I-55/75/26
Multimodal Corridor Study
▶Final Report

Prepared by:
AECOM
1000 Corporate Centre Drive, Suite 250
Franklin, TN 37067, USA
May 2020

TN TDOT Department of Transportation

I-55/75/26 Multimodal Corridor Study
Final Report

Introduction

Tennessee's freeways form the backbone of the state's transportation system, complemented by state highways, local roads, airports, railroads, transit systems, bicycle and pedestrian facilities, and waterborne navigation facilities. Tennessee's interstate highways carry about 30% of all vehicle miles traveled in the state, and 80% of all truck miles, making them the key component of the roadway system, facilitating the movement of people and goods across the state and across the country. Developing a multimodal transportation system that meets the changing needs of Tennessee's residents, businesses, and visitors will support the state's growth and provide a range of safe transportation options for everyone.

The I-55/75/26 Multimodal Corridor Study evaluated potential transportation improvements to address existing and emerging issues in the system. The analysis is centered on study areas surrounding four Interstate corridors: I-55 in southwestern Tennessee, I-155 in northwestern Tennessee, I-75 in the east-central part of the state, and I-26 in eastern Tennessee. Together, these corridors represent more than 200 miles of freeway traveling through urban and rural counties, supported by a robust network non-freeway facilities.

The study considered innovative, long-range approaches to addressing multimodal issues and opportunities in these corridors. Solutions were developed to address traffic and congestion, operations and safety, expanded transportation choice, and the ways in which the transportation system supports economic growth, freight movement, and access to employment. The study included multiple opportunities for stakeholder involvement, including surveys, regional meetings, interactive online mapping and the guidance of a project advisory committee made up of representatives from each corridor's study area.

The I-55/75/26 Multimodal Corridor Study is documented in four technical memoranda and a final report. This Executive Summary presents an overview of the key transportation deficiencies identified in each corridor and the top ranked solutions for addressing those deficiencies. For technical details and full explanations of the planning process and its outcomes, please refer to the study documents. This Executive Summary outlines the general shape of the future of transportation in these interstate corridors, suggesting planning and projects that will enable them to function efficiently for Tennessee's residents, businesses, and visitors long into the future.

Study Corridors

Four interstate corridors - I-55, I-155, I-75 and I-26 - are included in the study.

I-55 Corridor

▶ Final Report

Table of Contents

Tables

Figures

Figures cont.

I-55 Corridor

1. Introduction

The I-55 corridor serves as a backbone for economic development and growth in the Memphis region. As population and employment grow and redevelopment changes the face of the region, new travel demands place pressure on the Interstate as well as parallel and intersecting highways. This results in increased traffic congestion, travel times, and conflicts, which impact the corridor's ability to sustain future growth.

Interstate 55 (I-55) is a major north-south route connecting the Gulf of Mexico to the Great Lakes in the central United States. The length of the Tennessee portion of the I-55 corridor is approximately 13 miles from the Mississippi/Tennessee border to the Arkansas/Tennessee border within the City of Memphis. The project analysis area is shown in Figure 1-1. It includes all of Shelby County.

The main purpose of this study is to identify existing and emerging deficiencies along the I-55 corridor and to evaluate and prioritize improvements to address those deficiencies. The study explores multimodal issues and opportunities and considers innovative approaches available to the Tennessee Department of Transportation (TDOT) to address capacity and congestion, enhance operational efficiency, improve safety and security, expand transportation choices, and support economic growth and competitiveness.

Figure 1-2. I-55 Fast Facts

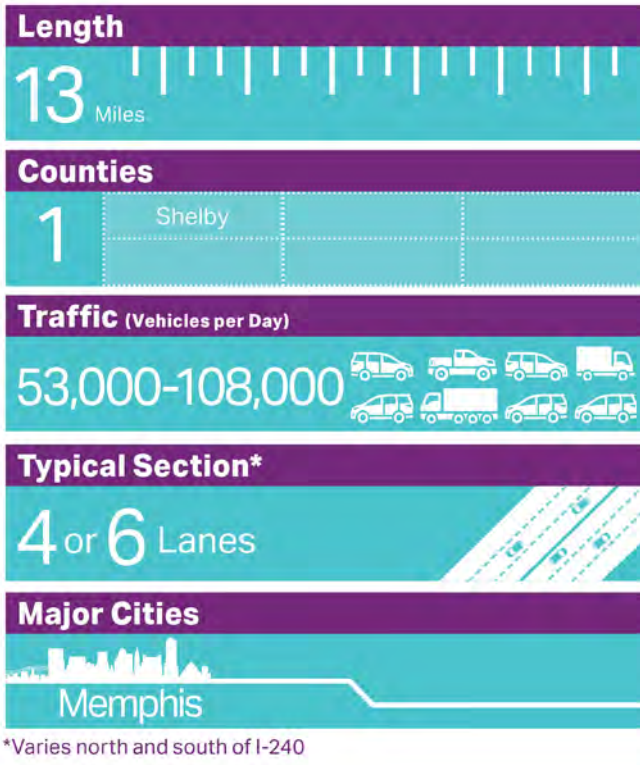


Figure 1-1. I-55 Study Area

Previous technical memoranda:

- Provided a data and information inventory for the corridor
- Assessed existing and future deficiencies and needs along the I-55 corridor
- Established goals and performance measures to assess the effectiveness of various solutions to the problems
- Filtered the I-55 universe of alternatives through a screening and prioritization process

This prioritization process evaluated solutions based on their impact on mobility and safety, potential environmental impacts, cost, and potential economic impacts. Ultimately, the prioritized solutions both resolve the identified deficiencies and have a high benefit-cost index.

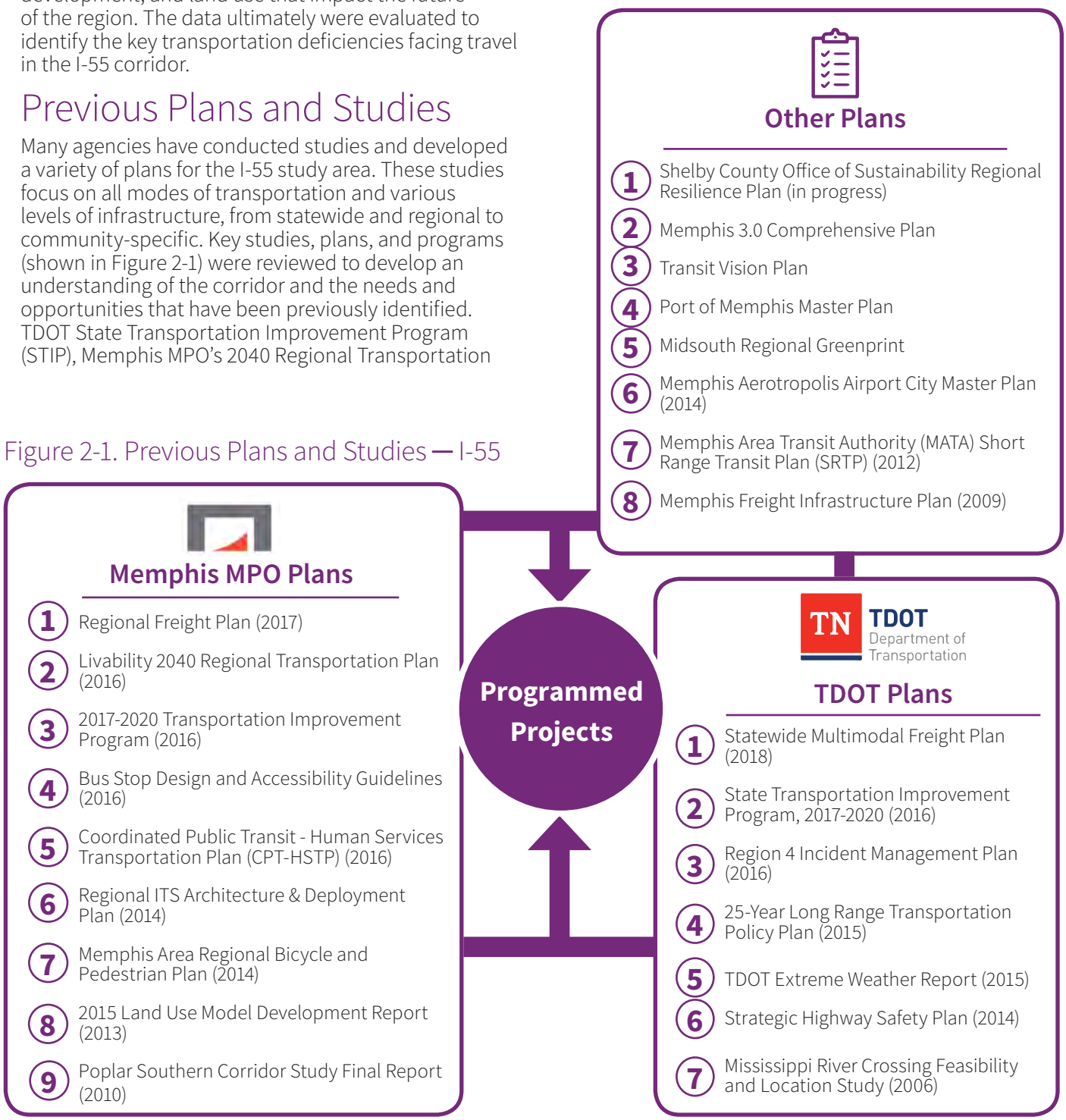
2. Sources of Data

Roadway, demographic, economic and performance data were collected from numerous sources. These were supplemented by a robust program to gather input from key stakeholders -- such as metropolitan planning organizations, business groups, and large institutions -- and the traveling public. These data were used to identify trends in travel, employment, development, and land use that impact the future of the region. The data ultimately were evaluated to identify the key transportation deficiencies facing travel in the I-55 corridor.

Previous Plans and Studies

Many agencies have conducted studies and developed a variety of plans for the I-55 study area. These studies focus on all modes of transportation and various levels of infrastructure, from statewide and regional to community-specific. Key studies, plans, and programs (shown in Figure 2-1) were reviewed to develop an understanding of the corridor and the needs and opportunities that have been previously identified. TDOT State Transportation Improvement Program (STIP), Memphis MPO's 2040 Regional Transportation Plan (RTP) and FY 2017-2020 Transportation Improvement Program (TIP) were specifically reviewed to develop an understanding of the needs and opportunities that have previously been identified and to identify projects within the study area for which money has already been allocated. These programmed projects are shown in Table 2-1 and Figure 2-2.

Figure 2-1. Previous Plans and Studies — I-55



Memphis MPO
FY2017 - 2020

Table 2-1. Corridor Programmed Projects — I-55

Figure 2-2 ID	Route and Project Limits	Improvement	Cost	Fiscal Year	Horizon Year	Lead Agency/ Funding Type	TIP# or STIP#
1	I-55 Interchange at Crump Blvd.	Interchange modification	$74,278,000	2017	2020	TDOT/NHPP	TIP # TN-IM-2011-01
2	I-240 Midtown (I-55 to I-40)	Widen from 6 to 8 lanes	$51,000,000	2019	2025	TDOT/NHPP	TIP # NHS-2002-01
3	Elvis Presley Blvd. (Shelby Dr. to Brooks Rd.)	Construct a 6 lane roadway; Widen from 4 to 6 lanes; Landscaping; Improved ped/ bicycle/bus stop facilities	$32,976,500	2017	2020	Memphis/ TDOT/ENH/ NHPP	TIP # ENH-2010-01
4	Holmes Rd. (Millbranch to Tchulahoma)	Widen from 2/4 to 7 lanes	$30,078,700	Unknown		STBG	TIP # STP-M-2002-14
5	US-61 (Third St.) from Vance Ave. to Winchester Rd.	Signal Coordination	$27,618,700	2017	NA	CMAQ-M/ CMAQ-S	TIP # CMAQ-2002-09

* Only projects listed in the TIP or STIP are included in this table.
Source: Memphis MPO FY2017-2020 TIP
The project list information is based off the previous MPO FY 2017-2020 TIP.

NHPP = National Highway Performance Program
ENH = Enhancement Grant
STBG = Surface Transportation Block Grant
CMAQ = Congestion Mitigation and Air Quality Improvement

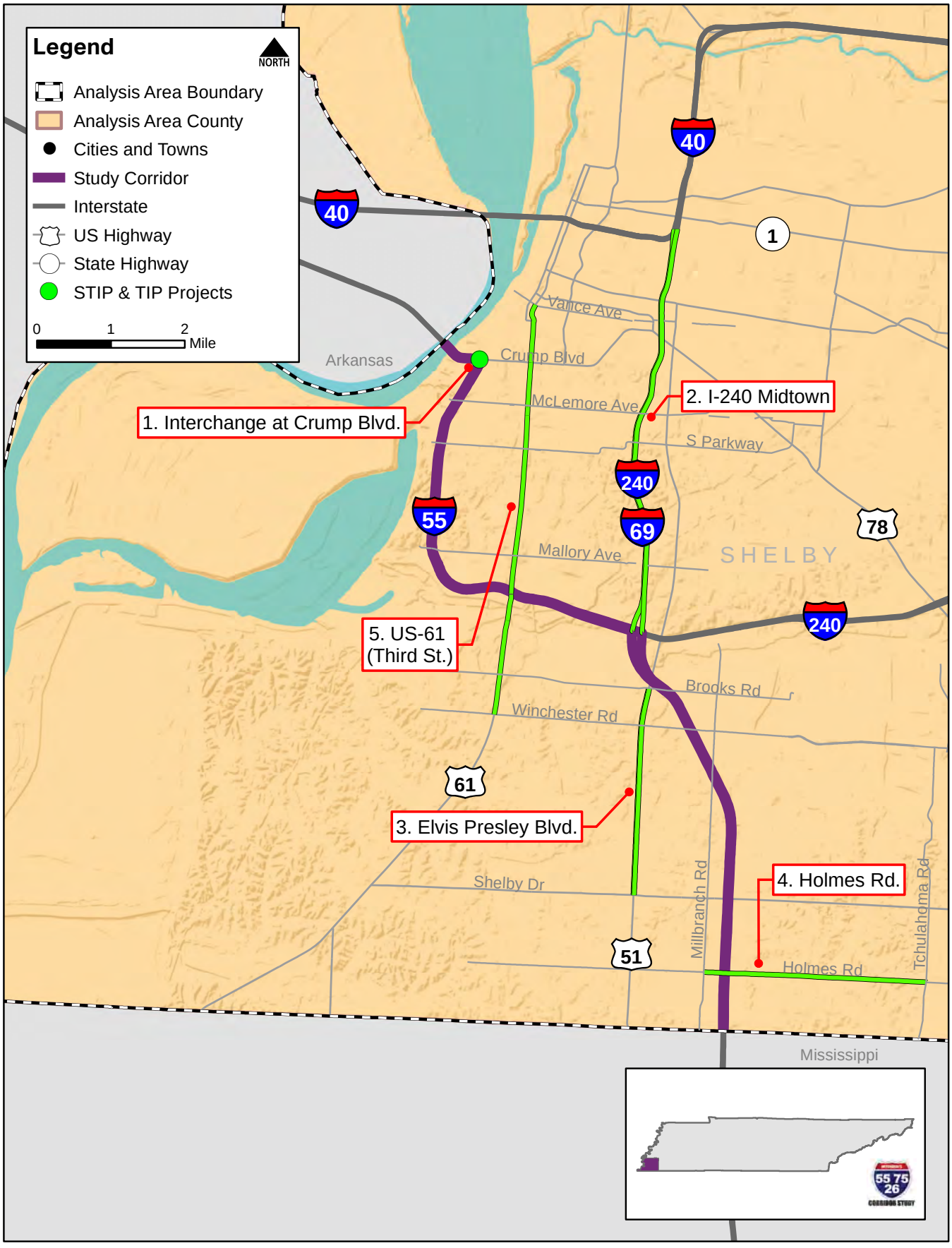
Data Analysis

A large body of technical data were analyzed to develop a picture of corridor conditions. These included sources detailing roadway conditions, traffic and freight operations, safety, population and employment growth, environmental conditions, and other factors to create a trend scenario. These data sources are shown in Figure 2-3.

Figure 2-3. Data Sources

TRIMS 2017 (Tennessee Roadway Information Management System)	**NPMRDS** (National Performance Management Research Data Set)	**HPMS** (Highway Performance Monitoring System)	**MPO Regional Travel Demand Models**	**USFWS** (United States Fish and Wildlife Service)
ATRI (American Transportation Research Institute)	**NHRP** (National Register of Historic Places)	**TDOT Traffic History Website**	**TSM** (Tennessee Statewide Travel Demand Model)	**Woods & Poole Economics, Inc.**
US Census Data (On the Map)	**NWI** (National Wetland Inventory)	**Transearch**	**Google Earth**	**TN Comptroller**

Figure 2-2. Corridor Programmed Projects* — I-55



* Only projects listed in the TIP or STIP are included in this figure.

Source: Memphis MPO FY2017-2020 TIP

The trend scenario predicts existing and future conditions if current practices, plans, and policies remain unchanged. The trend scenario establishes the existing and projected transportation conditions along the I-55 corridor and serves as the baseline for identifying needs and, ultimately, proposed improvements. The 2010 and 2040 Tennessee Statewide Travel Demand Model (TSM) trend scenarios were originally developed by the TDOT in 2017 (Phase 3/Version 3). As part of this study, the trend scenarios were updated and validated based on the following:

- Population and employment data and projections from Woods and Poole Economics, Inc.
- Projects currently programmed for construction in TDOT's STIP
- Projects currently programmed for construction in the Memphis MPO's FY 2017-2020 TIP
- Recent MPO travel demand model projections of socioeconomic data, traffic volumes, and travel times
- Recent Transearch freight data and projections

The study team (including TDOT and statewide MPO/MTPO staff) determined that the updated Phase 3/Version 3 TSM (with 2010 base year) was producing results comparable to regional models with more recent base years- creating better model efficiency.

Public / Stakeholder Input

The study's technical analyses were complemented by a robust stakeholder and public involvement effort. The data generated by outreach activities – which included public meetings, key stakeholder interviews and a public survey – was used to focus technical analysis on items that stakeholders perceive as critical, and to prioritize transportation issues to be addressed. This was complemented and enhanced by an effort to provide information to and gather input from traditionally under-represented and underserved populations.

Members of the public and stakeholders identified many areas along the interstate corridor as exhibiting transportation problems. As shown in Figure 2-4, three locations were singled out as being especially problematic:

- Interchange at I-55 and Crump Boulevard
  - The unconventional design of the interchange is perceived as leading to severe safety issues and congestion as vehicles attempt to enter, exit, and maneuver to change lanes over very short distances. This chronic congestion affects Interstate travel as the I-55 bridge over the Mississippi River is frequently backed up.
- Interchange at I-55 and I-240
  - Heavy volumes of traffic attempting to exit to I-55 at this location are perceived to cause congestion, with the two right lanes coming to a standstill during peak hours.
- I-55 at Holmes Road
  - Two stakeholders called for the addition of an interchange at this location.

3. Existing Conditions & Deficiencies

Existing and future deficiencies and needs along the I-55 corridor were identified by examining transportation issues including land use and economic development trends, highway capacity and congestion, travel demand, safety, presence of Intelligent Transportation Systems (ITS), freight, transit, and non-motorized travel.

Land Use & Economic Development

Land use, development patterns, and geographical and cultural features of the study area impact the demand for, design, and operations of transportation facilities. The locations of economic activity generators and the flows of goods and people between them are a key elements in identifying existing and future transportation needs.

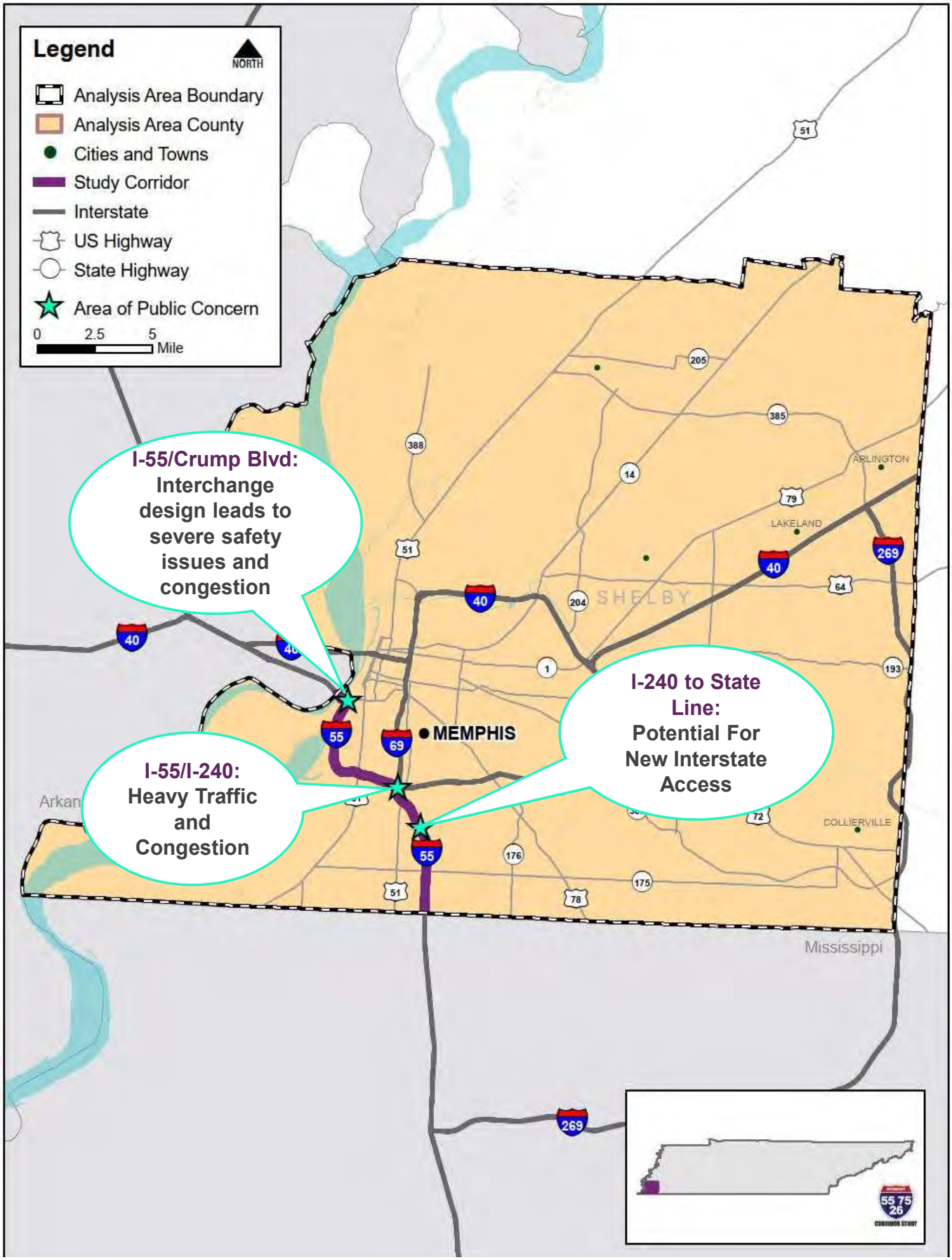
Population & Employment

Study area population and employment drives travel demand in the I-55 corridor. A high-level review of population and employment projections from Woods & Poole Economics, Inc. was undertaken for Shelby county. According to Woods & Poole Economics data, Shelby County is expected to see an additional 75,000 residents and 230,000 jobs by 2040. This represents an 8% increase in people and 37% increase in employment since 2010 (Figures 3-1 and 3-2). Figures 3-3 and 3-4 illustrate where the growth is expected to occur.

