles of roads, including 19 miles of I-26. All 19 miles of I-26 are designated as part of the National Highway Freight Network (NHFN), which is classified by FHWA. The NHFN has four categories of roadways, including the Primary Highway Freight System (PHFS), Other Non-PHFS Interstates, Critical Urban Freight Corridors (CUFCs), and Critical Rural Freight Corridors (CRFCs). These classifications are used to direct federal resources toward maintenance and performance needs of the national freight transportation system. Figure 5-15 illustrates the federally designated freight facilities within the region.

Railway

There are approximately 65 miles of active railroads within the MTPO area, owned and operated by two companies, CSX and Norfolk Southern. These Class I rail lines serve the Johnson City region and run from the northwest to southeast of Washington County (CSX) and from eastern Washington County north to Bristol, Virginia (Norfolk Southern). The Norfolk Southern lines in East Tennessee are part of a 2,500-mile route between the Northeastern region of the United States and the Southeast, known as the Crescent Corridor. There is also one short-line railroad, the East Tennessee Railway (ETRY), located in Johnson City. East Tennessee Railway provides local switching service for Norfolk Southern and CSX railroads. The railroad services local industry, including Omni Source metal recycling and Johnson City Chemical Corporation. This is a small but vital component of the freight system as it provides "first mile and last mile" services to industries in Johnson City. The existing rail system in the region is shown in Figure 5-15.

Aviation

Three airports serve the Johnson City MTPO region. The Johnson City Airport and the Elizabethton Municipal Airport are located within the Johnson City MTPO area and are general aviation facilities for small private planes and flight training. The Tri-Cities Airport is located outside of the Johnson City MTPO area but is one of six commercial service airports serving Tennessee and the only airport offering commercial and cargo flights in the region. The Tri-Cities Airport is jointly owned by the cities of Kingsport, Johnson City, Bristol (both in Tennessee and Virginia), and Sullivan and Washington Counties. Approximately 64,166 pounds of freight were flown from the Tri-Cities Airport in 2021, down from 2,719,595 pounds in 2019. Freight airlines serving the Tri-Cities Airport between 2019 and 2021 include PSA Airlines Inc., Piedmont Airlines, Envoy Air, Delta Airlines, and Ameristar Air Cargo.

Commodity Flows

The freight transportation systems are critical to the region's economy as many freight dependent businesses (Figure 5-16) utilize these networks to move goods into and out of the region. These movements were analyzed using the TRANSEARCH freight data purchased by TDOT, which provides insights into county-level imports and exports throughout the region for 2016 and projected to 2045. This data shows that approximately 18.3 million tons of freight valued at \$13.9 billion flowed through the region in 2016. Table 5-6 illustrates that commercial truck freight accounts for the largest percentage of tonnage and value moving throughout the region, and results in over 14 million tons of goods being transported by trucks on the region's roadways each year.

Table 5-6. Commercial Freight Tonnage and Value by Mode (2016)

Mode	2016 Tonnage	2016 Value
Air	25 (<1%)	\$5,877,856 (<1%)
Rail	4,239,829 (23%)	\$2,412,884,667 (17%)
Truck	14,091,891 (77%)	\$11,516,895,414 (83%)
Total	18,331,746 (100%)	\$13,935,657,937 (100%)

Source: TRANSEARCH, 2016

The region's top three imports and exports are shown in Table 5-7 by value and tonnage. Stone and riprap represent the largest export by tonnage, while plastic materials or synthetic fibers are the largest export by value. In terms of imports, stone and riprap are the heaviest imported commodity by weight and warehousing and distribution center supplies are the largest import by value. The largest exports by tonnage are traveling to areas around Charlotte and Greensboro, North Carolina, as well as Roanoke, Virginia. The largest freight imports to the region by weight originate from Knoxville, Nashville, Lexington, Kentucky, and Charlotte, North Carolina.

Table 5-7. Top Regional Imports and Exports by Tonnage and Value (2016)

Top Regional Imports	Tonnage	Top Regional Imports	Value
Broken Stone or Riprap	1,862,566	Warehouse & Distribution Center	\$787,600,020
Misc. Field Crops	666,066	Motor Vehicles	\$459,285,473
Warehouse & Distribution Center	635,164	Misc. Plastic Products	\$396,001,333
Top Regional Exports	Tonnage	Top Regional Exports	Value
Broken Stone or Riprap	2,437,517	Plastic Material or Synthetic Fibers	\$811,400,563
Misc. Waste or Scrap	401,848	Cyclic Intermediates or Dyes	\$411,431,842
Cyclic Intermediates or Dyes	352,958	Misc. Household Appliances	\$299,097,224

Source: TRANSEARCH, 2016

By 2045, freight imports and exports are expected to increase in tonnage by 51%, resulting in an increase of more than \$1 billion in commodity values being transported throughout the region. The majority of this increase is expected to be accommodated by truck freight transport. Projected county-level freight increases are shown in Table 5-8; the future dollar values reflect real values that have been adjusted for inflation.

Table 5-8. Projected Commodity Increases (2016-2045)

County	2016 Tonnage	2045 Tonnage	2016 Value	2045 Value
Carter County	1,469,466	1,733,117	\$668,614,905	\$576,899,759
Sullivan County	12,886,857	19,344,606	\$9,254,245,193	\$9,772,808,821
Unicoi County	1,014,137	1,150,195	\$658,344,656	\$975,173,731
Washington County	2,961,285	5,482,290	\$3,354,453,183	\$3,699,140,694
Total	18,331,746	27,710,208	\$13,935,657,937	\$15,024,023,005

Source: TRANSEARCH, 2016

Figure 5-15. Freight Facilities in the Johnson City Region

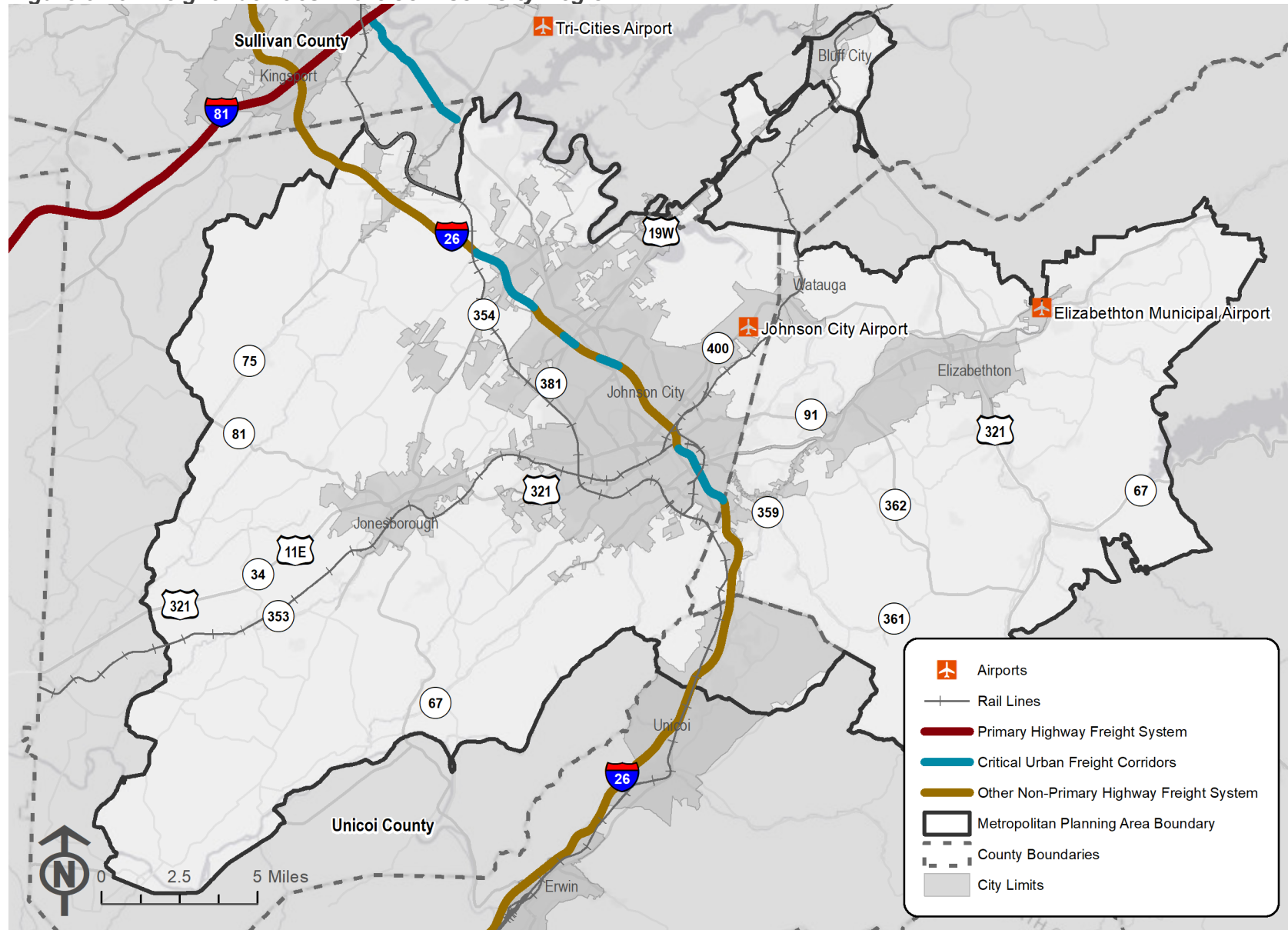
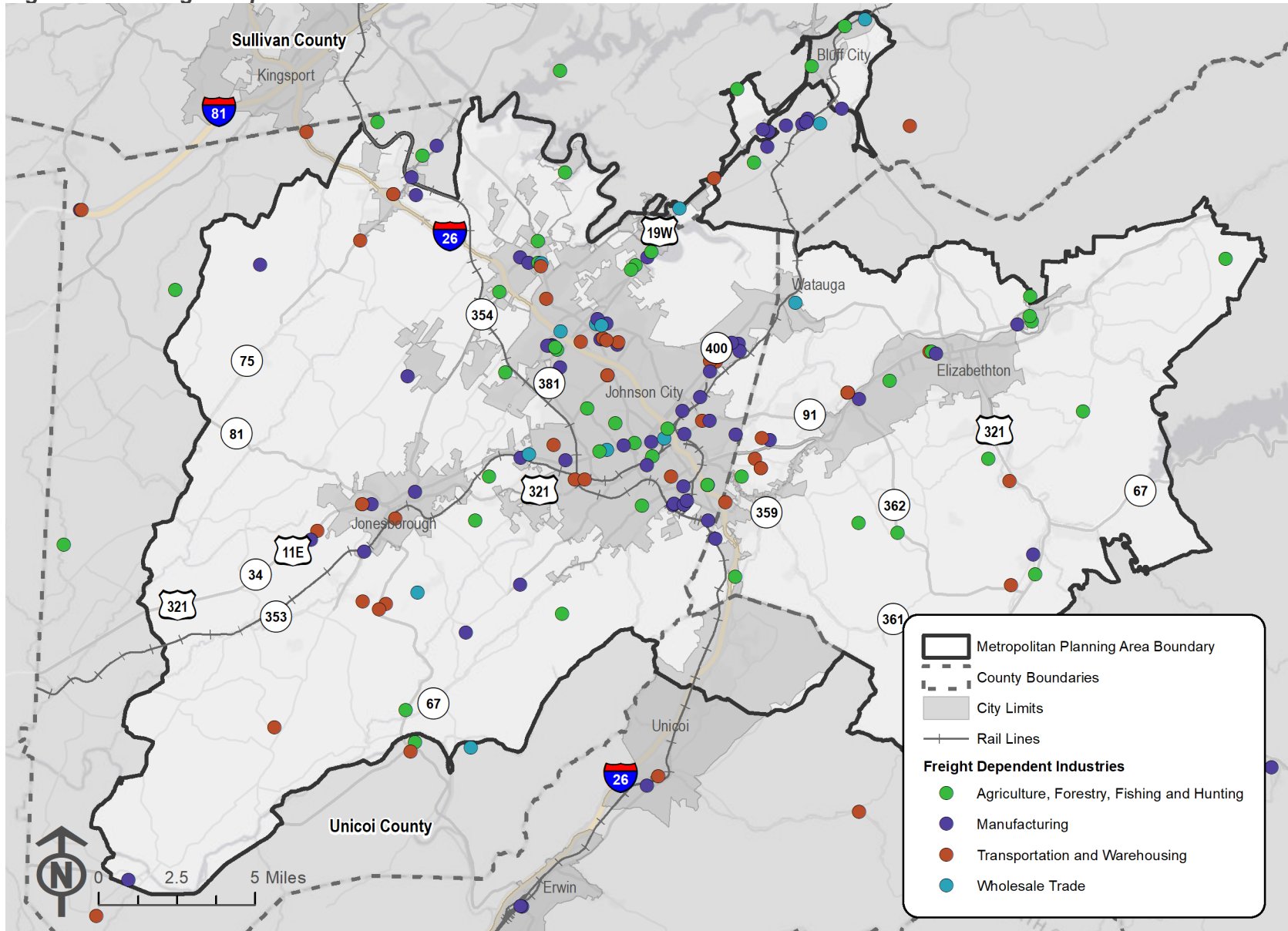


Figure 5-16. Freight Dependent Businesses



5.5 Technology and Transportation

Both technology and transportation are changing rapidly, with major impacts to how people work, travel and purchase goods. In many cases, technological improvements have the potential to make transportation systems safer and more efficient.

Intelligent Transportation Systems

Intelligent transportation systems (ITS) include technologies that incorporate advanced communication and information systems into transportation systems to improve mobility, safety, and efficiency. A wide variety of ITS technologies are available, including bus priority signals for transit, variable speed signs, traveler messaging systems, wireless traffic monitoring, loop detector systems, and many other technologies. The Johnson City MTPo Regional ITS Architecture and Deployment Plan was first developed in 2006 and most recently updated in 2022. The plan outlines regional ITS goals, project timelines, and resource sharing opportunities to encourage the development of interconnected ITS systems that will benefit the entire region. The development and regular update of the ITS plan is a pre-requisite for receiving federal funding to support ITS projects in the Johnson City MTPo region. The 2022 update included a variety of recommendations, such as:

- Improved coordination between TDOT and Johnson City to allow TDOT to utilize CCTV camera feeds for active traffic management and incident response;
- Permanent deployment of TDOT Rural Assist Trucks along I-26 to provide assistance to motorists during incidents;
- Expand fiber optic cable, CCTV installation, and road weather information systems throughout Johnson City and Elizabethton for traffic analysis, incident management, and weather monitoring;
- Development of a traffic management center in the City of Elizabethton; and
- Transit-specific recommendations for fare payment systems, transfer centers, and improved coordination between transit providers.

Transportation System Management and Operations

Transportation system management and operations (TSMO) strategies prioritize addressing congestion by improving the performance of the existing transportation system before choosing to increase roadway capacity through capital improvement projects. TSMO approaches prioritize the use of limited resources and include strategies like improved traffic incident management, improved bicycle and pedestrian crossings, congestion pricing, ramp management, road weather management, access management, technology-based strategies, and other activities. The City of Johnson City has established a Traffic Operations Center to actively monitor traffic with PTZ cameras, with central office software called Tactics. Johnson City also has access management policies and procedures for their jurisdiction that address their needs. Johnson City has explored adaptive traffic signal control and is planning for their installation in the future.

Micromobility

Micromobility devices are typically small, lightweight vehicles including bicycles, electric bicycles, scooters, electric skateboards, and other devices that are shared and reserved

through app-based systems. These devices are typically used for relatively short, mostly urban trips, and can be docked, requiring users to deposit them in a particular location, or dockless, where they are left at their destination for others to use within a defined service area. Within the MTPo area, bicycle-sharing businesses are allowed, though there are no providers currently operating in the region. Scooter sharing services are not currently permitted, but this policy may change in the future.

Connected and Autonomous Vehicles

Connected and Autonomous Vehicle (CAV) technologies are an advancing development in the vehicle market and may eventually result in completely autonomous options for transportation. Connected vehicles can communicate about their speed and location to other CAVs and will allow for active traffic management. Partial automation is available in many newer vehicles today, including assisted braking, lane departure warnings, steering functions, and dynamic cruise control. While widespread CAV technologies are not yet available, as they continue to be developed, the transportation system may eventually benefit from increased safety and reduced congestion. At this time, Johnson City is researching connected and autonomous vehicles but currently has no plans for implementation.

Electric Vehicles

As options for electric vehicles (EVs) become increasingly available and affordable, many drivers are opting to purchase vehicles that are completely or partially electric, which has spurred the need for expanded electric vehicle charging facilities along the interstate system. Within the Johnson City region, Interstate 26 is designated as “corridor pending”, meaning fast charging stations are not yet available at least every 50 miles. Currently, the only interstate segments designated as “corridor ready” in Tennessee are portions of I-24 northwest of Nashville, I-65 within Nashville, I-40 east of Knoxville, and I-81 between Knoxville and the Virginia border.

5.6 Transportation System Security and Resiliency

Transportation system security requires planning to prevent, manage, and respond to risks that may affect the transportation system, from natural disasters to man-made threats. Improving the region’s resiliency to a variety of hazards will ensure that mobility is maintained, even during times of crisis, and requires continued coordination with state and local emergency management and law enforcement agencies, engineering experts, and emergency personnel. This coordination includes support and participation in updating county hazard mitigation plans, TDOT incident response plans, and other planning efforts by local transit agencies, the Department of Homeland Security, the Tennessee Office of Homeland Security, and the Tennessee Emergency Management Agency.

The resiliency of the transportation system is predicated on preparing for and responding to climate change and extreme weather events, from flooding to tornadoes, to ensure that critical transportation infrastructure can withstand future events. In 2015, TDOT completed an analysis of statewide infrastructure assets to determine their vulnerability to extreme weather events. This effort included recommendations to implement climate adaptation strategies to protect

transportation facilities, such as strengthening bridge structures that are vulnerable to flooding and increasing design standards to improve infrastructure resiliency. At a regional level, the Johnson City MTPO should consider transportation infrastructure resiliency at all stages of project development, from planning through operations and maintenance.

FINANCIAL ANALYSIS AND PROGRAMMING



6.0 Financial Analysis and Programming

The Johnson City MTPO's ability to maintain and improve the region's transportation system is dependent upon available financial resources. This section outlines the funding sources available to the MTPO, summarizes the region's historic revenue trends for transportation-related improvements, and forecasts anticipated revenue over the 2050 MTP planning horizon. These revenues are then balanced against the costs of proposed capital projects identified through stakeholder engagement and technical analyses and ongoing costs of operating and maintaining the transportation system. This process ensures the recommended MTP improvements are fiscally constrained, a federal metropolitan planning requirement.

6.1 Funding Sources

To adequately maintain, operate, and enhance the transportation system in the Johnson City MTPO area, the MTPO and its members rely upon several sources including federal, state, and local funding. These sources provide varying amounts of funding, with all playing a critical role in supporting the region's transportation system.

As with most MPOs and individual jurisdictions, federal sources provide the most funding for highways the Johnson City MTPO area. These funds are generated through the nation's Highway Trust Fund (HTF), which is supported by motor vehicle fuel taxes. Revenues have been unable to keep pace with transportation system needs, requiring general revenue transfers allocated by Congress to bolster the HTF over the past two decades.

The Bipartisan Infrastructure Law (BIL), approved by Congress in November 2021, reauthorizes the federal surface transportation program covering fiscal years 2022-2026. All highway and transit programs included under its predecessor, the FAST Act, are continued, in addition to several new highway programs aimed at improving the transportation system's resiliency, as well as expanding electric vehicle (EV) charging infrastructure, among others. Total funding for the nation's highway programs exceeds \$350 billion, \$110 billion more than allocated in the FAST Act for roads, bridges, and other major projects, and an increase of \$39 billion for transit funding.

Highway Programs

Key programs carried forward by the BIL and relevant for the highway component of the Johnson City 2050 MTP include the following. Notable changes and additions are mentioned.

Highway Safety Improvement Program (HSIP)

The HSIP seeks to reduce the number of traffic fatalities and serious injuries on all public roads primarily through infrastructure improvements. Flexibility is allowed for funding specific non-infrastructure activities and behavioral safety projects, such as education and enforcement activities. States are now required to complete vulnerable road user (VRU) safety assessments utilizing a Safe Systems approach. If the state's VRU traffic fatalities are equal to or greater than 15% of the total state fatalities in a single year, TDOT is required to dedicate 15% of its HSIP

allocation to safety projects that address VRUs. The HSIP is managed by TDOT, with project selection also led by the agency.

National Highway Freight Program (NHFP)

The NHFP seeks to improve the efficient movement of freight on the National Highway Freight Network (NHFN) through projects that reduce congestion and improve system reliability, safety, security, and productivity. Under the BIL, project eligibility has been expanded to include modernization of marine corridors that are connected to the NHFP and/or likely to reduce on-road emissions. Furthermore, the legislation extends the amount of mileage that can be designated as “critical freight” corridors. In the Johnson City MTPo area, portions of I-26 near critical interchanges are currently designated as critical urban freight corridors, making those locations eligible for NHFP investments.

National Highway Performance Program (NHPP)

The NHPP supports the condition and performance of the National Highway System (NHS), the construction of new NHS roadways, and the assurance that investments using Federal aid directly support progression towards the state’s performance targets established in the NHS asset management plan. An additional purpose has been identified in the BIL, which focuses on improving the NHS’s resiliency against extreme weather events and natural disasters to mitigate the costs of damages. Furthermore, asset management plans are now required to consider extreme weather and resiliency in life cycle costs and risk management analyses. TDOT manages this program with project selection done in partnership with the MTPo.

Surface Transportation Block Grant Program (STBG) and Transportation Alternatives Program (TAP)

Project eligibility under the FAST Act for the STBG Program is carried forward with the BIL, including the preservation and improvement (reconstruction or construction) of any federal-aid-eligible highway, bridge or tunnel on any public road, pedestrian or bicycle infrastructure, and transit facility. New project eligibility is afforded to EV charging infrastructure, measures that increase system resiliency, the deployment of current and emerging intelligent transportation technologies (ITS), and even wildlife crossing structures. The BIL also provides for more granular suballocation of STBG funding, with a new population category for 50,000 to 200,000, and provides for state consultation with metropolitan planning organizations.

Of note, the amount of funding set aside for the Transportation Alternatives Program (TAP) from the STBG program was increased above levels previously allocated under the FAST Act to total \$7.2 billion nationally. Safe Routes to School projects were reaffirmed as eligible, while VRU safety assessment activities were added. TDOT receives an annual allocation of TAP funds for competitive discretionary grants in small urban areas, while the MTPo occasionally receives funding from successful grant awards from TDOT.

In addition to continuing and expanding existing programs, the BIL creates new formula and discretionary programs, as well as pilot programs. Table 6-1 includes a brief description of a few of these new programs.

Table 6-1. New Programs under the BIL

New Federal Program	Type	Description
Bridge Formula Program	Formula	Program to replace, rehabilitate, preserve, protect, and construct highway bridges.
Bridge Investment Program	Discretionary	Program to provide grants on a competitive basis to improve bridge condition and the safety, efficiency, and reliability of the movement of people and freight over bridges.
Carbon Reduction Program	Formula	Program to reduce vehicular carbon emissions through eligible activities, such as establishing and operating a traffic management facility, bicycle and pedestrian infrastructure, public transportation, and ITS projects. Of the State’s allocation, 65% is suballocated based on population to support eligible projects in local communities.
National Electric Vehicle Infrastructure	Formula + Discretionary	Provides funding to States to develop an interconnected network of electric vehicle (EV) charging infrastructure that can facilitate data collection and is accessible and reliable.
Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Grant Program	Formula + Discretionary	Program focuses on supporting transportation resiliency through a wide range of project types, including planning activities, such as developing planning documents or resilience scenario planning.
Safe Streets and Roads for All	Discretionary	Program supports local initiatives (“Vision Zero”) to prevent transportation-related fatality and serious injury crashes, including implementing projects identified in local safety action plans.
Reconnecting Communities Pilot Program	Discretionary	Pilot program to restore community connectivity through the removal, retrofit, mitigation, or replacement of eligible transportation facilities.

Like federal funding sources, Tennessee primarily funds surface transportation projects using revenues generated from motor vehicle taxes and other related fees. In 2017, the state's legislature passed the Improving Manufacturing, Public Roads and Opportunities for a Vibrant Economy Act (IMPROVE Act), which provided the first increase in fuel taxes since 1989. Additionally, the bill created additional local funding options for public transit. Projects included in the IMPROVE Act in the Johnson City MTPo area are listed in Appendix C for reference.

TDOT administers discretionary funding programs, which are competitively available to the local jurisdictions. These funds, if awarded, are not required to be shown in the TIP, unless they are regionally significant or compliment a federally funded project. These include the following:

- High Priority Bridge Replacement Program (HPBRP) – improvements or reconstruction of off-system bridges in need of repair
- Interchange Lighting Program – improvement or installation of lighting at interstate interchanges or interstate-type facilities
- Local Interstate Connector Program (LICP) – improvements associated with establishing and constructing important connector routes to interstate facilities
- State Industrial Access Road (SIA) – improvements focused on increasing access to new or expanding industries
- Multimodal Access Grant (MMAG) – improvements to pedestrian and bicycle networks along state routes.

In addition to these opportunities, the state also provides funds for improving and rehabilitating roadways through its State Aid Program. Examples of eligible activities for this program include paving, acquisition and maintenance of right-of-way, elimination of railroad crossings, street lighting, and purchasing of equipment necessary for construction.

Federal and state revenue sources most often require a local match, which is sourced from jurisdiction general funds. Furthermore, system operations, maintenance, and improvements are primarily funded by the general funds of counties, towns, and cities. Mechanisms for generating such revenue include taxes (i.e., property, sales, and wheel), development districts, and fees, such as motor vehicle, utility, and impact fees. Larger street and highway capital projects may also be supported through the sale of bonds.

Transit Programs

Transit funding is similar to highways in that sources include a variety of federal, state, and local funding streams. Like highways, federal grant programs serve as the largest funding source for transit investments. The BIL reauthorizes the Federal Transportation Administration (FTA) grant programs most often used by the MTPo area including Sections 5307, 5310, and 5339 funds, which are used to support transit operations and capital purchases

5307 Urbanized Area

The 5307 – Urbanized Area Formula Grant program provides support to transit programs in incorporated urbanized areas with a population of more than 50,000 residents. Funds may be used by private non-profit organizations and public bodies for operating, capital, and related

planning purposes, including activities such as preventative maintenance for vehicle fleets and the construction of maintenance and passenger facilities. Since the MTPO area has a population less than 200,000, funds can also be used for operating assistance though TDOT does not provide matching funds for operating activities. Both Johnson City Transit (JCT) and Northeast Tennessee Regional Public Transit (NET Trans) receive allocations of 5307 funds for providing urban service within the Johnson City Urbanized Area (UZA). Furthermore, under contract with the City and East Tennessee State University, JCT has operated the campus shuttle service, known as BucShot, since 2003. The service, also open to the public, is provided during ETSU's fall and spring semesters, serving the campus as well as nearby housing areas.

FTA allocates 5307 funds to TDOT as the designated recipient for urban areas under 200,000 in population based on factors such as population and population density. For small urban areas such as Johnson City, the 5307 funds are suballocated by TDOT based on additional factors. The federal share of funds is most often capped at 50% for operating and 80% for capital, although the share may increase to 85% should the funds be used for bringing equipment into compliance with ADA requirements.