To focus on the needs of underserved populations, minority (persons identifying as other than "white alone") and low income populations – in this case persons living in poverty -- in the study area were mapped using data from the US Census Bureau's 2012-2016 American Community Survey (ACS). It should be noted that persons living in poverty represent the most extreme range of the region's low-income population.

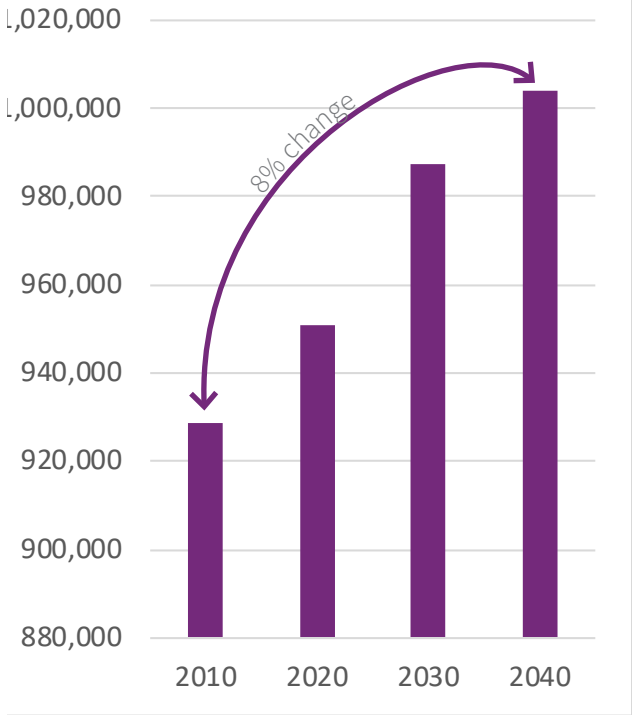
The ACS data showed the highest concentrations of minorities are found adjacent to the I-55 corridor in Memphis. The highest concentrations of people in poverty are found south of I-240 and east of I-55 and in downtown Memphis.

Figure 2-4. I-55 Corridor Stakeholder Priority Locations



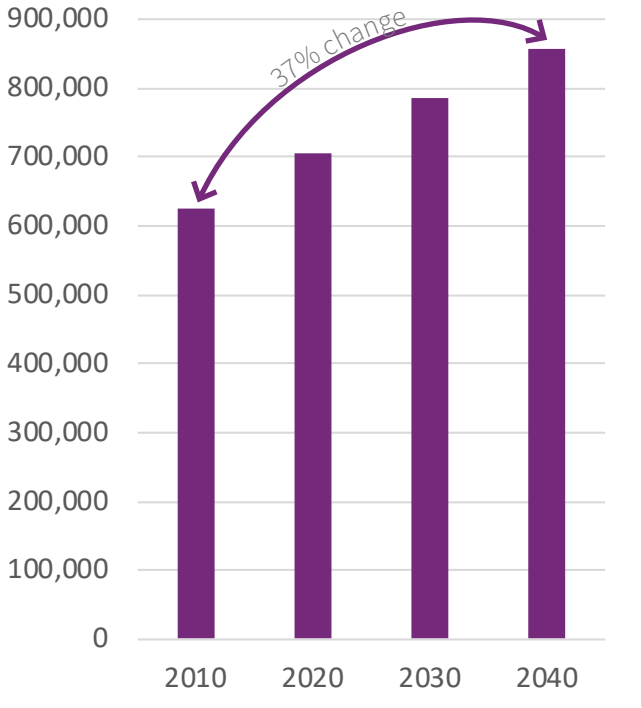
Source: TDOT Online Public Survey and I-55 Public Involvement Meeting (PIM)

Figure 3-1. County Growth Trends, Population — I-55



Source: Woods & Poole, Inc., 2018

Figure 3-2. County Growth Trends, Employment – I-55



Source: Woods & Poole, Inc., 2018

Land Use

Existing development patterns and in-progress plans will direct much of the forecasted population and employment growth over the next 20 years. Figure 3-5 and Table 3-1 show the distribution of land use within the Memphis city limits. Land use composition is fairly consistent with a large presence of residential and public/semi-pubic land. Due to the proximity of the Mississippi River and Nonconnah Creek (running alongside much of I-55), a significant portion of the land surrounding the corridor is located within the floodplain and is therefore vacant.

The City of Memphis recently updated its comprehensive plan, Memphis 3.0. This plan addresses existing land use conditions and lays the foundation for desired growth and development within the Memphis community. Future growth along the I-55 corridor is limited, with some residential and commercial development expected to occur in the far northern portion of the study area near downtown Memphis. In addition, Graceland is a major tourist attraction in the area, with future expansions in mind, and is primarily served by I-55. Due to historic disinvestment near the I-55 corridor, land in this area could be poised for redevelopment and growth, most of which would likely manifest in the warehousing, freight, and industrial employment sectors.

Table 3-1. Existing Land Use – I-55

Land Use Category	City of Memphis ~176 ,000 acres
Residential	35%
Commercial	6%
Industrial	3%
Public/Semi-Public	11%
Utilities/ Transportation/ Vacant	46%

Figure 3-3. I-55 Change in Population (2010 to 2040)

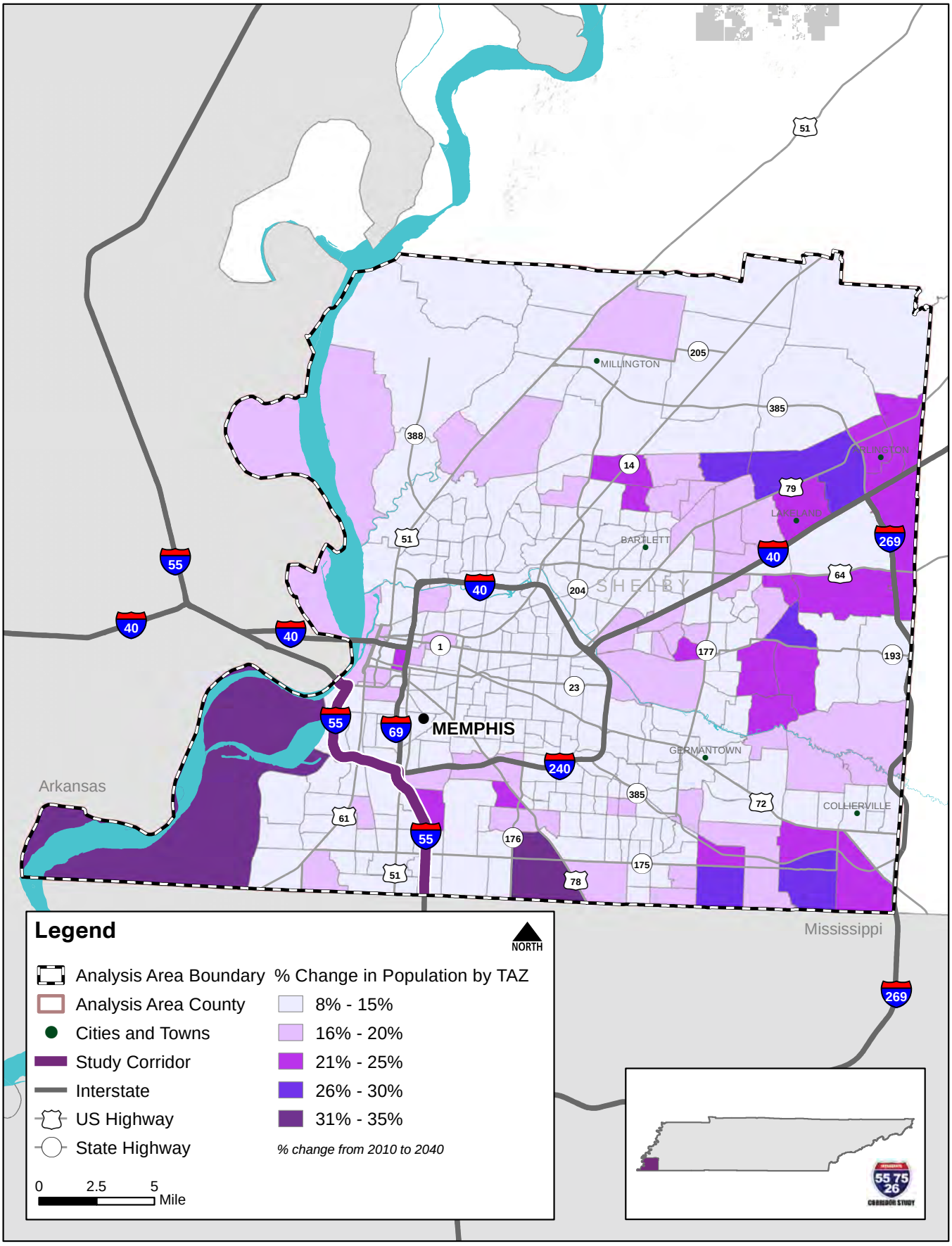


Figure 3-4. I-55 Change in Number of Jobs (2010 to 2040)

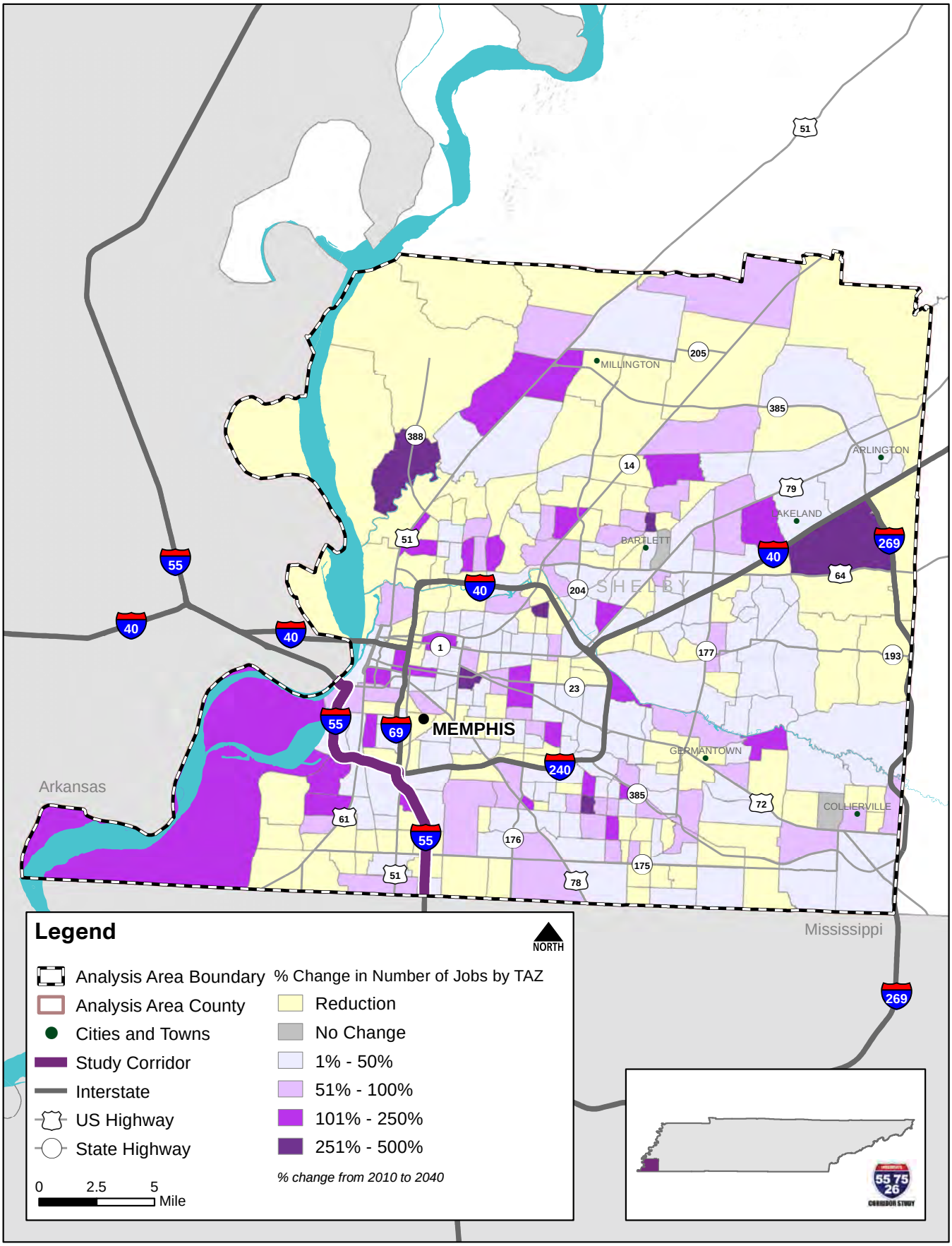
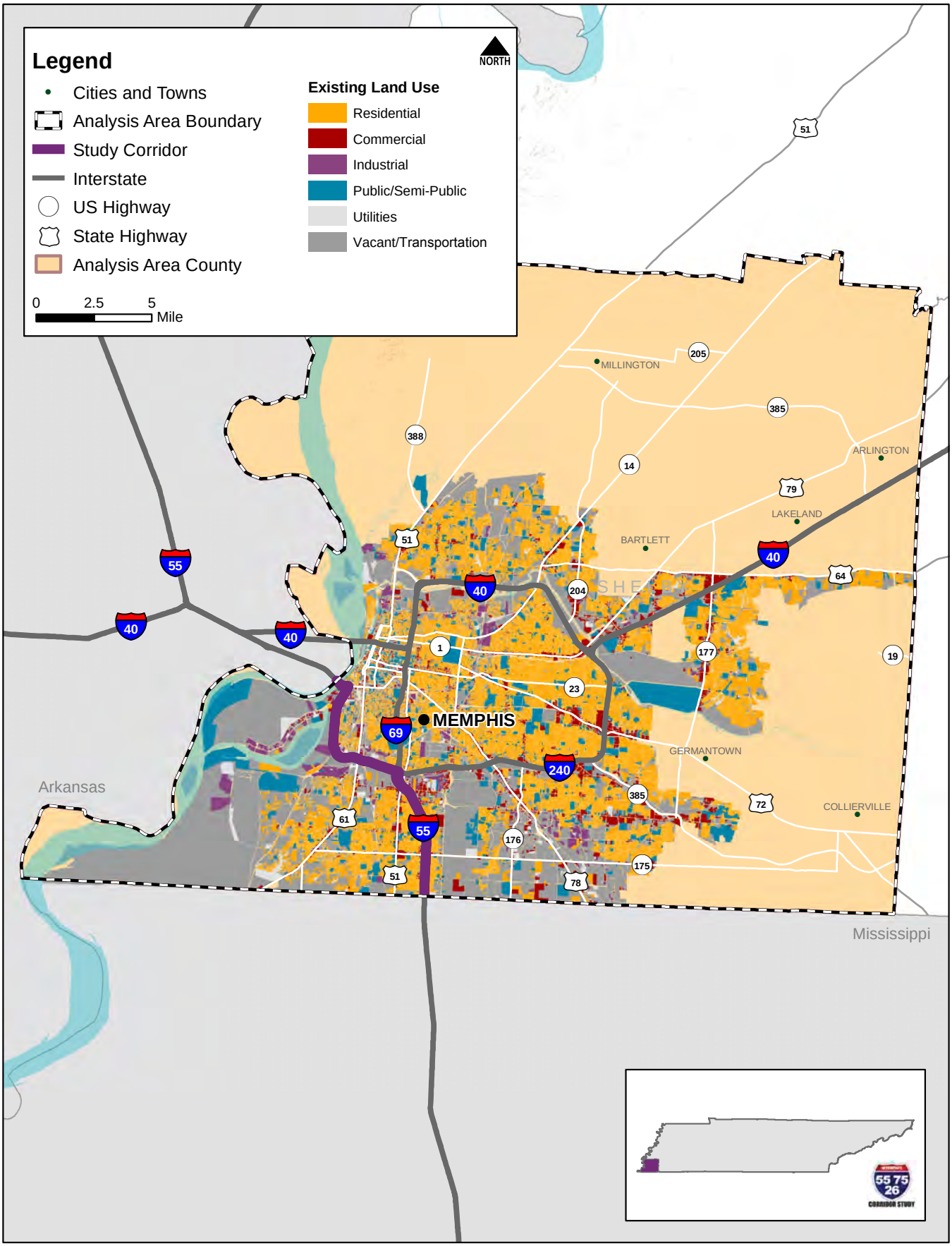


Figure 3-5. I-55 Existing Land Use



Traffic Operations

TDOT collects and maintains Annual Average Daily Traffic (AADT) volume data on roadways across the state. Figure 3-6 shows the 2017 AADT volumes recorded in the Tennessee Roadway Information Management System (TRIMS) at 12 count stations along I-55. As shown, daily volumes range from 83,590 vehicles per day (VPD) (16% trucks) near the Mississippi border, to 107,760 VPD (12% trucks) near the I-55/I-240/I-69 junction. Near the Arkansas border, volumes decrease to 53,180 VPD (49% trucks). The number of travel lanes varies from eight near the Mississippi state line to four near the Arkansas state line. For reference, the capacity of level four-lane, urban freeway facilities, similar to I-55, ranges from 79,200 VPD to 99,000 VPD. The capacity of a similiar eight-lane urban freeway facility ranges from 158,000 VPD to 198,000 VPD (Highway Capacity Manual 2010 Exhibit 10-8).

Table 3-2 is populated with data obtained from the TSM, which provides base year (2010) daily trip information and forecasts the daily trips that will be made in 2040 based on projected growth and land use changes.

As shown, total daily trips in Shelby County are expected to reach 6.3 million by 2040, representing a 19% increase over total trips in 2010.

Table 3-2. Area Daily Trip Breakdown 2010 and 2040 — I-55

	Daily Trips		
Trip Types	**2010**	**2040**	**% Change**
Personal Trips	5,066,100	5,955,900	18%
Truck Trips	238,000	360,400	51%
Total Trips	**5,304,100**	**6,316,300**	**19%**
Percent Truck Trips	4.5%	5.7%	

Source: Tennessee Statewide Travel Demand Model (TSM)

Volume-to-Capacity Ratios

Figure 3-8 illustrates the 2040 peak period volume-to-capacity (VC) ratios (obtained from the TSM) for each Interstate segment. Where the volume-to-capacity ratio is greater than 1.0, drivers experience poor operating conditions and high delay, represented as level-of-service (LOS) F (see Figure 3-7). As shown in Figure 3-8, south of I-240 and between US-61 and the Crump Boulevard interchange, congestion on I-55 is expected to increase such that motorists experience minimimal delay through 2040. The segments of I-55 between the Arkansas state line and the South Parkway interchange, as well as a segment west of the I-240 interchange, are anticipated to carry volumes that exceed the capacity of the roadway by 2040 resulting in LOS F. Note that the TSM model output reflects completion of the Crump Boulevard interchange modifications; which will improve safety and add capacity through the interchange. West of the interchange, however, future flows remain constrained by the four lanes provided on the Mississippi River bridge.