5310 Enhanced Mobility of Seniors and Individuals with Disabilities

FTA also administers the 5310 – Enhanced Mobility of Seniors and Individuals with Disabilities program, which focuses on improving mobility for seniors and individuals living with disabilities by removing barriers for transportation service and expanding mobility options. Examples of traditional eligible activities include the purchasing of buses and vans, the addition of wheelchair lifts and securement devices, and projects relating to scheduling systems. Nontraditional eligible project examples include building accessible infrastructure to bus stops, improving wayfinding technology, and the purchasing of vehicles to support new vanpooling or ridesharing programs.

Allocations from the federal level are based upon each state's share of seniors and populations living with a disability. These apportionments are then made available to small urban areas such as Johnson City through TDOT's competitive grant process. For capital costs, the federal match is to not exceed 80%. Although FTA allows 5310 funds to be used for operating, TDOT currently restricts the use of these funds for capital assistance for its grant awards.

5339 Bus and Bus Facilities

The 5339 – Bus and Bus Facilities program provides funds for states and designated recipients and subrecipients who operate fixed route systems to replace, rehabilitate, and acquire buses as well as fleet equipment. Furthermore, funds may be used to upgrade and/or construct transit-related facilities, including modernizing facilities and fleets with new technologies and innovations for purposes of reducing emissions. For the Johnson City MTPO area, the 5339 program is administered by TDOT through competitive grants. For most projects, an 80% cost-share is provided by the federal government for eligible capital costs. Similar to the 5307 program, the cost-share may exceed 80% for projects relating to ADA compliance.

The State of Tennessee, when incorporated and approved in the annual budget, provides transit funding through TDOT. The IMPROVE Act of 2017 provided additional state funding dedicated

to transit through additional revenue generated by the increase in motor fuel taxes and fees. These additional funds can be utilized to improve regional transit systems for purposes of mitigating congestion on state highways (through the Transit Capital Grant program) as well as provide further assistance to rural transit providers to improve demand response efficiency. For the Transit Capital Investment Grant program, the required local match is 25%. It is also worth noting that the IMPROVE Act provides enabling legislation for large cities and counties to approve dedicated transit funding through a referendum.

Additional transit-related funding programs are administered by TDOT, including the Urban Operating Program (UROP), Critical Trips Program (CRIT), and the IMPROVE Act Transit Capital Investment Grant program. UROP provides capital and operating assistance to support fixed route and complementary paratransit service in urban core areas. Eligible activities for agencies in urban core areas include capital costs (e.g., rolling stock, preventative maintenance, and equipment) and operating costs (e.g., fuel, salaries, wages, fringe benefits, travel, and training). For the first \$500,000 in expenses, the state matches 80% of the costs with a required 20% local match. After the first \$500,000, the match requirements become 50% state and 50% local. Of note is that UROP funds are only available to urban areas following the expenditure of all 5307 funds.

CRIT provides operating assistance (e.g., fuel, salaries, wages, and fringe benefits) to demand response providers in urban areas that are not serviced by the urban core's primary transit system ("urban fringe areas"). Like UROP, these funds are approved by the state Legislature and allocated based on population. Match requirements are 50% state and 50% local.

Finally, the IMPROVE Act Transit Capital Investment Grant program provides funding for eligible activities that focus on supporting increased ridership, congestion mitigation, and economic development. Examples range from park and ride lots, purchasing of transit vehicles, and transportation planning activities. Bus stop and right of way improvements, bus rapid transit projects, and fueling and charging stations are also eligible projects. As with the prior two programs, annual funding is dependent upon the approval by the State. Match requirements for this competitive program are 75% state and 25% local.

Like the highway programs, applicable local jurisdictions contribute funding to meet local match requirements for the aforementioned state and federal programs. Primary sources of revenue for these matches include property and sales taxes.

Additional transit funding includes farebox revenues though these are typically used to provide the local match for federal and state funds. JCT fares range from \$1.00 per ride for adults to \$25.00 for an unlimited monthly pass, while the BucShot shuttle service is free for campus visitors, ETSU students, staff, and faculty, as well as the general public. Funding for this service is provided by ETSU.

NET Trans fares start at \$2.00 with increasing fares based on distance and time of day. Rides outside of the service area are charged on a per-mile basis (\$1.50) once outside of the area.

NET Trans also contracts with TennCare to service critical medical trips, providing a relatively consistent level of ridership each year. Finally, discretionary grants, although relatively unreliable, are an additional potential source of revenue.

6.2 Historic and Projected Revenues

Highway Revenues

To develop the highway element of the 2050 MTP, allocations in the MTPO's TIPs as well as Tennessee apportionments from the FAST Act and the BIL were reviewed. Historic funding levels from 2016-2020 for various federal, state, and local funding sources, shown in Table 6-2, were used to establish an average annual allocation for each program and ultimately project anticipated revenues.

Using the above information, and in cooperation with TDOT and FHWA, an annual average growth rate was developed to project future revenues sources over the 2050 MTP planning horizon. An annual growth rate of 2% matches that of the FAST Act and BIL apportionments to the state, excluding the year 2021 given the jump in revenues from one bill to another, which skews the growth rate higher. Funds that can be reasonably expected for each plan horizon are detailed in Table 6-3, which amounts to approximately \$711 million over the life of the plan.

Table 6-2. Historic Highway Capital Revenues (FY 2016-2020)

Funding Source	Historic Annual Average		
	Federal Share	Non-Federal Share	Total
HSIP	\$1,931,604	\$214,623	\$2,146,227
NHPP	\$7,484,792	\$1,871,198	\$9,355,990
STBG-L	\$1,315,271	\$328,818	\$1,644,089
STBG-S	\$2,957,742	\$739,436	\$3,697,178
Other Federal-Aid Programs & Discretionary Funds (e.g., TAP)	\$252,041	\$63,010	\$315,051
Local Funding	\$0	\$2,172,708	\$2,172,708
Total	\$13,941,451	\$5,389,793	\$19,331,243

Table 6-3. Projected Highway Capital Revenues (FY 2023-2050)

Funding Source	2023-2030	2031-2050	Total
HSIP	\$18,789,416	\$62,321,000	\$81,110,416
NHPP	\$81,908,220	\$271,676,000	\$353,584,220
STBG-L	\$14,393,388	\$47,740,000	\$62,133,388
STBG-S	\$32,367,420	\$107,357,000	\$139,724,420
Other Federal-Aid Programs & Discretionary Funds (e.g., TAP)	\$2,758,154	\$9,148,000	\$11,906,154
Local Funding	\$19,021,251	\$63,090,000	\$82,111,251
Total	\$149,519,982	\$561,333,000	\$710,852,982

To develop anticipated operations and maintenance expenditures (O&M) for highways in the MTPO area, operating budgets for each member jurisdiction were reviewed. Historic and current funding levels were determined for activities such as repaving and restriping, street lighting, traffic signal maintenance, and maintenance relating to the active transportation networks. Annual average spending was determined for each jurisdiction based upon FY 2016 through 2020 data and mileage maintained by each agency within the Johnson City MTPO area (Table 6-4).

Based on local budget information for the region’s jurisdictions, maintenance funding in the MTPO area has been increasing an average of 2% each year between 2016 and 2020. Similar to capital revenue projections, the annual average over that same historic period was grown by 2% each year over the planning horizon. Table 6-5 shows reasonably expected O&M revenues for each MTPO jurisdiction with the growth factors applied, totaling approximately \$1.6 billion over the plan’s horizon.

Table 6-4. Historic Highway O&M Expenditures (FY 2016-2020)

Jurisdiction	Average Cost Per Mile	Miles Maintained Within MTPO	Annual Average Cost
City of Bluff City	\$25,396	11.5	\$291,567
City of Elizabethton	\$26,366	90.3	\$2,380,660
City of Johnson City	\$44,452	368.1	\$16,360,818
Town of Jonesborough	\$23,844	37.7	\$898,837
Town of Unicoi	\$5,223	27.0	\$140,967
City of Watauga	\$2,906	4.2	\$12,334
Carter County	\$6,419	317.6	\$2,038,314
Sullivan County	\$9,759	25.3	\$246,783
Unicoi County	\$8,499	2.9	\$24,671
Washington County	\$35,543	527.8	\$18,758,377
TDOT	\$13,977	192.7	\$2,567,758
Total	\$16,401	2,893.9	\$43,721,086

Table 6-5. Projected Highway O&M Revenues (FY 2023-2050)

Jurisdiction	2023-2030	2031-2050	Total
City of Bluff City	\$2,552,559	\$8,466,402	\$11,018,961
City of Elizabethton	\$20,841,794	\$69,128,667	\$89,970,461
City of Johnson City	\$143,232,881	\$475,078,982	\$618,311,863
Town of Jonesborough	\$7,868,987	\$26,100,086	\$33,969,074
Town of Unicoi	\$1,234,114	\$4,093,346	\$5,327,460
City of Watauga	\$107,981	\$358,156	\$466,137
Carter County	\$17,844,683	\$59,187,762	\$77,032,444
Sullivan County	\$2,160,491	\$7,165,980	\$9,326,472
Unicoi County	\$215,984	\$716,383	\$932,368
Washington County	\$164,222,618	\$544,698,353	\$708,920,971
TDOT	\$22,479,767	\$74,561,545	\$97,041,312
Total	\$382,761,860	\$1,269,555,663	\$1,652,317,522

Transit Revenues

To develop the financially constrained transit portion of the 2050 MTP’s financial plan, historic funding levels from the previously described federal, state, and local sources were analyzed to reasonably estimate future funding levels over the planning horizon for both capital and operating transit needs (Table 6-6). In addition to historic data included in the MTPO’s TIPs, consultation with JCT and NET Trans provided additional detail to publicly available data.

To develop the average annual growth rate for expected transit revenues, the historic FAST Act apportionments to Tennessee as well as the anticipated state funding apportionments from the BIL were utilized. FY 2021 was removed from consideration given a relatively significant jump in funding levels from the Coronavirus Aid, Relief, and Economic Security (CARES) Act. The growth rate of anticipated revenues prior to removal was 7.4%, which is an unrealistic expectation over the plan’s 27-year horizon. Therefore, a more realistic annual average growth rate of 2% was used to project future transit revenues (Table 6-7).

Table 6-6. Historic Transit Revenues (FY 2016-2020)

Revenue Source		Historic Annual Average		
		Federal Share	Non-Federal Share	Total
5307 Urbanized Area	Operating	\$1,884,709	\$1,673,108	\$3,557,817
	Capital	\$410,321	\$86,418	\$496,739
5310 Enhanced Mobility	Capital	\$327,863	\$79,378	\$407,241
5339 Bus and Bus Facilities	Capital	\$170,000	\$30,000	\$200,000
Total Operating		\$1,884,709	\$1,673,108	\$3,557,817
Total Capital		\$908,184	\$195,796	\$1,103,980

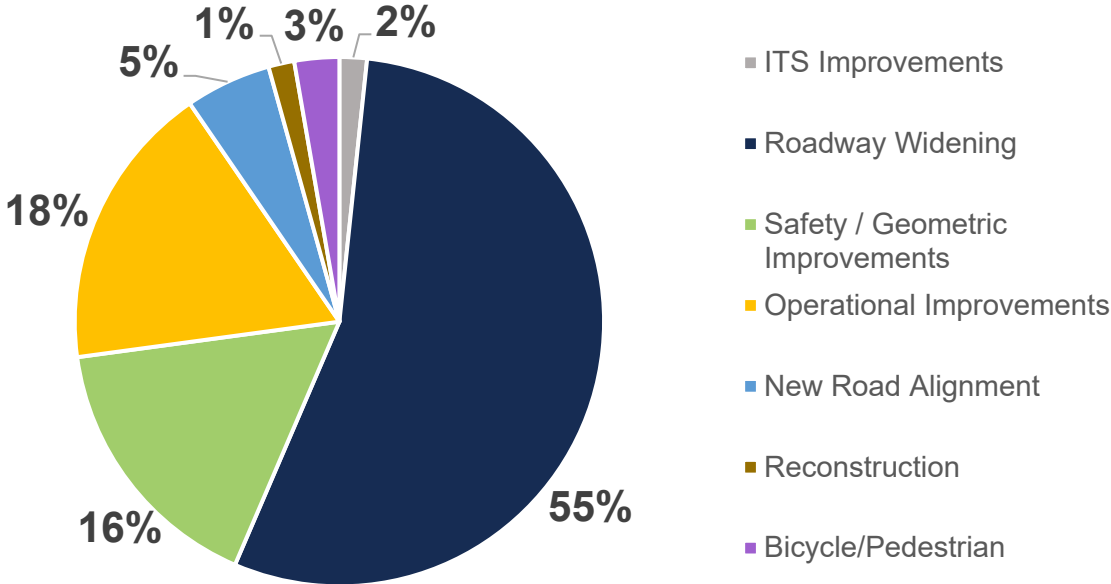
Table 6-7. Projected Transit Revenues (FY 2023-2050)

Revenue Source		FY 2023-2030	FY 2031-2050	Total
5307 Urbanized Area	Operating	\$31,147,366	\$103,310,489	\$134,457,854
	Capital	\$4,348,765	\$14,424,111	\$18,772,877
5310 Enhanced Mobility	Capital	\$3,565,244	\$11,825,304	\$15,390,547
5339 Bus and Bus Facilities	Capital	\$1,750,926	\$5,807,521	\$7,558,447
Total Operating		\$31,147,366	\$103,310,489	\$134,457,854
Total Capital		\$9,664,935	\$32,056,936	\$41,721,871

6.3 Project and Program Needs

Transportation needs in the Johnson City MTPO area were determined based on the assessment of multimodal deficiencies, a review of previous planning efforts in the region, and engagement with the public, stakeholders, and the MTPO’s member jurisdictions. These inputs yielded a list of candidate projects (which are shown in the fiscally constrained project list in Table 6-9 and the illustrative project list in Table 6-12) that included safety improvements, ITS infrastructure, operational improvements, roadway widenings, new roadway alignments, roadway reconstructions, and bicycle and pedestrian infrastructure. These projects were scored using the methodology outlined in Appendix D. In total, there were 62 projects totaling over \$500 million in current year dollars (2022). Project costs were developed using TDOT’s Project Cost Estimation Tool in conjunction with previous planning cost estimates and engineering evaluations. The distribution of project costs by type is depicted in Figure 6-1.

Figure 6-1. Candidate Project Types



6.4 Project and Program Selection Process

The cost of the needed transportation improvements far exceeds the anticipated revenues forecasted over the planning horizon. As such, a prioritization process was employed to help determine which projects should be funded with the available revenues. Each transportation recommendation was evaluated using a prioritization framework centered on the region's goals. More specifically, Table 6-8 highlights the alignment of the regional goals with the various metrics utilized for scoring projects. The distribution of points was based on input from the MTPO and the public on priorities for the region. More detailed information on the project scoring mechanism can be found in Appendix D.

The resulting score for each project reflects its consistency with the MTPO's stated goals. The higher the score, the more consistent the project is with the region's desires for transportation investments. The results of this scoring process were balanced against the MTPO's projected financial revenues and funding eligibility of projects, which resulted in the recommended projects of this MTP. Please note that larger projects were assigned logical termini based on the constructability and fiscal analysis of each project. Final termini will be determined during the project scoping process, and TDOT may choose to fund larger projects holistically to improve efficiency and cost savings.

Table 6-8. Project Prioritization Criteria

Regional Goal	Maximum Points	Performance Criteria
Safety & Security (30 points)	10	Number of vehicular crashes along segment in 5-year period
	10	Number of bike/pedestrian crashes along segment in 5-year period
	10	Existing crash rate along segment in 5-year period
Traffic Congestion Mitigation (20 points)	10	Existing (2020) volume-to-capacity ratio along segment
	10	Existing (2022) congested speed along segment
Sustainable Growth and Livability (40 points)	10	Potential impacts of project based on type (maintenance, operational, widening, bike/ped, etc.)
	10	Number of challenging areas the project touches (floodplains, historical areas, steep slopes, and parks)
	10	Number of above average transportation disadvantaged populations touched by project (65+, low income, zero-auto households)
	10	Potential for project to incorporate needed bike/ped improvements
Regional Access (10 points)	5	Projected employment growth surrounding project (2020-2050)
	5	Projected population growth surrounding project (2020-2050)

6.5 Project Expenditures

Transportation improvements within the recommended plan must be fiscally constrained, meaning that the projected expenditures cannot exceed the anticipated revenues the MTPO reasonably expects to receive over the planning horizon. This section demonstrates this requirement for fiscal accountability by balancing capital investments in roadway and transit infrastructure in with anticipated costs of operating and maintaining these systems over the next 27 years. Please note that some local jurisdictions will need to request that TDOT manage their projects, due to their complexity. If TDOT elects to manage a project, it is subject to their implementation schedule.

Highway Expenditures

Based on the anticipated revenues for highway capital expenditures (detailed in Section 6.2), the project scoring process (detailed in Section 6.4), and feedback collected on candidate projects during the second round of engagement (detailed in Section 3.2), Table 6-9 lists the fiscally constrained capital improvements to the roadway system with the following information:

- **ID** – This column includes a unique identifier for each project.
- **Lead Agency** – This column lists the implementing agency, typically a municipal or county government unless the facility is part of the State highway system, in which case the agency is typically TDOT.
- **Project/Route Name** – This column lists the name of the facility on which the project is located.
- **From/To** – This column lists the approximate beginning and ending termini of the project, which typically include major roadway facilities or intersections.
- **Type of Improvement** – This column classifies each project into one of the following seven types: bicycle/pedestrian, ITS, new road alignment, operational improvements, reconstruction, safety, and widening.
- **Description** – This column includes a more detailed description of the proposed project.
- **Horizon Year** – This column lists the anticipated timeframe for completion. Two distinct horizons are evaluated in this MTP – 2030 and 2050 – where projects classified in the 2030 horizon are anticipated to be completed between 2023-2030 and projects classified in the 2050 horizon are anticipated to be completed between 2031-2050.
- **YOE Cost** – This column lists the projected total cost of the project including all federal, state, and local funds in a year of expenditure (YOE) amount as federally required. The YOE costs are calculated by inflating the 2022 cost estimate by 5.0% annually for 2023-2028 and by 3.4% annually for 2029-2050. These inflation assumptions were developed in coordination with TDOT and FHWA and are based on data collected for FHWA's National Highway Construction Cost Index (NHCCI) between 2016 and 2020.
- **Funding Program** – This column designates the anticipated revenues to be used for project implementation based on project type and eligibility restrictions of the various funding programs.

These capital improvements are also shown in Figure 6-2.

Table 6-9. 2050 Fiscally Constrained Roadway Improvements

ID	Lead Agency	Project/Route Name	From/To	Type of Improvement	Description	Horizon	YOE Cost	Funding Program
Projects to be Completed 2023-2030								
1	Johnson City	Adaptive Signal Control	System wide deployment throughout Johnson City	ITS Improvements	Deployment of real-time adaptive signal control technologies	2030	\$255,256	STBG-L
4	TDOT	I-26 Exit 19-State of Franklin (SR 381) Interchange Signage (Project S6)	I-26 Exit 19-State of Franklin Road (SR 381) Interchange	Safety / Geometric Improvements	Install Additional Overhead Signage	2030	\$316,518	HSIP
6	TDOT	I-26 ITS Deployment	MM 8 to MM 26	ITS Improvements	Cameras, DMS, Sensors and communications	2030	\$9,189,227	NHPP
9	Washington County	Old Gray Station Road Section 1	Bobby Hicks Highway (SR 75) to Cherry Street	Roadway Widening	Improve roadway to three lane and shoulder	2030	\$10,669,714	Local

ID	Lead Agency	Project/Route Name	From/To	Type of Improvement	Description	Horizon	YOE Cost	Funding Program
10	TDOT	SR 362 Safety Improvements	Dry Creek Road (SR 361) to Big Springs Road	Safety / Geometric Improvements	Safety/geometric improvements (including paved shoulders, improvements at select locations) as determined through project development	2030	\$196,547	HSIP/STBG-S
14	Washington County	Washington County Industrial Park Traffic Signal	Intersection of Andrew Johnson Highway (SR 34/US 11E) at Precision Boulevard/ Stockyard Road	Operational Improvements	Install new traffic signal	2030	\$510,513	STBG-L
16	TDOT	Boones Creek Road (SR 354) Section 1	Christian Church Road to Highland Church Road	Roadway Widening	Widen existing 2 lane roadway to 4 lanes	2030	\$17,740,314	STBG-S

ID	Lead Agency	Project/Route Name	From/To	Type of Improvement	Description	Horizon	YOE Cost	Funding Program
30	TDOT	SR 361 Improvements	Okolona Road (SR 359) to Veterans Memorial Parkway (SR 37/US 19E)	Safety / Geometric Improvements	Safety/geometric improvements (including paved shoulders, improvements at select locations) as determined through project development	2030	\$7,914,222	HSIP
40	Johnson City	Novus Drive Extension	West Market Street (SR 34/US 11E) to McKinley Road	New Road Alignment	Construct new 2 lane road with median and additional turn lanes at intersections.	2030	\$15,315,379	Discretionary / STBG-L / Local
43	Sullivan County	Allison Road and Piney Flats Road Intersection Improvements	Bristol Highway (SR 34/US 11E/US 19W) and Allison Road/Piney Flats Road	Operational Improvements	Intersection Improvement	2030	\$3,190,704	STBG-L
55	Johnson City	Browns Mill Road and Peoples Street Roundabout	Browns Mill Road and Peoples Street Intersection	Operational Improvements	Install roundabout at the intersection of Browns Mill Road and Peoples Street	2030	\$638,141	Local

ID	Lead Agency	Project/Route Name	From/To	Type of Improvement	Description	Horizon	YOE Cost	Funding Program
57	Johnson City	Browns Mill Road Improvements	Browns Mill Road, from West Oakland Avenue to Peoples Street	Roadway Widening	Widen road, add turn lanes, add sidewalks	2030	\$3,190,704	Local
58	Johnson City	Cherokee Road (SR 67)	Sinking Creek Road to University Parkway (US 321/SR 381)	Operational Improvements	Operational improvements (including spot widenings, intersection improvements, turn lanes) at select locations as determined through project development	2030	\$641,331	HSIP

ID	Lead Agency	Project/Route Name	From/To	Type of Improvement	Description	Horizon	YOE Cost	Funding Program
60	Johnson City	West Walnut Street Safety Improvements	Antioch Road to West State of Franklin Road (US 321/SR 381)	Safety / Geometric Improvements	Safety/geometric improvements (including paved shoulders, improvements at select locations) as determined through project development	2030	\$392,457	Local

Projects to be Completed 2031-2050

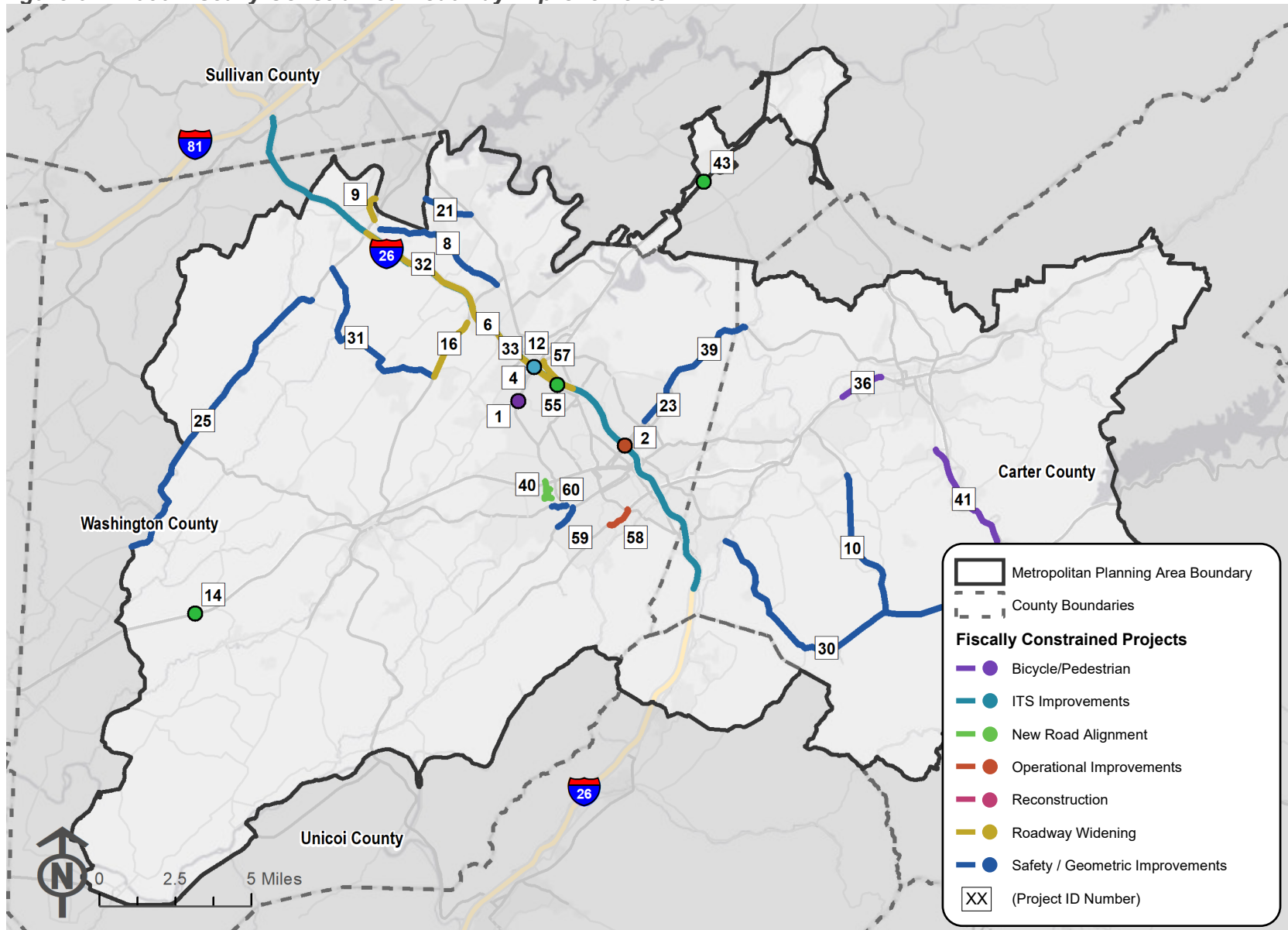
2	TDOT	I-26 Exits 22 & 23 Interchange Improvements (Project C1)	East Unaka/Watauga Avenue (SR 400) to West Market/Main Street (SR 91)	Roadway Widening	Widen Eastbound Off-Ramp to Provide Option Lane	2050	\$2,582,094	NHPP
8	Johnson City/ Washington County	Old Gray Station Road Section 3	Buckingham Road to Boones Creek Road (SR 354)	Safety / Geometric Improvements	Safety/geometric improvements (including paved shoulders, improvements at select locations) as determined	2050	\$5,554,504	STBG-L

ID	Lead Agency	Project/Route Name	From/To	Type of Improvement	Description	Horizon	YOE Cost	Funding Program
					through project development			
12	TDOT	I-26 Exit 19 - North State of Franklin Road (SR 381) Improvements	On and Off Ramps from I-26 at Exit 19- North State of Franklin Road (SR 381) Interchange	Operational Improvements	Reconfiguration, operational improvements, add turning lanes, on all approaches, etc.	2050	\$60,048,687	NHPP
21	Washington County	Free Hill Road	Kingsport Highway (SR 36) to Cedar Creek Road	Safety / Geometric Improvements	Reconstruct 2 lane roadway addressing geometric issues	2050	\$1,981,607	STBG-L
23	TDOT	East Unaka Avenue (SR 400)	Broadway Street to East Fairview Avenue	Safety / Geometric Improvements	Safety/geometric improvements (including paved shoulders, improvements at select locations) as determined through project development	2050	\$1,651,339	STBG-S
24	TDOT	Okolona Road (SR 359) Realignment	I-26 to existing Okolona Road (SR 359)	Due to environmental issues and public opposition, this project is no longer recommended.				