Figure 3-7. LOS Characteristics

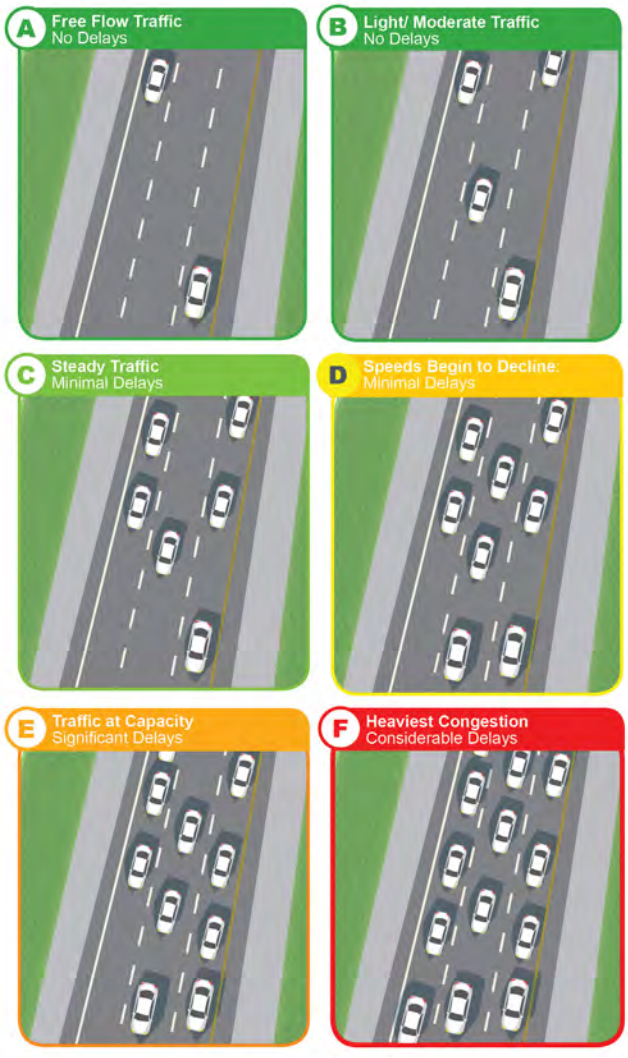


Figure 3-6. 2017 Average Annual Daily Traffic Volumes Along I-55

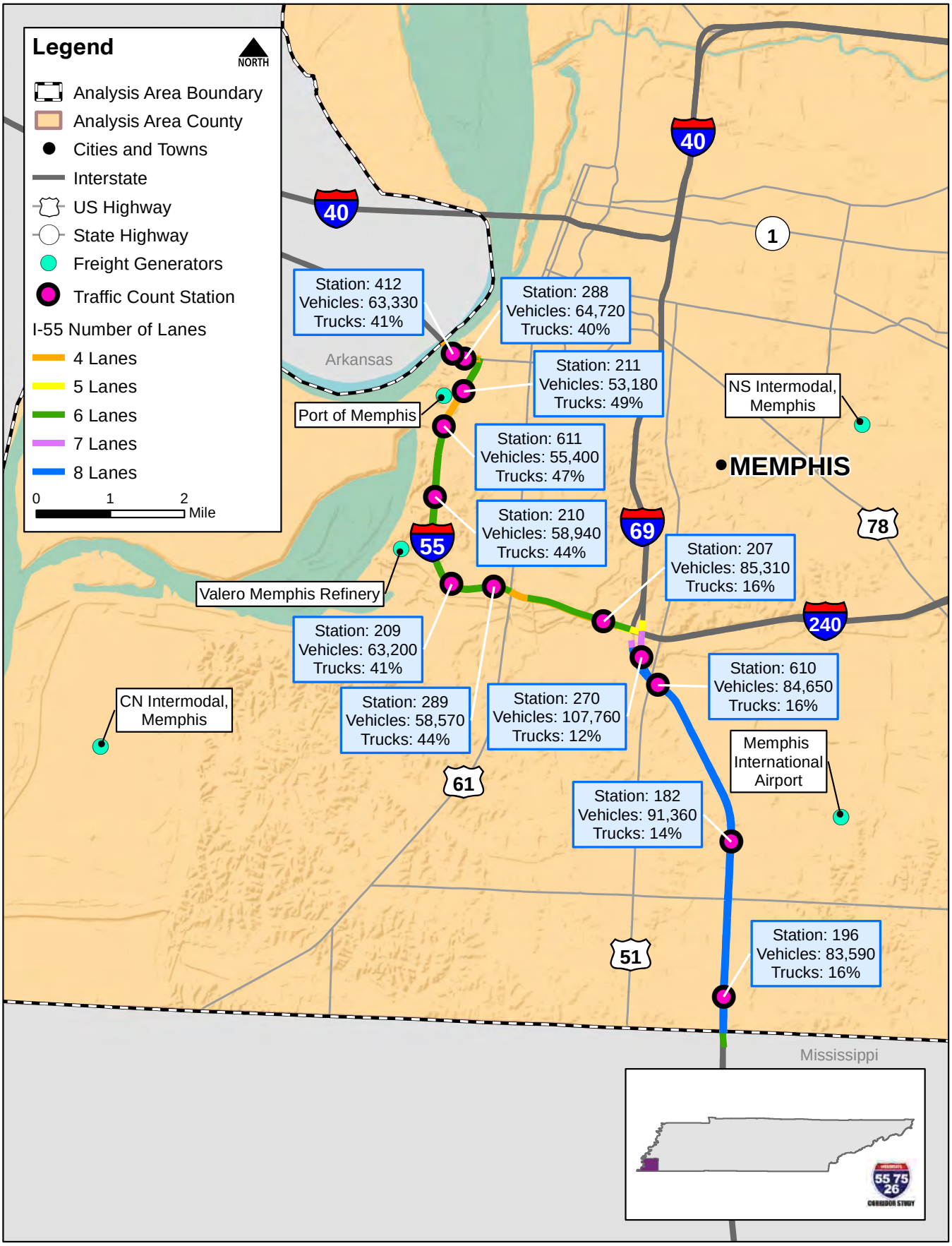
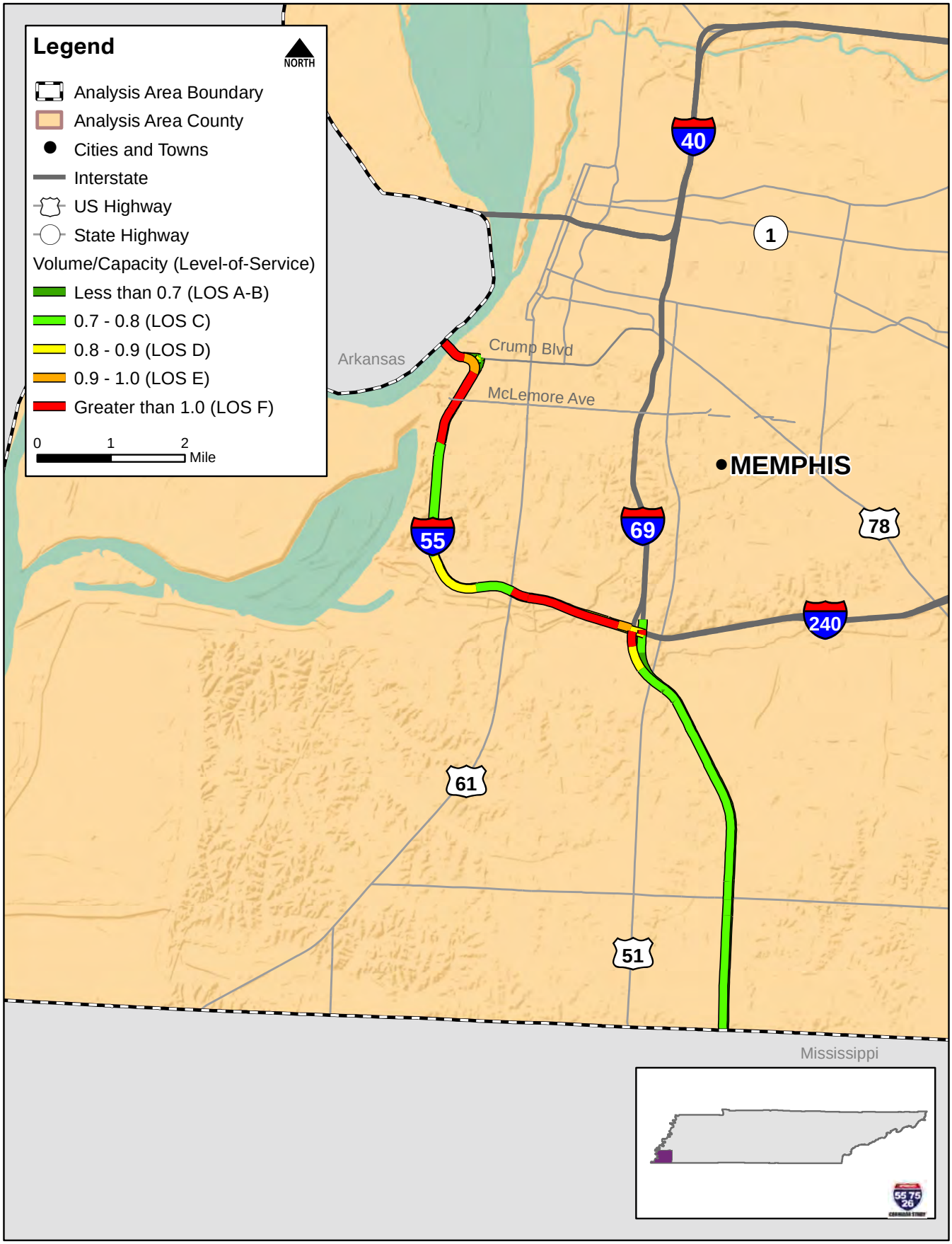


Figure 3-8. Volume-to-Capacity Ratios/Level-of-Service (2040) — I-55



Source: Tennessee Statewide Travel Demand Model (TSM)

Bottlenecks

Bottlenecks occur when the capacity or flow of a facility is suddenly restricted. This can be caused by geometric changes (lane reductions, merge/diverge areas, interchanges), changes in speed limit, or unexpected traffic incidents. TDOT's traffic management centers and HELP program work diligently to quickly address unexpected incidents; however, improvements to bottleneck areas created by geometric changes must be planned and programmed.

Two bottleneck locations were identified on the I-55 corridor. At both bottleneck locations, the PM volume-to-capacity ratio exceeds 1.0.

- Bottleneck #1 - Near the McLemore Interchange
  - Southbound I-55 drops from three lanes to two lanes at the southbound off-ramp to McLemore Avenue. The third lane is reintroduced approximately 1,400 feet south as the on-ramp from McLemore Avenue. The lane drop also occurs in the northbound direction between the McLemore Avenue ramps.
- Bottleneck #2 - 3rd Street Interchange
  - At this location approximately 45% of the I-55 traffic enters/exits from 3rd Street, resulting in sufficient capacity on I-55 through the interchange and to the north. The bottleneck areas occur south of the interchange as a result of a lane drop, near the northbound exit ramp to 3rd Street and south of the southbound on ramp from 3rd Street. Congestion at these locations is most likely due to weave and merge areas caused by high number of vehicles weaving to exit in the northbound direction and merging onto I-55 in the southbound direction. The effect of the weave/merge areas is amplified by the total volume on I-55 south of 3rd Street, which is approaching the capacity of a six-lane facility.

Transportation Systems Management & Operations (TSM&O)

ITS

Intelligent Transportation Systems (ITS) provide information which improves transportation safety, operations, and mobility. TDOT's ITS program, SmartWay, utilizes cameras and sensors to monitor interstate corridors throughout Tennessee.

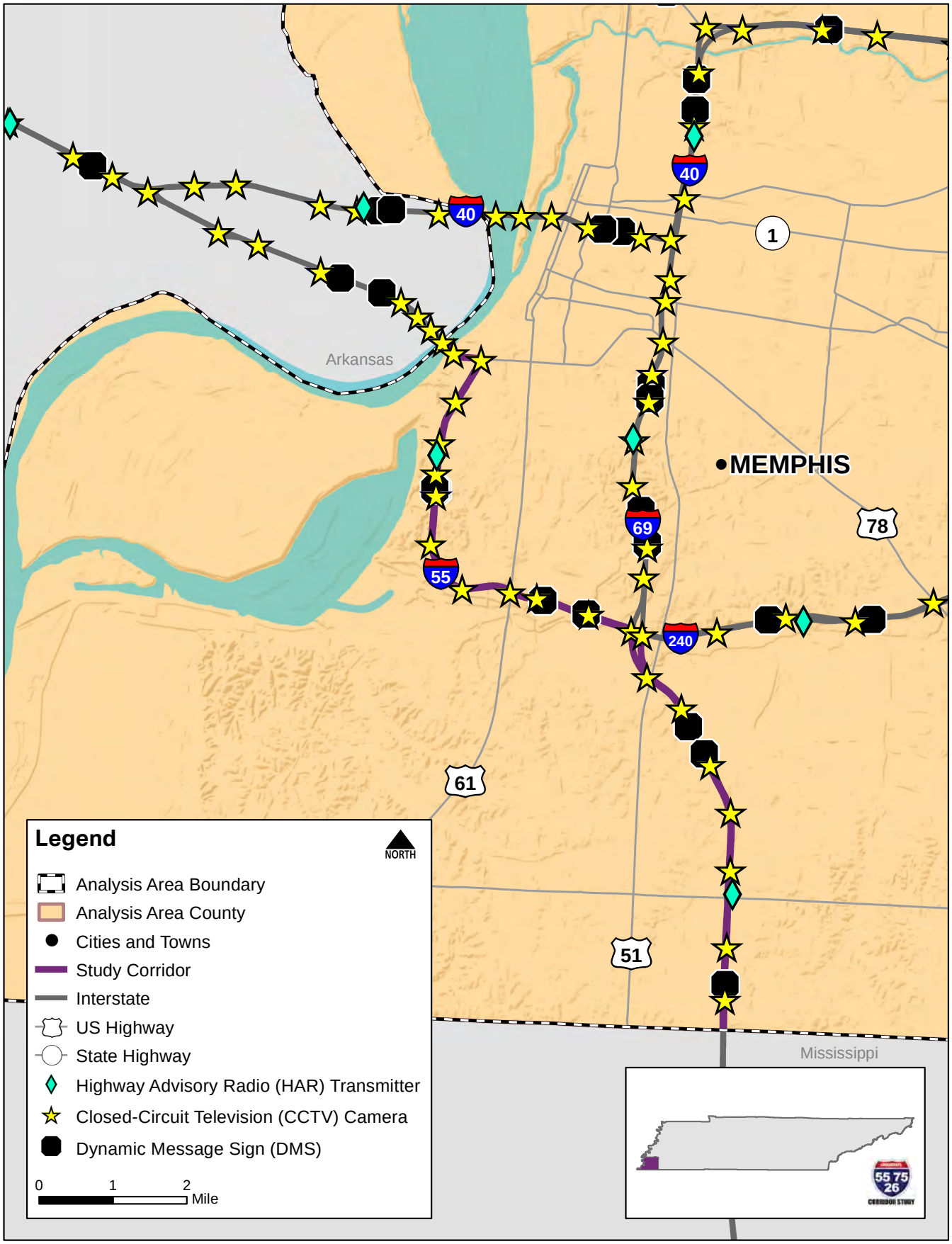
A detailed inventory and location map of existing ITS components in Shelby County are shown in Table 3-3 and Figure 3-9. In addition to planned ITS and transit projects shown in Figure 4-5 of Technical Memorandum 1, it should be noted that the Memphis MPO amended the Transportation Improvement Program (TIP) in August of 2018 to include an ITS expansion on SR-385 from Piperton to Germantown. The expansion is expected to add a power and communication network, Closed Circuit Televisoin (CCTV) cameras, Dynamic Message Signs (DMS) and a Radar Detection System (RDS) at a total cost of $4.0 million.

Table 3-3. ITS Resources – I-55

ITS Resource	Count
TMC Operators*	25
HELP Operators*	25
HELP Vehicles*	28
IT Technicians*	2
Closed Circuit Television (CCTV) Cameras	21
Speed Detectors	23
Dynamic Message Signs (DMS)	7
HIghway Advisory Radio (HAR) Transmitters	3
HAR Signs w/Beacons	7

*Applies to entire Memphis area, not just I-55

Figure 3-9. Intelligent Transportation System Components — I-55



Source: Tennessee Department of Transportation

Traffic Incident Management

Responding to traffic incidents in an effective and timely manner reduces congestion, wasted fuel, and the likelihood of secondary crashes. The time it takes to respond to an incident and clear the roads is directly related to the likelihood of a secondary crash. This response time can be greatly reduced using ITS technologies, including monitored CCTV cameras, radar detectors to determine travel speeds, and DMS to direct/notify drivers. The highly coordinated incident management process requires accurate and efficient communication among numerous agencies.

In addition to TDOT's HELP program, which has been incorporating the latest ITS technologies and strategies since its inception in 1999, TDOT has also established specific, regional Interstate incident management plans focusing on major incidents (those that will require total roadway closure for at least two hours). Goals of these living plans include decreased response time and planned detour routes with appropriate signing so that motorists experience minimal delay in moving toward their destinations. The plans also detail work zone traffic control and point to the regional transportation management centers as the "home base" of coordination and communication during an event. The plans are distributed to regional TDOT Maintenance and Incident Management staff so that the defined detour routes can be implemented quickly upon confirmation of an incident. The Region 4 incident management plan notes that for incidents on I-55, detours will be coordinated with the City of Memphis. Traffic can be diverted a much shorter distance by using city streets, however city approval must be received before this can be done. Detouring traffic on I-55 is handled by the Memphis Police Department.

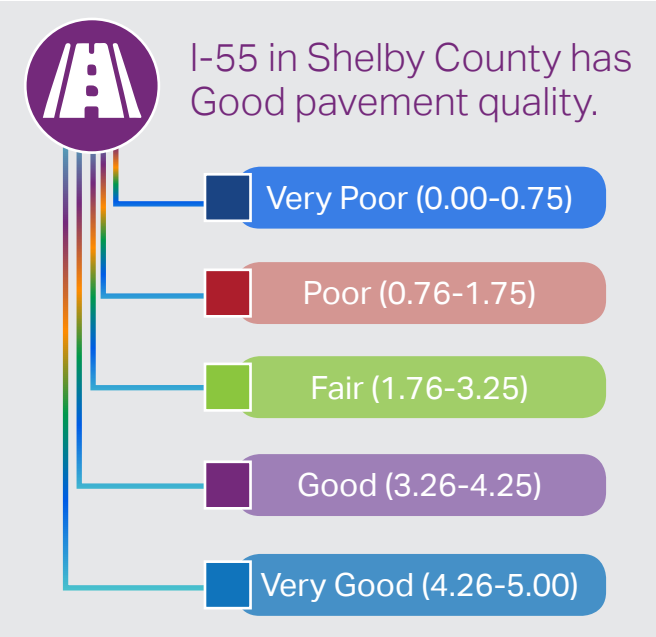
System Maintenance

Pavement

TDOT collects and maintains pavement management data for all roads included in the state's network. The Pavement Quality Index (PQI), expressed on a scale from 0-5, is the overall measure of a pavement's roughness and distress. The PQI is calculated based on both the Pavement Distress Index and the Pavement Smoothness Index, the latter of which is a function of the International Roughness Index (IRI). The IRI measures the number of vertical deviations over a section of road, and has been used as a performance measure toward goals set by the Federal Highway Administration (FHWA) since 1998. As of 2006, FHWA designated an IRI equal to 95 inches/ mile or less to be representative of a road with good ride quality.

Eighty-one percent of the roadway miles on I-55 in Shelby County have an IRI equal to or less than 95 inches/mile indicating "Good" ride quality, with a PQI of 4.068. TRIMS maintenance history (as of 2017), illustrated in Figure 3-11, indicates that segment of I-55 from Horn Lake Road (L.M. 8.05) to the Mississippi River (L.M. 12.11) should be considered next for resurfacing.

Figure 3-10. Pavement Quality Index

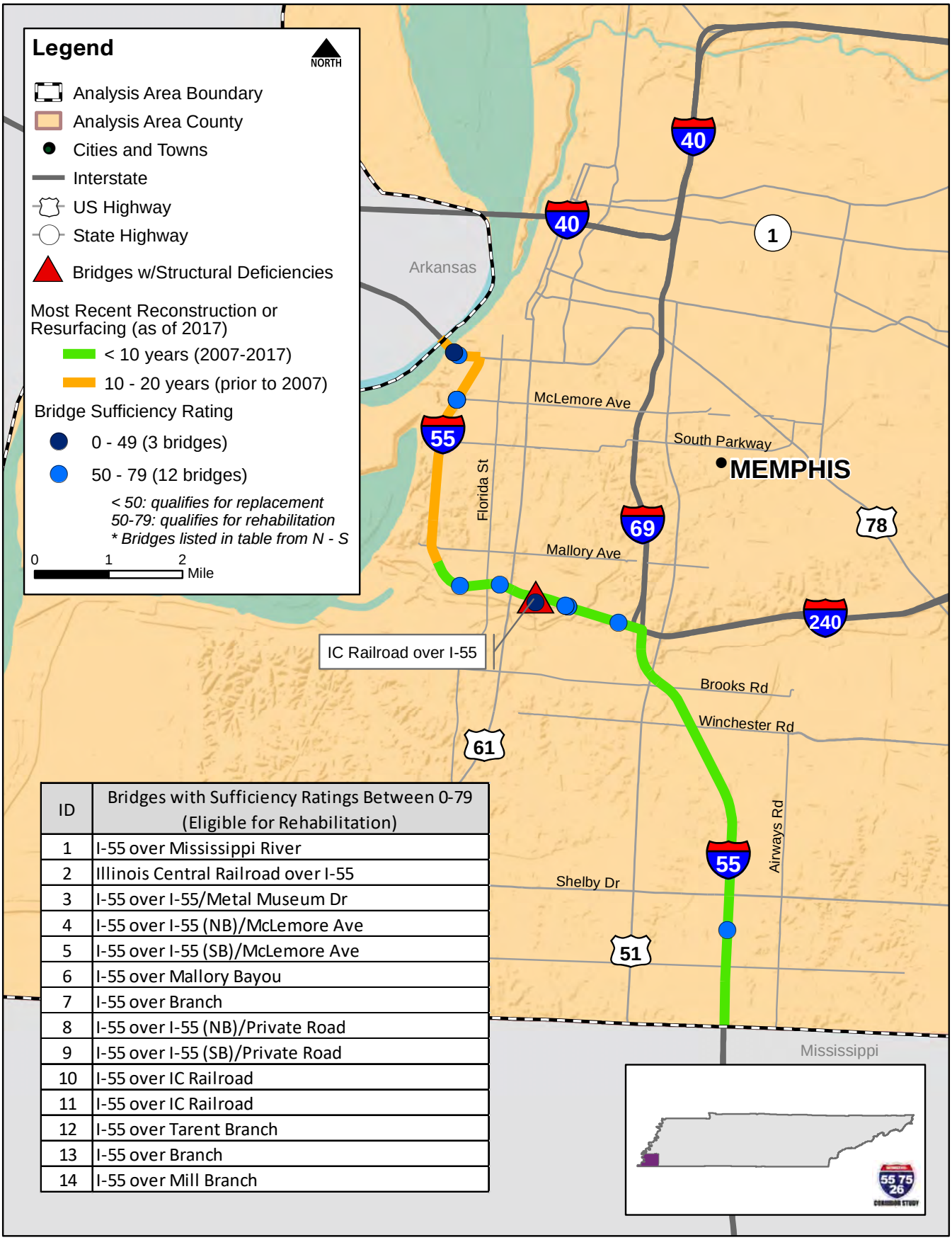


Bridge Conditions

TDOT routinely inspects and evaluates the 19,822 structures designated as public highway bridges in the state. These include bridges owned and maintained by TDOT, as well as those owned and maintained by local governments. TDOT designates a bridge as "structurally deficient" if one or more major structural components are rated in poor condition, or if its load carrying capacity is well below current design standards. Via the Better Bridge Program, the state addressed deficiencies on 193 of the 200 structurally deficient state-owned bridges in 2013. As shown in Figure 3-11, the Illinois Central Railroad bridges over I-55 are designated as structurally deficient.