ID	Lead Agency	Project/Route Name	From/To	Type of Improvement	Description	Horizon	YOE Cost	Funding Program
25	TDOT	SR 75 Improvements	Boones-borough Road to Andrew Johnson Highway (US 11E)	Safety / Geometric Improvements	Safety/geometric improvements (including paved shoulders, improvements at select locations) as determined through project development	2050	\$18,032,621	STBG-S
31	Washington County	Shadden Road / Highland Church Road	Suncrest Drive (SR 75) to Boones Creek Road (SR 354)	Safety / Geometric Improvements	Safety/geometric improvements (including paved shoulders, improvements at select locations) as determined through project development	2050	\$7,494,076	STBG-L
32	TDOT	I-26	Exit 13 to 17	Roadway Widening	Widen Existing 4 lane interstate to 6 lanes	2050	\$85,479,306	NHPP
33	TDOT	I-26	Exit 17 to 20	Roadway Widening	Widen Existing 4 lane interstate to 6 lanes	2050	\$87,821,204	NHPP
36	TDOT	Elk Avenue / Broad Street (SR 67)	Williams Avenue to Holly Lane	Bicycle / Pedestrian	Add sidewalks on north side of SR 67	2050	\$6,341,141	STBG-S

ID	Lead Agency	Project/Route Name	From/To	Type of Improvement	Description	Horizon	YOE Cost	Funding Program
39	TDOT	Watauga Road (SR 400)	East Fairview Avenue to Piney Flats Road	Safety / Geometric Improvements	Safety/geometric improvements (including paved shoulders, improvements at select locations) as determined through project development	2050	\$4,203,408	STBG-S
41	Carter County	Tweetsie Trail Extension	End of Tweetsie Trail at Hatcher Lane with State Line Road to Hampton TN	Bicycle / Pedestrian	Trail extension, bridge rehabilitation over the Doe River and access through old railroad tunnel	2050	\$14,391,669	Discretionary / STBG-L / Local
59	Johnson City	Greenwood Drive Safety Improvements	Seminole Drive to West State of Franklin Road (US 321/SR 381)	Safety / Geometric Improvements	Safety/geometric improvements (including paved shoulders, improvements at select locations) as determined through project development	2050	\$1,209,326	Local

Figure 6-2. 2050 Fiscally Constrained Roadway Improvements



In addition to the specific project needs identified, the MTPO has also determined that a programmatic approach is needed to address bridge repair and maintenance, improvements to the bicycle and pedestrian infrastructure, and safety and operational improvements. Allocating funding to these three programs allows the MTPO to readily address these types of needs as they arise. These programs and amounts are shown in Table 6-10 and should be allocated through the MTPO’s TIP development based on funding eligibility.

Table 6-10. 2050 Fiscally Constrained Programs

Type of Improvement	Horizon	Anticipated Funding Source	Total Funding
Bridge Improvements	2030	NHPP STBG-S	\$42,295,588
Bridge Improvements	2050	NHPP STBG-S	\$32,225,210
Bicycle and Pedestrian Improvements	2030	STBG-L Discretionary Local	\$1,004,964
Bicycle and Pedestrian Improvements	2050	STBG-L Discretionary Local	\$22,839,430
Safety and Operational	2030	NHPP STBG-S HSIP	\$27,385,654
Safety and Operational	2050	NHPP STBG-S HSIP	\$57,725,632

Based on the total cost of capital projects and programs for the roadway system, Table 6-11 highlights the anticipated revenues and expenditures in each plan horizon, demonstrating fiscal constraint of the MTP.

With the implementation of the fiscally constrained roadway projects, operation of the region’s roadways is largely expected to remain the same. As shown in Figure 6-3, percentage of streets operating at LOS D or better is projected to fall slightly from 99% to 98% by 2050. However, over-capacity facilities and congestion will still exist even with these investments, which is why provision of other transportation options, including ITS, walking and biking facilities and transit services, will be key to maintaining quality of life for residents.

Table 6-13 provides a list of the capital roadway projects that were identified as a need during the MTP planning process but that are not included in the fiscally constrained portion of this plan. These projects, which are often referred to as illustrative, are not currently affordable given

their relatively high costs and the anticipated revenues available to the region. Should additional revenues become available in the future, these improvements that can be amended into the fiscally constrained portion of the MTP.

Table 6-11. Revenues and Expenditures for Roadway Capital (2023-2030)

Revenue Source	Expenditures	Revenues 2023-2030	Expenditures 2023-2030	Carryover Balance	Revenues 2031-2050	Expenditures 2031-2050	Remaining Balance
NHPP	Capital Projects		\$9,189,227			\$235,931,290	
	ITS/TSMO/Safety Program	\$81,908,220	\$20,498,651	\$20,498,651	\$271,675,564	\$21,073,590	\$11,000,427
	Bridge Program		\$31,721,691			\$24,168,907	
S-STBG	Capital Projects		\$17,838,587			\$30,228,509	
	ITS/TSMO/Safety Program	\$32,367,420	\$1,977,468	\$1,977,468	\$107,357,198	\$18,616,953	\$52,432,901
	Bridge Program		\$10,573,897			\$8,056,302	
HSIP	Capital Projects		\$8,970,345			\$--	
	ITS/TSMO/Safety Program	\$18,789,416	\$4,909,536	\$4,909,536	\$62,321,283	\$18,035,089	\$49,195,730
STBG-L	Capital Projects		\$13,911,469			\$18,628,103	
	Bicycle and Pedestrian Program	\$14,393,388	\$240,960	\$240,960	\$47,740,409	\$7,398,556	\$21,954,709
Discretionary	Capital Projects		\$1,531,538			\$7,195,834	
	Bicycle and Pedestrian Program	\$2,758,154	\$613,308	\$613,308	\$9,148,327	\$794,777	\$1,771,024
Local	Capital Projects		\$18,719,860			\$4,807,243	
	Bicycle and Pedestrian Program	\$19,021,251	\$150,696	\$150,696	\$63,090,239	\$14,646,097	\$43,787,595
Total		\$169,237,850	\$140,847,232	\$28,390,618	\$561,333,019	\$409,581,252	\$180,142,385

***The 2031-2050 revenues column is the sum of carryover funds from the 2030 horizon and the new projected revenues for each program.*

Figure 6-3. Projected Daily Level of Service (2050)

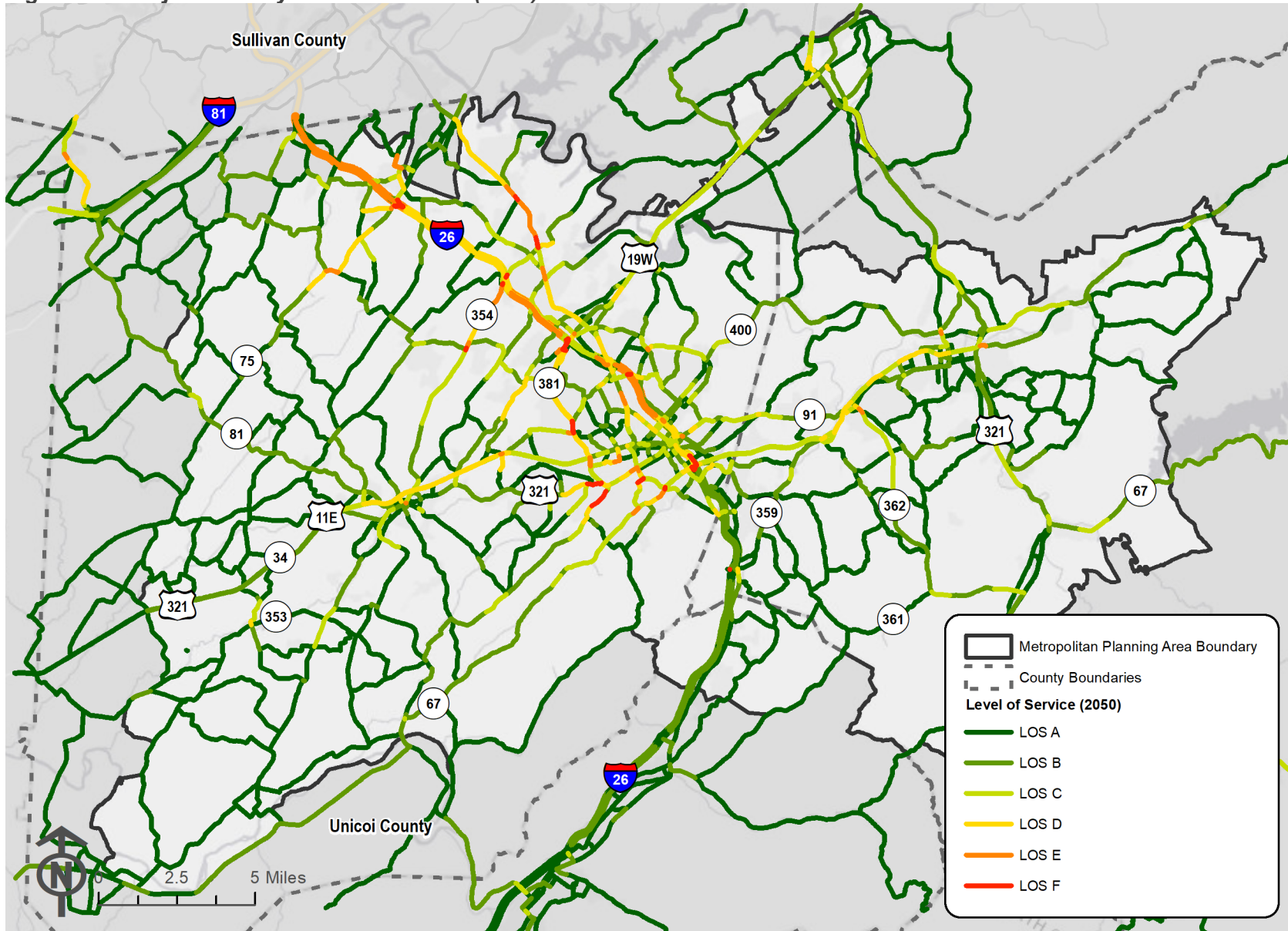


Table 6-12. Illustrative Projects

ID	Lead Agency	Project/Route Name	From/To	Type of Improvement	Description
17	TDOT	Boones Creek Road (SR 354) Section 2	Highland Church Road to Bugaboo Springs Road	Roadway Widening	Widen existing 2 lane roadway to 4 lanes
18	TDOT	Boones Creek Road (SR 354) Section 3	Bugaboo Springs Road to West Jackson Boulevard (SR 34/US 11E)	Roadway Widening	Widen existing 2 lane roadway to 4 lanes
19	Jonesborough	Jonesborough Parkway	Boones Creek Road (SR 354) to West Jackson Boulevard (SR 34/US 11E) at intersection with Persimmon Ridge Road	New Road Alignment	Construct 3 lane roadway
20	TDOT	North State of Franklin Road (SR 381) Section 1	I-26 Exit 19 to Knob Creek Road	Roadway Widening	Widen existing 4 lane roadway to 6 lanes
34	TDOT	I-26	Exit 20 to 24	Roadway Widening	Widen Existing 4 lane interstate to 6 lanes
35	TDOT	North State of Franklin Road (SR 381) Section 2	Knob Creek Road to Sunset Drive	Roadway Widening	Widen Existing 4 lane interstate to 6/7 lanes
61	Johnson City	Triangle Intersection Improvements	North Roan Street (US 11E/SR 34) / Broyles Drive / Browns Mill Road and Princeton Road / Sunset Drive Intersection	Operational Improvements	Intersection Improvement
62	TDOT	Suncrest Drive (SR 75) Widening	I-26 to Boonesboro Road	Roadway Widening	Widen existing 3 lane roadway to 5 lanes

Please note, Project IDs 3, 5, 7, 22, 26, 27, 28, 29, and 42 are not listed individually in the MTP but are considered eligible for Safety and Operation and Bicycle and Pedestrian Improvements groupings and consistent with the plan, if additional funding for these groupings is identified.

In addition to capital expenditures, the MTP must also account for the significant cost of operating and maintaining the transportation system. These costs include routine and regular expenditures required to keep highways, streets, and rights-of-way in usable conditions such as repaving and restriping, mowing and landscaping, street lighting, traffic signal maintenance, and maintenance relating to the active transportation networks. The MTPO, in consultation with TDOT, was able to determine future operations and maintenance (O&M) funding levels for streets and highways for the MTPO area based on historic funding trends. A 2% annual growth rate was determined to be appropriate for O&M funding based on past funding growth trends within the MTPO area.

O&M expenses are assumed to grow at a similar rate accounting for incremental increases in operating and maintenance costs and the additional mileage to be added to the roadway system through expansion over the planning horizon. To determine the impact of these incremental increases, mileage additions resulting from the fiscally constrained capital roadway improvements were included in future year costs. Average costs per mile were applied to mileage increases on facilities maintained by TDOT, Washington County, and Johnson City stemming from the implementation of projects 9, 16, 32, 33, 40, and 57 beginning with the horizon year in which they are expected to be complete. With these increases and the expected inflation of O&M costs more generally, Table 6-13 illustrates the expected revenues and expenditures of state and local dollars for these actives over the planning horizon.

Table 6-13. Revenues and Expenditures for Roadway O&M (2023-2050)

Jurisdiction	Mileage Increases	Total Revenues	Total Expenditures
City of Bluff City	--	\$11,018,961	\$11,018,961
City of Elizabethton	--	\$89,970,461	\$89,970,461
City of Johnson City	1.57	\$618,311,863	\$620,731,506
Town of Jonesborough	--	\$33,969,074	\$33,969,074
Town of Unicoi	--	\$5,327,460	\$5,327,460
City of Watauga	--	\$466,137	\$466,137
Carter County	--	\$77,032,444	\$77,032,444
Sullivan County	--	\$9,326,472	\$9,326,472
Unicoi County	--	\$932,368	\$932,368
Washington County	0.69	\$708,920,971	\$709,771,261
TDOT	8.76	\$97,041,312	\$99,710,769
Total	11.02	\$1,652,317,522	\$1,658,256,913

For agencies that are expanding the roadway system, the projected costs of maintaining the system will outpace the assumed 2% growth in available revenues; however, many of the local and federal funding programs have significant carryover balances as shown in Table 6-11. While typically reserved for capital projects, these funds may need to be utilized for maintenance activities in order to meet fiscal constraint requirements.

Transit Expenditures

To fund transit service in the Johnson City MTPO area, the MTP must account for both the capital needs of providers as well as the cost of operating both fixed route and demand response service. Capital needs for transit agencies largely consist of vehicle replacements, which occur on a recurring basis to keep vehicles in a state of good repair. Using the JCT and NET Trans Transit Asset Management (TAM) Plans, Table 6-14 and Table 6-15 forecast the number of transit vehicles that will need to be replaced over each planning horizon and the YOE costs. To develop YOE costs for vehicles, a 5% annual inflation factor was used for the first five years of the plan horizon with a 3.4% annual inflation factor used each year after, similar to the assumptions utilized in the highway fiscal constraint analysis. In total, there are approximately 170 transit vehicles that will need to be replaced by 2050 totaling over \$39 million. Table 6-16 and Table 6-17 summarize the projected revenues and expenditures for transit capital needs, illustrating fiscal constraint. As shown, there are approximately \$2.5 million in excess revenues. These excess funds can potentially cover unanticipated capital costs and/or the capital costs associated with equipment replacement and/or facilities improvement.

Table 6-14. Projected Transit Capital Needs (2023-2030)

Agency	Vehicle Type	Useful Life	Total Replacements	YOE Cost Estimates
NET Trans	ADA Minivan	8 years	12	\$818,824
Johnson City Transit	Low Floor Cutaway	10 years	17	\$2,995,297
	Low Floor Heavy Duty Bus	14 years	6	\$3,266,719
	ADA Minivan	8 years	8	\$470,807
	ADA Van	10 years	7	\$495,499
Total			50	\$8,047,144

Table 6-15. Projected Transit Capital Needs (2031-2050)

Agency	Vehicle Type	Useful Life	Total Replacements	YOE Cost Estimates
NET Trans	ADA Minivan	8 years	32	\$3,737,151
Johnson City Transit	Low Floor Cutaway	10 years	16	\$10,076,704
	Low Floor Heavy Duty Bus	14 years	34	\$13,032,179
	ADA Minivan	8 years	24	\$2,650,305
	ADA Van	10 years	14	\$1,709,367
Total			120	\$31,205,706

Table 6-16. Revenues and Expenditures for Transit Capital (2023-2030)

Funding Source	Total Revenues	Total Expenditures	Remaining Balance
5307 Urbanized Area			
5310 Enhanced Mobility	\$9,664,935	\$8,047,144	\$1,617,790
5339 Bus and Bus Facilities			

Table 6-17. Revenues and Expenditures for Transit Capital (2030-2050)

Funding Source	Total Revenues	Total Expenditures	Remaining Balance
5307 Urbanized Area			
5310 Enhanced Mobility	\$33,674,727	\$31,205,706	\$2,469,021
5339 Bus and Bus Facilities			

***In the 2050 horizon period, the total revenues column is the sum of carryover funds from the 2030 horizon and the new projected revenues for each program, which total \$32,056,936.*

In addition to vehicle replacements, transit agencies receive federal funding to operate fixed route and demand response service. Operating revenues are largely sourced from FTA's 5307 Urbanized Area Formula funding, which equates to approximately \$3.5 million per year. As noted in Section 6.2 and shown in Table 6-18 and Table 6-19, after accounting for small increases in revenues the Johnson City MTPO area can expect approximately \$134 million from this program to operate the region's transit services from 2023-2050. Based on historic operating expenditures reported in the National Transit Database (NTD) annual reports, this amount is unlikely to be sufficient for maintaining current service levels in the MTPO area. Therefore, reduction of current service and/or pursuit of additional funding for operating expenses may need to occur.

Table 6-18. Revenues and Expenditures for Transit Operating (2023-2030)

Funding Source	Total Revenues	Total Expenditures	Remaining Balance
5307 Urbanized Area	\$31,147,366	\$31,147,366	\$0

Table 6-19. Revenues and Expenditures for Transit Operating (2030-2050)

Funding Source	Total Revenues	Total Expenditures	Remaining Balance
5307 Urbanized Area	\$103,310,489	\$103,310,489	\$0

PROJECT IMPACTS



7.0 Project Impacts

Projects included for funding in the 2050 MTP have the potential to impact the region’s residents, economy, and transportation system in multiple ways. This chapter provides a summary of the system performance impacts of these projects, as well as potential impacts to natural and cultural resources, minority and low-income populations, and individuals with Limited English Proficiency (LEP). As these projects move through the development process, negative impacts should be comprehensively avoided where possible, minimized where impacts are unavoidable, and mitigated to compensate for affected resources.

7.1 System Performance

As outlined in Section 2.4, TDOT has established performance targets to meet each of the federally required performance measure categories, including safety, bridge and pavement conditions, reliability, emissions reduction, and transit. The Johnson City MTPO is committed to funding transportation projects that align with both federal and state performance management requirements to meet or exceed state targets in these areas. Table 7-1 provides examples of projects that are funded in the Johnson City MTPO area through this plan and that will aid the State in achieving its targets in the three performance management categories.

Table 7-1. Project Funding by Federal Performance Management Category

Performance Management Category	Associated Project Types	Example Projects
Safety (PM 1)	Roadway Safety Improvements, Bicycle/Pedestrian/Complete Streets Improvements	SR 362 Safety Improvements; West Walnut Street Safety Improvements; Tweetsie Trail Extension
Pavement and Bridges (PM 2)	Roadway & Bridge Rehabilitation/Replacement	Bridge Rehabilitation and Maintenance Program
System Performance and Freight (PM 3)	Roadway Capacity, System Operation/Technology, Intersection Improvements, Transit Capital/Operations, Transit Fixed Route Services, Transit On-Demand Services	I-26 Widening; I-26 ITS Deployment; Adaptive Signal Control

7.2 Title VI and Environmental Justice

Transportation and health are inextricably linked, and the impacts of transportation projects can have a direct impact on quality of life for the Johnson City region’s residents, particularly traditionally underserved populations, which include minority, low-income, and Limited English

Proficiency (LEP) populations. As a recipient of federal funds, the Johnson City MTPO is statutorily required to assess the impacts of transportation projects on underserved populations and engage with these communities during the planning process. These federal requirements are outlined in Table 7-2.

Table 7-2. Key Guidance Regarding Traditionally Underserved Populations

	Title VI	Environmental Justice	Limited English Proficiency
Authorizing Directive	Civil Rights Act of 1964 (42 USC § 2000d et seq.)	E.O. 12898 (1994)	E.O. 13166 (2000)
Required Population	Race, color, and national origin	Minority persons and low-income persons	Individuals with a limited ability to read, write, speak, or understand English
Applicable Programs/Agencies	Programs receiving federal assistance	Federal agencies and recipients of federal financial assistance	Federally funded programs and activities
Guidance	23 CFR Part 200 and 450 FTA Title VI Circular 4702. 1B (2012)	FTA EJ Circular 4703.1 (2012)	U.S. DOJ Guidance to Federal Financial Assistance Recipients Regarding Title VI Prohibition Against National Origin Discrimination Affecting Limited English Proficient Persons (2000)

The potential impact of the projects included in this MTP were analyzed using 2020 Census data available at the block group level from the U.S. Census Bureau. Within each block group, the average percent of minority, low-income, and LEP populations was used to determine potential impacts for each project. Minority populations are defined as residents who identify as African American, Asian American, American Indian and Alaska Native, Native Hawaiian or other Pacific Islander. The average percent minority population by Census block group is approximately 7% in the Johnson City MTPO area. Low-income populations are defined by the Census at the household level. Within Census block groups in the Johnson City MTPO area, approximately 19% of households are classified as low-income on average. Similarly, approximately 2% of households are classified as having limited English proficiency. Figure 7-1, Figure 7-2, and Figure 7-3 highlight the overlap of MTP fiscally constrained projects and high concentrations (i.e., above the regional average) of minority, low-income, and LEP populations. MTP projects that are located in areas with the potential to impact traditionally underserved populations are also listed in Table 7-3.

Figure 7-1. MTP Projects Near Minority Populations

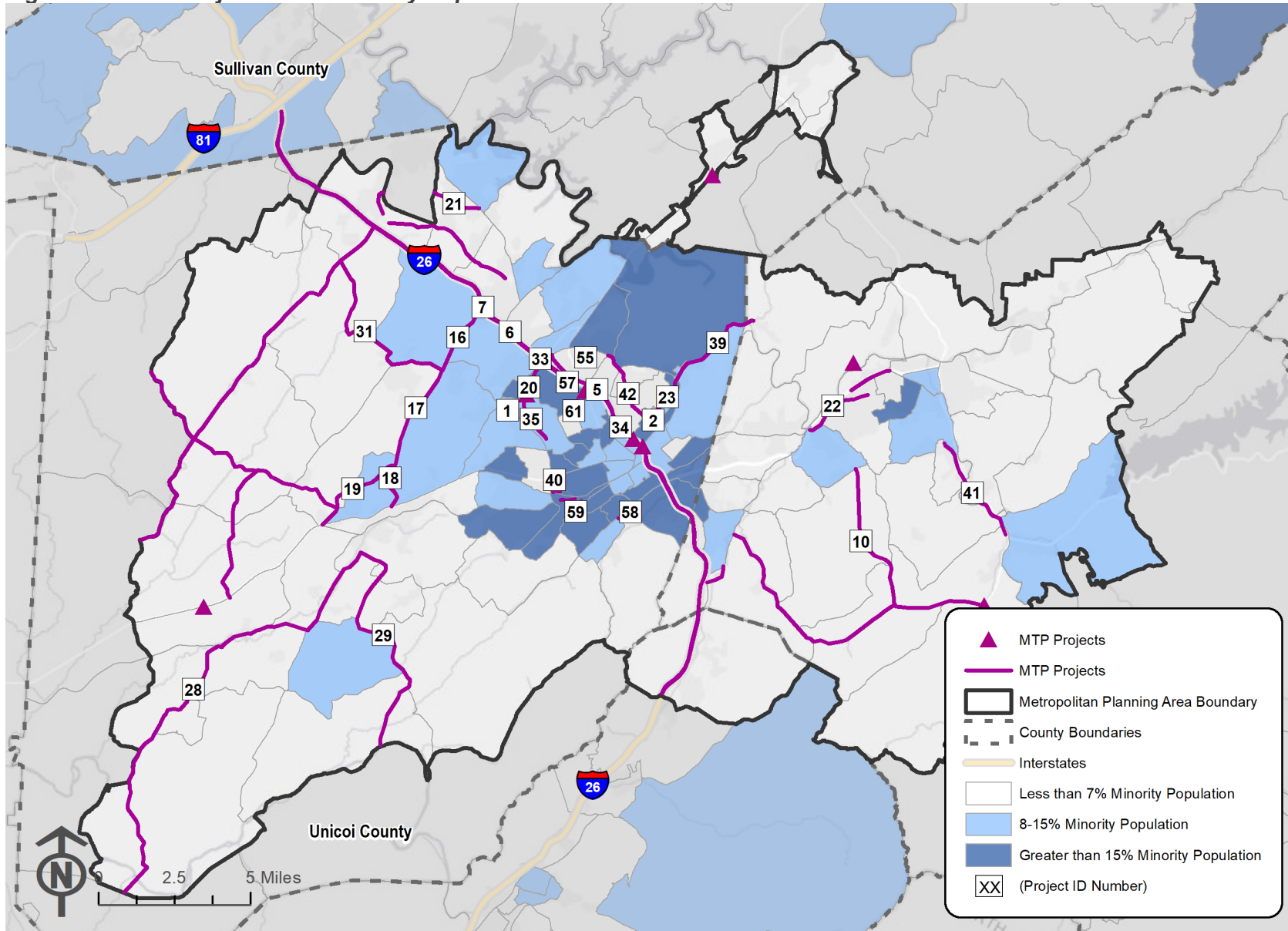


Figure 7-2. MTP Projects Near Low-Income Populations

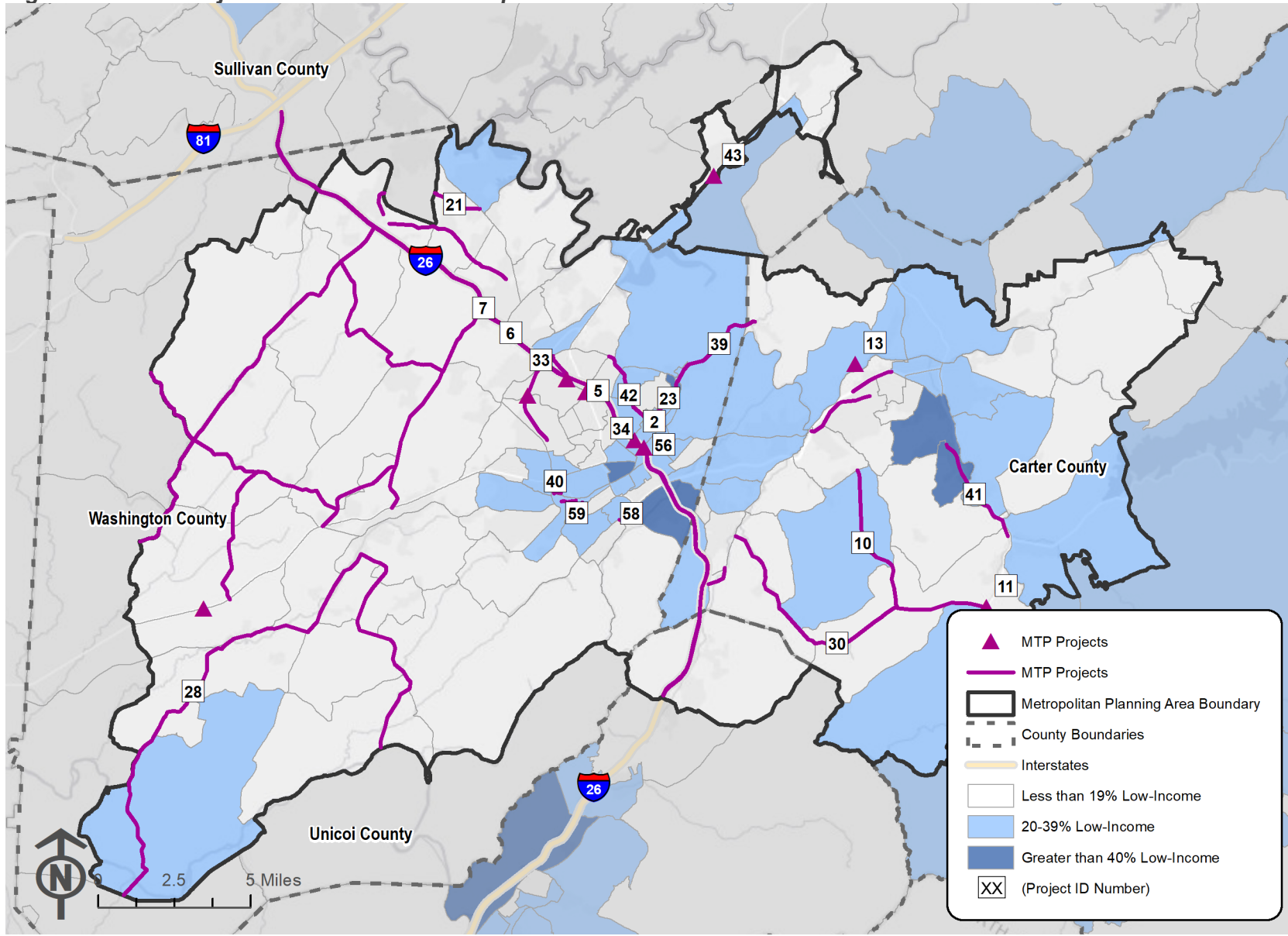


Figure 7-3. MTP Projects Near LEP Populations

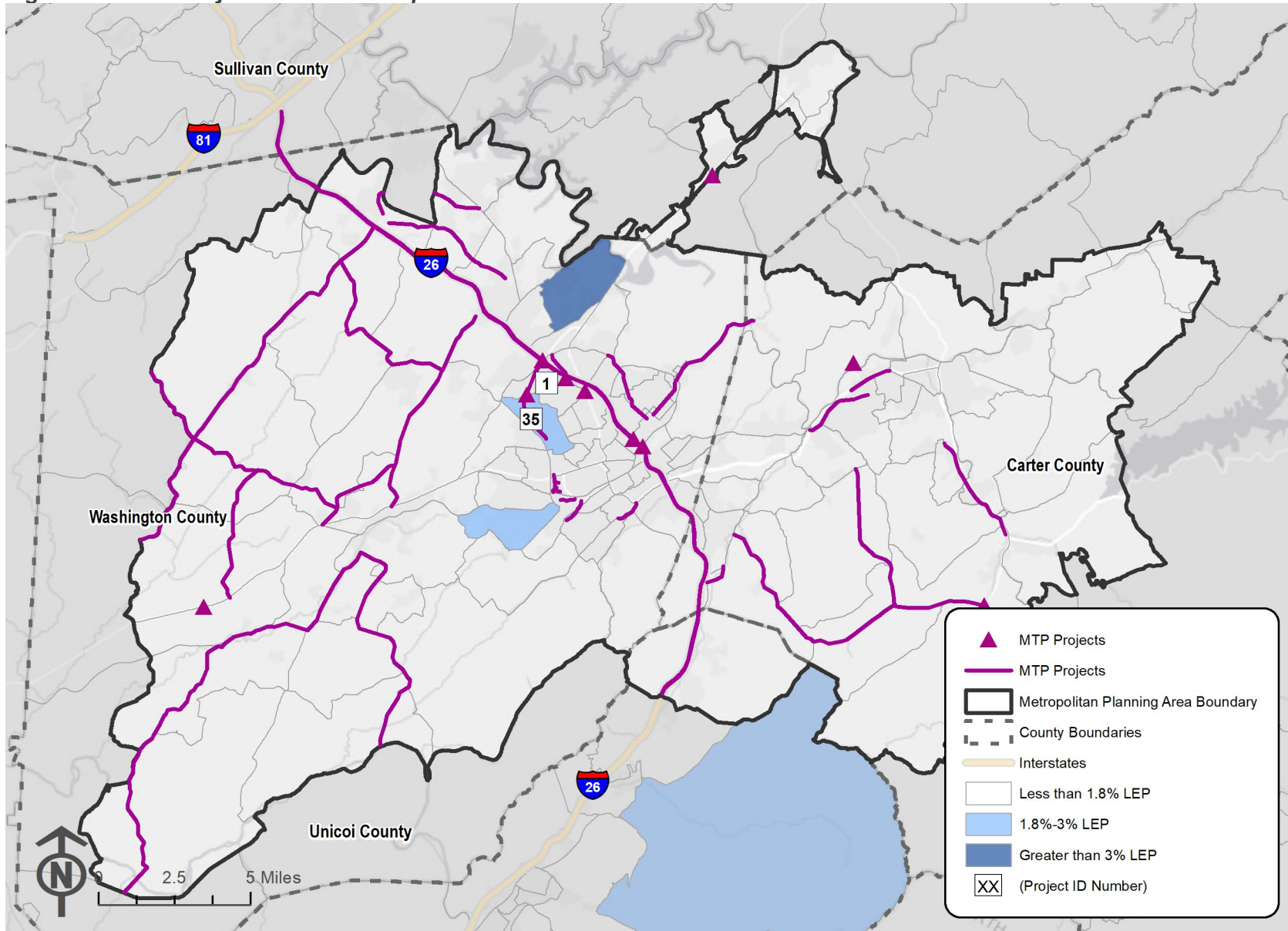


Table 7-3. MTP Projects with Potential Impacts to Traditionally Underserved Populations

Project ID	Project Description	Above Average Populations		
		Minority	Low-Income	LEP
1	Deploy real-time adaptive signal control technologies throughout Johnson City	✓		✓
2	Widen eastbound off ramps on I-26 to provide option lane at East Unaka/Watauga Avenue (SR 400) and West Market/Main Street (SR 91)	✓	✓	
4	Install additional overhead signage on I-26 at the Exit 19 - State of Franklin Road (SR 381) interchange	✓	✓	
6	Install cameras, DMS, sensors and communications along I-26 from mile marker 8 to 26	✓	✓	
10	Safety/geometric improvements along SR 362 from Dry Creek Road (SR 361) to Big Springs Road	✓	✓	
12	Reconfigure I-26 on and off ramps at Exit 19 for operational improvements, add turning lanes on all approaches	✓	✓	
16	Widen Boones Creek Road (SR 354) to 4 lanes from Christian Church Road to Highland Church Road	✓		
17	Widen Boones Creek Road (SR 354) to 4 lanes from Highland Church Road to Bugaboo Springs Road	✓		
18	Widen Boones Creek Road (SR 354) to 4 lanes from Bugaboo Springs Road to West Jackson Boulevard (SR 34/US 11E)	✓		
19	Construct new 3 lane road from Boones Creek Road (SR 354) to West Jackson Boulevard (SR 34/US 11E) at intersection with Persimmon Ridge Road	✓		
20	Widen North State of Franklin Road (SR 381) to 6 lanes from I-26 Exit 19 to Knob Creek Road	✓		
21	Reconstruct 2 lane roadway to address geometric issues along Free Hill Road from Kingsport Highway (SR 36) to Cedar Creek Road	✓	✓	

Project ID	Project Description	Above Average Populations		
		Minority	Low-Income	LEP
23	Safety/geometric improvements along East Unaka Avenue (SR 400) from Broadway Street to East Fairview Avenue, including paved shoulders and other improvements at select locations as determined through the project development process	✓	✓	
30	Safety/geometric improvements along SR 361 from Okolona Road (SR 359) to State Line Road at Veterans Memorial Parkway (SR 37/US 19E)		✓	
31	Safety/geometric improvements along Shadden Road/Highland Church Road from Suncrest Drive (SR 75) to Boones Creek Road (SR 354)	✓		
33	Widen I-26 to 6 lanes from Exit 17 to 20	✓	✓	
34	Widen I-26 to 6 lanes from Exit 20 to 24	✓	✓	
35	Widen North State of Franklin Road (SR 381) to 6 lanes from Knob Creek Road to Sunset Drive	✓		✓
39	Safety/geometric improvements along Watauga Road (SR 400) from East Fairview Avenue to Piney Flats Road	✓	✓	
40	Construct new 3 lane road with median and turn lanes from West Market Street (SR 34/US 11E) to McKinley Road	✓	✓	
41	Extend Tweetsie Trail from Hatcher Lane terminus to Hampton, TN	✓	✓	
43	Intersection Improvements at Bristol Highway (SR 34/US 11E/US 19W) and Allison Road/Piney Flats Road		✓	
55	Install roundabout at the intersection of Browns Mill Road and Peoples Street	✓		
57	Widen road, add turn lanes, add sidewalks along Browns Mill Road, from West Oakland Avenue to Peoples Street	✓		
58	Safety/geometric improvements along Cherokee Road (SR 67) from Sinking Creek Road to University Parkway (US 321/SR 381)	✓	✓	

Project ID	Project Description	Above Average Populations		
		Minority	Low-Income	LEP
59	Safety/geometric improvements along South Greenwood Drive from Seminole Drive to West State of Franklin Road (US 321/SR 381)	✓	✓	
60	Safety/geometric improvements along West Walnut Street from Antioch Road to West State of Franklin Road (US 321/SR 381)	✓	✓	
61	Operational improvements at the North Roan Street (US 11E/SR 34) / Broyles Drive / Browns Mill Road and Princeton Road / Sunset Drive Intersection	✓		

7.3 Historic, Cultural, and Natural Resources

Transportation projects can negatively impact key natural and cultural resources, including historic buildings and sites, cemeteries, rivers, streams, forested areas, floodplains, wetlands, and other habitat conservation areas. Topographical features, such as steep slopes, ridges, and mountains, are critical elements of the Johnson City region’s character, and are also natural resources that should be protected. Key natural and historical features in the Johnson City region include the Cherokee National Forest, many creeks and streams (Boones Creek, Brush Creek, Knob Creek, Sinking Creek, etc.), historic mill sites, and the Doe and Watauga Rivers.

The 2050 MTP projects listed in Table 7-4 and shown in Figure 7-4 are located in close proximity to some of these key natural and cultural resources. While these projects are still in the early planning stages, their scopes should be adjusted throughout the project development process to minimize and avoid impacts to natural and cultural features. Where impacts are unavoidable, mitigation activities should be conducted to compensate for the loss of critical environmental resources.

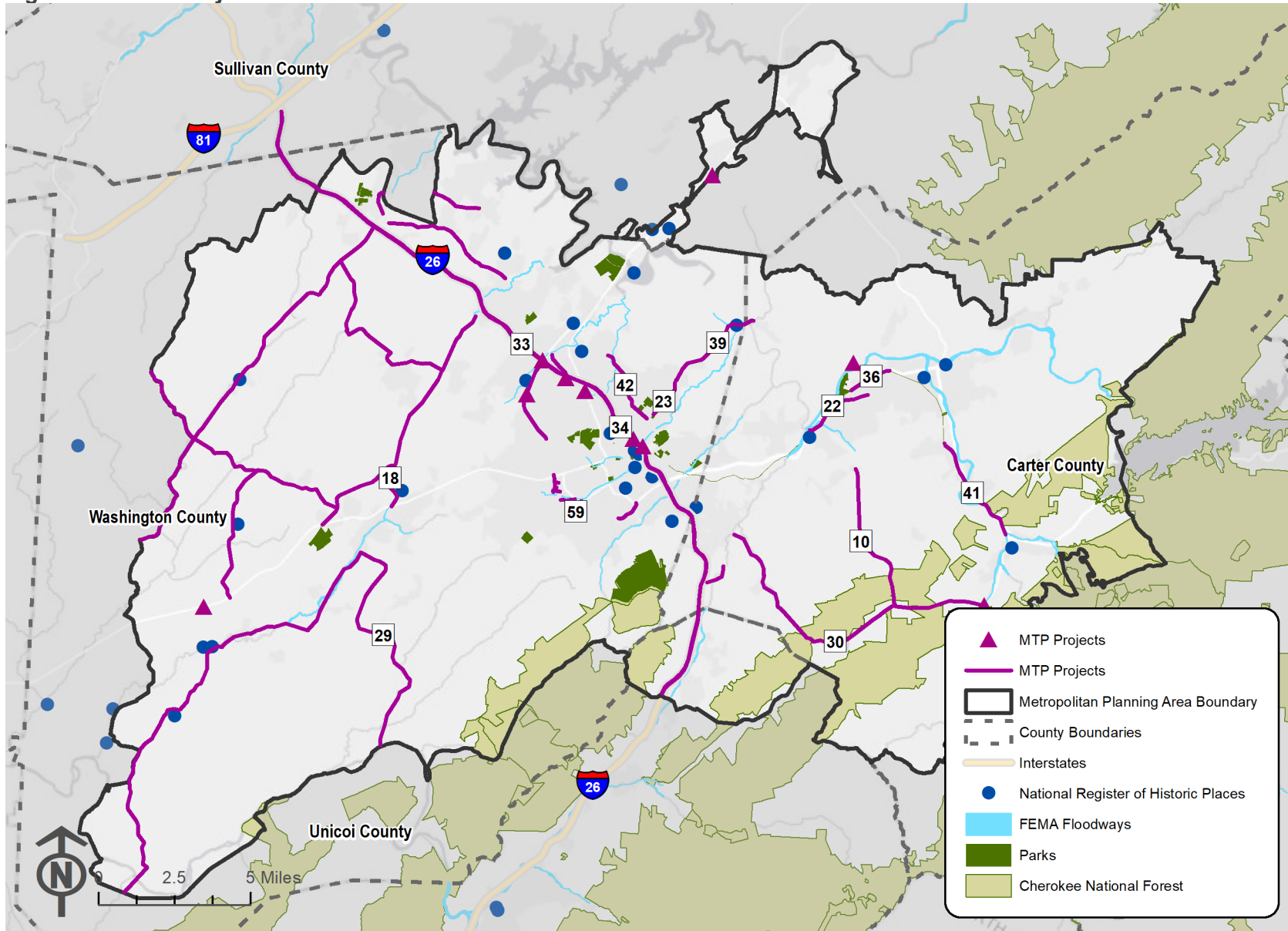
Table 7-4. MTP Projects with Potential Impacts to Cultural and Natural Resources

Project ID	Project Description	Potential Impact
10	Safety/geometric improvements along SR 362 from Dry Creek Road (SR 361) to Big Springs Road	Cherokee National Forest
18	Widen Boones Creek Road (SR 354) to 4 lanes from Bugaboo Springs Road to West Jackson Boulevard (SR 34/US 11E)	100-Year Floodway
23	Safety/geometric improvements along East Unaka Avenue (SR 400) from Broadway Street to East Fairview Avenue	Carnegie Park, Lions Park
30	Safety/geometric improvements along SR 361 from Okolona Road (SR 359) to State Line Road at Veterans Memorial Parkway (SR 37/US 19E)	100-Year Floodway, Cherokee National Forest
33	Widen I-26 to 6 lanes from Exit 17 to 20	100-Year Floodway
34	Widen I-26 to 6 lanes from Exit 20 to 24	100-Year Floodway
39	Safety/geometric improvements along Watauga Road (SR 400) from East Fairview Avenue to Piney Flats Road	100-Year Floodway, Dungan’s St. John Mill and Stone House
41	Extend Tweetsie Trail from Hatcher Lane terminus to Hampton, TN	100-Year Floodway, Cherokee National Forest
59	Safety/geometric improvements along South Greenwood Drive	ETSU Betty Basler Softball Campus

The cultural and natural resources analysis considered potential project impacts to a variety of features, including floodways, parkland and national forests, and historic buildings and sites. As projects move forward from planning to development, additional impacts should be considered,

such as the need for property and right-of-way acquisition, wetland impacts, and impacts to other critical environmental areas. Public support and opposition to projects should also be considered. For example, the Okolona Road (SR 359) Realignment (Project ID 24) received significant opposition during the second round of public engagement and was removed from consideration in this Plan update.

Figure 7-4. MTP Projects Near Cultural and Natural Resources



7.4 Environmental Mitigation Strategies

As the projects included in this MTP move through the project development process from planning, to engineering and design, and finally to construction, impacts to both natural and cultural resources should be avoided wherever possible. Where conflicts are unavoidable, they should be minimized to the fullest extent possible and mitigated to ensure that lost resources are compensated for elsewhere. Table 7-5 outlines a variety of environmental mitigation strategies that should be employed to reduce the negative impacts of transportation projects in the Johnson City region.

Table 7-5. Mitigation Strategies

Resource	Mitigation Strategy
Air Quality	Apply an environmentally safe soil stabilizer on dirt roads
	Sweep roadways
	Encourage the use of electric vehicles and alternative fuels
Agriculture and Farmlands	Avoid agricultural lands when possible when siting projects
	Monitor agricultural lands for future environmental damage after projects are developed
Cultural and Historical Resources	Consult early with the state historic preservation officer and other interested persons and parties to determine what resources may exist in a specific area
	Engage in community discussions to understand valuable resources
	Employ relocation, marking, and other measures as appropriate
Habitat and Wildlife Areas	Avoid impacts by relocating projects or most impactful portions of projects to a less sensitive area
	Minimize impacts by modifying projects to reduce impacts
	Repair and restore affected areas to pre-disturbance conditions or mitigate adverse impacts by restoring and improving conditions as part of a mitigation bank
Open Space, Parks, and Recreation	Replace affected lands with areas of equivalent usefulness and location, and of at least comparable value
	Restore and landscape disturbed areas
	Replace and improve facilities affected by projects, including sidewalks, paths, benches, lights, trees, and other facilities
Water Resources	Promote redevelopment over new development to preserve existing permeable lands
	Require low-impact development and strongly encourage zero-impact development
	Avoid impacts to wetlands or other aquatic resources; minimize impacts and compensate where unavoidable
	Compensate for lost functions of affected aquatic resources and set measurable and enforceable ecological performance standards to ensure successful compensation

The MTPO will continue to coordinate with the following state and federal agencies to minimize environmental and cultural impacts related to the implementation of projects included in the 2050 MTP:

- Tennessee Department of Environment and Conservation (TDEC)
- Tennessee State Historic Preservation Office (SHPO)
- Tennessee Wildlife Resource Agency (TWRA) Federal Agencies
- U.S. Environmental Protection Agency (EPA)
- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- U.S. Forest Service
- U.S. Department of Agriculture
- National Park Service (NPS)
- Tennessee Valley Authority (TVA)

7.5 Climate Change, Adaptation, and Resiliency

In addition to the impacts of projects on existing resources, the MTPO must anticipate and plan for environmental changes that will have an impact on existing and future capital assets. As the climate continues to change, extreme weather and climate-related disasters will become increasingly common and require advanced planning to ensure the resiliency of the region's transportation system. Planning for a resilient transportation system will help guarantee that our investments in transportation infrastructure continue to serve the diverse needs of the region into the future. To further increase the resiliency of the transportation system to climate change and extreme weather, the Johnson City MTPO will continue to support climate adaptation and mitigation activities, including:

- Analyzing the potential impact of extreme weather and other climate-related stressors on the transportation system and mitigating risks as they are identified;
- Supporting low-emissions transportation options, including transit, non-motorized transportation (walking and bicycling), and electric vehicle technologies;
- Prioritizing maintenance of the existing transportation system as well as transportation system management and operations strategies over capital system expansion; and,
- Supporting conservation development strategies, including infill development, transit oriented development, and mixed use development to reduce the impacts of sprawl and discourage car-oriented development patterns.

APPENDICES



Appendix A. Public and Stakeholder Engagement

First Round of Public Outreach: Survey #1 – Summary of Responses:

The first MTP Update survey was available online from January to March 2022 and was completed by 313 respondents. Respondents provided information about past and future development preferences, transportation priorities, and locations of transportation-related issues and opportunities. Key results include:

- Congestion on the region’s roadways: 89% of respondents believe that roads have become more congested, while 16% perceive that congestion has remained the same.
- Past development: More than half (53%) of respondents believe that development has occurred at just the right density over the past 10 years, while 25% believe it has been too sprawling, and 22% believe it has been too compact.
- Future development: Respondents have relatively evenly distributed opinions about where future development should occur – 30% believe it should be evenly spread throughout the region, while 24% think it should be focused near or next to existing development. 19% of respondents believe future development should be focused along road corridors.
- Overall system priorities: Maintenance of existing roadways was the top priority (185 votes), followed by reduced congestion and delay (156 votes), and improved safety (154 votes).
- Preferred roadway improvements: Respondents most preferred bridge and pavement improvements (171 votes), while improved timing of traffic lights (154 votes) and improved safety (146 votes) were a close second and third.
- Preferred transit improvements: the highest ranked transit improvement was the development of more sidewalks and trails connecting to transit stops (108 votes). Improved security was a close second (93 votes). The third highest ranked transit improvement was expanded service hours (70 votes).
- Preferred bicycle and pedestrian improvements: An emphasis on safe routes to school (151 votes) was the top priority, followed by more off road facilities (126 votes) and more sidewalks (123 votes).

The priority ranking questions included the option to provide additional clarification through expanded comments, which included the following feedback:

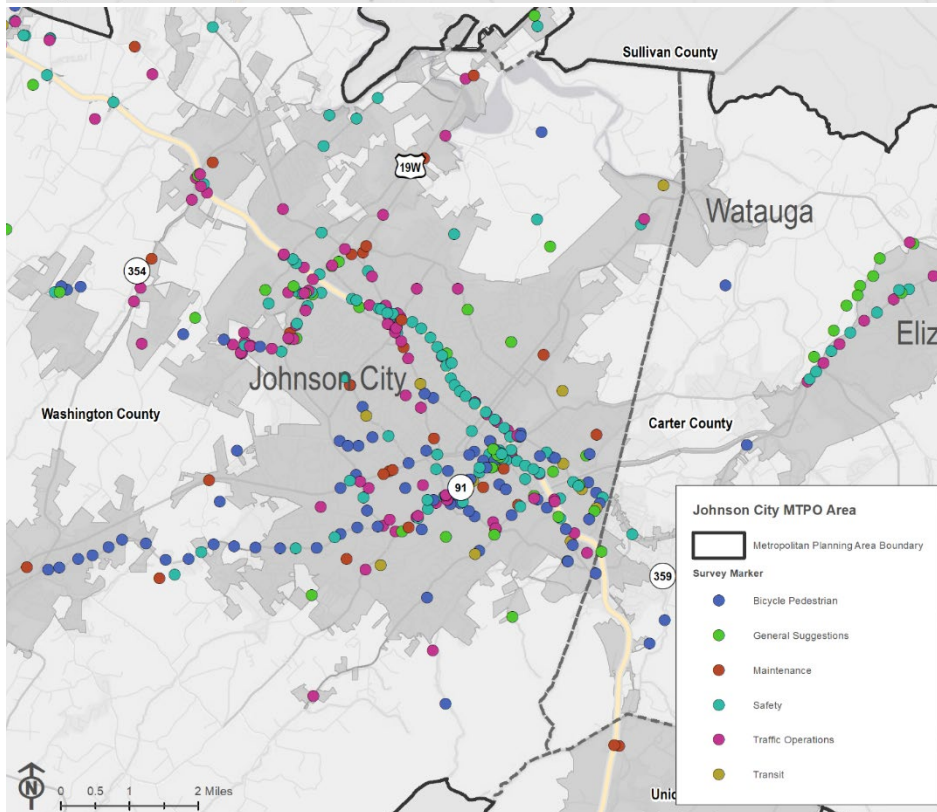
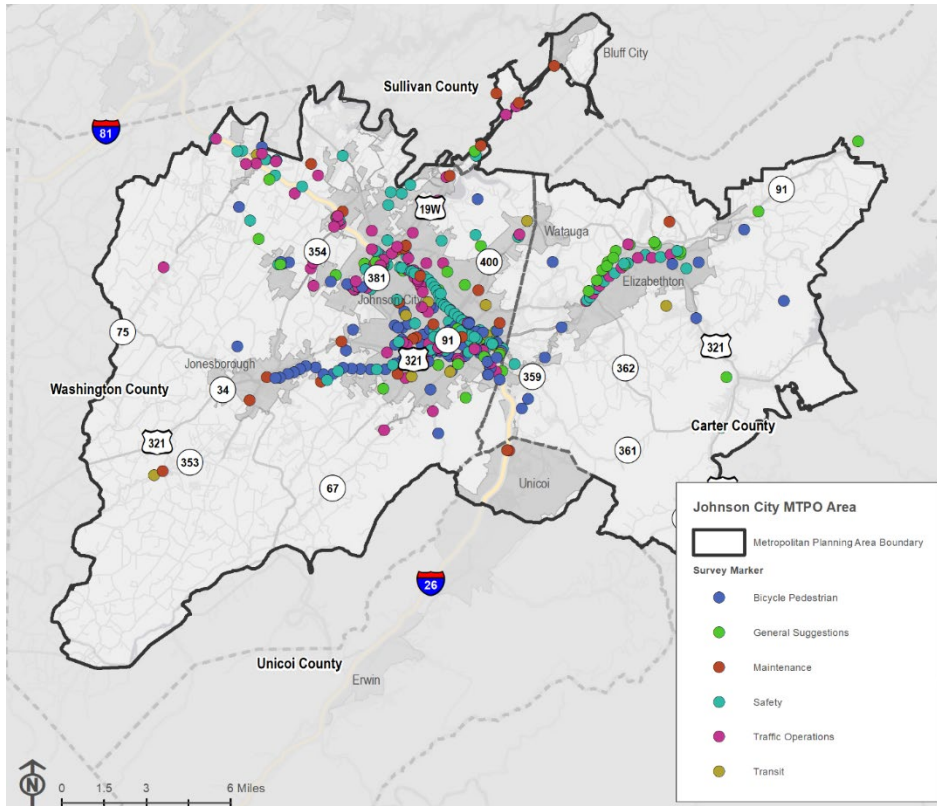
Item	Number of Comments	Summary Comments
Add/lengthen turn lanes	3	Suggestions for roundabouts instead of turn lanes, complaints about ineffective turn lanes
Additional transit facilities	3	Support for expanded transit service and additional investment in safety
Beautification of transportation facilities	2	Support for beautification and street lighting