The Federal Highway Administration's Highway Bridge Replacement and Rehabilitation Program provides funds to assist states in replacing or rehabilitating deficient highway bridges located on any public road. To be eligible, a bridge must carry highway traffic, be deficient, and have a sufficiency rating of 80 or less. The sufficiency rating of an individual bridge, on a scale of 0 to 100, is based on structural adequacy and safety, serviceability and functional obsolescence, and essentiality for public use. A rating of 0 is the worst possible bridge. A sufficiency rating that is less than 50 is eligible for replacement and a sufficiency rating of less than 80 but greater than 50 is eligible for rehabilitation.

Figure 3-11. Recent Reconstruction/Resurfacing, Bridge Sufficiency Ratings — I-55



ID	Bridges with Sufficiency Ratings Between 0-79 (Eligible for Rehabilitation)
1	I-55 over Mississippi River
2	Illinois Central Railroad over I-55
3	I-55 over I-55/Metal Museum Dr
4	I-55 over I-55 (NB)/McLemore Ave
5	I-55 over I-55 (SB)/McLemore Ave
6	I-55 over Mallory Bayou
7	I-55 over Branch
8	I-55 over I-55 (NB)/Private Road
9	I-55 over I-55 (SB)/Private Road
10	I-55 over IC Railroad
11	I-55 over IC Railroad
12	I-55 over Tarent Branch
13	I-55 over Branch
14	I-55 over Mill Branch

Source: Tennessee Roadway Information Management System (TRIMS) - 2017

Of the 31 bridges on I-55 in the study area, there are three bridges with a sufficiency rating of less than 50. The Mississippi River Bridge, with a rating of 48, is a candidate for replacement under this program. The previously mentioned Illinois Central Railroad bridges over I-55 are the other candidates. There are 12 bridges with ratings between 50 and 80 and the remaining 17 bridges have sufficiency ratings greater than 80.

Multimodal Facilities

Public Transportation

The I-55 study area is served by the Memphis Area Transit Authority (MATA). MATA offers fixed bus service across Shelby County as well as several trolley routes in downtown Memphis. Despite substantial transit coverage, MATA has seen a continual decrease in ridership over the last several years[1]. As part of the Memphis 3.0 comprehensive plan, MATA's existing network was evaluated and recommendations were made for transit improvement throughout the greater Memphis region.

Figure 3-12 shows MATA's routes and areas of high employment concentration. While MATA provides good coverage to the City of Memphis, regional connections are missing, especially to eastern suburbs with high employment concentrations.

MATA currently offers over 40 fixed bus routes throughout Shelby County, three fixed trolley routes serving downtown Memphis and MATAplus, an on-demand paratransit service. Existing bus routes connect with the Memphis Amtrak station and the Memphis International Airport. However, airport connections often require a transfer to the airport shuttle causing excessive layovers for users. Currently over 500,000 residents in Shelby County have access to transit within ½ mile of their residence[2]. Unfortunately, most of the transit that is accessible to residents has long headways of 30 minutes or more and limited service on nights and weekends. There are also limited north-south connections. While a few bus routes offer limited stop services, no true commuter routes exist[3]. Of the 11 routes identified as being in close proximity to I-55, only one, Route 280, is a limited stop service route.

The greater Memphis region includes parts of northern Mississippi and eastern Arkansas that are not serviced by MATA. Employees who live outside of Shelby County do not have transit options to get to and from work and other important services located in Shelby County.

According to 2015 U.S. Census Bureau data, 47% of employees living in DeSoto County, Mississippi are employed in Shelby County.

Pedestrian/Bicycle

In order to serve all transportation users, bicycle and pedestrian infrastructure is necessary in many locations, especially along transit corridors, at transit stops, in dense neighborhoods and in downtown areas. The I-55 corridor is surrounded by bicycle and pedestrian infrastructure as it falls within the City of Memphis. While Shelby County is a dense environment with bicycle and pedestrian infrastructure, there are gaps in coverage. Existing infrastructure is often designed to minimum design standards or is segmented by an Interstate facility. Most existing bicycle and pedestrian facilities are supported locally or regionally, however, some state-wide bicycle routes are in development through TDOT.

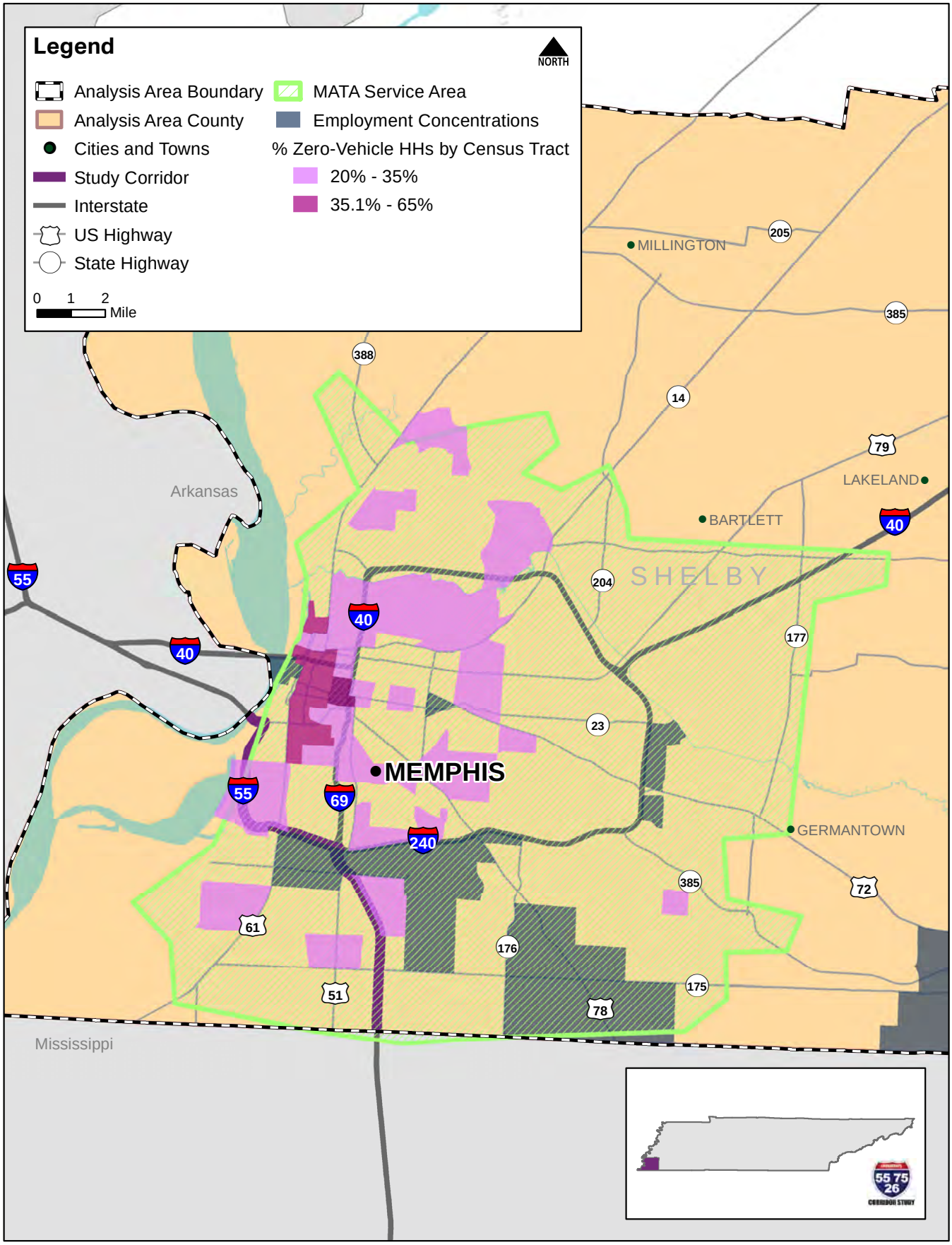
Unless planned for ahead of time, geometric limitations created by Interstate structures often result in discontinuous pedestrian and bicycle accommodations on cross-streets through an interchange. Where bicycle lanes and sidewalk may be present on either side of the Interstate, the cross-section through the interchange may be limited to only vehicular traffic, which discourages multi-modal connectivity. Furthermore, ramp intersections often create bicycle lanes and sidewalk paths that are difficult to navigate, and in some cases unsafe. As shown in Figure 3-13 and Table 3-4, I-55 interchanges with U.S. and state routes were evaluated to assess connectivity for pedestrians and bicyclists across the Interstate. Where pedestrian and bicycle accommodations existed on the cross-street, free-flow right turns at ramp interchanges were also noted. While free-flow right turns have operational benefits, the movement allows vehicles to maintain higher rates of speed off the ramp and through the intersection, putting pedestrians and bicyclists at a disadvantage. Motorists traveling at higher speeds are less likely to yield to pedestrians and higher intersecting speeds are more difficult for bicyclists to judge and manoeuvre. AADT on the cross-roads was also noted as higher traffic volumes limit mobility for pedestrians and bicyclists.

Noteworthy are the interchanges of I-55 with SR-175 (Shelby Drive) and with SR-3/US-51 (Elvis Presley Boulevard).

- On SR-175, the existing sidewalk and crosswalk at the northbound off-ramp leads pedestrians to the off-ramp shoulder where they must walk 20 to 25 feet before accessing a set of steps leading to sidewalk on an adjacent frontage road. No bicycle accommodations exist at this interchange.

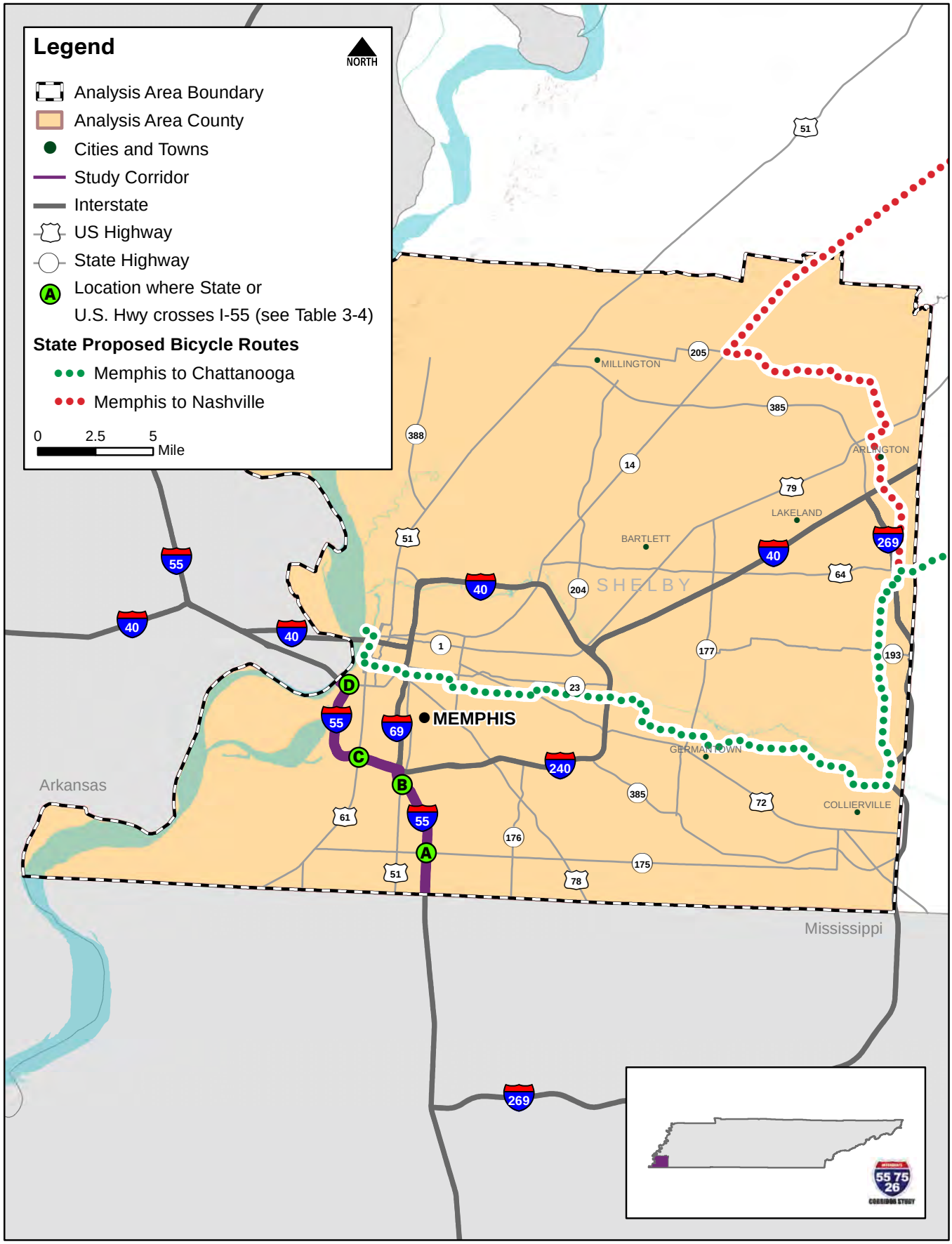
1- American Public Transit Association. Access 3/6/2019. https://www.apta.com/resources/statistics/Documents/Ridership/2018-Q2-Ridership-APTA.pdf
2- Memphis 3.0 Transit Vision. Access 3/6/2019. https://docs.wixstatic.com/ugd/100a0d_67ea22e3bc5147a6889a754d8da14b9f.pdf
3- Memphis 3.0 Transit Vision. Access 3/6/2019. https://docs.wixstatic.com/ugd/100a0d_67ea22e3bc5147a6889a754d8da14b9f.pdf

Figure 3-12. Zero-Vehicle Households and Transit Service — I-55



Source: U.S. Census Bureau, Memphis Area Transit Authority

Figure 3-13. Planned State Bicycle Routes and U.S./State Highway Crossings — I-55



Source: Tennessee Department of Transportation

Table 3-4. Locations Where a U.S. or State Highway Crosses I-55

Map Letter	State Route/ U.S. Hwy Crossings	Crossroad AADT (2018)	Bicycle Lane/ Multi-Use Path?	Paved Shoulder >2'?	Sidewalk?	Free-Flow Right with Bicycle/Ped Facilities?
A	SR-175 (Shelby Dr.)	41,900 (E)* 30,200 (W)**	No	No	Yes	Yes
B	SR-3/US-51 (Elvis Presley Blvd.)	34,000 (W)	No	No	Yes	Yes
C	SR-14/US-61 (3rd St.)	21,900 (E) 34,600 (W)	No	No	Yes (Discontinuous through NB on/ off ramps)	Yes
D	SR-1/US-70 (Crump Blvd.)	13,600 (N*** leg)	South and west legs of the interchange are Interstate facilities (no ped/ bicycle facilities allowed). Ped/Bicycles can cross north leg via Channel 3 Drive overpass, which provides sidewalk. Ped/Bicycles can cross south leg via independent pedestrian bridge. No ped/bicycle facilities provided for crossing east leg (Crump Blvd.)			

* East approach; ** West approach; ***North
Source: TDOT Traffic History website, Google Earth

- On SR-3/US-51, no bicycle accommodations are provided at this interchange. Sidewalk is provided; however, the existing sidewalk is discontinuous, leaving pedestrians stranded on SR-3, east of the southbound off-ramps. AADT volumes near these interchanges ranged from 30,000 to 41,900 vpd in 2018.

No bicycle accommodations are provided at these interchanges.

Passenger Air and Rail Services

The Memphis International Airport is located less than one mile east of the I-55 corridor. While access to the airport is available from I-55, the main airport connection is from I-240.

Memphis International Airport is the hub for FedEx Global and is the busiest cargo airport in the United States.

The Memphis International Airport is a large regional employment center with a major economic impact on the region. In 2015, the Memphis International Airport supported 83,199 jobs in the Memphis MSA (metropolitan statistical area).[2] The airport is served by many major airlines, including Air Canada, Frontier, Southwest airlines, and others. Memphis International Airport serves over 4 million passengers per year.[3]

The airport is also the hub for FedEx Global, making it the busiest cargo airport in the United States and the Western Hemisphere.[4] FedEx employs over 30,000 people at Memphis International Airport and has plans to expand its facilities.[5] In addition to FedEx being a major employer in the region, its operations generate considerable freight traffic in the area, including on I-55.

Figure 3-14. Airports — I-55

2-"The Economic Impact of Memphis International Airport". 2017. Accessed 05-18-20. https://www.flymemphis.com/Areas/Admin/Images/Upload_20181912092527.pdf
3- http://www.flymemphis.com/Areas/Admin/Images/Upload_2018025103908.pdf
4-"FedEx keeps Memphis airport No. 2 in world ranking despite flat growth in 2017". Commercial Appeal. Accessed 12-13-2018. https://www.commercialappeal.com/story/money/industries/logistics/2018/04/19/fedex-keeps-memphis-airport-no-2-world-ranking-despite-flat-growth-2017/532815002/
5-"The Economic Impact of Memphis International Airport". 2005. Accessed 12-14-2018. http://www.flymemphis.com/Areas/Admin/Images/FinancialReports/EcImpactFinal.pdf

Currently, no fixed rail transit services exist within the I-55 study area; however, Amtrak services to New Orleans and Chicago run near the corridor. An Amtrak train station is located on South Main Street, near the I-55 and Crump Boulevard interchange. The Amtrak station was renovated in the 1990s and contains commercial and residential uses in addition to transportation. The Amtrak station serves Memphis residents as well as the greater southwestern Tennessee region, as only a few Amtrak stations exist in Tennessee. Other Tennessee Amtrack stations are located in Newbern and Nashville.

Transportation Demand Management

Transportation Demand Management (TDM) is a set of strategies that influence travel behavior to reduce single-occupancy vehicle travel. Ranging from ridesharing, bicycling, teleworking, taking transit, car sharing and on-demand or real-time applications, TDM strategies redistribute commuter travel across a variety of alternatives and away from daily peak periods. TDM programs represent a flexible, low-cost way to engage residents, travelers, businesses and local governments in the effort to reduce commuter travel and associated costs and impacts on the community including traffic congestion and emissions. The Statewide TDM Plan identified a number of ways regional TDM programs can support TDOT with managing mobility. They can also provide needed assistance on selected corridors when capacity is at a premium – especially during large construction projects. Within the Memphis area, two local partners are responsible for program implementation: Memphis Area Rideshare (MAR) and Commute Options.

MAR is the local TDM program run by the Shelby County Department of Health's Air Quality Improvement Division and is primarily funded with Congestion Mitigation and Air Quality (CMAQ) funds administered by TDOT's Long-Range Planning Division. The program offers vanpool service (through Commute with Enterprise) and an Emergency Ride Home (ERH) program that provide taxi vouchers to registered users of carpools, vanpools, bicycles, and transit. Currently, the vanpool program operates 49 vanpools within the Memphis area; resulting in an estimated reduction of over 345,000 vehicle-miles of travel per month. MAR also promotes transportation mobility options through frequent employer education and outreach activities.

Innovate Memphis is a non-profit think tank whose mission is to bring together public and private to "create strategies and collaborative opportunities, and seek ways to improve communities and neighborhoods throughout the city [Memphis]." One area of concentration is Transportation and Mobility, which houses the Commute Options program that serves as a clearinghouse for mobility options in and around the Memphis region. The Commute Options program includes regional branding and marketing materials that are used for distribution at community and employer-based activities and rely on the existing vanpool and ridematching services through Memphis Area Rideshare. Innovate Memphis is also working to include support strategies such as parking management and bicycle-sharing. Overall, Innovate Memphis allows partners to test ideas and concepts, tweak and customize them and set them up for success and then pass them to another organization to sustain, which means they could look to Memphis Area Rideshare for a program transition in the future.

HOV Lanes

HOV lanes are currently designated on I-55 in Memphis between the hours of 7:00 AM-9:00 AM (inbound) and 4:00 PM-6:00 PM (outbound). Since 2009, Tennessee has offered a Smart Pass program which allows owners of low-emissions and energy-efficient vehicles to apply for a decal that enables them to drive in the HOV lanes without the minimum occupancy requirement. As of January 2019, 4,236 vehicles were registered in the Smart Pass program, including 164 in Shelby County. According to a study prepared by Tennessee State University and Vanderbilt University in 2018, the violation rate for HOV lanes on I-55 is approaching 90%.