Item	Number of Comments	Summary Comments
Better connected travel options	5	Support for mixed use, walkable developments, less parking, passenger trains, connected sidewalks, and additional bicycle infrastructure
Bicycle parking	2	Support for additional bicycle infrastructure to reduce barriers to bicycling
Build new roadways	4	Support for additional density along existing roads, more alternatives to I-26, desire to focus on maintenance of existing roads before investing in new roads, and crosstown connectivity for Johnson City
Economic development	1	Support for higher density, walkable developments for better ROI
Education/enforcement	5	Complaints about safety issues for pedestrians, desire for stricter requirements for bicycle/pedestrian safety education to motorists before issuing driver's licenses
Emphasize safe routes to school	7	Support for more walkable communities, public health improvements, desire for more police presence in school zones, longer crossing times for pedestrians
Expanded service hours	4	Improved transit as an equity issue, expanded service hours improving safety and better connecting ETSU to downtown Johnson City
Improve pavement and bridges	3	Preference for maintenance over emergency repair
Improved safety of roadways	4	Desire for roundabouts, addressing signal timing near the McDonalds by ETSU, removing 1-lane tunnels
Improve timing of traffic lights	9	Support for roundabouts, loop detectors, increased turning times, improved traffic timing in general
Improved connections	1	Support for more sidewalks
Improved safety	8	Support for roundabouts, law enforcement on I-26, more barriers between sidewalks and bikeways, school zones, sidewalks near grocery stores
Improved security	2	Support for police and encouraging more transit ridership through security improvements
Interchange and ramp improvements	2	Recommendation to address safety issues at the I-81 and I-26 interchange
Less pollution	6	Support for roundabouts, preserving air quality for tourism and public health
Maintenance	3	Address crosswalk issues in downtown, sidewalk maintenance, additional cleaning of bike lanes
Maintenance of existing roadways	4	Address potholes, city-maintained roads need particular help
More bus routes	3	Support for additional transit service

Item	Number of Comments	Summary Comments
More off-road facilities	7	Support for additional off-road bike/ped facilities, support for expanding the Tweetsie trail and additional greenway facilities
More on-road facilities	8	Support for expanded on-road bicycle facilities with physical barriers from cars where possible
More sidewalks	12	Strong support for more sidewalks
More sidewalks and trails	5	Strong support for more sidewalks and trails
More transportation choices	11	Support for expanded bicycle infrastructure, a bus from Johnson City to Kingsport, and additional sidewalks
New or wider streets/highways	6	Preference for investing in existing infrastructure before expanding the system, no new roads without pedestrian infrastructure
Other improvements	67	Requests for bicycle and pedestrian facilities, additional housing, increased density, native plantings, widening I-26, walkable communities, bus services, stronger planning and zoning policies, passenger rail service, focus on maintenance, parking enforcement, county road improvements
Pedestrian improvements and intersections	4	Support for pedestrian visibility projects at crosswalks
Reduced congestion/less delay	6	Support for publicly accessible traffic cameras, providing alternative transportation options, investments now to address future issues
Reduced freight transportation conflicts	2	Complaints about train noise
Use technology to manage roadways	1	Complaint about red light cameras
Wayfinding signage	2	Support of signage to help walkability
Widen existing roads	4	Support for widening to provide pedestrian facilities, no comments support widening for vehicle lanes

The interactive map received 456 comment markers in the following categories:

- Traffic operations – 26% (118 comments)
- Safety – 27% (125 comments)
- Bicycle/Pedestrian – 21% (97 comments)
- General Suggestions – 13% (61 comments)
- Maintenance – 8% (38 comments)
- Transit – 4% (17 comments)



Stakeholder Meeting #1 – Economic Development, Freight, and Tourism

03/21/2022

Attendees: Amy Kosanovic (TDOT), Dr. Jon Lane Smith (ETSU), Glenn Berry, Mary Butler, Kayla Ferguson, Hannah Plummer

Discussion:

- The MTP plan will acknowledge the rapidly changing technologies associated with electric vehicles but will likely not include major recommendations for EV infrastructure. That work will be completed at the state level and will incorporate findings from previous studies, such as the I-40/I-81 Alternative Fuels Corridor Study.
- The ETSU campus is generally constrained to its 317 acres, though it plans to increase the student population to 18,000 in the coming years. Student housing will likely densify on-campus where possible, and the private sector will provide the excess capacity that's required. No major plans for off-campus development that would affect transportation on a wide scale.
- The on-campus shuttle service is well used, though there is still some congestion on the road networks that serve student housing (e.g., Seminole Drive and Greenwood Drive)
- Students would likely take advantage of additional facilities to walk and bike, and additional JCT service would also be utilized by students.
- TDOT has submitted a request to FHWA to increase the mileage of interstate in Tennessee that is designated as part of the Primary Highway Freight Network, but the effects in the Johnson City region are unknown at this point.
- TDOT will soon be updating its Statewide Freight Plan and will be incorporating the findings from previous studies including corridor plans and freight studies.
- TDOT recommends reviewing the I-26 Corridor Study to include project recommendations along I-26 that may affect freight, including safety projects, TSMO projects, truck climbing lanes, overnight parking locations, etc.
- There were previous discussions about developing an inland port in the region, but conversations stalled during the pandemic.
- The Tri-Cities Airport has recently re-graded 120 acres near the existing runways to position itself for expansion in the future. Improvements to SR 75 heading south toward the MPA may help accommodate future residential and economic development near the I-26 interchange.
- SR 67 heading west from Johnson City may also see additional growth and development over the next 25 years.
- Lone Oak is frequently cited as a safety issue for cyclists and pedestrians as it has no shoulders and challenging turns/visibility due to horizontal and vertical curvature.

Stakeholder Meeting #2 – Bike/Ped, Transit, Health and Equity

3/28/2022

Attendees:

- Ashley Davies (Tennessee Department of Health)
- Chris Hodgins (Washington County Health Department)
- Jerry Boyd (Washington County Schools)
- Steven Barnett (Johnson City Schools)
- Chase Milner (First Tennessee RPO)
- Glenn Berry (Johnson City MTPO)
- Kayla Ferguson, Hannah Plummer (KCI)

Discussion:

- The Boones Creek Road bike lane and the Tweetsie Trail are used for both recreation and commuting. The Tweetsie Trail provides good access between Johnson City and Elizabethton, and there is support for additional facilities beyond the Trail to support commuting trips.
- There are a lot of bicyclists on Knob Creek Road, but vehicle speeds are high, making it uncomfortable for cyclists so the use of sidewalks and side streets is common.
- Some schools are surrounded by well-connected sidewalks in Johnson City, but once you get into the unincorporated areas, there's a significant decrease in access to schools. Lack of safe roadway crossings on major facilities and lack of sidewalks are barriers that prevent students from walking to school.
- For the county school system, sidewalks are more limited. Schools are often located on a major highway, so there are no adequate bike/ped facilities. Due to low residential density and lack of facilities, most students ride the bus, and there are very few that walk to school. Buses in the county often have to go door to door to pick up students because there are few areas for them to safely wait for the bus outside of neighborhoods.
- There are few protected bicycle facilities, and in general, more protected facilities would likely see more use if they were available. Additional bike lanes are needed to provide access to downtown Johnson City and commercial areas north of downtown.
- Additional bikeway and trail access to north and east Johnson City would be great. Access is currently pretty comfortable near ETSU and the hospital.
- General attitudes toward bicyclists have improved over the last 20 years.
- There are opportunities to encourage more economic and tourism framing around the existing and future trails systems in the region.
- The Carter County Mayor and the Carter County Parks and Recreation Board is working to secure funding for expanding the Tweetsie Trail to connect Valley Forge and Hampton, which would include a railroad bridge and tunnel and would be a big draw for recreational tourism.
- There was an attempt to get the Tweetsie Trail signed on the interstate, but TDOT did not approve the request.
- There is an additional project to connect the Tweetsie Trail and the linear path in Elizabethton near the covered bridge.
- Johnson City is installing new sidewalks near the Walmart off Highway 11E.
- The Washington County Highway Department doesn't install or maintain sidewalks, which makes it difficult to expand pedestrian facilities outside of incorporated areas.

- There is a desire to extend the Tweetsie Trail or construct other safe and comfortable bike connections to Jonesborough as an economic and recreational draw. Public comments support the idea of utilizing W. Walnut Street instead of Highway 11E.
- TDOT plans to update the statewide bike network. Current bike route signage by the state was installed in the 1980s and may not reflect a recommended network for most cyclists. In many cases, roads that are currently marked as bike routes are no longer safe for cycling, particularly in urban areas that have seen significant growth. For example, Allison Road near Piney Flats is more developed now than when it was signed as a bike route, so it's no longer safe for biking.
- Projects like the complete streets grant in Sneedville provide inspiration for the region. There's a need for complete streets improvements near the Sevier Tower in Johnson City where there's low-income housing and plans for additional housing near the Food City.
- Carroll Creek Road near the Sullivan County line would be a great opportunity to have multimodal access to parks and the creek in that area. Public Works is aware of this desire. Public comments supported the general desire to improve bike/ped access to parks across the region.
- The Johnson City MTPO may develop a separate bicycle/pedestrian plan for the region in the future. It would help feed the next MTP update and quantify bike/pedestrian needs in the region.
- The RPO is interested in the Tweetsie Trail extension and is willing to partner with the MTPO.
- North/South Roan Street has the need for dedicated multimodal facilities – especially near Food City – to serve as a key multimodal connection north-south through Johnson City.

Stakeholder Meeting #3 – Growth and Development, Regional Planning Discussion 4/6/2022

Attendees:

- Ronda Sawyer (TDOT)
- Angie Charles (Washington County)
- Logan Engle (City of Elizabethton)
- Preston Mitchell (City of Johnson City)
- Chris Schuettler (Carter County)
- Glenn Berry, Mary Butler (Johnson City MTPO)
- Kayla Ferguson, Hannah Plummer (KCI)

Discussion:

- Growth in Washington County:
 - They are seeing a lot of growth around the new school in the Boones Creek area, multifamily housing in Gray, single family in the outskirts of the city limits.
 - Not a lot of new commercial development in the unincorporated areas, but more businesses locating in the industrial parks.
 - Near Jonesborough, there's additional development along Boones Creek Road and on US 11E/Jackson Blvd.
 - In general, if there's vacant land that doesn't have environmental issues, someone's looking at it for development potential.
 - There are two EBM-Pabst plants - and one is being renovated to become a manufacturing facility that will employ 200 people within the next 3 years. There is a project to address geometric changes and potentially a future project to install a new traffic signal for the entrance to the Washington County Industrial Park.
 - There may be a need to improve the entrance to the new Jonesborough school.
 - The old Boones Creek Elementary school will be a satellite campus for TCAT.
 - There are no preservation overlays in Washington County.
 - A casino is proposed for development in Bristol that will potentially generate additional commercial employment in the MTPO area.
 - There is a push for expansion of the Aerospace Park near the Tri-Cities Airport but no tenant currently.
 - Available utilities serves as a constraint for development across the County and in Jonesborough. However, many areas near the Johnson City city limits have utilities in place.
 - Growth in Johnson City:
 - Development is highly dependent on geology – karst bedrock limits where development is physically possible.
 - Expanding out towards Jonesborough, land southwest of the city limits is filling in. There's lots of development in the areas northeast of town near the Boones Creek area, which typically involves annexation.
 - The urban services area layer is available on the GIS portal.
 - Johnson City growth will continue to happen around Boones Creek Road based on land availability and proximity to I-26. There are ongoing discussions about when and where to widen Boones Creek Road and Knob Creek Road based on this anticipated growth, especially in the Regional Retail Tourism Development District around Exit 17 on I-26.
-

- Growth in Gray:
 - Utilities are the primary limiting factor for growth in this area. There was a sewer study recently conducted that highlighted the lift stations as a maintenance challenge. Sewer and lift stations are a priority issue. Replacement is expensive so other alternatives are being weighed right now.
 - Historically, the annexations in Gray were pivotal in changing the state legislation around annexation
 - Pushing hard on infill development in Gray. Near Sullivan County and Piney Flats, a lot of growth happening in that area, but there will be some limitations because of inability to do water/sewer expansion.
- Growth in Carter County:
 - A new outdoor center is being discussed for the Watauga area, modeled after the Nantahala Outdoor Center (NOC) seen mostly in North Carolina. The Carter County Commission is on board as this could be a way to capitalize on natural resources to grow the economy surrounding outdoor recreation/tourism.
 - Most potential development is concentrated in west Carter County on the west side of Elizabethton, nearest to Johnson City employment opportunities. Some is in the Urban Services Area (USA), but the city doesn't extend sewer outside the USA currently.
 - A portion of SR-91 near Holly Street is being widened, which should encourage additional development/redevelopment along this corridor.
 - Horton Development Company is trying to enter the Elizabethton housing market by building houses on small lots.
 - Elizabethton annexed out along Milligan Highway – there's no sewer out there, which is not an issue currently but could become one at any point.
 - Watauga is on Elizabethton's city water. Elizabethton has a planning contract with Watauga, but there's not a lot going on in that area though there are few commercial lots that could develop in the future.
 - Elizabethton has been trying to attract a chain hotel though there's no near term plans at the moment.
 - Carter County has approved 900 acres of development in the mountainous, unincorporated parts of the county. These are mostly large lot residential developments. The Watauga Development Corporation is behind a lot of this development.
 - There's development occurring on Mary Patton Highway; approximately 35 lots near Gap Creek Road.
 - The intersection of Gap Creek Road and US 19E will be getting a signal.
 - In general, National Forest land is protecting the area around Watauga from development.
 - All the drainage is being replaced along Dennis Cove Road in east Carter County. This road is primarily used for residents to access Laurel Falls/Dennis Cove recreation areas and Appalachian Trail.
- Growth in Unicoi County:
 - Johnson City owns the former golf course in Unicoi and would like to see it sold or redeveloped. There have been conversations about redeveloping that area, most likely for residential, but topography makes this complicated. As such, there's currently no development plan for the golf course.
- Legislation affecting development:
 - The Regional Retail Tourism Development District Act was passed by the Tennessee General Assembly in May 2019 and is only applicable to Johnson

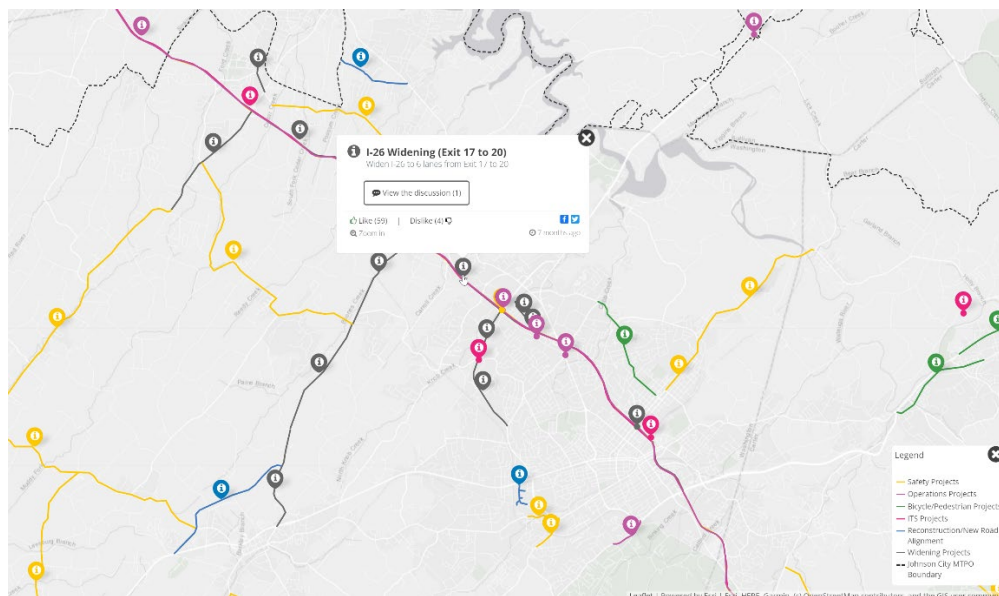
City, specifically 950 acres within a 1.5 mile radius around Exit 17 (SR 354) on I-26. It was requested by Johnson City, small group of developers and business owners and is a massive tax rebate incentive program. If the site is developed for entertainment and retail and it meets the criteria outlined in the legislation, 75% of the sales and use taxes go to the city of Johnson City for incentives or infrastructure.

- Development in the area may necessitate a new connection between Boones Creek Road and State of Franklin Road. A potential connection point could be tying Browns Mill Road to Christian Church Road but would require an interstate overpass.

Second Round of Public Outreach: Survey #2 – Summary of Responses:

The second MTP Update survey was available online from May to June 2022 and was visited by 1,400 users. Respondents were able to use an online map using Social Pinpoint to view locations and information on individual candidate projects, upvote or downvote projects, and provide comments. There were 1,581 upvotes and 206 downvotes provided. The top five projects that received the most upvotes are:

1. Adaptive Signal Control (73 upvotes);
2. I-26 at Exit 19-North State of Franklin Road (SR 381) Interchange Improvements (65 upvotes);
3. Tweetsie Trail Extension (64 upvotes);
4. East Oakland Avenue Pedestrian Safety Improvements (62 upvotes); and
5. I-26 Widening (Exit 17 to 20) (59 upvotes).



In addition to the votes on candidate projects, 47 comments were also submitted. In summary, key feedback include:

- Widespread support for the ITS and safety projects, particularly adaptive signal control, ITS deployment along I-26, and projects addressing sight-distance issues and other geometric deficiencies;
- General support for the recommended widening of I-26 and Boones Creek Road;
- Strong opposition to the Okolona Road (SR 359) realignment due to property acquisition and environmental concerns; and,
- Strong support for the bicycle and pedestrian recommendations, particularly the Tweetsie Trail Extension and East Oakland Avenue pedestrian safety improvements.

On the next page is a summary of the votes and comments received on the candidate projects shown on the Social Pinpoint map.

ID	Project Name	Project Type	Project Upvote	Project Downvote	Comment
1	Adaptive Signal Control	ITS	73	2	Project is long overdue.
2	I-26 Exits 22 & 23 Interchange Improvements	Widen	51	0	
3	I-26 Road Weather Information System	Safety	46	3	
4	I-26 Exit 19- State of Franklin Road (SR 381) Interchange Signage	Safety	26		
5	I-26 Guardrail and Median Cable Barrier	Safety	29		Better separation between E & W lanes
6	I-26 ITS Deployment	ITS	38	12	Add the ITS from VA state line to NC state line
7	I-26 Operational Improvements	Operational Improvements	43	1	
8	Old Gray Station Road Section 3 Safety Improvements	Safety	36	0	Need to address sight distance issues at key intersections.
9	Old Gray Station Road Section 1 Widening	Widen	18	5	Need to address Gray school traffic
10	SR 362 Safety Improvements	Safety	14	2	
12	I-26 at Exit 19- North State of Franklin Road (SR 381) Interchange Improvements	Operational Improvements	65	1	

ID	Project Name	Project Type	Project Upvote	Project Downvote	Comment
14	Washington County Industrial Park Traffic Signal	Operational Improvements	41	4	
16	Boones Creek Road (SR 354) Section 1 Widening	Widen	45	13	Need to address future growth
17	Boones Creek Road (SR 354) Section 2 Widening	Widen	35	11	
18	Boones Creek Road (SR 354) Section 3 Widening	Widen	31	12	
19	Jonesborough Parkway	Reconstruction/New Road Alignment	38	4	
20	North State of Franklin Road (SR 381) Section 1 Widening	Widen	36	14	Should consider fixing Exit 19 interchange before widening road
21	Free Hill Road Reconstruction	Reconstruction/New Road Alignment	14	1	Need to address sight distance issues at key intersections and straighten curves
22	West G Street Pedestrian Facilities	Pedestrian	46	2	Need better access to the Tweetsie Trail; need better pedestrian access for schools
23	East Unaka Avenue (SR 400) Safety Improvements	Safety	20	1	
24	Okolona Road (SR 359) Realignment	Reconstruction/New Road Alignment	20	33	This project should not be considered due to the environmentally and historically sensitive areas

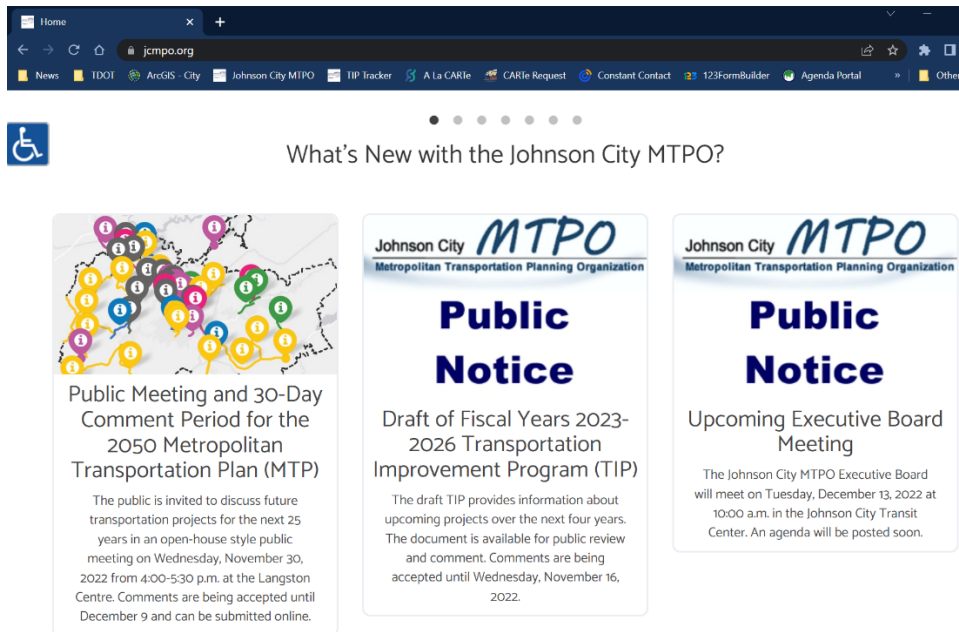
ID	Project Name	Project Type	Project Upvote	Project Downvote	Comment
25	SR 75 Safety Improvements	Safety	12	2	Traffic signal is needed at the intersection of Shadden Rd/ Gray Station Rd
26	Highway 81 North (SR 81) Safety Improvements	Safety	11	1	
27	Leesburg Road Safety Improvements	Safety	10	--	
28	Old State Route 34 (SR 353) Safety Improvements	Safety	14	2	
29	Highway 81 North (SR 81) Safety Improvements	Safety	16	--	
30	SR 361 Safety Improvements	Safety	23	--	
31	Shadden Road/Highland Church Road Safety Improvements	Safety	31	2	Project is needed; need to address safety issues; need to add shoulders for bicyclists
32	I-26 Widening (Exit 13 to 17)	Widen	54	3	This project needs to be done sooner and all the way to I-81
33	I-26 Widening (Exit 17 to 20)	Widen	59	4	Extend on-ramps to accommodate traffic
34	I-26 Widening (Exit 20 to 24)	Widen	41	4	
35	North State of Franklin Road (SR 381) Section 2 Widening	Widen	42	22	Need better bicycle lanes on State of Franklin Road.

ID	Project Name	Project Type	Project Upvote	Project Downvote	Comment
36	West Elk Avenue/Broad Street (SR 67) Bicycle and Pedestrian Facilities	Bicycle/ Pedestrian	42	0	Need better pedestrian access and crosswalks for kids walking to school
39	Watauga Road (SR 400) Safety Improvements	Safety	12	0	
40	Novus Drive Extension	Reconstruction/New Road Alignment	29	1	
41	Tweetsie Trail Extension	Bicycle/ Pedestrian	64	4	Wide support to expand the Tweetsie Trail in every direction
42	East Oakland Avenue Pedestrian Safety Improvements	Bicycle/ Pedestrian	62	3	Support for neighborhood connectivity
43	Bristol Highway (SR 34/US 11E/US 19W) Intersection Improvements at Allison Road/Piney Flats Road	Operational Improvements	44	2	
55	Browns Mill Road and Peoples Street Intersection	Operational Improvements	40	18	
57	Browns Mill Road Improvements	Widen	28	3	Need to address issues with Burkley Court
58	Cherokee Road (SR 67) Safety Improvements	Operational Improvements	48	4	
59	South Greenwood Drive Safety Improvements	Safety	31	0	A traffic light at the intersection of Greenwood and Seehorn Drives needed

ID	Project Name	Project Type	Project Upvote	Project Downvote	Comment
60	West Walnut Street Safety Improvements	Safety	31	0	Support for more sidewalks in the city and to Jonesborough
61	Triangle Intersection Improvements	Operational Improvements	52	0	
62	Suncrest Drive (SR 75) Widening	Widen	20	10	Also need traffic signals, especially at Suncrest and Shadden

Third Round of Public Outreach: Draft 2050 MTP – Summary of Responses:

The third and final round of public outreach was to seek public comment on the full draft of the 2050 MTP. The draft of the 2050 MTP was available online for download from the Johnson City MTPO website and was also available in print at the MTPO offices. The notice of the public meeting on November 30, 2022 and the 30-calendar day public comment period from November 9 to December 9, 2022 was published in the Johnson City Press and also posted on the MTPO’s website and social media. Emails were also sent out to the MTPO’s distribution list. Postcards with a QR code linking to the MTPO’s website were also placed at the Langston Centre, the city’s multicultural facility.



During this public comment period, 8 comments were received. These comments are listed on the next page.

Date	Name	Comment
11/10/2022	Grete Scott	Daily, I see young middle schoolers walking to school 12 inches away from cars driving 50 MPH on Knob Creek between Regency Dr. and Guaranda Dr. Please please please add a bike/pedestrian lane here. There's a sidewalk, but with no grass to separate it from a tight four-lane road, we will soon have walker injuries or even casualties. I'm even more worried about this now that 6th graders go to Liberty Bell, adding younger walkers on this road.
11/10/2022	Jess Smythe	Definitely need bike lanes. So unsafe and slow for them to be on the road. Thank you!
11/10/2022	Caleb Perhne	<p>I would like to see an emphasis on non-car transportation options, particularly in the downtown and surrounding neighborhoods.</p> <p>Particularly, I would like to see proper bicycle lanes with barriers to segregate riders from car traffic. Look at the Dutch model. Right now it is much too dangerous to bicycle to downtown or nearby grocery stores without getting hit or angering drivers. Bike lanes either don't exist or are painted stripes on speedy highways that would incur death or injury if tested. I imagine a world where most tasks can be done by bicycling around town and saving a lot of gas money.</p> <p>A long range addition to this- passenger rail. It would be amazing to walk from home or hop on a city bus (that doesn't take all afternoon to arrive like our current nearly-useless transit) and arrive at a train station downtown with affordable tickets to Atlanta or DC or New York.</p>
11/14/2022	Keith Kelley, US Forest Service	We have no comment on this plan. Thank you.
11/16/2022	Christy Smith	We desperately need transportation in Unicoi County. Many citizens are limited to shopping, doctors appointments in Johnson City, recovery group support, etc. Transportation has always been a need in the county. I would love to see JC MTPO help rural communities. I fully support this plan and commend JC MTPO for progressively planning this great idea for the future of our region
11/17/2022	Danette Waugh, Tennessee Wildlife	Please make the change (name and address) below: Jason Maxedon, Executive Director, Wildlife Resources Agency, 5107 Edmondson Pike, Nashville, TN37211-5129

	Resources Agency	
11/27/2022	Erin Cassity	<p>Johnson City resident here: I'm happy to see some focus on improving public transit as well as bicycle/pedestrian infrastructure, but I would like to see more. I'm enthusiastically in favor of the W. Walnut St. improvements and other similar projects. I would like to see more projects like this as well as changing zoning to develop complete neighborhoods (reducing car-dependent sub-divisions) as well as complete streets.</p> <p>I'm also generally against plans to widen I-26. Interstate widening is an expensive band-aid solution. I would much rather more investment be poured into making public transit more reliable, accessible, frequent, and desirable even for those with potential access to a car. This way, traffic is alleviated by reducing demand, which I've found to be the only lasting solution. I personally would much rather take public transit across Johnson City for my commute than drive, but the route near my workplace doesn't run frequently/late enough for me to make it back home. I would love to be able to live here in Johnson City without feeling the need to own a car, especially as the area becomes more urbanized.</p> <p>On a much smaller scale, I would love to see some pedestrian/bicycle infrastructure improvement on Southwest Ave. between Cherokee Rd. and the ETSU campus</p>
11/30/2022	Terry Cox	<ol style="list-style-type: none"> 1. Please finish 4 laning last 3.5 miles of SR 36 in Sullivan County. This will finish project 4-laning from Kingsport, TN, to Johnson City, TN. 2. Please build more sidewalks on Southwest Ave to ETSU from Cherokee Rd. 3. Need signal light at Cherokee Rd (SR 67) and Southwest Ave. Need quickly

Targeted Outreach Efforts:

The following table outlines the various outreach methods employed during the MTP Update.