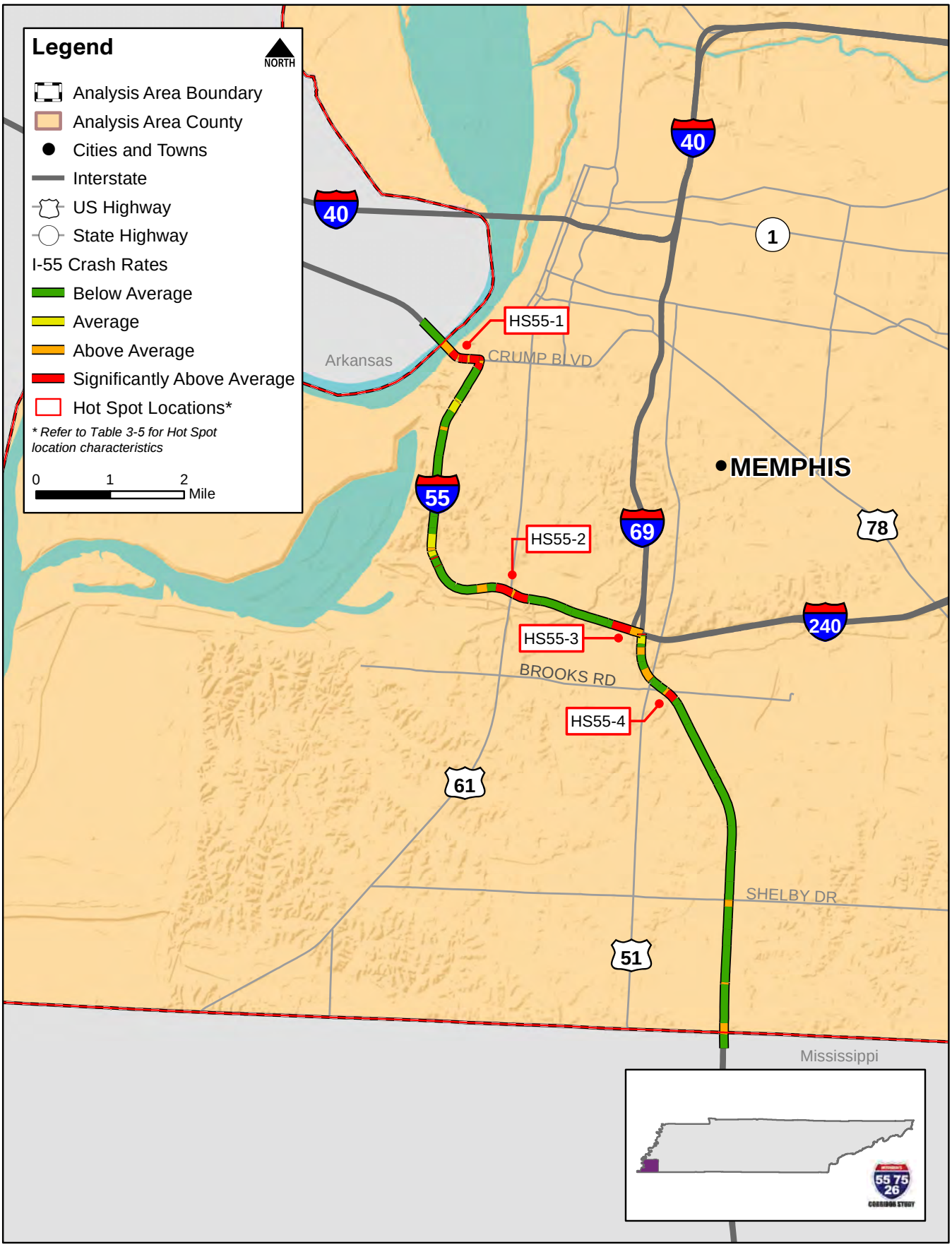
Safety

Increase traffic volumes and vehicle miles traveled increase the likelihood of traffic incidents. To identify trends in potential safety issues along the I-55 corridor, five-year (2014-2018) crash data was collected from TRIMS and evaluated.

Tennessee is working to reduce traffic fatalities as part of the nation's vision Toward Zero Deaths®. This vision is a highway system free of fatalities.

Using TDOT's traffic volumes collected in 2018, crash rates were also calculated. These rates are reported in terms of crashes per million vehicle miles traveled. Figure 3-15 shows the comparison of these rates to the statewide averages for facilities of a similar type. More specifically, the statewide average crash rate is 0.528 crashes per million vehicle miles traveled for rural freeways and 1.112 crashes per million vehicle miles for urban freeways. I-55 crash rates were compared to the Tennessee statewide averages based on the following metrics:

Figure 3-15. Crash Rates (2014-2018) — I-55



Source: Tennessee Statewide Travel Demand Model

- **Below Average**: Locations with crash rates below the statewide average
- **Average**: Locations with crash rates at or within 15 percent above the statewide average
- **Above Average**: Locations with crash rates between 15 and 100 percent above the statewide average
- **Significantly Above Average**: Locations with crash rates greater than or equal to 100 percent higher than the statewide average

Areas where the crash rates were significantly above statewide averages were identified as hot spots and are shown in Figure 3-15 in red. Hot spots crash records were examined to discern if patterns indicated deficiencies that could be addressed. Table 3-5 shows the results of this analysis. In general, each of the hot spots were examined for trends in severity,

Figure 3-16. I-55 Safety Snapshot

prevalent collision types, non-vehicular accident events, lighting/weather conditions, relation to ramps and interchanges, as well as horizontal and vertical curvature. From these trends, potential crash factors were identified for each location, which ultimately informed the development of safety project solutions.

While there was only a single pedestrian crash that actually occurred on the I-55 corridor, there were a number that occurred in close proximity to the corridor. Pedestrian and bicycle safety on streets that parallel and intersect I-55 impacts the effectiveness of the transportation system to provide travel options across the corridor. To determine the impact of I-55 on non-motorized safety in the study area, pedestrian and bicyclist crashes within 500 feet of I-55 ramps were analyzed for the five-year period spanning 2014-2018. In total, there were 14 non-motorized crashes, all of which were pedestrian crashes. Of these, three crashes resulted in a fatality and 11 crashes resulted in an injury or possible injury. Interestingly, the majority of these crashes occurred near the ramps for Brooks Road and Shelby Drive.

Freight

Freight movement is an important element of a regional and national economy, as more efficient modes and routes enable improved logistics and result in reduced transportation costs. These cost savings can then be reallocated to growth, providing better jobs and higher wages in the area. Freight movement is an important element of a regional and national economy, as more efficient modes and routes enable improved logistics and result in reduced transportation costs. These cost savings can then be reallocated to growth, providing better jobs and higher wages in the area. The existing and future freight flows in the region were analyzed using the most current available data and existing conditions.

The I-55 corridor area encompasses Memphis, TN and is the approximate midpoint along a larger corridor that connects the Chicago, IL and Great Lakes regions in the north to LaPlace, LA at the southern terminus. LaPlace is the location of the Port of South Louisiana and the largest grain port in the U.S[6]. Memphis is a hub for freight traffic, most notably as the headquarters of FedEx Corporation. In addition, the I-55 corridor is on the western edge of the "auto west corridor," along which automobile assembly and support services are expanding in the U.S. The region benefits from its proximity to Mexico's automobile manufacturing industry and the domestic auto production facilities along the I-75 and I-69 corridors[7]. The automobile industry is just-in-time and depends highly on trucking. Figure 3-17 shows the expected growth in truck volume throughout the corridor. Steady growth in truck volumes are anticipated on I-55 and adjacent routes.

The I-55 corridor also boasts easy access to water, rail, and air modes. Truck is the predominant mode both in 2016 and in 2045 for the inbound and outbound directions. Air and rail freight make up a negligible portion of freight traffic, and water represents a small but measurable share of the total. Tonnage by all modes is projected to grow. Inbound and outbound truck tonnages are estimated to grow by 1.7 and 1.6 percent, respectively, year over year. Truck value is projected to grow faster than tonnage in both directions.

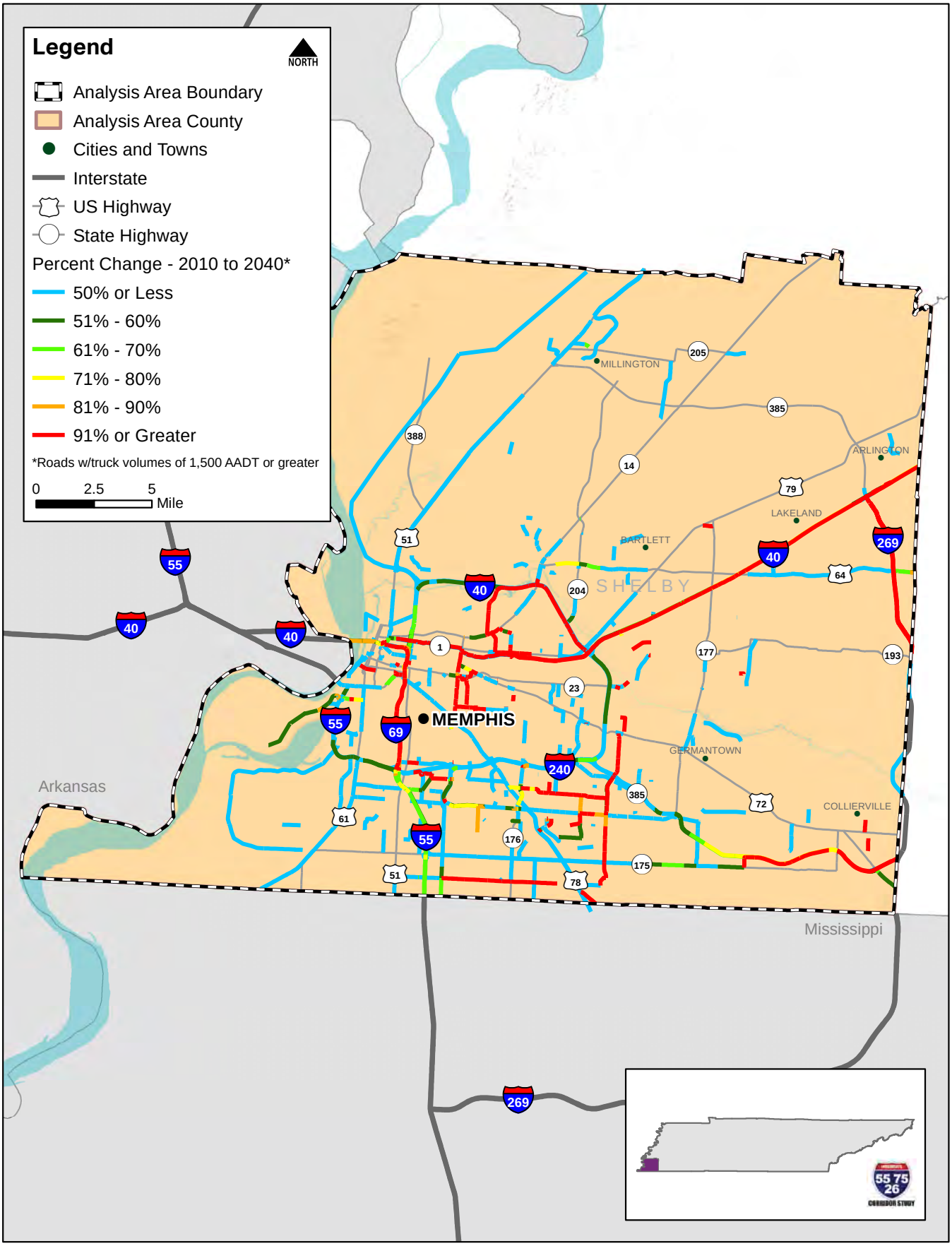
6- Port of South Louisiana, Facts at a Glance, http://portsl.com/facts-at-a-glance/
7- Cuneo et al, Area Development, "The Changing Geography of the American Auto Industry," 2014, https://www.areadevelopment.com/Automotive/Advanced-Industries-2014/changing-geography-of-american-auto-industry-2552541.shtml

Table 3-5. Hot-Spot Crash Location Characteristics – I-55

	Hot Spot ID			
	HS55-1	**HS55-2**	**HS55-3**	**HS55-4**
Termini	Mississippi River Bridge to Crump Boulevard Interchange	South 3rd Street	I-240/ I-55 Southbound	Brooks Road
Number of Crashes	328	238	283	78
Severity (Fatal or Injuries)	16% (52)	21% (50)	22% (63)	14% (11)
Prevelant Collision Types	20% (67) Angle 20% (35) Non-Vehicle 33% (109) Rear-End 55% (85) Sideswipe	18% (44) Angle 48% (115) Non-Vehicle 16% (39) Rear-End 16% (38) Sideswipe	17% (47) Angle 30% (86) Non-Vehicle 28% (78) Rear-End 23% (65) Sideswipe	19% (15) Angle 50% (39) Non-Vehicle 22% (17) Rear-End
Non-Vehicle Trends	35% (23) Roadway Barrier	49% (56) Roadway Barrier 18% (21) Utility Poles/ Signs/Posts	48% (41) Roadway Barrier	69% (27) Roadway Barrier
Lighting/ Weather	3% (9) in Dark-Unlit Conditions 11% (37) in Rain/Snow	5% (12) in Dark-Unlit Conditions 35% (84) in Rain/Snow	1%(4) in Dark-Unlit Conditions 21% (59) in Rain/Snow	3% (2) in Dark-Unlit Conditions 50% (39) in Rain/Snow
Interchange Related	42% (138)	34% (80)	42% (118)	19% (15)
Curvature Issues	Data Unavailable	Data Unavailable	Data Unavailable	Data Unavailable
Potential Crash Factors	• Inadequate signing for I-55 movements • Prevalent weaving issues and short merge/diverge area • High access point density	• Short merge/ acceleration lanes • Small radii for ramps potentially prevent adequate acceleration time/ distance	• Inadequate signing for I-55/I-240 movements • Short merge/ acceleration lanes on I-55 SB before Exit-Only lane for Brooks Road • Small radii and grade separation of ramps potentially prevent adequate acceleration time/ distance from I-240 to I-55	• Inadequate drainage in rain events

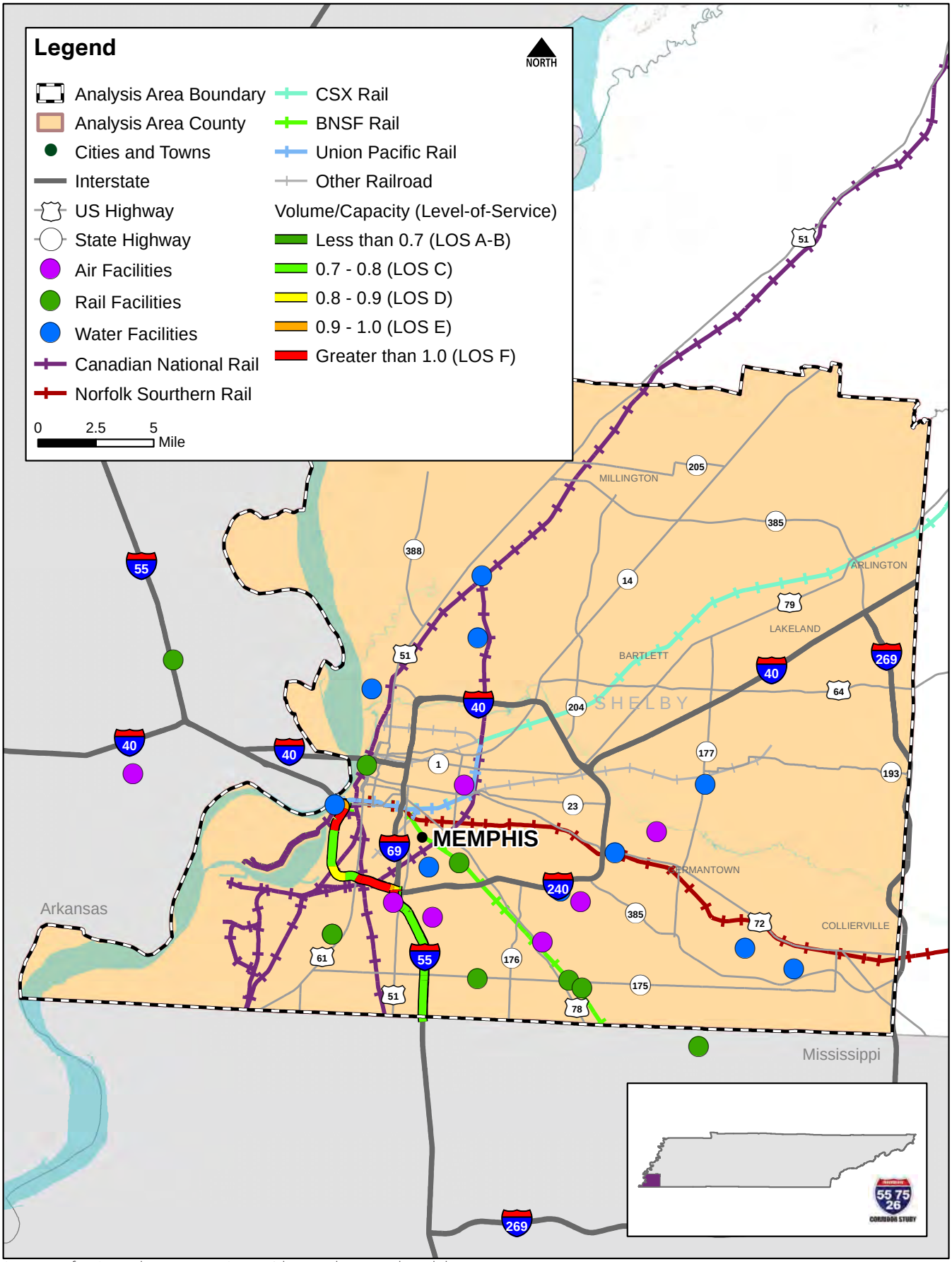
Source: Tennessee Roadway Information Management System (TRIMS) - 2017

Figure 3-17. Growth in Truck Volume from 2010 to 2040 — I-55



Source: Tennessee Statewide Travel Demand Model

Figure 3-18. Freight Facilities — I-55



Source: InfoUSA and Tennessee Statewide Travel Demand Model

A. Lamar Avenue: Lamar Avenue in Memphis is a bottleneck for freight traffic in the region. Adjacent to the BNSF intermodal yard and the Memphis International Airport, truck traffic is a constant issue for the City of Memphis and the study area. The June 2011 Lamar Avenue Corridor Study found that the greatest benefit would be through adding lanes at a cost of $89.1 million. Intersection upgrades would also be necessary and could be implemented in a shorter timeframe. Signal optimization is currently used in the corridor to manage traffic flow, but the projected growth in truck traffic and cargo shipments by both air and rail will continue to exacerbate the congestion in this corridor[8].

B. Mississippi River Bridges: The Tennessee Statewide Multimodal Freight Plan (2018) notes the I-55 Mississippi River bridge (as well as the I-40 Mississippi River Bridge) was not built to withstand earthquakes. With the nearest Interstate crossing 60 miles away near Helena-West Helena, Arkansas, an earthquake resulting in the loss of the bridges would result in economic costs to the region and nation estimated at $4.2 to $4.3 billion. The cost of constructing another bridge that would accommodate vehicles and rail traffic is a high priority project in the state, but is estimated to cost over $1 billion[9].

C. Bottleneck Locations: The Tennessee Freight Plan also lists one potential bottleneck location on the I-55 corridor. The bottleneck is from north of West McLemore Avenue to the Arkansas State Line. The bottleneck involves an interchange with Crump Boulevard near downtown Memphis.

D. Truck Parking: Truck parking is a critical component of supply chain operations. Hours of service rules state that drivers must stop after 14 hours; therefore, it is important that drivers are offered a selection of locations throughout their journey where they can rest and possibly eat, shower, or sleep overnight. Without proper rest, drivers risk fines and crashes, jeopardizing the safety of all road users. Drivers often spend the last hour of their driving time looking for a place to park. In the absence of available truck parking, trucks often stop on highway on- and off-ramps, which is both unsafe and illegal. As of 2015, Tennessee had one of the lowest rates of commercial vehicle truck parking spaces per 100,000 miles of combination truck vehicles miles of travel (VMT) in the nation, at less than 60.[10]

The website www.truckstopguide.com lists four truck stops along I-55 in Tennessee; only two provide overnight parking and all four have a combined 88 parking spots. The Shelby County I-55 Northbound Welcome Center has 13 truck parking spots. Other nearby welcome centers include the Tennessee Welcome Center on I-40 (6 spots), the Arkansas Welcome Center on I-55 directly across the Mississippi River (8 spots), and the Mississippi Welcome Center on I-55 southbound approximately 13 miles south of the Tennessee/Mississippi state line (12 spots), but none of these are directly on the I-55 corridor within Tennessee.

Is is also noteworthy that all parking spaces at Tennessee Welcome Centers and rest areas have a maximum 2 hour parking limit. No overnight parking is allowed. Although the I-55 corridor is only 13 miles long, the existing truck parking locations are not sufficient given the high volume of truck traffic. According to the FHWA *Model Development for National Assessment of Commercial Vehicle Parking*[11], this segment of I-55 should have 50 rest area parking spots and 168 truck stop parking spots. Overall, the area should have over 100 more parking spaces than what is currently available. Truck parking within the city center is more expensive than similar parking outside the city due to land costs; however, that cost can be justified if parking near truck origins/destinations can reduce truck traffic entering the city during peak morning rush hour.

Deficiencies Summary

As detailed in the previous subsections, this study identified and evaluated existing and forecast transportation deficiencies in the I-55 corridor based on extensive plans review, data analysis, and stakeholder outreach. The identified deficiencies are summarized, by mode or strategy, in Table 3-6. In addition to the location and description of each deficiency, Table 3-6 shows the source by which each deficiency was identified.