Format	Event
Johnson City Press Advertisement	Public meetings (virtual and in-person events); surveys
Johnson City MTPO webpage	Public meetings; surveys; MTP Update general information
Johnson City MTPO Twitter and Facebook	Public meetings; surveys; MTP Update general information
City of Johnson City webpage	Public meetings; surveys
City of Johnson City Twitter and Facebook	Public meetings; surveys
Johnson City Transit Twitter	Public meetings; surveys
Johnson City MTPO Email Distribution Lists	Public meetings; surveys; MTP Update general information
Infogroup Business Community Email List	Public meetings; surveys
Posters at Johnson City Transit Facility	Public meetings; surveys

The following agencies, organizations, and individuals that represent advocates for environmental protection, land use management, natural resource and historic preservation were consulted as part of the MTP update.

Organization	Contact
East Tennessee State University	Director of Campus Planning
Elizabethton Housing Authority	Director
Federal Lands – Eastern Division	Division Director
Greyhound Bus Lines	Logistical Officer
Johnson City Housing Authority	Director
Milligan University	President
National Park Service	Southeast Region Regional Director
Sycamore Shoals State Park	Park Manager
Tennessee Department of Economic & Community Development	Deputy Commissioner
Tennessee Department of Environment & Conservation	Regional Director for External Affairs
Tennessee State Historical Commission	Executive Director
Tennessee Valley Authority	Manager NEPA Compliance
Tennessee Wildlife Resource Agency	Executive Director
U.S. Army Corps of Engineers	District Commander and District Engineer

U.S. EPA Region 4 Regional	NEPA Coordinator
U.S. Fish and Wildlife Service	Field Supervisor
uRidez LLC Taxi	Manager
USDA Forest Service	Forest Supervisor
Veterans Affairs Administration	Engineer
Veterans Transportation Services	Veterans Transportation Services
W W Cab Co.	Manager

The following Executive Board meetings were held during the development of the Johnson City Metropolitan Transportation Plan Update.

- Executive Board Meeting #1, January 29, 2022 – This presentation included a review of the MTP’s goals and objectives, as well as population and employment control totals and growth assumptions to be applied in the development of the travel demand model. These were approved by the Executive Board for use in the 2050 MTP.
- Executive Board Meeting #2, April 28, 2022– This presentation included an overview of the financial assumptions including revenue assumptions and inflation rates for concurrence by the Board. These rates were used to calculate future revenue estimates and year of expenditure costs for the MTP.
- Executive Board Meeting #3, June 21, 2022 – This presentation included a review of the draft project list for inclusion in the MTP document, as well as the financial constraint analysis and results for concurrence.
- Executive Board Meeting #4, December 13, 2022 – This presentation included a brief overview of the executive summary of the MTP as well as the public comments received as part of the third round of outreach, resulting in the plan’s formal adoption by the Board.

Appendix B. Travel Demand Model Documentation

1.0 MODEL UPDATE AND VALIDATION REPORT



1.1 INTRODUCTION

As part of the Johnson City 2050 Transportation plan, RSG updated the Johnson City model to have a validated base year of 2020 and a horizon year of 2050. This document describes the updates the consultant made to the Johnson City MTP travel demand model (“the model”) for application to the organization’s Metropolitan Transportation Plan (MTP) update. Prior to updating and applying the model for the MTP Update, an overview of the current model was conducted to further define the actions to be taken as part of the update. This memo is a required deliverable as described below.

1.2 MODEL OVERVIEW

The Johnson City MTP currently serves the jurisdictions of Bluff City, Elizabethton, Johnson City, Jonesborough, part of the town of Unicoi, and parts of Carter, Sullivan, and Washington Counties in Tennessee. The Model study area consists of Carter County, Unicoi County, Washington County, and parts of Sullivan County. The previous model had a validated base year of 2015 and a future year of 2045. The interim model year was 2025. The model follows the basic “four step” travel demand forecasting process of trip generation, trip distribution, mode split, and traffic assignment.

This document describes the updates to the Johnson City travel demand model. It does not replace the model documents developed for the previous model developed in 2017. Detailed information on the steps for setting up and running the model should follow the previous model documents.

1. QuickStartGuide_3_23_2018
2. JohnsonCity_TDM_Users_Manual_v1_8_4_2017

The model updates are described below.

1.3 MODEL INTERFACE

The model is designed to utilize TransCAD’s native scripting language, Geographic Information System’s Development Kit (GISDK), which provides an intuitive, yet flexible interface. The model features an interface that can run different steps of the model individually or as a set with a *Run All* function. The model allows flexibility in managing files, scenarios, and mapping. **The model has been updated to run in TransCAD 8 Build 22410 64 bit.**

1.4 BOUNDARY AND TAZ REVIEW

A traffic analysis zone (TAZ) is a geographic area that is used to divide the planning region into small, relatively homogenous areas. TAZs are used to represent travel activity within the zone because it’s difficult to model individual households and employment. Therefore, housing and employment are aggregated to the TAZ and used through the modeling process to develop the origins and destinations of

trip travel within the model. The Johnson City Model TAZ boundaries were reviewed for splits or modifications, but no changes were made to the 2015 geographies and the TAZ zonal numbers are consistent with the previous model (Table 1). In addition, State ID, County, and District IDs were reviewed in the 2015 TAZ database and no changes were made. Model code and relevant TAZ attributes were updated with the base year of 2020.

TABLE 1 TAZ NUMBERING SYSTEM

SUMMARY	TAZ RANGE	TAZ'S
Internal TAZ's	1- 269	269
External TAZ's	501- 539	39
Total		308

TAZ boundaries are consistent with the federal urban designation for the Johnson City Urbanized Area (Figure 1).

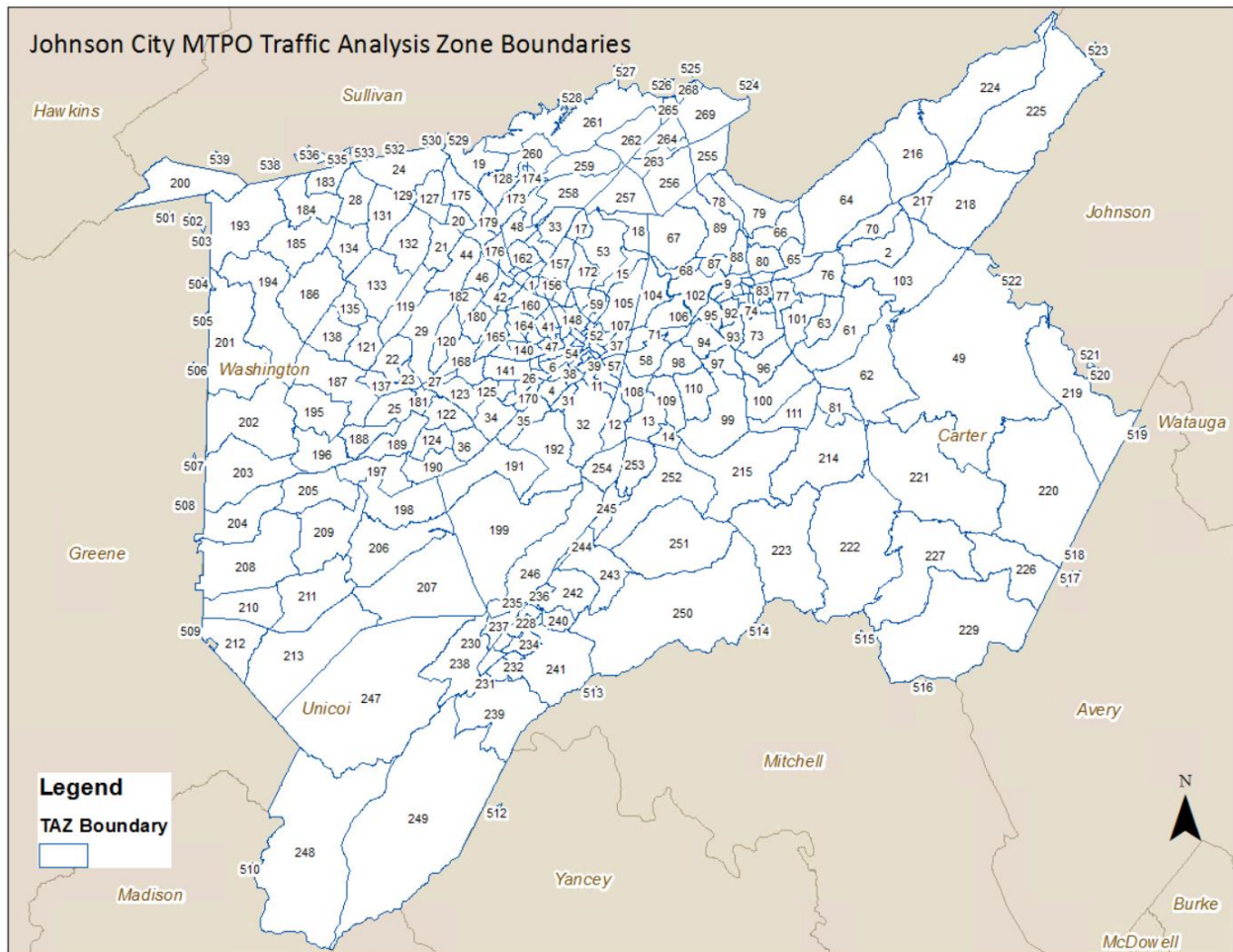


FIGURE 1 JOHNSON CITY MPO TRAFFIC ANALYSIS ZONES

1.5 BASE YEAR DEMOGRAPHIC AND EMPLOYMENT DATA

Base year population was updated using the 2020 Census ACS 5-year estimates and 2019 ACS 5-Year estimates were used to compare the differences between 2019 and 2020. 2020 employment data was purchased from Infogroup, which was then transferred to the model database to update the demographic and employment data to 2020 totals. Due to the travel impacts of the COVID-19 pandemic, consideration was given to the selection of the base year, namely whether 2019 or 2020 data should be utilized for population and employment totals. Availability of the decennial Census data and pre-pandemic employment data (collected in February of 2020) made available by TDOT through InfoGroup made 2020 the preferable base year. On another note, 2019 population and employment data would be estimates based on the American Community Survey and not actual census counts. As such, KCI completed a high-level comparison of population and employment in the MTPO model area between 2019 and 2020 to evaluate the potential impacts of base year selection on the model's socioeconomics. Table 2 highlights the results of this comparison of total population and total employment, which is broken down in the model by the NAICS industry codes shown in Table 3. As shown, the difference between 2019 and 2020 population and employment is approximately 2.4% and 5.2%, respectively. This review confirms the use of 2020 as preferable for the model base year.

TABLE 2: POPULATION AND EMPLOYMENT COMPARISON

DATA	COUNTY	2019	2020	DIFFERENCE
Population	Carter	56,433	56,356	(77)
	Sullivan	16,221	16,334	113
	Unicoi	17,811	17,928	117
	Washington	127,805	133,001	5,196
	Total	218,270	223,619	5,349
Employment*	Carter	14,315	14,326	11
	Sullivan	4,614	4,370	(244)
	Unicoi	5,406	5,361	(45)
	Washington	71,495	76,775	5,280
	Total	95,830	100,832	5,002

Source: Population, 2020 Census and ACS 5-year estimates, Employment, Infogroup

*These numbers are pre-Covid pandemic estimates

TABLE 3: EMPLOYMENT CATEGORIES

DESCRIPTION	NAICS
Agricultural	11, 21, 23
Manufacturing/Transportation	22, 31-33, 42, 48, 49
Retail	44, 45
Office	51, 52, 53, 54, 55, 56
Service	61, 62, 71, 72, 81
Government	92, 99

Base year school enrollment data were updated to the new base 2020. The data was sourced from the National Center for Education Statistics, 2020-2021. The data was spatially joined to the model's TAZ layer; and enrollment for K-12 and college were aggregated and updated to 2020 totals. (Table 4)

TABLE 4: SCHOOL ENROLLMENT

YEAR	K-12 ENROLLMENT	COLLEGE	CHANGE	
			K-12	COLLEGE
2017	29,379	14,260	-0.63%	12.43%
2020	29,195	16,032		

Source: National Center for Education Statistics, 2020-2021 (U.S. Department of Education, Common Core of Data (CCD)).

The household cross-classifications were updated using the current Census Transportation Planning Package¹ (CTPP) totals. The current CTPP datasets use a special tabulation of the 2012-2016 5-year estimates of the US Census American Community Survey (ACS). Data is available down to the Census tract level. The following cross-classification values were updated:

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

Table 5, Table 6, and Table 7 show the different distributions of the three cross-classification tables for the Johnson City MTPG region.

TABLE 5: HOUSEHOLD SIZE BY VEHICLE OWNERSHIP CROSS-CLASSIFICATION

PERSONS	VEHICLES				TOTAL
	0	1	2	3+	
1	2.11%	18.67%	5.67%	1.17%	27.63%
2	0.51%	7.20%	24.53%	10.19%	42.42%
3	0.10%	2.87%	7.49%	5.33%	15.79%
4+	0.04%	1.60%	8.72%	3.80%	14.16%
Total	2.76%	30.34%	46.41%	20.49%	100%

TABLE 6: HOUSEHOLD SIZE BY NUMBER OF CHILDREN CROSS-CLASSIFICATION

PERSONS	CHILDREN			TOTAL
	0	1	2+	
1	20.35%	3.85%	3.75%	27.96%
2	22.85%	6.36%	6.23%	35.44%
3	12.88%	2.62%	2.49%	17.99%
4+	13.29%	2.66%	2.66%	18.61%
Total	69.37%	15.49%	15.13%	100%

TABLE 7: NUMBER OF WORKERS BY VEHICLE OWNERSHIP CROSS-CLASSIFICATION

WORKERS	VEHICLES				TOTAL
	0	1	2	3+	
0	1.91%	12.29%	10.44%	4.62%	29.26%
1	0.66%	12.98%	14.72%	8.11%	36.46%
2	0.04%	1.74%	17.25%	10.98%	30.01%
3+	0.00%	0.02%	0.25%	4.00%	4.26%
Total	2.61%	27.03%	42.66%	27.71%	100%

¹ <https://ctpp.transportation.org/ctpp-data-set-information/>

Using the MPTO approved 2020 household control totals, the cross-classification distributions from the above tables were applied to each TAZ to obtain the total number of households in each cross-classification bin. It should be noted that there are several Census tracts within Tennessee that do not have data available, likely due to privacy controls with the ACS (e.g., a tract with very few households, where individuals could be easily identifiable). If there were TAZs with tracts that did not have data available, the average distributions for the available data were used.

The total number of households for the base year 2020 in the model study area is 102,394, with a total population of 218,487, (Figure 2). This is an increase of 2.6% from the 2015 households of 99,671 with a total population of 214,535. Total employment for base year 2020 decreased from 2015, with a total of 81,343 jobs within the study area compared to 91,016 respectively, (Figure 3).

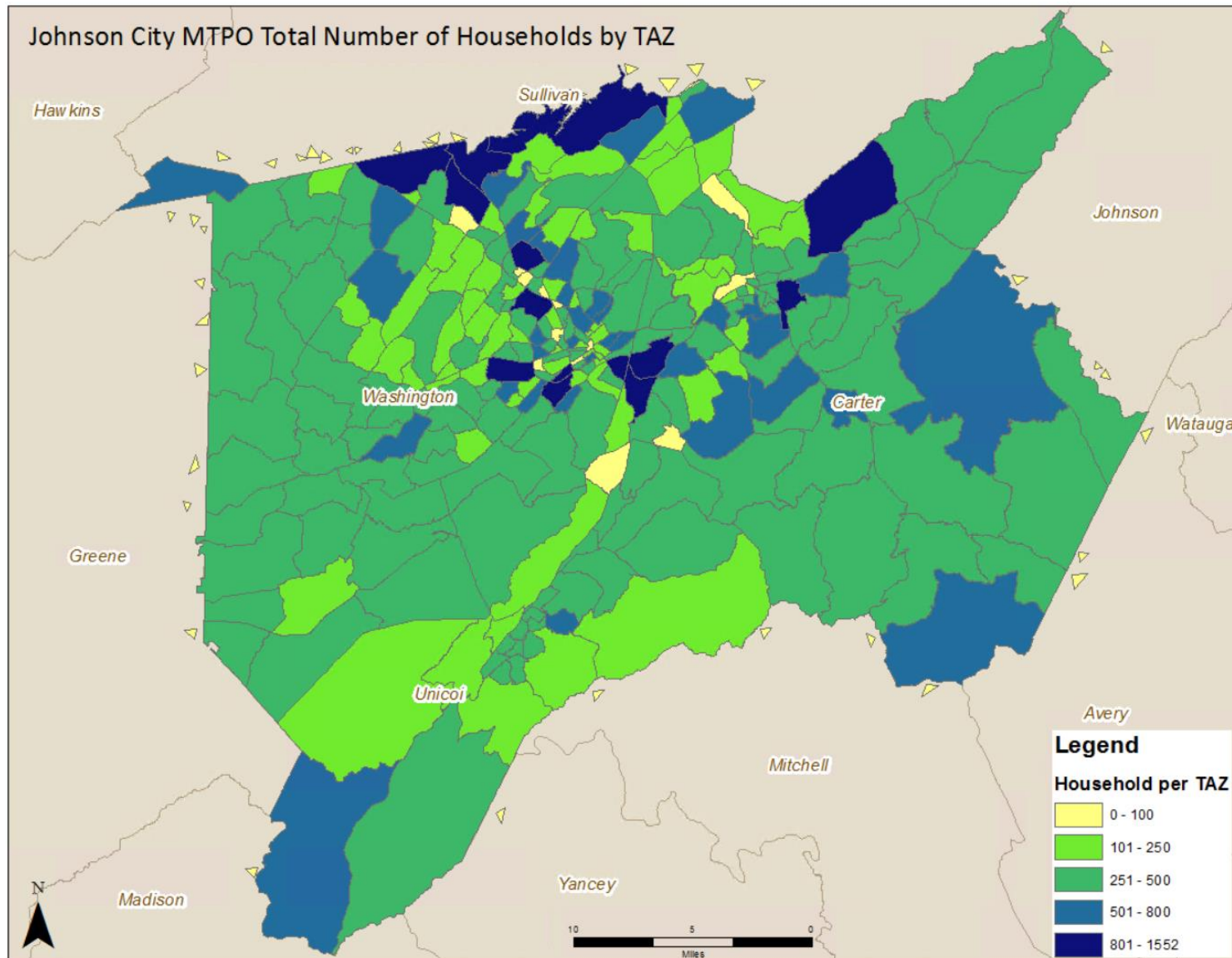


FIGURE 2: TOTAL HOUSEHOLDS BY TAZ

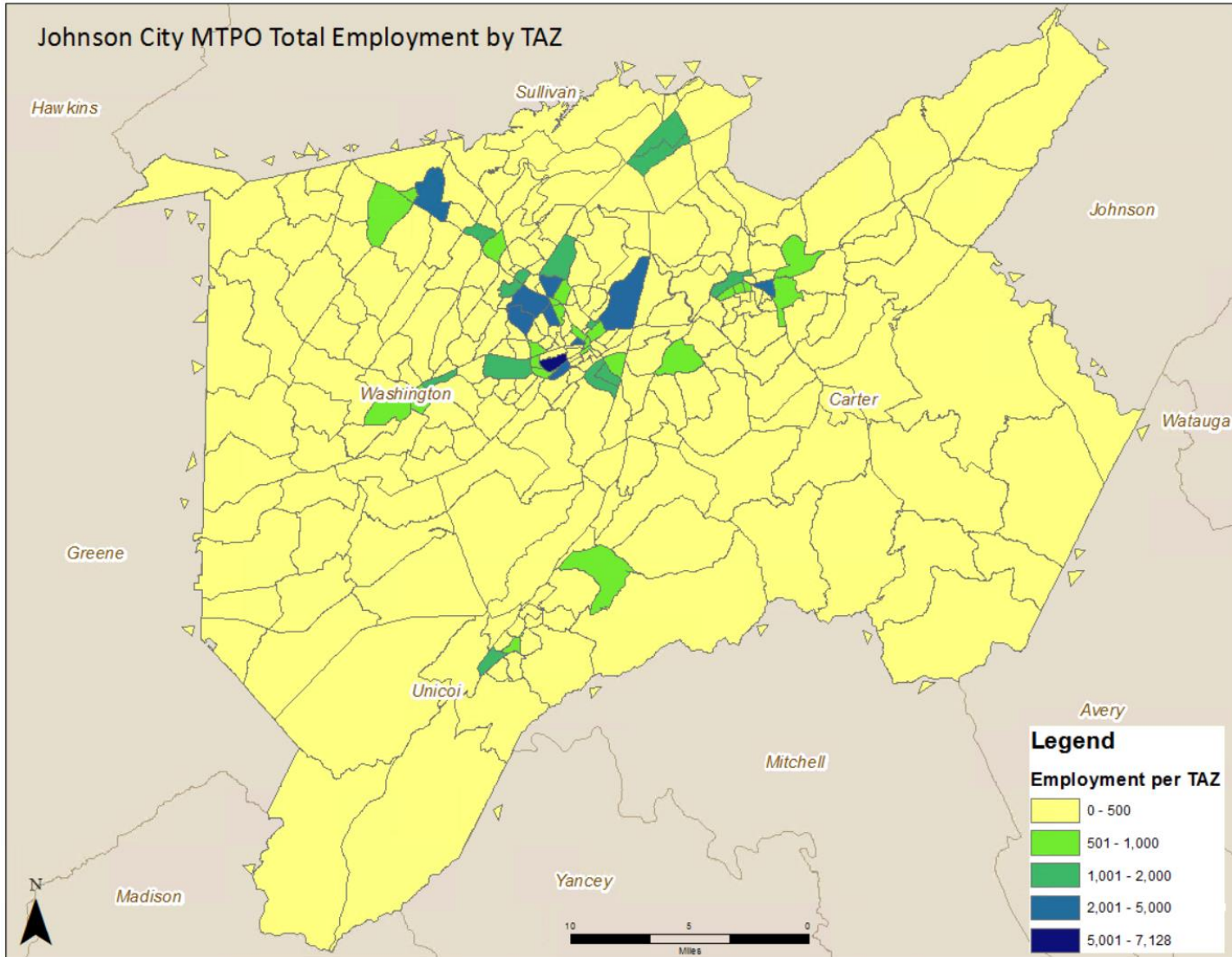


FIGURE 3: TOTAL EMPLOYMENT PER TAZ

1.6 ROAD NETWORKS

The previous model update was completed in 2017. A review and update to the roadway network consisted of checks with the Johnson City 2020-2023 Transportation Improvement Program (TIP). The network underwent a review of model linework and was edited where necessary. The network attributes were reviewed, and attribute information was updated with Year naming in the field name (Table 8). Roadway additions include a completed roadway project, a connector road at the VA Medical Center (Gold Star Blvd.) connecting to SR-34 (West Market St). One alley that existed in the network was removed since it is a lower facility type which would not attract a significant amount of traffic volume. The link specific turn penalty table was checked and a total of 18 additional turn penalties were added to the table. These consisted of illegal interchange turns and U-turns, mostly along US-19E and US-19W.