8- Tennessee Department of Transportation, Tennessee Statewide Multimodal Freight Plan, 2018, https://www.tn.gov/content/dam/tn/tdot/long-range-planning/TDOT_FreightPlan_02.27.18.pdf
9- Ibid.
10- https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/jasons_law/truckparkingsurvey/ch2.htm
11- https://www.fhwa.dot.gov/publications/research/safety/01159/3.cfm

Table 3-6. Deficiencies Summary — I-55

Mode/ Strategy	Location	Issue/Deficiency	Source
Highway Capacity	Crump Blvd Interchange	Current geometry leads to severe safety issues & congestion	Public/Stakeholder
	I-240 Interchange	Heavy traffic & congestion	Public/Stakeholder
	I-55 Bridge over the MS River	Volume exceeds capacity by 2040	Data Analysis
	McLemore Avenue Interchange	Volume exceeds capacity through interchange (lane drop)	Data Analysis
	US-61 (3rd St) to I-240	Volume exceeds capacity; weave/merge areas	Data Analysis
Safety	MS River Bridge to Crump Blvd	Inadequate signage; weaving and short merge/diverge areas; high access point density	Data Analysis
	US-61 (3rd St) interchange	Short merge/acceleration lane; small radii for ramps impact acceleration time/distance	Data Analysis
	I-240 Interchange (SB I-55 ramps)	Inadequate signage; short merge/acceleration lanes; small radii and grade separation of ramps impact acceleration time from I-240 to I-55	Data Analysis; Public/ Stakeholder
	Brooks Rd Interchange	Inadequate drainage in gore area during rain events	Data Analysis; Public/ Stakeholder
	Throughout Corridor	Pavement needs resurfacing	Public/Stakeholder
TSM&O	I-240 to MS State Line	High HOV violation rate	Data Analysis
	WB Approach to MS River Bridge	Over-dimensional vehicles approach bridge, can't fit and have to turn around. Blocks traffic.	Public/Stakeholder
	Throughout Corridor	Need for corridor management assets (ITS/DMS)	Public/Stakeholder
Freight	McLemore Ave to Crump Blvd	Potential freight bottleneck	Tennessee Freight Plan
	Illinois Central Bridge Over I-55	Structurally deficient	Data Analysis
	MS River Bridge	Eligible for replacement based on sufficiency rating; not built to withstand earthquakes	Data Analysis / Tennessee Freight Plan
	Lamar Avenue	Freight bottleneck	Tennessee Freight Plan
	Throughout Corridor	Truck stop parking needed to accommodate hours of service	Data Analysis
	Holmes Road	Need for new interchange	Tennessee Freight Plan, Regional Freight Plan
Multimodal	Throughout Corridor	MATA transit has long headways and requires transfers	Memphis 3.0 Transit Vision
	Southern portion of MPO area	Northern MS not serviced by transit	Livability 2040 RTP
	Throughout Corridor	Need improved shuttle service to Memphis Airport and other nearby employers	Memphis 3.0 Transit Vision
	Memphis Intermodal Facility	Need employment access express route / circulator shuttle	Livability 2040 RTP
	SR-175 Interchange and Brooks Road Interchange	Pedestrian & bicycle safety issues	Data Analysis
	SR-3/US-51 interchange	No bicycle accommodations through interchange; sidewalk is discontinuous	Data Analysis
	SR-175, SR-3/US-51, and SR-14/US-61 interchanges	Free-flow right turns from off-ramps with bicycle/pedestrian facilities	Data Analysis
Economic Development	I-240 to MS State Line	Potential for New Interstate Access	Public/Stakeholder

4. Multimodal Solutions/ Universe of Alternatives

Introduction

Following the identification and analysis of corridor transportation deficiencies, the study developed goals for the corridor and performance measures used to assess the effectiveness of various solutions to those problems. A universe of alternatives, or potential solutions, was developed. The universe of alternatives was organized based on the issues each potential solution addresses, including safety, traffic congestion, freight movement, and multimodal travel. Many of the solutions may benefit more than one aspect of travel in the corridor. Ultimately, selected solutions were assembled into a Build (2040) scenario that accounted for their impacts on regional travel.

27 potential solutions for the I-55 corridor are discussed in this final report.

Performance Measures

Goals for potential improvements along the I-55 corridor were selected to reinforce the three strategic emphasis areas in TDOT's 25-Year Long-Range Transportation Plan: efficiency, effectiveness, and economic competitiveness. As shown in Table 4-1, the five identified goals were further developed into 12 specific objectives, intended to guide development and evaluation of possible solutions. In order to evaluate how well a potential solution satisfies an objective - and ultimately a goal - measures must be established that are data driven and comparable across the Base (2010), Trend (2040) and Build (2040) scenarios. Table 4-2 outlines the performance measures established for the I-55 corridor. As indicated, the measures fall into four categories (Traffic Operations, Safety, Operations & Maintenance, and Multimodal), which directly support the objectives identified in Table 4-1.

Highway Capacity Alternatives

As indicated in Section 3 of this report, TSM analysis of the 2040 Trend scenario identified three specific locations for more detailed traffic operations analysis and evaluation of possible solutions:

Table 4-1. Performance Goals and Objectives — I-55

Goals	Objectives		
Provide efficient and reliable travel	Improve travel times and reduce delay	Provide transportation options for people and freight	Optimize freight movement
Improve safety conditions	Reduce crash rates along the corridor – especially at identified crash "hot spots"	Implement or upgrade technologies that promote safety and effective incident management	Improve bicycle and pedestrian accommodations
Coordinate transportation investments with economic development plans	Improve interchange on/ off ramps	Coordinate with MPOs/ RPOs to determine areas where new/improved Interstate access is needed	
Invest equitably throughout the corridor	Expand transportation options for traditionally underserved populations within the corridor	Consider regional transit options	Identify areas with the greatest data-driven needs
Protect the natural environment and sensitive resources within the corridor	Identify transportation improvements that are not likely to result in major impacts to environmental, social, and cultural resources		

Table 4-2. Performance Measures — I-55

Goal	Performance Measure		Unit
Traffic Operations	Traffic on interstate operates at LOS D or better		% of interstate operating at LOS D or better
	Total Daily Vehicle Miles Traveled (VMT)		Miles (1,000s)
	Total Daily Vehicle Hours of Travel (VHT)		Hours (1,000s)
	Total Peak Hour Vehicle Hours of Delay (VHD)		Hours
	Total VMT / Trip		Miles
	Total Vehicle Minutes Traveled / Trip		Minutes
	Average Peak Hour Travel Speed	Urban Interstate	MPH
		Rural Interstate	MPH
	Congested Travel Time between key O&D Pairs along Corridor (Total)		Minutes
	Peak Hour Density at Improved Interchanges		Vehicles/Mile/Lane
	Average and Max Queues at Improved Interchanges		Feet
Safety	Crash reduction in safety "hot spots"		Above or Below Average Crash Reduction Potential
Operations & Maintenance	Bridge Condition (Sufficiency Rating)		% of bridges < 50
			50 < % of bridges < 80
	Pavement Condition (Resurfacing)		% of corridor resurfaced within the last 10 years
Multimodal	Pedestrian and Bicycle Accommodations at U.S. and State Route Interchanges		% interchanges with bike facilities
			% interchanges with ped. facilities
	Freight (Truck Parking)		# of Rest Area Spots
			# of Truck Stop Spots

- I-55 between US-61 and the I-240 / I-69 interchange
- I-55 through the McLemore Avenue interchange
- I-55 Bridge over the Mississippi River.

Possible solutions to be considered at the three identified locations are shown in Figure 4-1. As part of that evaluation, Transmodeler software was used to measure traffic operations under 2040 Trend and Build conditions, the latter reflecting widening of I-55 to remove the lane drop through the McLemore Avenue interchange. Since the Mississippi River Bridge is an independent segment and the need is clearly additional capacity, analysis of widening the bridge to provide 6 travel lanes was conducted using the TSM. (Analyses are described in the I-55 Traffic Operations Technical Memorandum). Due to insufficient availability of traffic data, further operational analysis of the US-61 to I-240 segment was deferred to a future study. The recommendation (C1) was carried forward in the Universe of Alternatives as "Evaluate options for increasing capacity and improving merge/ diverge and weave areas between the US-61 and I-240 interchanges.

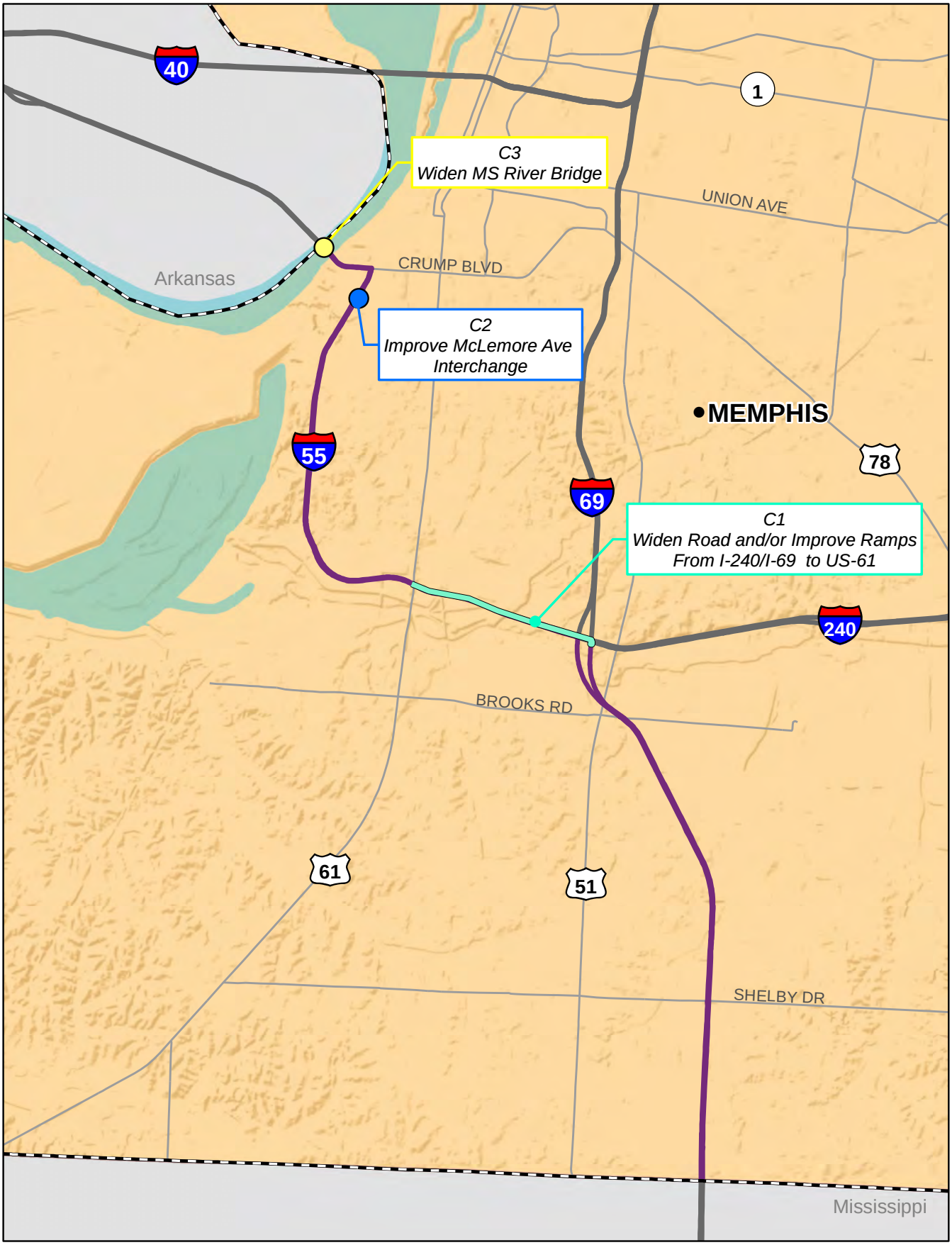
Note that the conceptual planning and preliminary design phases of all interchange improvements recommended in this report should incorporate pedestrian and bicycle planning.

Safety Alternatives

As a first step in identifying safety solutions to address crash hot spots along the I-55 corridor, TDOT's April 2017 IMPROVE Act was reviewed to determine if any safety-related solutions were recommended in these areas. There were no explicit safety solutions proposed as part of the IMPROVE Act on I-55.

However, there are a number of hot spot locations where previous TDOT studies have identified

Figure 4-1. Potential Highway Capacity Improvements — I-55



improvements through TDOT's Interchange Access Request (IAR) process. More specifically, there are previously identified solutions for the Crump Boulevard/Metal Museum Drive and I-240 interchanges.

Improvements recommended for those areas in this technical memorandum, therefore, should be considered interim solutions or should be implemented in concert with those larger interchange modifications.

The potential crash factors at each hot spot were then reviewed, in tandem with public comments as well as aerial and street-level photography to identify potential solutions. It is important to note that some recommendations are unrelated to a crash hot spot, but instead may have originated from public or stakeholder input obtained throughout the planning process, or were noted during a field review.

In addition to identifying potential safety improvements for locations along the corridor, the crash reduction potential for each recommendation was explored through the research of Crash Modification Factors (CMFs). A CMF estimates a safety countermeasure's ability to reduce crashes and crash severity. Based on data provided by the CMF Clearinghouse, each recommendation is categorized as having above or below average crash reduction potential, specific to the I-55 corridor, where data was available. It is important to note that the reduction potential for each recommendation is only applicable to crash types that would be prevented by implementing the improvements.

Figures 4-2a and 4-2b depict each safety solution and its crash reduction potential.

TSM&O Alternatives

According to FHWA, TSM&O is "a set of strategies that focus on operational improvements that can maintain and even restore the performance of the existing transportation system before extra capacity is needed." Based on the definition of TSM&O, the I-55 corridor is a prime candidate for such strategies; for most of the corridor, levels of service are currently such that motorists experience congestion, but not yet significant delays.

Two of the possible solutions outlined in other sections of this report would also be considered TSM&O solutions:

- Freight Solution, F5: Apply signal coordination on adjacent arterial streets with heavy truck traffic to manage on- and off-ramp congestion (Crump, McLemore, US-61, Brooks)
- Multimodal Solution, BP1: Consider a study to identify bicycle and pedestrian connectivity and safety improvements at existing U.S. and State Route interchanges.

Additional solutions were developed via review of existing plans, public / stakeholder feedback, and field observations. Specifically, TDOT's Region 4 office recommended installation of corridor management assets (ITS/DMS). The Region also noted continued issues with low overhead clearance on the I-55 Mississippi River Bridge. "When over height loads approach these bridges, they pull over to shoulders and we have to close the interstate down to back the trucks up and turn around." As an interim solution to capacity improvement C3, which addresses the bridge deficiencies, the Region 4 office suggested advanced warning and construction of a pull over area or a collapsible barrier in the median to address this issue. It should be noted that due to low clearance bridges on Riverside Drive and Crump Boulevard, over-dimensional vehicles must access the I-40 Mississippi River Bridge via I-55 south and I-240. The only other routes to the I-40 bridge pass through downtown urban areas or bordering neighborhoods on roads ill-equipped for such vehicles.

Figure 4-3. I-55 WB Approaching Mississippi River Bridge

Photo Credit: Google Earth

Freight Alternatives

Potential options for improving freight mobility include infrastructure improvements, such as truck climbing lanes and interchange redesigns, as well as management and operation strategies, such as truck parking and communication strategies. Suggested freight improvements for the I-55 corridor are shown in Figure 4-4 and discussed as needed below.

Truck Parking

Truck Parking is a critical component of supply chain operations. Hours of service rules state that drivers must stop after 14 hours; therefore, it is important that drivers are offered a selection of locations throughout their journey where they can rest and possibly eat, shower, or sleep overnight. Without proper rest, dirvers risk fines and crashes, jeopardizing the safety of all road users. Drivers often spend the last hour of their driving time looking for a place to park. In the absence of available truck parking, trucks often stop on highway