TABLE 8 ROADWAY NETWORK ATTRIBUTES

ID	Field Name	Type	Purpose	Option	Description
1	ID	Integer	Read-Only	Link ID	
2	Length	Real	Read-Only	Length (miles)	
3	Dir	Integer	Input	Link Travel direction code	
				1	One Way – A to B
				0	Two Way
				-1	One Way – B to A (not used)
4	NAME	String	Reference	Street Name	
5	In_AQ_Study_Area	Integer	Input	Within air quality analysis area or not	
				1	Within MTPO's air quality analysis area
				Not 1	Outside MTPO's air quality analysis area
6	County	String	Input	County Name	
					Carter TN
					Sullivan TN
					Unicoi TN
					Washington TN
7	Area_Type	Integer	Input	Area type (by 4 category)	
				1	CBD
				2	Urban
				3	Suburban
				4	Rural
8	District ID	Integer	Input	Planning district ID (8 districts)	
				1	Washington Inside MPA
				2	Washington Outside MPA
				3	Unicoi Inside MPA
				4	Unicoi Outside MPA
				5	Carter Inside MPA
				6	Carter Outside MPA
				7	Sullivan Inside MPA
9	Y20_In_Network	Integer	Input	In Year 2020 highway network or not	
				1	In highway network
				Not 1	Not in highway network
10	Y20_Fac_Type	Integer	Input	Year 2020 Roadway functional class	
				1	(Rural) Interstate
				2	(Rural) Other Principle Arterial
				3	(Rural) Ramp
				6	(Rural) Minor Arterial
				7	(Rural) Major Collector
				8	(Rural) Minor Collector
	9	(Rural) Local			

				11	1 (Urban) Interstate
				12	1 (Urban) Other Freeway / Expressway
				13	(Urban) Ramp
				14	(Urban) Other Principle Arterial
				16	(Urban) Minor Arterial
				17	(Urban) Major Collector
				18	(Urban) Minor Collector
				19	(Urban) Local
				98	(Rural) Centriod Connector
				99	(Urban) Centriod Connector other Links kept in master network for future use
				99 network for future use	(Urban) Centriod Connector other Links kept in master network for future use
11	Y20_Posted_Speed	Integer	Input	Year 20 posted speed (mph)	
12	Y20_Median_Type	Integer	Input	Year 2020 Median Type	
				0 or null	No Median
				2	Median divided (concrete or landscape)
				4	TWLTTL
13	Y20_[AB/BA]_Lanes	Integer	Input	Year 2020 number of lanes for AB or BA direction	
14	Y20_[AB/BA]_Lane_Width	Integer	Input	Year 2020 lane width for AB or BA direction (ft)	
15	Y20_[AB/BA]_Shoulder_Width	Integer	Input	Year 2020 shoulder wide for AB or BA direction (ft)	
16	Y20_[AB/BA]_Parking	Integer	Input	Year 2020 roadside parking allowed for not for AB or BA direction	
				1	Roadside parking allowed
				Not	Roadside parking not allowed
17	Y20_Signal_Density	Real	Input	Traffic signal density in segment (signals/mile)	
18	Y20_Signal_Coordination	Integer	Input	1	Traffic Signals coordinated
				Not 1	Traffic Signals not coordinated
19	Screen_Line_IDs	Integer	Input	Screen line / Cut line definition (One single digit represents the ID of a screen line or cut line)	
20	Screen_Line_Name	String	Reference	Name of the screen lines (To be consistent with the IDs)	
21	Y20_Count_[Auto/SU/CU/AllVeh] _[AM/MD/PM/OP/Daily]	Integer	Input	(Year 2015) Traffic counts by three vehicle class [Auto/SU/CU] by four time-of-day periods [AM/MD/PM/OP] and total	
22	TNTIMES_LOCAL_ID	Integer	Input	TN Times database ID	
23	Cnt_Sta_ID_TDOT	Integer	Input	(Year 2020) Traffic count station ID (TDOT)	
24	Notes	Real	Input	Notes	
25	PRJ_ID[1/2/3/4/5/6]	Integer	Real	Future year project ID [1/2/3/4/5/6]	
26	In_Network	Integer	Scenario	In (Scenario Year) highway network or not	
27	Fac_Type	Integer	Scenario	(Scenario year) Roadway Functional Class	
28	Posted_Speed	Integer	Scenario	(Scenario year) Posted speed (mph)	
29	Median_Type	Integer	Scenario	(Scenario year) Median type	
30	[AB/BA]_Lanes	Integer	Scenario	(Scenario year) Number of lanes for AB or BA direction	
31	[AB/BA]_Lane_Width	Integer	Scenario	(Scenario year) Approach width for AB or BA direction (ft)	
32	[AB/BA]_Shoulder_Width	Integer	Scenario	(Scenario year) Shoulder width for AB or BA direction (ft)	

33	[AB/BA]_Parking	Integer	Scenario	(Scenario year) Roadside parking allowed or not for AB or BA direction								
34	FF_Speed	Real	Output	Free flow speed (mph)								
35	FF_TT	Real	Output	Free flow travel time (minutes)								
36	Alpha	Real	Output	Alpha parameter for BPR function								
37	Beta	Real	Output	Beta parameter for BPR function								
38	[AB/BA]_Preload	Real	Output	Preload traffic for AB or BA direction								
39	AB/BA]_Cong_Speed _AM/MD/PM/OP]	Real	Output	Congested speed (mph) by travel direction and time-of-day								
40	[AB/BA]_Cong_TT _AM/MD/PM/OP]	Real	Output	Congested travel time (minutes) by travel direction and time-of-day								
41	[AB/BA]_MSA_Speed _AM/MD/PM/OP]	Real	Output	MSA speed for feedback loop (mph) by travel direction and time-of-day								
42	[AB/BA]_MSA_TT _AM/MD/PM/OP]	Real	Output	MSA travel time for feedback loop (minutes) by travel direction and time-of-day								
43	[AB/BA]_MSA_Flow _AM/MD/PM/OP]	Real	Output	MSA flow for feedback loop by travel direction and time of-day								
44	[AB/BA/BothDir]_Capa _AM/MD/PM/OP/Daily]	Real	Output	Link capacity by travel direction and time-of-day								
45	[AB/BA/BothDir]_VOC _AM/MD/PM/OP/Daily]	Real	Output	Volume to capacity ratio by travel direction and time-of day								
46	[AB/BA/BothDir]_LOS _AM/MD/PM/OP/Daily]	Real	Output	Level of service by travel direction and time-of-day <table border="1" data-bbox="917 850 1429 961"> <tr> <td>C</td> <td>v/c < 0.7</td> </tr> <tr> <td>D</td> <td>v/c >= 0.7 and</td> </tr> <tr> <td>E</td> <td>v/c >= 0.85 and <1</td> </tr> <tr> <td>F</td> <td>v/c >1</td> </tr> </table>	C	v/c < 0.7	D	v/c >= 0.7 and	E	v/c >= 0.85 and <1	F	v/c >1
C	v/c < 0.7											
D	v/c >= 0.7 and											
E	v/c >= 0.85 and <1											
F	v/c >1											
47	Worst_Case_LOS	Real	Output	Worst LOS among all time-of-day period and travel direction								
48	AB/BA/BothDir]_Vol _Auto/SU/CU/AllVeh] _AM/MD/PM/OP/Daily]	Real	Output	Traffic volume by travel direction, vehicle class, and time of-day								
49	[AB/BA/BothDir]_VMT _Auto/SU/CU/AllVeh] _AM/MD/PM/OP/Daily]	Real	Output	Vehicle miles traveled by travel direction, vehicle class, and time-of-day								
50	AB/BA/BothDir]_VHT _Auto/SU/CU/AllVeh] _AM/MD/PM/OP/Daily]	Real	Output	Vehicle hours traveled by travel direction, vehicle class, and time-of-day								

1.7 INVESTIGATE COUNT FILES

Traffic counts are used in the modeling process to validate the model’s accuracy. The current model integrates base year counts from the Tennessee Department of Transportation’s (TDOT) transportation data management system, TN TIMES² traffic count database, as part of the roadway network input file. All counts within the roadway network were reviewed and updated where possible. As part of the meeting with staff from KCI, RSG, and the Johnson City MTPO on December 15, 2021, a decision was made to use 2019 traffic counts as part of the validation process. A review of TDOT’s traffic data from 2019, 2020, and 2021 for the four counties in the region indicated a dip in traffic volumes in 2020, which correlates with travel and social distancing restrictions imposed during the COVID-19 pandemic. Table 9 summarizes this comparison, which highlights that for all facility types, using 2020 Annual Average Daily Traffic (AADT) values for validation would likely not represent ‘normal’ travel conditions; therefore, 2019

² [Transportation Data Management System \(ms2soft.com\)](https://www.ms2soft.com)

data was used for the base year model development. The Johnson City MTPo also consulted with Johnson City Traffic Division about the decision to use 2019 traffic count data and they concurred. Count data for the year 2019 was obtained from the TN TIMES and AADT counts were applied to the count field within the model’s roadway network for a total of 469 counts within the roadway network.

TABLE 9: COMPARISON OF AADT VALUES BY FACILITY TYPE

FACILITY TYPE	2019 AVERAGE AADT	2020 AVERAGE AADT	2021 AVERAGE AADT
Non-State-Owned Roads	2,947	2,632	2,752
State Routes	10,375	9,502	10,041
Interstates	37,294	30,892	33,627

The model contains input fields for vehicle classification counts by time of day, which includes Auto, Single Unit Truck, and Combination Truck. A limited number of 2019 vehicle classification count locations are available through the TN TIMES count database. About 14% are observed TDOT counts, while the rest are estimated from the previous counts. For consistency with the previous model’s count locations, in locations where vehicle classification count data was not available, the distribution of counts by vehicle classification and time-of-day period for 2015 was applied to the updated 2019 counts.

In addition, there were seven 2015 counts belonging to external stations where the TN TIMES database did not have matching counts for 2019. In these instances, an average growth rate of 4%, which is the average growth from 2015 to 2019 in observed data, was applied to the 2015 counts for an estimated 2019 count.

The count data was joined to the model network via a spatial join and the network was extensively checked for incorrect joins or count locations throughout the network, e.g., an intersection in downtown Johnson City where three model links are tagged to one count station, or one direction of a divided facility being tagged with a traffic count but not on the opposing direction. In addition, counts that exist on one-way links in the model, represented by the network attribute “DIR” being 1 or -1, were halved since the 2019 counts from TDOT exist as 2-way totals, regardless of facility type. Figure 4 shows count locations in the model network.

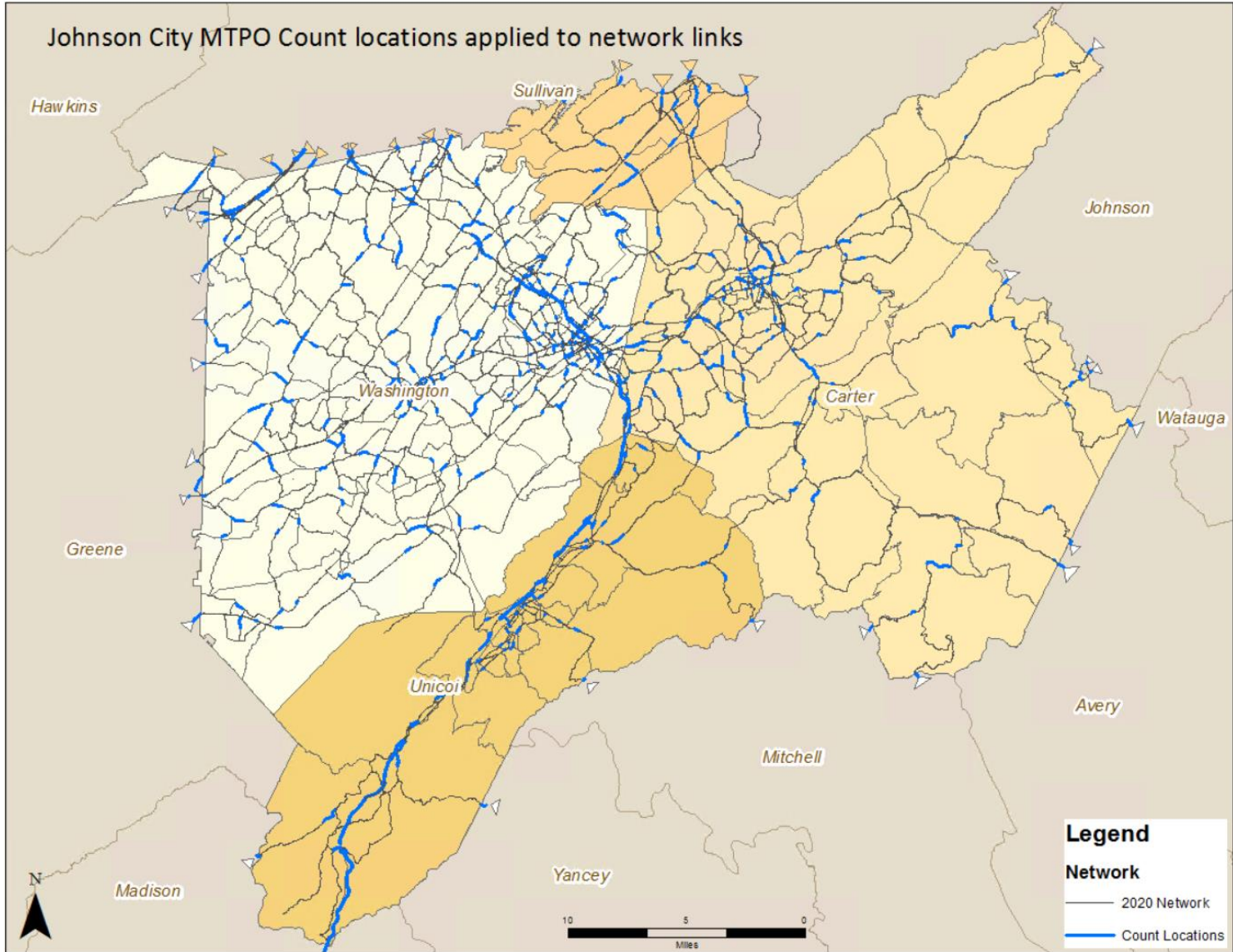


FIGURE 4: COUNT LOCATIONS

1.8 REVIEW PREVIOUS EXTERNAL STATION LOCATIONS

All 39 external stations were reviewed, and stations were updated with 2019 data from TDOT or North Carolina DOT. Where 2019 count data was unavailable, a growth rate of 4% was applied. This applies to the following eight external stations: 503, 506, 507, 518, 520, 524, 528, and 531 where 2019 counts were unavailable. These stations are shown in red in Figure 5. Counts within the state were either updated with the nearest count location internal to the model, or, if deemed more appropriate, a TDOT count station external to the model region. For external stations that exist in North Carolina, 2019 AADT³ from NCDOT were used.

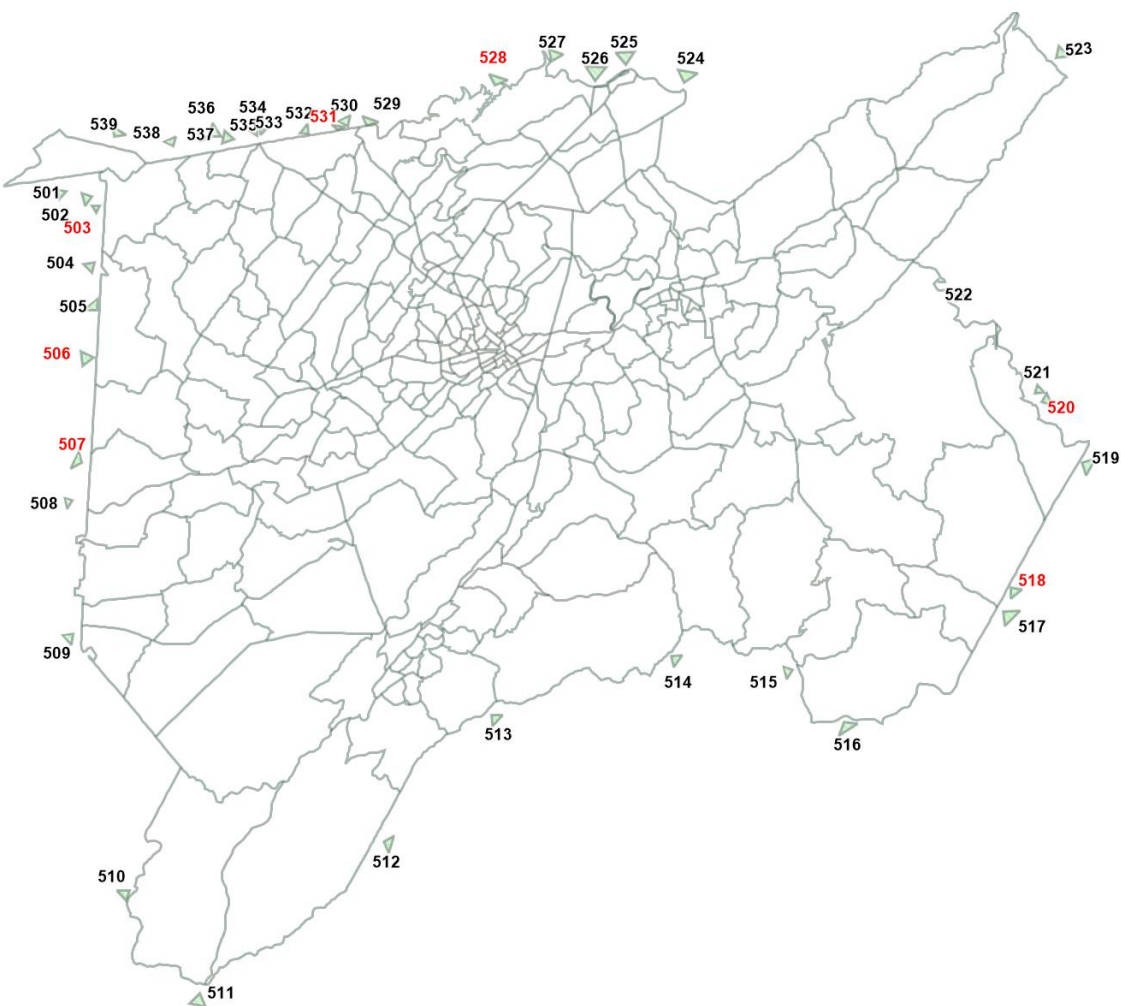


FIGURE 5: EXTERNAL STATIONS

³ [Traffic Survey GIS Data Products & Documents \(ncdot.gov\)](https://www.ncdot.gov/TrafficSurveyGISDataProducts/Documents)

1.9 TRIP PURPOSES AND TRIP RATES

Due to the absence of a local household travel survey in the Johnson City MTPO area, the 2017 model used production rates from the National Household Travel Survey (NHTS) 2009 add-on data from TDOT and VDOT and the attraction rates were borrowed from the Chattanooga Regional Planning Agency (RPA) model. For the 2020 model, trip productions rates were updated following a similar method from the previous model update using the 2017 NHTS.

With the absence of add-on data for the 2017 NHTS⁴, rates were solely calculated based on the base data from the 2017 NHTS. This data was then filtered by Metropolitan Statistical Areas (MSAs) that are less than 1 million residents located in Tennessee and Virginia to match as closely as possible to the previous 2009 NHTS add-on data locations. Table 10 shows the trip production rates calculated based on the 2017 NHTS. Table 11 shows the rates adjusted during the calibration process. In addition, only trips occurring on Tuesday, Wednesday and Thursday were included in calculations. Household trips from the survey were then categorized by the Johnson City model trip purposes and cross-classifications and household-level trips rates were calculated by the number of trips by each model category and stratification divided by the total number of households in the selected MSAs. Following the previous model update's methodology, trip attraction rates were estimated using ordinary least squares (OLS) without an intercept. With the absence of a travel survey, the updated 2020 scenario trip attractions were used as a response variable for the regression models. Table 12 and Table 13 show the outputs of the trip rate and trip purpose benchmarks.

TABLE 10: 2017 NHTS PRODUCTION RATES

CLASS	HBW	HBSC	HBSP	HBSR	HBO	NHB
WK0_VH0	0					
WK0_VH1	0					
WK0_VH2	0					
WK0_VH3	0					
WK1_VH0	0.90838					
WK1_VH1	0.92562					
WK1_VH2	0.99514					
WK1_VH3	0.99447					
WK2_VH0	1.85252					
WK2_VH1	1.69493					
WK2_VH2	1.81411					
WK2_VH3	1.91660					
WK3_VH0	2.95833					
WK3_VH1	2.90435					
WK3_VH2	2.73906					

⁴ [National Household Travel Survey \(ornl.gov\)](http://ornl.gov)

CLASS	HBW	HBSC	HBSP	HBSR	HBO	NHB
WK3_VH3	3.20742					
HH1_CHO		0.01558				
HH1_CH1						
HH1_CH2						
HH2_CHO		0.03143				
HH2_CH1		0.82073				
HH2_CH2						
HH3_CHO		0.18774				
HH3_CH1		0.62411				
HH3_CH2		1.61776				
HH4_CHO		0.76453				
HH4_CH1		1.44311				
HH4_CH2		1.55237				
HH1_VH0			1.16269	0.45540	0.78047	1.18536
HH1_VH1			1.08234	0.55783	0.71003	1.74306
HH1_VH2			1.06003	0.56527	0.68129	1.80448
HH1_VH3			1.04008	0.49348	0.60454	1.76775
HH2_VH0			1.74559	0.69383	1.13767	1.69163
HH2_VH1			1.81295	0.83335	1.42519	2.51745
HH2_VH2			1.86104	0.96951	1.18857	2.62921
HH2_VH3			1.79665	0.90480	1.15919	2.80238
HH3_VH0			1.85467	1.01038	1.55363	2.25260
HH3_VH1			1.73631	1.01055	2.00251	3.16273
HH3_VH2			1.82960	1.08547	1.74467	3.19119
HH3_VH3			1.97816	1.14886	1.46275	3.23728
HH4_VH0			2.16744	1.26047	2.47442	2.63721
HH4_VH1			2.11149	1.22435	3.01847	3.65458
HH4_VH2			2.07259	1.71743	2.83138	4.17916
HH4_VH3			2.31063	1.74056	2.53500	4.38971

TABLE 11: ADJUSTED 2020 PRODUCTION RATES

CLASS	HBW	HBSC	HBSP	HBSR	HBO	NHB
WK0_VH0	0					
WK0_VH1	0					
WK0_VH2	0					
WK0_VH3	0					
WK1_VH0	0.89					
WK1_VH1	1.17					
WK1_VH2	1.5					

CLASS	HBW	HBSC	HBSP	HBSR	HBO	NHB
WK1_VH3	1.59					
WK2_VH0	1.92					
WK2_VH1	1.76					
WK2_VH2	2.18					
WK2_VH3	2.22					
WK3_VH0	2.95					
WK3_VH1	2.95					
WK3_VH2	3.18					
WK3_VH3	3.35					
HH1_CH0		0.016				
HH1_CH1						
HH1_CH2						
HH2_CH0		0.031				
HH2_CH1		0.821				
HH2_CH2						
HH3_CH0		0.188				
HH3_CH1		0.624				
HH3_CH2		1.618				
HH4_CH0		0.765				
HH4_CH1		1.443				
HH4_CH2		1.55				
HH1_VH0			0.59	0.4554	0.78047	0.65
HH1_VH1			0.95	0.55783	0.71003	1.52
HH1_VH2			0.95	0.56527	0.71	1.65
HH1_VH3			1.082338	0.49348	0.60454	1.652
HH2_VH0			1.74559	0.69383	1.13767	1.69163
HH2_VH1			1.8129	0.83335	1.42519	2.51745
HH2_VH2			1.81945	0.96951	1.18857	2.62921
HH2_VH3			1.812	0.9048	1.15919	2.80238
HH3_VH0			1.85467	1.01038	1.55363	2.2526
HH3_VH1			1.854671	1.01055	2.00251	3.16273
HH3_VH2			1.8546	1.08547	1.74467	3.19119
HH3_VH3			1.97816	1.14886	1.46275	4.798
HH4_VH0			2.156	1.26047	2.47442	4.093
HH4_VH1			2.156	1.22435	3.01847	4.108
HH4_VH2			2.156	1.71743	2.83138	4.59
HH4_VH3			2.31063	1.74056	2.535	4.75

TABLE 12 AGGREGATE TRIP RATE BENCHMARKS

	TDOT BENCHMARKS		JOHNSON CITY MODEL
	Low	High	
Person Trips/TAZ	N/A	15,000	2,556
Person Trips/Person	3.3	4.0	3.7
Person Trips/Household	8.0	10.0	7.7*
HBW Person Trips / Employee	1.20	1.55	1.6*

*Out of range from TDOT Benchmarks

TABLE 13 TRIP PURPOSE BENCHMARKS

	TDOT BENCHMARKS		JOHNSON CITY MODEL
	Low	High	
Home-Based Work	12%	24%	17%
Home-Base School	5%	8%	5%
Home-Based Shopping	10%	20%	19%
Home-Based Social Recreation	9%	12%	11%
Home-Based Other	14%	28%	16%
Non-Home Based	20%	33%	32%

1.10 VALIDATION

Model validation involves comparing model outputs to observed behavior. The model was calibrated and validated following recommended FHWA and TDOT guidelines. The TDOT guidelines include FHWA desirable percent deviations, as well as reference to Michigan for comparison purposes. The Federal Highway Administration (FHWA) has guidelines for validating results which includes **NCHRP 765: Travel Demand Forecasting: Parameters and Techniques**⁵. Model validation compares measures against the suggested FHWA targets to assess model validity for tasks such as supporting regional plan updates.

There are multiple validation checks used with each of the major steps of the model. The full model validation includes measures on VMT, percent root mean square (RMSE), R-Squared, daily volume within FHWA targets, and volumes validated with counts at screenlines. The model’s highway assignment report features validation criteria from FHWA [i.e., VMT, RMSE, R Square] and therefore no changes were made to the assignment reporting criteria within the travel demand model’s assignment reporting output to excel. The screenlines were kept consistent with the previous model, and only slightly modified if a roadway link no longer had a count available. The screenline locations are shown in Figure 6.

⁵ <https://www.trb.org/Publications/Blurbs/167055.aspx>

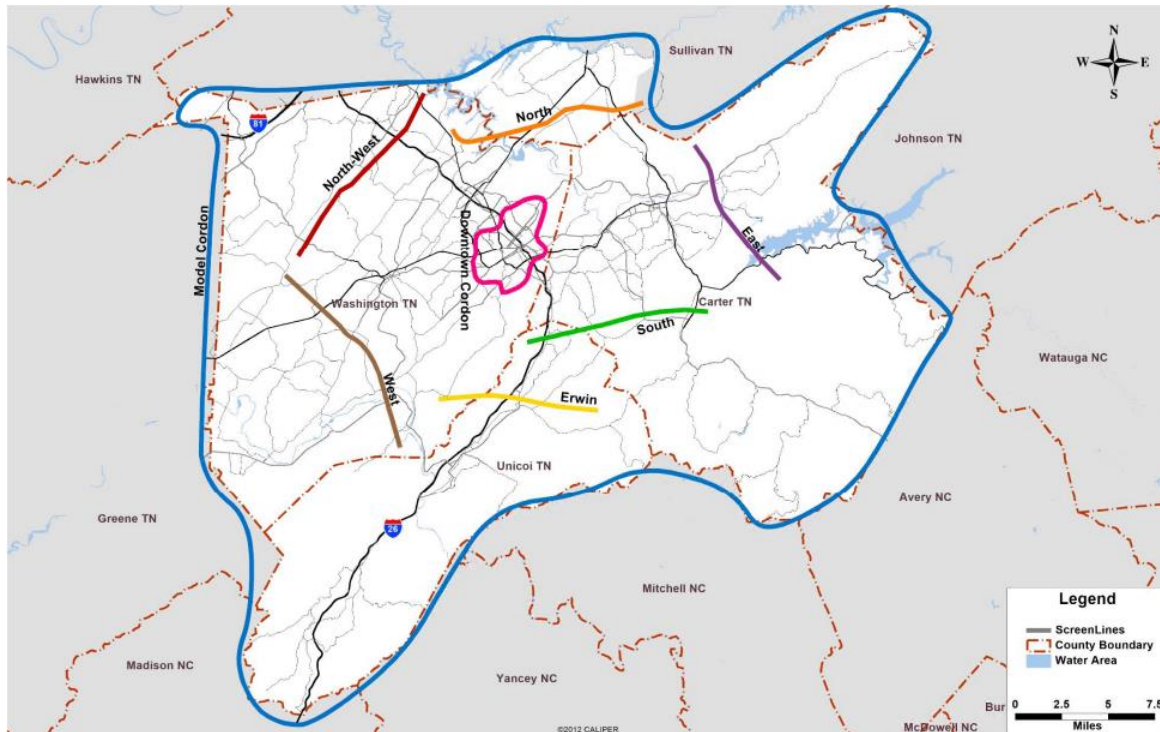


FIGURE 6: SCREENLINE LOCATIONS

Following the update to the 2020 land use and 2019 traffic counts the model was calibrated to align with current TDOT and FHWA guidelines for RMSE and percentage error across volume groups and roadway facility types. Table 14 through Table 19 provide percent error, error by facility type, root mean squared, error by (RMSE), and validation metrics comparing the 2015 to the 2020 model update. Overall, the 2020 updated model’s validation is consistent with or slightly differs from the 2015 validation report. Several metrics are slightly out of range of the TDOT guidelines and in these cases, the metrics are identified.