Figure 4-2a. Potential Safety Improvements — I-55

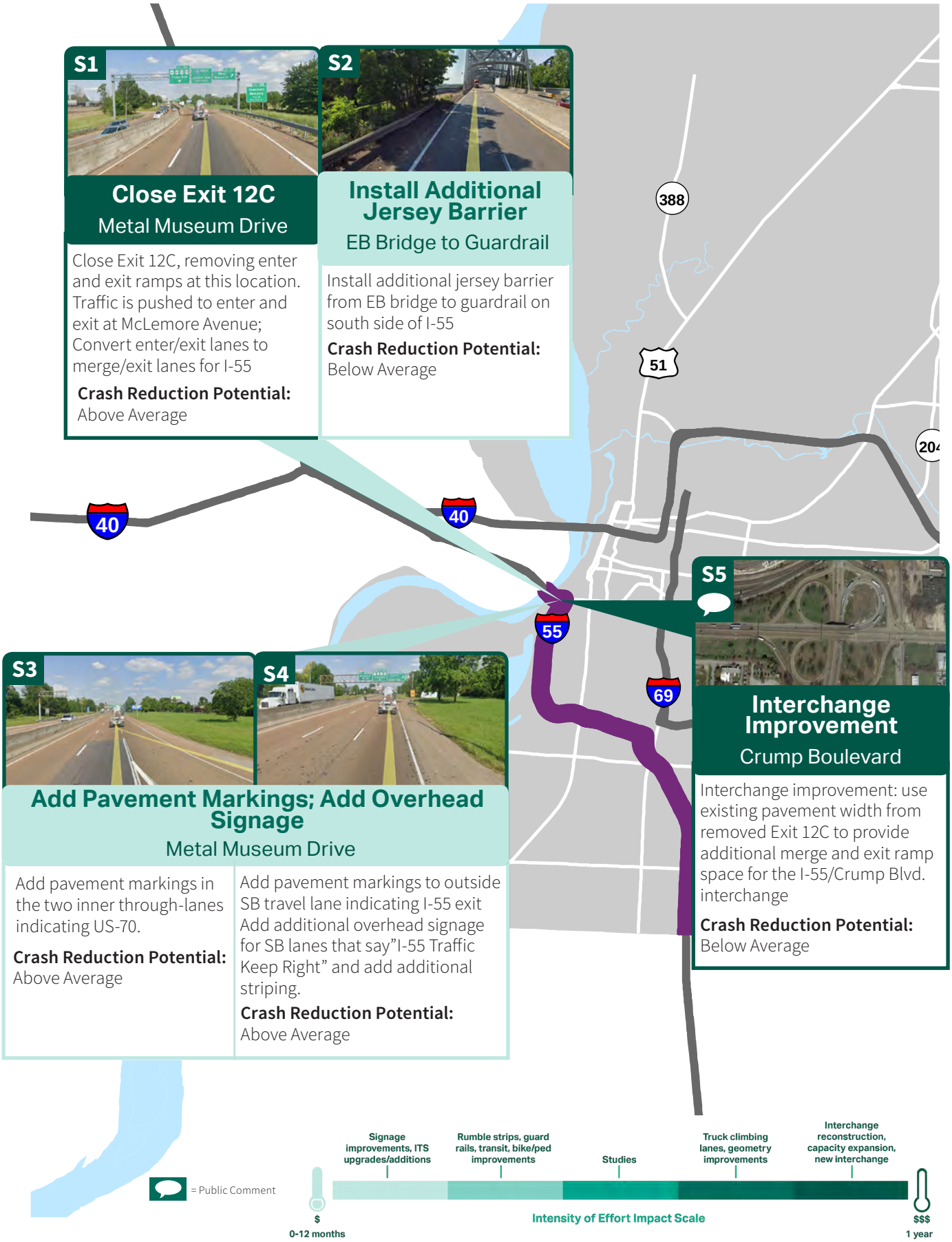


Figure 4-2b. Potential Safety Improvements — I-55

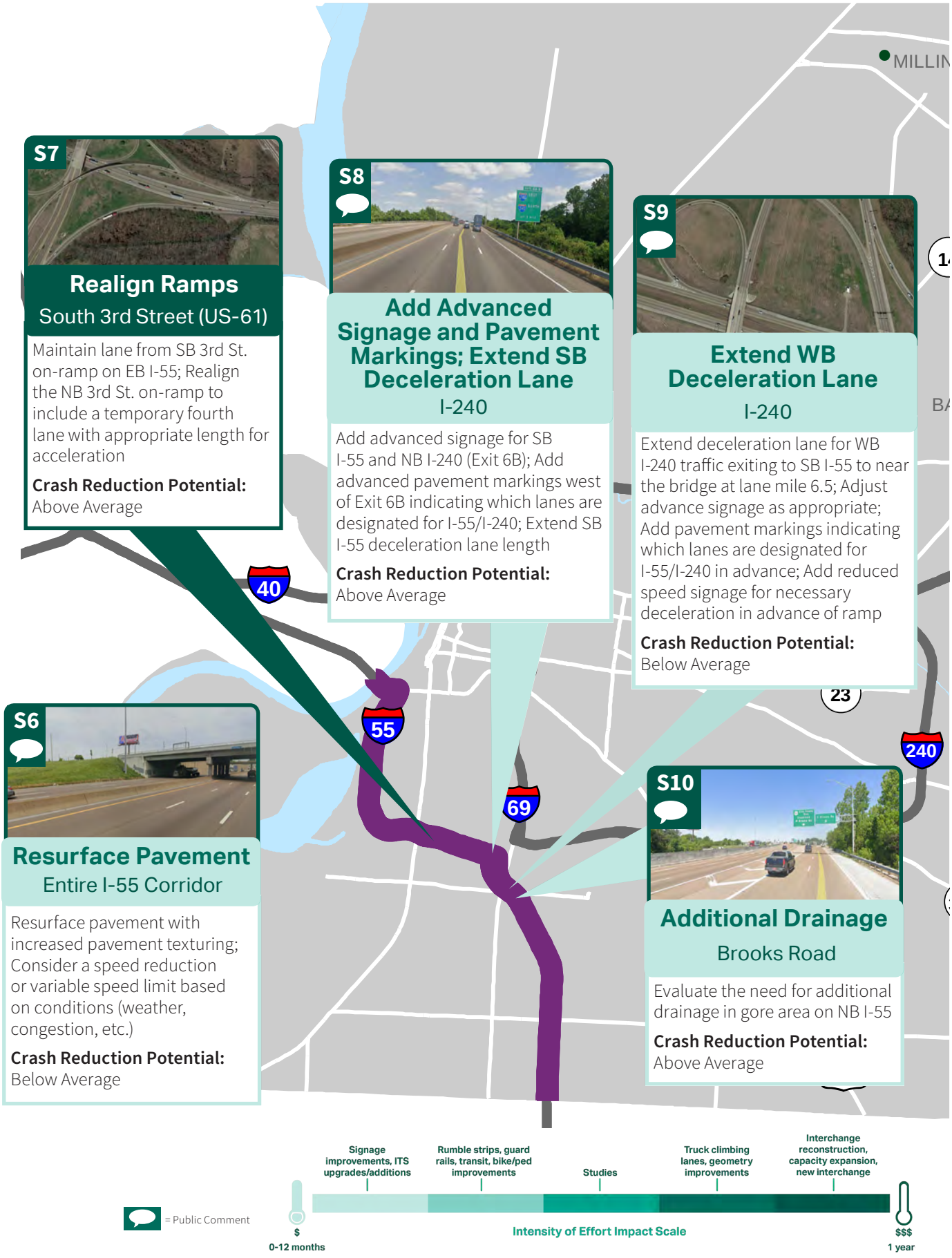
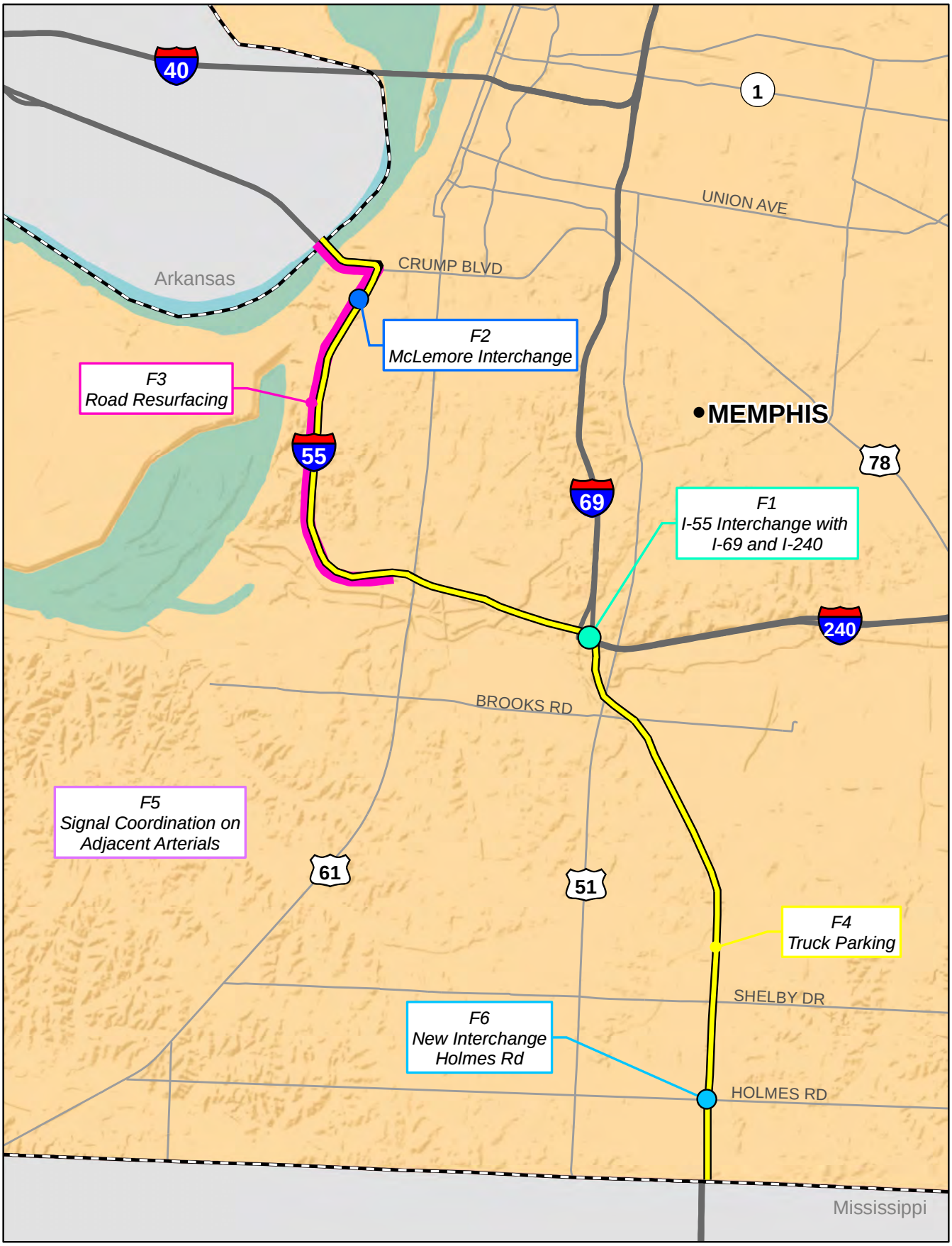


Figure 4-4 . Potential Freight Improvements — I-55



on- and off-ramps, which is both unsafe and illegal. To address truck stop parking needs supportive of hours of service needs, an additional 100 truck parking spots (with overnight availability) should be constructed along the corridor.

Interchange Redesigns

The TN Freight Plan indicated a potential truck bottleneck near the McLemore Avenue interchange. Data analysis also suggests that the design of the I-55 I-65 movements along the I-240 interchange should be evaluated to ensure safe and efficient truck movement.

ITS

To monitor congestion and accidents on I-55 ramps, signal coordination is recommended on adjacent arterials with heavy truck volumes.

Parallel Corridors

The identification and use of alternative, parallel routes can be an approach to accommodate increasing traffic. Only one other Mississippi River crossing exists in the area via I-40, approximately one mile north of the I-55 crossing. Although I-69 and I-40 can provide an alternative route across the River for incident management purposes, this route is likely to be just as congested as I-55. For longer north-south routes, alternatives include I-559 or I-240 to avoid the downtown area. I-240 between US-78 (Lamar Ave) and I-55 is currently programmed for widening to six to eight lanes, which could make this alternative route more attractive.

In general, diverting truck traffic from interstate highways to lower order roads will increase potential multimodal safety problems, pavement wear, and traffic disruption. Existing structures on lower order roads must also be able to accommodate the loads and dimensions of freight vehicles.

Driver Education and Stakeholder Engagement

In addition to the infrastructure and management strategies previously discussed, a key freight stakeholder noted several other items that can improve truck freight traffic in the State. These include driver education and stakeholder engagement regarding roadway construction. Driver education can include both truck and non-truck driving populations.

The Tennessee Trucking Association has partnered with the Tennessee Highway Safety Office to educate students and senior citizens about sharing the road with trucks and has expressed interest in connecting with other agencies to teach the public about freight safety.

Economic Development

The Tennessee transportation system supports the economy of the state by providing access to employment for workers and facilitating the movement of goods into, out of, and within the state. Among the goals for transportation system planning in this study is the following: Coordinate transportation system investments with economic development plans. This goal is informed by two objectives:

- Improve interchange on/off ramps.
- Coordinate with MPOs/RPOs to determine areas where new or improved Interstate access is needed.

To assess needs and develop a universe of potential actions that support economic development, the study team interviewed key stakeholders and analyzed future employment projections to determine economic development focus areas in each corridor. Studies of these areas that may be subject to development pressure were included in the universe of potential solutions. Other potential solutions that impact regional economic development are included in the capacity, safety, operations, and freight sections of this report.

Employment growth in the I-55 study corridor is expected to be centered on the area west of the interstate surrounding and including the Port of Memphis. Access to and from the Interstate is currently gained at the McLemore and W. Mallory Avenue interchanges. Job growth in this area is anticipated to reach up to 250% between 2010 and 2040, with numerous new logistics and industrial jobs attracted to the area. Additional employment growth is expected around the Memphis airport, near Graceland, and along the Mississippi state line. Adding employee traffic to these areas may lead to increased congestion or interchange-related safety issues.

Interviewees and transportation experts in the corridor suggest that an additional interchange serving the Port of Memphis area may be desirable to support future growth. Note that the extension of Paul Lowry Road to Shelby Drive is included in the Memphis 2020-2023 TIP. This project will provide the Port with a second access to I-55 via Shelby Drive.

A potential interchange at Holmes Road, near the state line (shown in Figure 4-5), was also suggested as a potential longer term improvement to support economic development in this growing area. That project is identified in the MPO's 2050 Regional Transportation Plan as a future vision project (ID 53), but at this time is not included in the fiscally constrained project list of the RTP.

Figure 4-5. Potential Economic Development Improvements — I-55

Multimodal

While driving is the mode of choice throughout the I-55 corridor, it is important to ensure that multimodal transportation options exist. Multimodal projects support demand management and operational solutions to congestion. Relatively cost-effective, multimodal solutions generally reduce vehicle miles traveled and improve safety.

As noted in Technical Memorandum 2, MATA provides great service coverage but has long headways and limited night and weekend service. There is also a missed transit connection between Memphis commuters to the west, (Arkansas) and south (Mississippi). Meaningful transportation choices provide mobility opportunities for all users and can help alleviate congestion along I-55. A complete multimodal network includes transit, bicycle and pedestrian infrastructure, and additional resources that promote carpooling and transit use.

Potential transit and bicycle/pedestrian solutions recommended for the I-55 corridor include:

- T2: Airport Shuttle – Recommendation to improve frequency of airport shuttle service to the Memphis International Airport and, indirectly, major employment centers in the vicinity of the airport. Reliable and efficient transit connections to the Memphis International Airport could help alleviate congestion on I-55 and create better access to employment for residents.
- T9 & T10: Employment Access Express Route/ Circulator Shuttle – The Memphis Intermodal Facility along I-55 is a large trip generator, as it employs a large number of workers. This destination could be better serviced by an express route from the SR-64/Stage Rd and by a circulator shuttle within the Memphis Intermodal Facility area. These transit improvements could keep vehicles off the I-55 corridor, decreasing congestion.
- T12: Evaluate extension of transit service to DeSoto County (northern Mississippi). Many residents from northern Mississippi commute north, along I-55 into Memphis daily. By providing transit access, traffic along I-55 could be reduced.
- BP1: Conduct a study to identify bicycle and pedestrian connectivity and safety improvements at existing U.S. and state route interchanges, as well as the Brooks Road interchange. A significant number of bicycle and pedestrian related crashes have occurred at I-55 interchanges. As indicated in Technical Memorandum 2, no bicycle accommodations are provided at these interchanges, and at each free flow right turns from off-ramps jeopardize pedestrian safety.

  Further bicycle and pedestrian study should consider the following measures:

  - In-field, Geometric Analysis, including:
    - Average pedestrian crossing distance
    - Whether motor vehicles cross through crosswalks using free flow or slip lanes
    - Average buffer distance from traffic flow
    - Sidewalk width
    - Bicycle facility width
    - Existence of vertical buffers for pedestrians or cyclists
  - Land Use Analysis (rural, rural town, suburban, urban core)
  - Evaluation of Adjacent Infrastructure
  - Detailed review of pedestrian and bicycle-related crashes within 0.5 miles of an interchange

Universe of Alternatives

Table 4-3 gathers these potential solutions into the total universe of alternatives for the I-55 corridor. The universe of alternatives presents a wide range of potential solutions to identified deficiencies. No solution is excluded from the universe of alternatives – it is essentially a brainstorming effort comprised of public and stakeholder ideas as well as best practices identified by planners and engineers. The list is supplemented by projects proposed in existing plans and studies.

Figure 4-6. Potential Solutions By Category — I-55

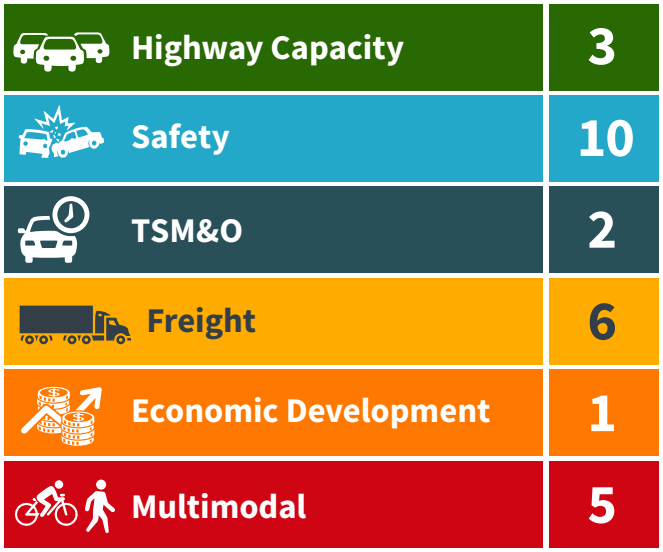


Table 4-3. Universe of Alternatives — I-55

	ID	Termini (From)	Termini (To)	Description	Source of Recommended Solution
Highway Capacity	C1	I-240/I-69	US-61	Evaluate options for increasing capacity and improving merge/diverge and weave areas between the US-61 and I-240 interchanges	Data Analysis and Regional Freight Plan, Livability 2040 RTP
	C2	McLemore Ave. Interchange		Improve interchange to maintain six lanes between ramps	Data Analysis
	C3	Mississippi River Bridge		Widen existing 4-lane bridge	Data Analysis
Safety	S1*	Metal Museum Drive		Close Exit 12C; Convert enter/exit lanes to merge/exit lanes for I-55	Data Analysis
	S2*	Metal Museum Drive		Install additional jersey barrier	Data Analysis
	S3*	Metal Museum Drive		Add pavement markings; add additional overhead signage	Data Analysis
	S4*	Metal Museum Drive		Add pavement markings	Data Analysis
	S5*	Crump Boulevard		Interchange improvement	Public/Stakeholder/ TN Freight Plan (2018) Regional Freight Plan
	S6	MS River Bridge	MS State Line	Resurface pavement	Public/Stakeholder
	S7	South 3rd Street (US-61)		Realign ramps	Data Analysis
	S8*	I-240		Add advanced signage and pavement markings; Extend SB deceleration lane	Public/Stakeholder
	S9*	I-240		Extend WB deceleration lane	Public/Stakeholder
	S10	Brooks Road		Evaluate the need for additional drainage	Public/Stakeholder

Table 4-3. Universe of Alternatives cont. — I-55

	ID	Termini (From)	Termini (To)	Description	Source of Recommended Solution
TSM&O	TS1	Advance of Mississippi River Bridge WB Approach		Advance warning and pull-off OR collapsible barrier in the median for over-dimensional vehicles	Public/Stakeholder
	TS2	Throughout Corridor		Install corridor management assets (ITS/DMS)	Public/Stakeholder
Freight	F1	West of I-69	South of I-240	Study interchange design to ensure safe efficient truck movement	Data Analysis
	F2	McLemore Ave. off-ramp	McLemore Ave. on-ramp	Add auxiliary lane between off-ramps and on-ramps at McLemore Avenue	Tennessee Freight Plan (2018) Regional Freight Plan
	F3	Horn Lake Road	Mississippi River	Resurface so that at least 90% of the corridor has good ride quality	Data Analysis
	F4	Arkansas State Line	Mississippi State Line	Add overnight truck parking capacity (~100 spots)	Data Analysis
	F5	Arkansas State Line	Mississippi State Line	Apply signal coordination on adjacent arterial streets with heavy truck traffic to manage on- and off- ramp congestion (Crump, McLemore, US-61, Brooks)	Data Analysis
	F6	Holmes Road		New interchange at Holmes Road	Tennessee Freight Plan (2018) Regional Freight Plan, Livability 2040 RTP
Economic Development	ED1	I-240	Mississippi State Line	Evaluate need for additional interstate access point to accommodate economic growth	Public/Stakeholder
Multimodal	T2	All Transit Centers	Memphis International Airport	Improve shuttle service frequency to the Memphis International Airport and major employment centers in the vicinity of the airport.	Data Analysis and Memphis 3.0 Transit Vision
	T9	SR-64/Stage Road	BNSF Railway/ Memphis International Airport	Express route along I-240 with select stops around the international facility could fulfill this need	Livability 2040 Regional Transportation Plan
	T10	Memphis Intermodal Facility		Circulator shuttle allowing a more direct connection to places of employment	Livability 2040 Regional Transportation Plan
	T12	US-61	Goodman Road/MS-305	Study transit extension to DeSoto County, Mississippi	Data Analysis and Livability 2040 Regional Transportation Plan
	BP1	Throughout Network		Conduct a study to propose bike/ped accommodations at U.S. and S.R. interchanges, as well as the Brooks Road interchange	Data Analysis

*To be completed as interim solutions and/or in concert with Crump Avenue and I-240 interchange modification projects

5. Solutions Screening & Project Priorities

The I-55 universe of alternatives were filtered through a solutions screening and prioritization process (see Figure 5-1). This process evaluates solutions based on their impact on mobility and safety, potential environmental impacts, cost, and potential economic impacts. Ultimately, the prioritized solutions both resolve the identified deficiencies and have a high benefit/cost ratio.

Solutions Screening, Phase 1

The Phase 1 solutions screening process was intended to eliminate solutions with evident fatal flaws. To do so, each possible solution was evaluated against the following questions:

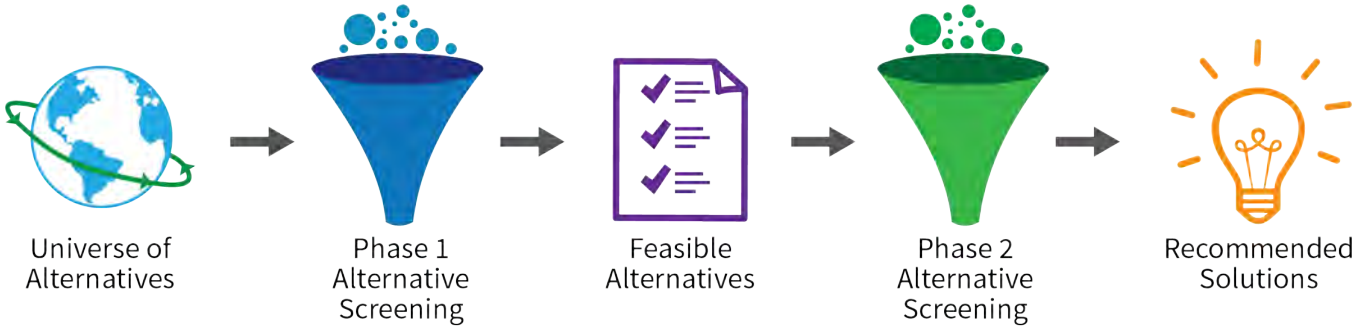
1. Does the proposed solution make sense given the identified deficiency?
2. Does the proposed solution align with other planned or programmed projects in the area?
3. Is the proposed solution supported by stakeholders and the public?
4. Does the proposed solution negatively impact environmental features such as wetlands, rare or protected species, or superfund sites?
5. Does the proposed solution negatively impact cultural features such as sensitive community populations, historic sites, public lands, or community institutions?

Projects which received a "NO" response for questions 1, 2, or 3, or a "YES" response for questions 4 or 5 were eliminated and did not move forward to the Phase 2 solutions screening. Exceptions include projects where the potential is high for environmental/cultural impact mitigation. As shown in Figure 5-2, no I-55 solutions were eliminated in the Phase 1 solutions screening process.

Figure 5-2. Solutions Passing Phase 1 Screening — I-55

Highway Capacity	3
Safety	10
TSM&O	2
Freight	6
Economic Development	1
Multimodal	5

Figure 5-1. Solutions Screening and Prioritization Process



Solutions Screening, Phase 2

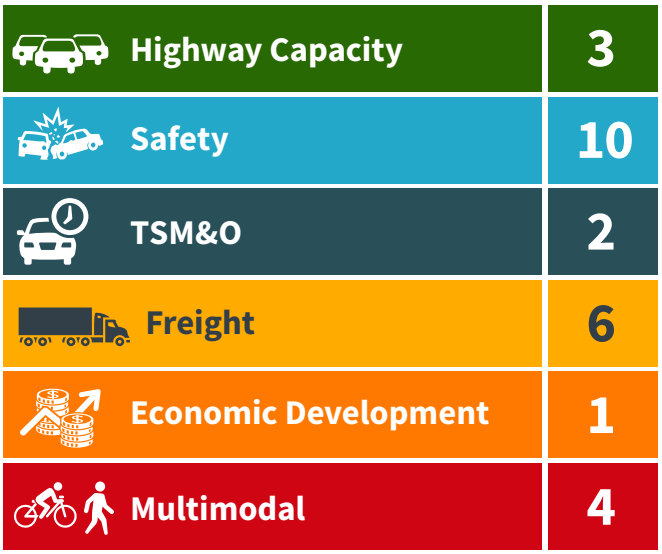
The Phase 2 alternatives screening process utilized performance measures to further refine the list of feasible alternatives. Potential solutions that passed the Phase 1 Screening were evaluated against the following questions:

1. Does the proposed solution improve level of service on the interstate corridor?
2. Does the proposed solution improve peak hour travel speeds on the interstate corridor?
3. Does the proposed solution improve travel times between key origin and destination (O&D) pairs along the corridor?
4. Does the proposed solution improve peak hour densities at the improved interchange?
5. Does the proposed solution reduce average and max queues at the improved interchange?
6. Does the proposed solution have the potential to reduce crashes in safety hot spots?
7. Does the proposed solution address deficiencies in bridges with a low sufficiency rating?
8. Does the proposed solution increase pavement quality?
9. Does the proposed solution provide for pedestrian / bicycle connectivity and safety at interchanges?
10. Does the proposed solution provide additional truck parking opportunities, particularly in urban areas?
11. Does the proposed solution have the potential to reduce vehicle miles traveled (VMT)?
12. Does the proposed solution improve incident management?
13. Does the proposed solution provide potential economic development opportunities?

Projects which received only "NO" responses were eliminated and did not move forward as feasible multimodal solutions. As indicated by Figure 5-3, multimodal solution T9 was removed from further consideration due its lack of impact on the I-55 corridor. The termini of the proposed express route were Stage Road (in Bartlett) and the BNSF Railway/ Memphis Intermodal Facility (east of the Memphis airport). This express route would have the most benefit to mobility on I-240.