TABLE 14: 2015 PERCENT ERROR BY VOLUME GROUP

VOLUME GROUP	OBSERVED	MODEL	#COUNTS	+/-%	ACCEPTABLE (+/-)	PREFERABLE (+/-)	FHWA (+/-)	MICHIGAN (+/-)
< 1000	51,444	69,931	97	35.9%	50%	25%	200%	60%
1000 - 2500	132,127	163,957	84	24.1%	50%	25%	100%	47%
2500 - 5000	281,392	286,498	78	1.8%	50%	25%	50%	36%
5000-10000	578,064	601,275	92	4.0%	50%	25%	25%	29%
10000 - 25000	756,146	702,505	72	-7.1%	30% ⁶	20%	20%	25%
25000 - 50000	714,591	675,506	36	-5.5%	25% ⁷	15%	15%	22%
> 50000	166,056	182,166	6	9.7%	20% ⁸	10%	10%	21%
Total	2,679,820	2,681,838	465	0.1%	-	-	-	-

TABLE 15: 2020 PERCENT ERROR BY VOLUME GROUP

VOLUME GROUP	OBSERVED	MODEL	#COUNTS	+/-%	ACCEPTABLE (+/-)	PREFERABLE (+/-)	FHWA (+/-)	MICHIGAN (+/-)
< 1000	48,151	52,536	86	9.1%	50%	25%	200%	60%
1000 - 2500	138,677	135,074	88	-2.6%	50%	25%	100%	47%
2500 - 5000	304,819	298,476	82	-2.1%	50%	25%	50%	36%
5000-10000	520,445	493,939	77	-5.1%	50%	25%	25%	29%
10000 - 25000	784,289	708,380	78	-9.7%	30%	20%	20%	25%
25000 - 50000	736,820	624,277	42	-15.3%	25%	15%	15%	22%
> 50000	428,761	412,828	14	-3.7%	20%	10%	10%	21%
Total	2,961,962	2,725,509	467	-8.0%	-	-	-	-

⁶ Benchmarks for 10,000-30,000 Volume Group⁷ Benchmarks for 30,000-50,000 Volume Group⁸ Benchmarks for 50,000-65,000 Volume Group

TABLE 16: 2015 ERROR BY FACILITY TYPE

FACILITY TYPE	OBSERVED	MODEL	COUNTS	+/-%	PERCENT RMSE	TDOT BENCHMARK	
						Small Regions	Large Regions ⁹
Freeway	617,016	635,530	42	3.0%	14.2%	20%	20%
Major Arterial	836,885	807,230	74	-3.5%	23.3%	30%	35%
Minor Arterial	809,129	821,281	125	1.5%	41.0%	40%	50%
Collector	416,790	417,796	224	0.2%	67.2%	70%	60%
Total	2,679,820	2,681,838	465	0.1%	35.3%	-	-

TABLE 17: 2020 ERROR BY FACILITY TYPE

FACILITY TYPE	OBSERVED	MODEL	COUNTS	+/-%	PERCENT RMSE	TDOT BENCHMARK	
						Small Regions	Large Regions
Freeway	771,997	727,829	44	-5.7%	16.6%	20%	20%
Major Arterial	879,276	813,739	73	-7.5%	27.1%	30%	35%
Minor Arterial	917,873	817,546	134	-10.9%	44.2%*	40%	50%
Collector	392,816	366,396	216	-6.7%	51.8%	70%	60%
Total	2,961,962	2,725,509	467	-8.0%	37.0%	-	-

*Out of range for small region, TDOT Benchmark

⁹ Large regions are defined as Metropolitan Statistical Areas of population greater than 500,000 or have at least 200,000 population and are part of a metropolitan area with a population of more than 500,000.

TABLE 18: 2015 SCREENLINE PERCENT ERRORS

SCREENLINE	OBSERVED	MODEL	# COUNTS	+/-%	TDOT BENCHMARK
Downtown Cordon	287,934	284,182	28	-1.3%	Screenlines with greater than 70,000 AADT should achieve +/-10 percent
West	29,457	35,615	10	20.9%	Screenlines with less than 35,000 AADT should achieve +/-20 percent
North-West	78,875	91,504	8	16.0%	Screenlines with greater than 70,000 AADT should achieve +/-10 percent
North	42,463	51,503	8	21.3%	Cutlines +/-15 percent
East	17,420	18,906	3	8.5%	Cutlines +/-15 percent
South	39,400	43,021	9	9.2%	Cutlines +/-15 percent
Erwin	29,159	25,072	5	-14.0%	Cutlines +/-15 percent
Model Cordon	205,036	205,033	45	-0.0%	External model cordon lines should achieve +/-1 percent

TABLE 19: 2020 SCREENLINE PERCENT ERRORS

SCREENLINE	OBSERVED	MODEL	# COUNTS	+/-%	TDOT BENCHMARK
Downtown Cordon	288,059	245,148	27	-14.9%*	Screenlines with greater than 70,000 AADT should achieve +/-10 percent
West	36,813	41,067	10	11.6%	Screenlines with less than 35,000 AADT should achieve +/-20 percent
North-West	72,985	72,635	5	-0.5%	Screenlines with less than 35,000 AADT should achieve +/-20 percent
North	36,412	27,644	6	-24.1%*	Cutlines +/-15 percent
East	17,582	18,200	3	3.5%	Cutlines +/-15 percent
South	40,859	43,457	9	6.4%	Cutlines +/-15 percent
Erwin	28,931	28,849	5	-0.3%	Cutlines +/-15 percent
Model Cordon	235,633	238,156	43	1.1%	External model cordon lines should achieve +/-1 percent

*Out of range for acceptable or preferable

In addition to the percent error and RMSE tables, the 2015 trip length frequency distribution (TLFD) was reviewed and compared to the updated 2020 model TLFD. Figures 7 and 8 show the respective TLFDs for the previous and current base year models. Tables 20 through 23 provide validation on the average trip lengths, percent intrazonal trips, vehicle miles traveled by roadway classification, and RSME by volume group. Figure 9 shows the coefficient of determination which estimates the correlation between the traffic counts and the model traffic volume.

Table 20

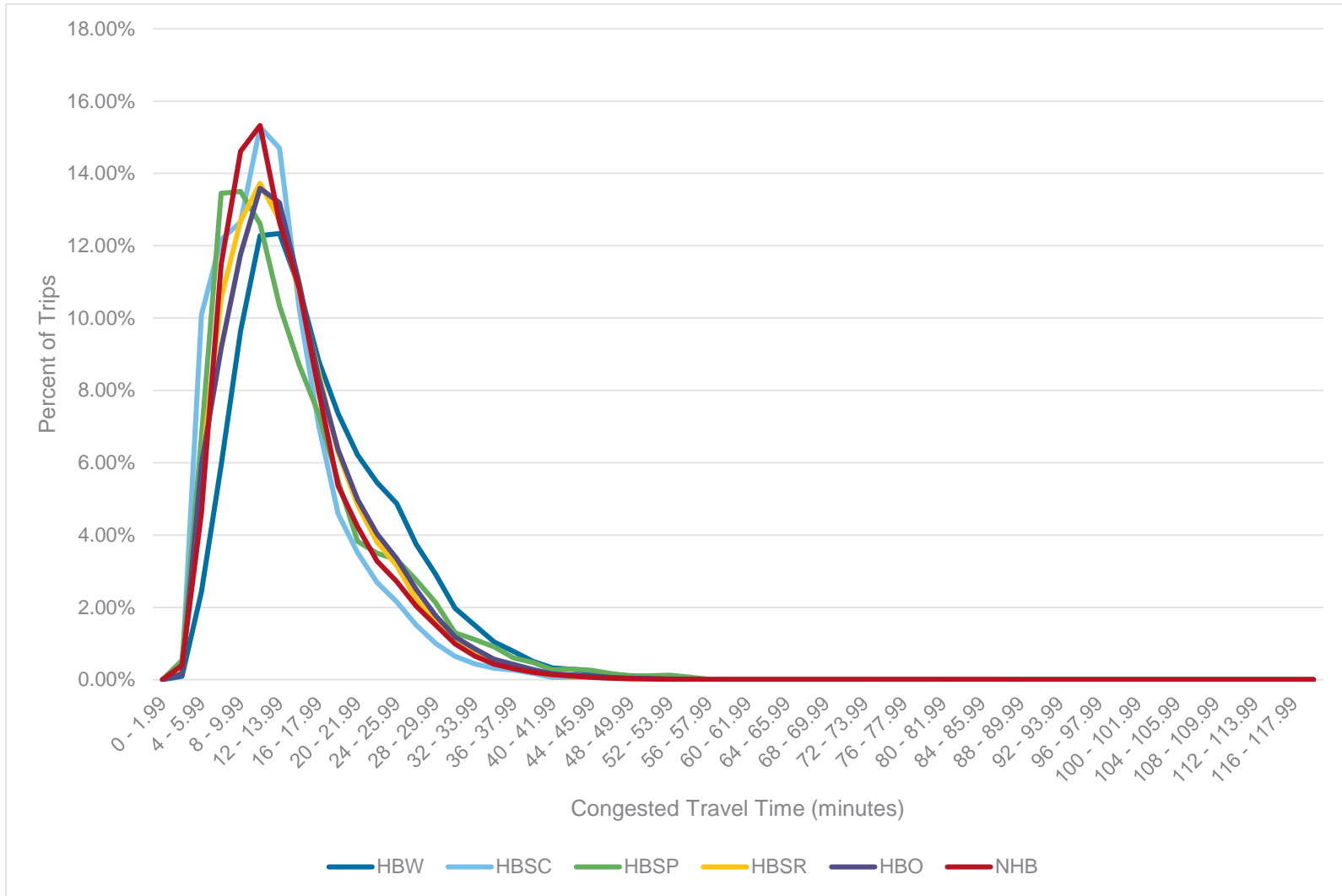


FIGURE 7: 2015 INTERNAL TLFD

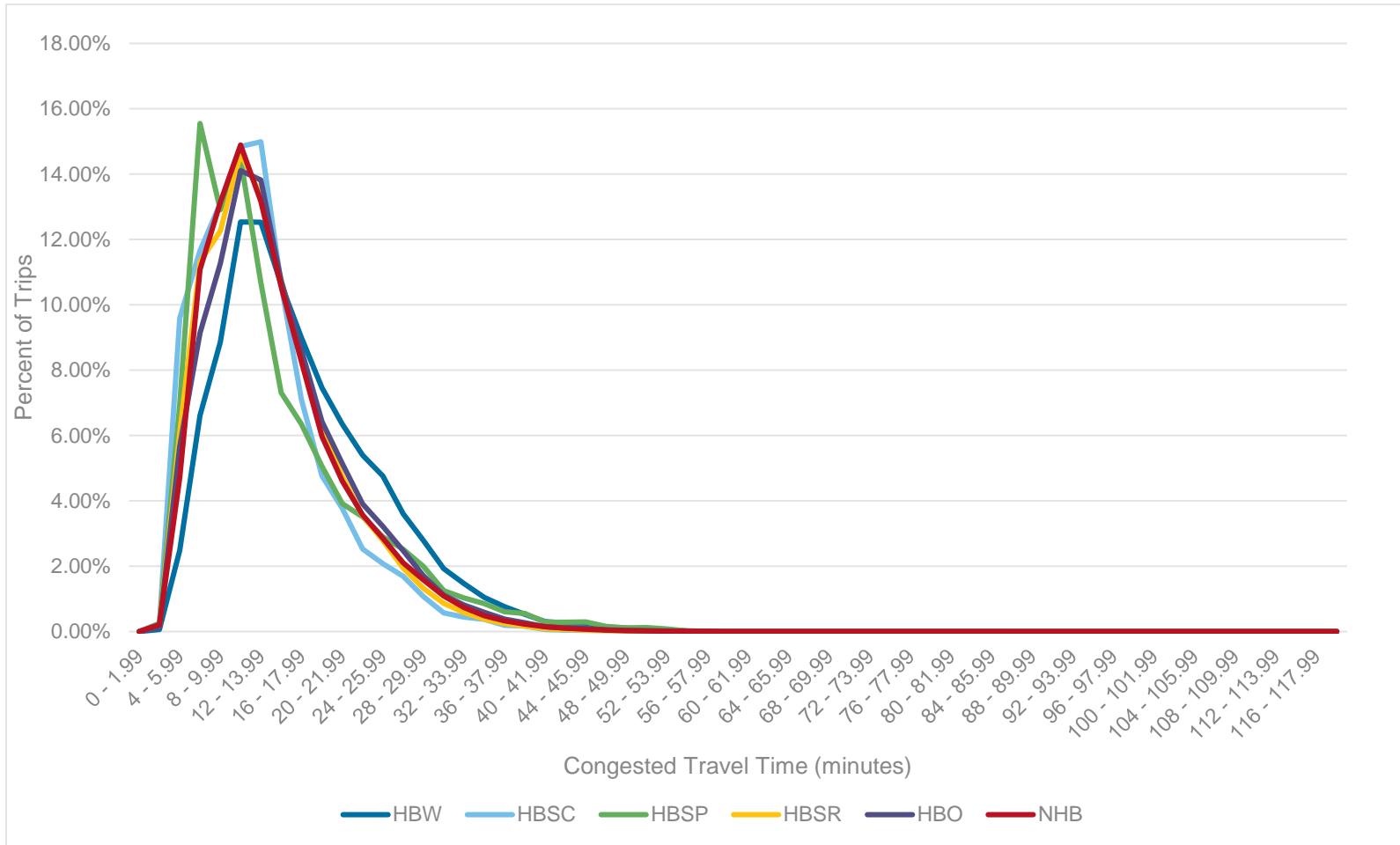


FIGURE 8: 2020 INTERNAL TLFD

Tables 20 through 23 provide validation on the average trip lengths, percent intrazonal trips, vehicle miles traveled by roadway classification, and RSME by volume group. Figure 9 shows the coefficient of determination which estimates the correlation between the traffic counts and the model traffic volume.

TABLE 20: AVERAGE TRIP LENGTH BY PURPOSE

AVERAGE TRIP TIME	2015 MODEL	2020 MODEL	BENCHMARKS	
			Low	High
HBW - minutes	17.05	17.03	12	35
HBSP - minutes	14.79	14.60	9	19
HBSR - minutes	14.43	14.11	11	19
HBSC - minutes	13.07	13.21	7	16
HBO - minutes	14.86	14.88	8	20
NHB - minutes	14.05	14.38	6	19

TABLE 21 PERCENT INTRAZONAL TRIPS

PERCENT INTRAZONAL TRIPS			
	Johnson City Model	TDOT Benchmarks	
		Low	High
Home-Based Work	3%	12%	24%
Home-Base School	9%	5%	8%
Home-Based Shopping	9%	10%	20%
Home-Based Social Recreation	8%	9%	12%
Home-Based Other	6%	14%	28%
Non-Home Based	8%	20%	33%

TABLE 22 ROADWAY CLASSIFICATION VMT

Roadway Classification VMT			
Functional Class	Johnson City Model		Medium Urban Area (200K-1M)
	Modeled VMT	+/-	Acceptable +/-
Freeways/Expressways	1,404,912	-9.3%	33-38%
Principal Arterials	1,546,102	-4.8%	27-33%
Minor Arterials	1,138,562	-1.4%	18-22%
Collectors	693,084	10.4%	8-12%

TABLE 23 RMSE BY VOLUME GROUP

VOLUME GROUP	# 2015 COUNTS	# 2019 COUNTS	2015 PERCENT RMSE	2020 PERCENT RMSE	BENCHMARK	
					Acceptable	Preferable
< 5000	259	256	65.9%	52.7%	100%	45%
5000 - 10000	92	77	38.5%	33.0%	45%	35%
10000 - 15000	28	41	26.5%	44.7%*	35%	27%
15000 - 20000	24	23	27.3%	27.8%	30%	25%
20000 - 30000	35	40	24.1%	26.5%	27%	15%
30000 - 50000	21	16	11.6%	25.3%	25%	15%
50000 - 60000	6	8	12.5%	10.2%	20%	10%
> 60000	0	6	-	7.9%	19%	10%
Total	465	467	35.3%	37.0%	45%	35%

*Out of range for acceptable or preferable

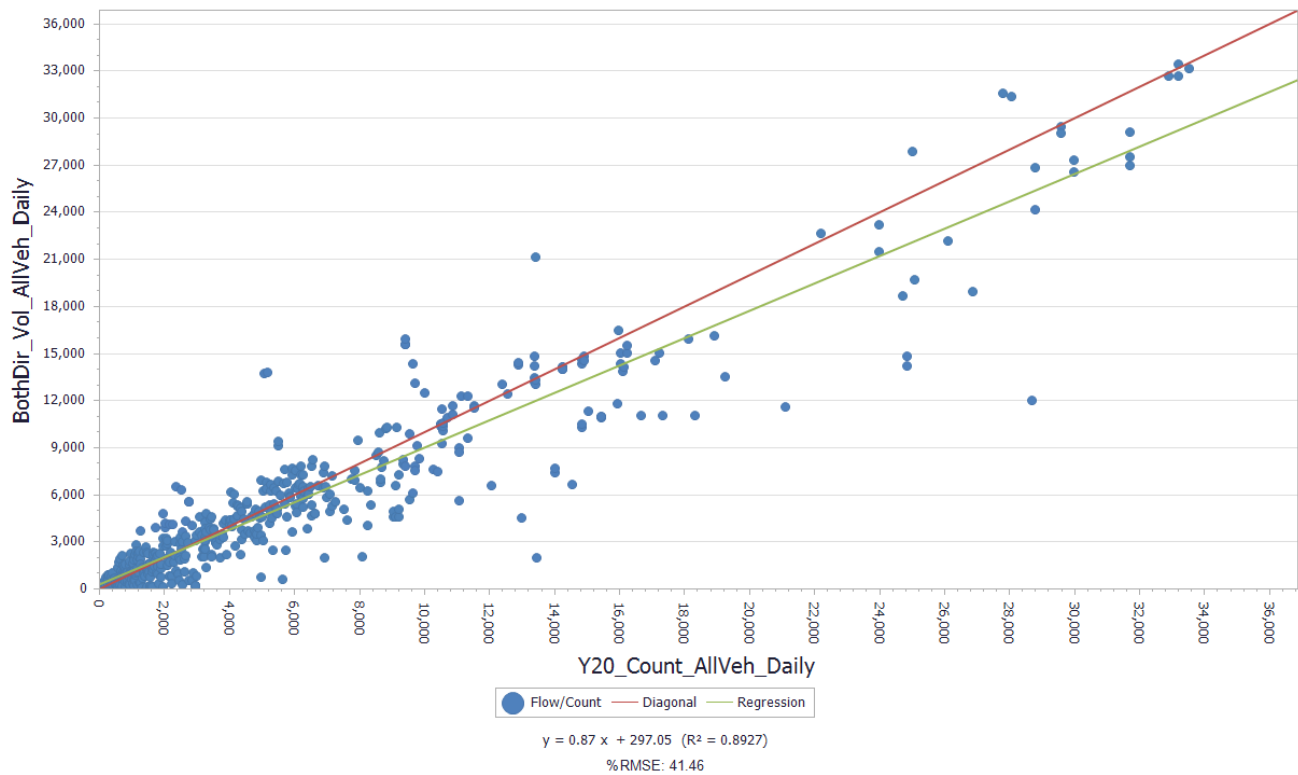


FIGURE 9 COEFFICIENT OF DETERMINATION

1.11 CONCLUSION

The model has been updated with network and socioeconomic data and then validated to meet the criteria from FHWA and the TDOT guidelines. The travel demand model sufficiently models travel behavior as observed with count data from the TDOT TN TIMES traffic count database.

Appendix C. IMPROVE Act Projects

The following table of projects was extracted from the State of Tennessee's Improving Manufacturing, Public Roads and Opportunities for a Vibrant Economy (IMPROVE) Act – Public Chapter Number 181 (2017) House Bill Number 534. This list contains projects located in Carter, Sullivan, Unicoi, and Washington counties in Tennessee. Highlighted projects are located within the Johnson City MTPo Metropolitan Planning Area.

Project #	County	Route Number	Description	Log Mile
89	Carter County	Route 01385	Smalling Road bridge over Watauga River	LM 1.990
90		Route 02609	Governor Alfred Taylor Road bridge over Buffalo Creek	LM 3.510
91		Route 02680	Cove Creek Road bridge over Doe River	LM 0.570
92		Route 04833	Southside Road bridge over Gap Creek	LM 1.140
93		Route 0A 102	Big Sandy Road bridge over Stoney Creek	LM 0.618
94		Route 0A250	Reeser Road bridge over Buffalo Creek	LM 0.107
95		Route 0A373	Hillside Drive bridge over Doe River	LM 0.020
96		Route 0A618	Paul Blevins Road bridge over Tiger Creek	LM 0.030
97		Route 0A634	Railroad Grade Road bridge over Bear Gage Road/Doe River	LM 1.757
98		Route 0A642	Crabtree Road bridge over George Creek	LM 0.625
99		Route 0A656	Sugar Hollow Road bridge over Doe River	LM 0.009
100		Route 0A724	Stevens Road bridge over Little Doe River	LM 0.087
101		Route 0A746	Old SR 67 bridge over Laurel Fork Creek	LM 0.294
102		Route 0A752	Stout Hollow Road bridge over Laurel Fork Creek	LM 0.008
103	Route 0A765	Dennis Cove Road bridge over Laurel Fork Creek	LM 4.520	
104	Route 0A767	Crow Road bridge over Laurel Fork Creek	LM 0.023	

Project #	County	Route Number	Description	Log Mile	
105		Route 0A869	Earl Williams Road bridge over Stoney Creek	LM 0.561	
106		Route 0A906	Danner Subdivision Road bridge over Stoney Creek	LM 0.393	
107		Route 0A961	Ensor Graveyard Road bridge over Stoney Creek	LM 0.018	
108		Route 0A967	Blevins Hollow Road bridge over Stoney Creek	LM 0.048	
109		Route 0A972	Estep Hollow Road bridge over Stoney Creek	LM 0.110	
110		Route 0A974	Estep Loop bridge over Stoney Creek	LM 1.614	
111		Route 0A984	Big Sandy Road bridge over Stoney Creek	LM 0.058	
112		Route 0B001	Honeycutt Street bridge over Doe River	LM 0.017	
113		Route 0B085	Powell Road bridge over Hampton Creek	LM 0.015	
114		Route OC102	Hopson Road bridge over Little Doe Creek	LM 0.015	
115		SR 362	Gap Creek Road bridge over Gap Creek	LM 3.845	
116		US 321 (SR91)	W. Elk Avenue from SR 67 (US 321) to SR 37 (US 19E)	--	
837		Sullivan County	Route 01375	Muddy Creek Road bridge over Booher Creek	LM 0.220
838			Route 01392	Old SR-37 bridge over Indian Creek	LM 1.240
839			Route 02599	Devault Bridge Road bridge over Muddy Creek	LM 0.310
840			Route 02640	Fordtown Road bridge over CSX Railroad	LM 3.670
841	Route 03899		Fort Robinson Drive bridge over Dry Branch in Kingsport	LM 0.390	
842	Route 03930		State Street bridge over Beaver Creek	LM 0.170	
843	Route 0A353		Old Carden Hollow Road bridge over Back Creek	LM 0.445	
844	Route 0A456		Eighth Street bridge over Beaver Creek	LM 0.048	
845	Route 0A839		Wyatt Hollow Road bridge over Harpers Creek	LM 8.630	

Project #	County	Route Number	Description	Log Mile
846		Route 08419	Old Blair Gap Road bridge over Walker Fort Creek	LM 2.980
847		Route 0C473	Reedy Creek Lane bridge over Reedy Creek	LM 0.028
848		Route 0C534	Meadow Brooke Lane bridge over Reedy Creek	LM 0.011
849		Route 0C835	Henry Road bridge over Muddy Creek	LM 0.040
850		I-81	ITS expansion between I-26 (Exit 57) interchange and Virginia state line	--
851		SR 126	(Memorial Boulevard) from East Center Street in Kingsport to east of Cooks Valley Road	--
852		SR 126	(Memorial Boulevard) from east of Cooks Valley Road to I-81 in Kingsport	--
853		SR 355	Industry Drive bridge over Reedy Creek	LM 1.910
854		SR 36	Ft. Henry Drive bridge (right lanes) over South Holston River	LM 5.020
855		SR 36	Ft. Henry Drive bridge (left lanes) over South Holston River	LM 5.030
856		SR 44	Dry Branch Road bridge over branch	LM 5.030
857		SR 93	Sullivan Gardens Parkway from south of Horse Creek to north of Derby Drive (spot improvements)	--
858		SR 93	John B. Dennis Highway bridge over CSX Railroad	LM 8.440
859		SR 34	From US 11E (SR 34) near Bristol Motor Speedway to US 11W (SR 1) near Pinnacle Parkway	--
882	Unicoi County	Route 0A048	Hensley Road bridge over South Indian Creek	LM 0.008
883		Route 0A051	Tumbling Creek Road bridge over Spivey Creek	LM 0.224

Project #	County	Route Number	Description	Log Mile
884		Route 0A0481	Carver Road bridge over Dry Creek	LM 0.010
885		Route 0A601	Locust Lane bridge over South Indian Creek	LM 0.039
886		SR 107	Unicoi Drive bridge over Indian Creek	LM 5.370
904	Washington County	Route 0A970	Mill Street bridge over Little Limestone Creek	LM 0.031
905		Route 0B099	Little Cassi Creek Road bridge over Cassi Creek	LM 0.769
906		Route 0B181	Tommy Campbell Road bridge over Little Cherokee Creek	LM 0.098
907		Route 0B435	Magnolia Extension bridge over CSX Railroad	LM 0.048
908		Route 0C900	Austin Springs Road bridge over Watauga River	LM 3.537
909		I-26	Interchange at SR 354 (Exit 17)	--
910		SR 353	Old SR 34 bridge over Little Limestone Creek	LM 11.720
911		SR 93	Sullivan Gardens Parkway from north of Davis Road to north of Fire Hall Road (spot improvement)	--
912		Route 06040	Knob Creek Road from SR 354 (Boones Creek Road) to Mizpah Hills Drive	--
913		US 11E/321 (SR 34)	W. Market Street bridge over CSX Railroad	LM 15.530
860	Sullivan and Washington counties	SR 93	Sullivan Gardens Parkway from Morgan Lane in Washington County to south of Baileyton Road in Sullivan County (spot improvement)	--
914		SR 36	Fort Henry Drive from SR 75 to I-81	--

Appendix D. Project Scoring Mechanism

Regional Goal	Total # Points	Measure	Purpose	Scoring Process
Safety & Security (30 points)	10	Number of vehicular crashes along segment in 5-year period	This criterion prioritizes projects located on facilities with known safety issues for all motorists.	Numeric Ranking - Points were subdivided based on data quartiles.
	10	Number of bike/pedestrian crashes along segment in 5-year period	This criterion prioritizes projects located on facilities with known safety issues specifically for cyclists and pedestrians.	Numeric Ranking - Points were subdivided based on data quartiles.
	10	Existing crash rate along segment in 5-year period	This criterion prioritizes projects located on facilities with known safety issues for all users.	Numeric Ranking - Points were subdivided based on data quartiles.
Traffic Congestion Mitigation (20 points)	10	Existing (2020) volume-to-capacity ratio along segment	This criterion prioritizes projects located on routes with existing capacity issues.	Numeric Ranking - Points were subdivided based on data quartiles.
	10	Existing (2022) travel time reliability along segment	This criterion prioritizes projects located on routes with existing reliability issues.	Numeric Ranking - Points were subdivided based on data quartiles.
Sustainable Growth and Livability (40 points)	10	Potential impacts of project based on type (maintenance, operational, widening, bike/pedestrian, etc.)	This criterion prioritizes projects that minimize future maintenance needs. The smaller the footprint of the project, the more points it receives.	Select One Option: 10 points: Maintenance, Intersection, Minor Reconstruction, Transit Vehicle Replacement, Operations/ITS, Multimodal 8 points: Center Turn Lane Only 5 points: Additional Through Lanes / Transit Fleet/Service Expansion 2 points: New Road Extension

Regional Goal	Total # Points	Measure	Purpose	Scoring Process
	10	Number of challenging areas the project touches (floodplains, historical areas, steep slopes, and parks)	This criterion prioritizes projects that do not impact natural or cultural resources.	Select All That Apply: 3 points: Project does not impact parks 3 points: Project does not impact historical areas 1 point: Project does not impact floodplains 3 points: Project does not impact steep slopes
	10	Number of above average transportation disadvantaged populations touched by project (65+, low income, zero-auto households)	This criterion prioritizes projects that can provide access to areas with high concentrations of transportation disadvantaged residents.	Select One Option: 10 points: Project touches all three above average populations 7 points: Project touches two above average populations 5 points: Project touches one above average population
	10	Potential for project to incorporate needed bike/ped improvements	This criterion prioritizes projects that can incorporate needed bicycle and pedestrian infrastructure improvements.	Yes/No
Regional Access (10 points)	5	Projected employment growth surrounding project 2020-2050	This criterion prioritizes projects that provide access to projected employment growth in the region.	Numeric Ranking - Points were subdivided based on data quartiles.
	5	Projected population growth surrounding project 2020-2050	This criterion prioritizes projects that provide access to projected population growth in the region.	Numeric Ranking - Points were subdivided based on data quartiles.