It should be noted that projects Freight F6 and Economic Development ED1, which recommend evaluation of a new interchange near Holmes Road, received "NOs" to questions 1-5, related to capacity and safety. The current spacing between adjacent interchanges (Shelby Drive to the north and State Line Road to the south) is two miles. Holmes Road crosses I-55 approximately half way between the two, offering a proposed one-mile interchange spacing. Per FHWA, this is the minimum allowable interchange spacing in an urban area, primarily due to the interruptions caused by merge, diverge, and weave areas on the main line. Addition of any new interchange also increases the potential for crashes both on the mainline and at the ramp terminals. Since the spacing meets FHWA's minimum requirements, Freight F6 and Economic Development ED1 recommendations were moved forward to prioritization; however, further discussions regarding this project should consider the capacity and safety impacts on I-55.

Figure 5-3. Solutions Passing Phase 2 Screening — I-55



Prioritization Methodology

Aligning with previous TDOT multimodal corridor studies, the prioritization methodology for this study addresses coordinated construction efforts (priority given to projects that could be accomplished simultaneously at a given location) and culminates in a benefit-cost index for each project, which recognizes the relative multimodal benefit of each project compared to the estimated financial investment. Consistency with TDOT and MPO programmed projects has been maintained throughout the alternative development process, having identified such projects as part of the Trend Scenario.

Table 5-1. Prioritization Criteria and Measures by Mode and Strategy — I-55

Mode/ Strategy	Mobility	Safety	Economic Development	System Maintenance	Implementation	Cost Efficiency
Highway Capacity	2040 Trend V/C	Crash Rate (Relative to Statewide Avg)	2020 Employment	Project addresses bridge deficiency (Y/N)	# of related projects	Methodology TBD
	2040 Build V/C	Project improves incident management (Y/N)	2040 Employment	Project addresses pavement deficiency (Y/N)	Cost Estimate	
Safety	2040 Trend V/C	Crash Rate (Relative to Statewide Avg)	2020 Employment	Project addresses bridge deficiency (Y/N)	# of related projects	Methodology TBD
	2040 Build V/C	Project improves incident management (Y/N)	2040 Employment	Project addresses pavement deficiency (Y/N)	Cost Estimate	
		Crash Reduction Potential				
TSM&O	2040 Trend V/C	Crash Rate (Relative to Statewide Avg)	2020 Employment	Project addresses bridge deficiency (Y/N)	# of related projects	Methodology TBD
	2040 Build V/C	Project improves incident management (Y/N)	2040 Employment	Project addresses pavement deficiency (Y/N)	Cost Estimate	
Freight	2040 Trend V/C	Project improves incident management (Y/N)	2020 Employment	Project addresses bridge deficiency (Y/N)	# of related projects	Methodology TBD
	2040 Build V/C		2040 Employment	Project addresses pavement deficiency (Y/N)	Cost Estimate	
	% Trucks			Provides truck parking (Y/N)		
Multimodal	2020 Population	Project improves incident management (Y/N)	2020 Employment	Project addresses bridge deficiency (Y/N)	# of related projects	Methodology TBD
	2040 Population		2040 Employment	Project addresses pavement deficiency (Y/N)	Cost Estimate	
Economic Development	2020 Population	Project improves incident management (Y/N)	2020 Employment	Project addresses bridge deficiency (Y/N)	# of related projects	Methodology TBD
	2040 Population		2040 Employment	Project addresses pavement deficiency (Y/N)	Cost Estimate	

The most recent TDOT multimodal corridor study introduced flexible decision-making support tool wherein weights can be applied to priority settings based on policy, programming, and political decisions. The prioritization criteria and measures for the I-55 corridor are structured in a similar fashion, such that weights can be applied by decision-makers. As indicated in Table 5-1, solutions developed for the I-55 corridor were evaluated over six categories: mobility, safety, economic development, system maintenance, implementation and cost efficiency, as detailed here.

Prioritization Criteria and Measures

Mobility

Appropriate measures for mobility differ across modes/strategies. While the volume-to-capacity (V/C) ratio is appropriate for measuring highway capacity, it does not capture mobility for bicycles and pedestrians, for example. As shown in Table 5-1, comparison of the 2040 Trend V/C ratio versus the 2040 Build V/C ratio was used as a measure of mobility for highway capacity, safety, TSM&O, and Freight projects. Numeric scores 1, 2, and 3, were recorded based on the following thresholds, which consider the resulting change in V/C and, for freight projects, the percent trucks on the adjacent section of interstate:

Capacity, Safety, TSM&O

1 = No improvement to mobility

2 = Likely improvement to mobility

3 = Definite improvement to mobility

Freight

1 = No improvement to mobility

2 = Improvement to mobility, % trucks < 20%

3 = Improvement to mobility, % trucks > 20%

Comparison of 2020 population versus 2040 population within three miles of each project was used for multimodal and economic development projects. Population numbers were obtained via the Tennessee Statewide Travel Demand Model (TSM) and by traffic analysis zone. Resulting numeric scores were based on the following thresholds:

Multimodal, Economic Development

1 = 0-10% Increase

2 = 10-15% Increase

3 = 15% + Increase

Where criterion could not be measured and "N/A" was noted, engineering judgement was used to score the project's potential for mobility improvement within the applicable thresholds.

Safety

Criterion used to measure the potential safety improvement for each project also vary across mode/strategy. One measure common to all was a "yes" or "no" response to the question "Does the project improve incident management?" For freight, multimodal and economic development projects, this was the only measure used for safety. Thresholds were applied as follows:

Freight, Multimodal, Economic Development

1 = N/A

2 = No

3 = Yes

Building upon hot spot calculations from Technical Memorandum 2, capacity, safety, and TSM&O projects are measured by the relative crash rate as well. The impact of safety projects is further refined by the crash reduction potential, which was determined in Technical Memorandum 3. The following thresholds were applied:

Capacity, TSM&O

1 = Crash rate < statewide average crash rate[1]

2 = Crash rate > statewide average crash rate; Does not improve incident management

3 = Crash rate > statewide average crash rate; Improves incident management

Safety

1 = Crash rate < statewide average crash rate

2 = Crash rate > statewide average crash rate; Below average crash reduction potential

3 = Crash rate > statewide average crash rate; Above average crash reduction potential OR Improves incident management

Where criterion could not be measured and "N/A" was noted, engineering judgement was used to score the project's potential for safety improvement within the applicable thresholds.

Economic Development

The economic development potential of each project was measured by the projected change in employment from 2020 to 2040 within three miles of each project. Employment projections were obtained via the TSM and by traffic analysis zones. The following thresholds were used to score each project.

1- The statewide average crash rate for rural interstate facilities is 0.528 and 1.112 for urban interstates.

Capacity, Safety, TSM&O, Freight, Multimodal, Economic Development

1 = 10-20% increase

2 = 20-25% increase

3 = 25%+ increase

System Maintenance

System maintenance was added as a measure for the I-55 corridor prioritization to recognize opportunities where projects will also address existing bridge and/or pavement deficiencies. The following thresholds were used to score each project, given "yes" or "no" responses to the questions "Project addresses bridge deficiency?" and "Project addresses pavement deficiency?'. For freight projects, an additional "yes" / "no" question was added: "Project provides truck parking?"

Capacity, Safety, TSM&O, Multimodal, Economic Development

1 = No to both

2 = Yes to one

3 = Yes to both

Freight

1 = No to all

2 = Yes to one

3 = Yes to all

Implementation

The implementation measure was included to give priority to projects that could be constructed or initiated in conjunction with other projects, thus conserving the time and money associated with multiple, individual contracts. Figure 5-4 illustrates the relative proximity of the multimodal solutions prioritized for the I-55 corridor. The following thresholds were utilized to score the implementation of each project:

Capacity, Safety, TSM&O, Freight, Multimodal, Economic Development

1 = 0 overlapping projects

2 = 1 or 2 overlapping projects

3 = 3+ overlapping projects

Cost Efficiency

For the I-55 corridor project prioritization, a benefit-cost index and a dollar-per-benefit was calculated for each solution. These measures capture the benefit of each prioritization criteria and compare the total relative benefit to the estimated project cost. Specifically, the score assigned to each of the five prioritization criteria were summed to represent the total relative benefit of each project. To calculate the benefit-cost index, this total relative benefit was divided by the cost (in millions) estimated for each project. The dollar-per-benefit is simply the cost estimate divided by the total benefit score. Note that cost estimates were prepared for solutions that were recommended for further study. However, because the total benefit represents the potential of the associated capital improvement, no direct benefit-cost index or dollar-per-benefit was calculated for these solutions.

Project Rankings

When evaluated side-by-side, the total benefit score, benefit-cost index, and dollar-per-benefit indicate projects with high benefit that can be implemented with smaller financial investment. The project rankings are discussed per mode/strategy below. Tables 5-1 through 5-6 of Technical Memorandum 4 detail the prioritization effort and rank the projects by the total benefit score, which ranges from 5 (lowest) to 15 (highest).

Project Rankings by Mode and Strategy

Highway Capacity

Each of the three capacity solutions developed for the I-55 corridor received high total benefit scores. Note that the total benefit of capacity solution C1 reflects the capital improvement that would result from the recommended study. Improvements resulting from further evaluation of I-55 between US-61 and I-240 will address safety and capacity deficiencies, as well as structural deficiencies associated with the Illinois Central bridges which span this section of I-55.

The Mississippi River Bridge widening is by far the most expensive capacity solution; however, the dollars would address structural deficiencies (including seismic retrofit) and provide additional capacity on one of only two Mississippi River crossings within 60 miles of this strategic freight corridor.

C2 addresses the existing McLemore Avenue interchange lane drop, which will become more apparent when bottlenecks associated with the existing Crump Avenue interchange configuration are addressed. Widening through the McLemore Avenue interchange is a relatively low-cost solution that would also address the I-55 northbound and southbound bridges over McLemore Avenue which currently have sufficiency ratings that qualify for rehabilitation.

Figure 5-4. Relative Proximity of Multimodal Solutions — I-55

Safety

The benefit-cost index quickly identifies safety projects that offer high benefit and are low cost: (S2 and S3) signage, pavement marking and additional jersey barrier between the Mississippi River Bridge and the Crump Avenue interchange. S1 and S7 received the highest total benefit, representing safety improvements to the Metal Museum Drive area (which would work in concert with proposed Crump Avenue interchange modifications) and ramp reconfiguration at the 3rd Street (US-61) interchange. The latter aligns closely with capacity solution C1 and would also require modification of the Illinois Central bridges (addressing structural deficiencies). Note that S1, S2, S3, S4, and S5 are solutions which could be implemented as a single project, at an estimated cost of approximately $1 million.

TSM&O

Both TSM&O solutions have a similar, high, total benefit. However, TS1 (collapsible barrier in advance of the Mississippi River bridge), has a much higher benefit-cost index and would address a stakeholder-reported, recurring incident management issue.

Freight

Of the six freight solutions that passed the Phase 2 screening, F2 (auxiliary lanes between the McLemore Avenue interchange ramps) scored the highest total benefit. This solution corresponds with capacity solution C2 and is attributed all the same benefits. F5 shows the highest benefit-cost index among the freight solutions. Signal coordination on adjacent arterial streets with heavy truck volumes has the potential to reduce on and off-ramp congestion at a relatively low cost. F5 specifically recommends this solution for Crump Avenue, McLemore Avenue, 3rd Street (US-61) and Brooks Road.

Multimodal

Evaluation of a transit extension into DeSoto County, Mississippi accumulated a total benefit score of 8, recognizing the potential positive impact on growing population and employment centers. Capital improvements resulting from a study of pedestrian / bicycle accommodations at interchanges would also benefit areas with expected population and employment growth.

Economic Development

Only one economic development solution was introduced as part of the I-55 corridor study. ED1 corresponds to freight solution F6. As discussed in Section 3, further evaluation of a new interchange at Holmes Road should focus on capacity and safety issues resulting from its proximity to adjacent interchanges.

6. Key Findings

The prioritized solutions address the key corridor transportation deficiencies identified by stakeholders and through data analysis.

As a result of the structure of the project prioritization system, all projects have a potential total benefit range of 5-15 and can therefore be compared across modes/ strategies. Table 6-1 tabulates all solutions for the I-55 corridor, sorted by total benefit score. Solutions which recommend studies are shown in Table 6-2. Projects scoring a total benefit of 10 or higher have generally demonstrated benefit to mobility, safety, economic development, system maintenance, and implementation.

Use of Table 6-1 in conjunction with Figure 5-4 can be used to inform decisions on fund allocation and construction packages. As mentioned previously, weights can easily be applied to the prioritization criteria in Tables 5-1 through 5-6 of Technical Memorandum 4 to adjust for policy, programming, and political decisions.

Finally, Table 6-3 summarizes the performance benefits of the of the collective solutions recommended for the I-55 corridor. As shown, proposed solutions improve network VHD during the peak period by only one percent (compared to the 2040 Trend scenario). As reflected by the 5% improvement in urban interstate peak travel speeds however, the corresponding peak VHD for urban interstates is improved by 12%. These improvements in delay are largely attributed to capacity improvements at the Mississippi River Bridge, McLemore Avenue, and the I-240 interchange.

Additionally, performance measures indicate improvement to bridge and pavement conditions as well as truck parking.

Further improvements to the I-55 corridor are expected to result from the “deep dive” studies shown in Table 6-2. The drainage study, for example may reveal the need for geometric or pavement improvements at the Brooks Road interchange. Likewise, the bike/ped connectivity study has the potential to propose several small-scale safety and connectivity improvements for non-vehicle users across the corridor.

Table 6-1. Project Ranking Across all Modes/Strategies — I-55

ID	Project Description	Termini	Cost Efficiency			
			Total Benefit	Cost Estimate	Benefit Cost Index	Dollar per Benefit
C3	Widen existing 4-lane bridge	Mississippi River Bridge	14	$164,000,000	0.1	$11,714,300
C2	Improve interchange to maintain six lanes between ramps	McLemore Ave Interchange	13	$9,930,000	1.3	$763,800
S1	Close Exit 12C; Convert enter/exit lanes to merge/ exit lanes for I-55	Metal Museum Drive Interchange	12	$567,000	21.2	$47,300
S7	Realign Ramps	South 3rd (US-61) Street Interchange	12	$19,200,000	0.63	$1,600,000
S8	Add advanced signage and pavement markings; Extend SB deceleration lane	I-240 Interchange	11	$1,560,000	7.1	$141,800
F2	Add auxiliary lane between off-ramps and on-ramps at McLemore Avenue	McLemore Ave Interchange	11	$9,930,000	1.1	$902,700
TS1	Advance warning and pull-off OR collapsible barrier in the median for over-dimensional vehicles	Advance of Mississippi River Bridge (WB approach)	10	$27,000	370.4	$2,700
S3	Add pavement markings; add additional overhead signage	Metal Museum Drive Interchange	10	$249,000	40.2	$24,900
S4	Add pavement markings	Metal Museum Drive Interchange	10	$345,000	30.0	$34,500
F5	Apply signal coordination on adjacent arterial streets with heavy truck traffic manage on- and off- ramp congestion (Crump, McLemore, US-61, Brooks)	Throughout Corridor	10	$1,090,000	9.2	$109,000
TS2	Install corridor management assets (ITS/ DMS)	Throughout Corridor	10	$7,380,000	1.4	$738,000
S2	Install additional jersey barrier	Metal Museum Drive Interchange	9	$55,700	337.1	$3,000
S5	Interchange improvement: Use existing pavement width from removed exit 12C to provide additional merge and exit ramp space at Crump Blvd	Crump Blvd Interchange	9	$125,000	72.0	$13,900
S9	Extend WB deceleration lane	I-240 Interchange	9	$2,000,000	4.5	$222,200
F3	Resurface so that at least 90% of the corridor has good ride quality	Horn Lake Rd to Mississippi River	9	$3,120,000	2.9	$346,700

Table 6-1. Project Ranking Across all Modes/Strategies (cont.) — I-55

ID	Project Description	Termini	Cost Efficiency			
			Total Benefit	Cost Estimate	Benefit Cost Index	Dollar per Benefit
S6	Resurface Pavement	MS River Bridge to Mill Branch Rd	9	$6,520,000	1.4	$724,400
T2	Improve shuttle service frequency to the Memphis Airport and major employment centers in its vicinity	All Transit Centers to Memphis Airport	8	$1,200,000	6.7	$150,000
T10	Circulator shuttle allowing a more direct connection to places of employment	Memphis Intermodal Facility	8	$600,000	13.3	$75,00
F4	Add overnight truck parking capacity (~100 spots)	Throughout Corridor	8	$2,440,000	3.3	$305,000
F6	New interchange at Holmes Road	Holmes Rd	8	$29,700,000	0.3	$3,712,500

Table 6-2. Project Ranking Across all Modes/Strategies (Studies) — I-55

ID	Project Description	Termini	Cost Efficiency			
			Total Benefit	Cost Estimate	Benefit Cost Index	Dollar per Benefit
C1	Evaluate options for increasing capacity and improving merge/diverge and weave areas between the US-61 and I-240 interchanges	I-240/I-69 to US-61	13	$175,000	N/A	N/A
F1	Study interchange design to ensure safe efficient truck movement	I-240 Interchange	10	$25,000	N/A	N/A
ED1	Evaluate need for additional interstate access point to accommodate economic growth	I-240 to MS State Line	8	$100,000	N/A	N/A
T12	Study transit extension into DeSoto County (Mississippi)	US-61 to Goodman Rd (MS-305)	8	$50,000	N/A	N/A
S10	Evaluate need for additional drainage	Brooks Rd Interchange	7	$20,000	N/A	N/A
BP1	Conduct study to identify bike/ped accommodations at U.S. and S.R. interchanges, as well as the Brooks Road interchange	Throughout Corridor	7	$25,000	N/A	N/A

Table 6-3. Performance Measure Summary — I-55

Goal	Performance Measure		Unit	Base (2010)	Trend (2040)	Build 2040	% Change (Base vs Trend)	% Change (Trend vs Build)
Traffic Operations	Traffic on interstate operates at LOS D or better		% of interstate operating at LOS D or better	87.5	80.8	86.9	8	7
	Total Daily Vehicle Miles Traveled (VMT)		Miles (1,000s)	20,726	25,572	25,504	23	<1
	Total Daily Vehicle Hours of Travel (VHT)		Hours (1,000s)	725	958	956	32	<1
	Total Peak Hour Vehicle Hours of Delay (VHD)		Hours	22.5	25.6	26.3	18	-1
	Total VMT / Trip		Miles	3.91	4.05	4.04	4	<1
	Total Vehicle Minutes Traveled / Trip		Minutes	8.20	9.10	9.08	11	<1
	Average Peak Hour Travel Speed	Urban Interstate	MPH	46	41	43	-10	5
		Rural Interstate	MPH	72	74	74	0	0
	Congested Travel Time between key O&D Pairs along Corridor (Total)		Minutes	100	111	106	11	-5
	Peak Hour Density at Improved Interchanges		Vehicles/Mile/Lane	See “Traffic Operations Memo”				
	Average and Max Queues at Improved Interchanges		Feet	See “Traffic Operations Memo”				
Safety	Crash reduction in safety “hot spots”		Above or Below Average Crash Reduction Potential	See “Safety Recommendations”				
Operations & Maintenance	Bridge Condition (Sufficiency Rating)		% of bridges < 50	9	0	0	N/A	N/A
			50 < % of bridges < 80	38	47[1]	28	N/A	N/A
	Pavement Condition (Resurfacing)		% of corridor resurfaced within the last 10 years	66[2]	66[3]	100	N/A	N/A
Multimodal	Pedestrian and Bicycle Accommodations at U.S. and State Route Interchanges		% interchanges with bike facilities	0	25	25	N/A	N/A
			% interchanges with ped. facilities	100	100	100	N/A	N/A
	Freight (Truck Parking)		# of Rest Area Spots	13	13	13	0	0
			# of Truck Stop Spots	88	88	188	0	114

1- Per TDOT Structures Division, repair projects ongoing or scheduled for Mississippi River Bridge, ICGRR Bridges, and US-61 Bridge. Assumed these moved to 50-80 range.
2- Based on 2017 TRIMS data
3- Per TDOT Pavement Office’s 2020 and 2021 Resurfacing Program. Also review of 2018-Feb 2020 TDOT Bid Lettings. (included resurfacing of L.M. 0.00-3.56)

I-155 Corridor

▶ Final Report

Table of Contents

Tables

Figures

Figures cont.

I-155 Corridor

1. Introduction

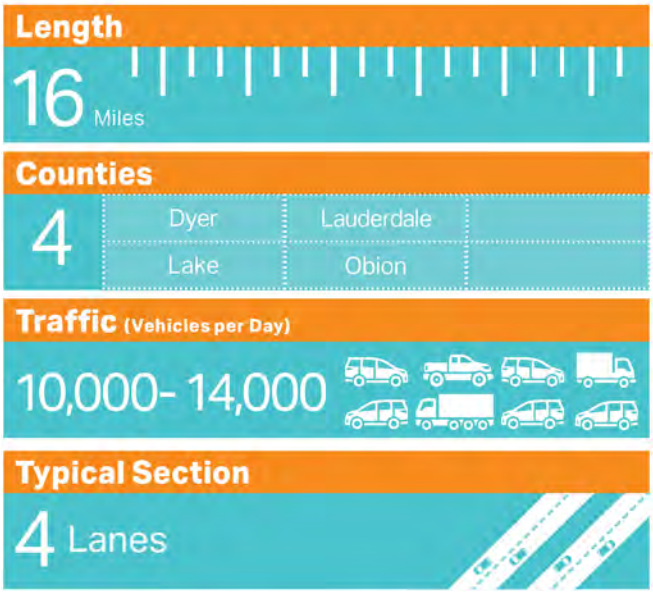
The I-155 corridor serves as a backbone for economic development and growth in northwestern Tennessee. As population and employment grow and redevelopment changes the face of the region, new travel demands place pressure on the Interstate as well as parallel and intersecting highways. This results in increased traffic congestion, travel times, and conflicts, which impact the corridor's ability to sustain future growth.

Interstate 155 is an east-west spur freeway connecting I-55 in southeast Missouri with the city of Dyersburg, Tennessee, terminating at US-51 in Dyersburg. The length of the Tennessee portion of the I-155 corridor is approximately 16 miles. The study area is shown in Figure 1-1; it includes Dyer, Lake, Lauderdale, and Obion counties.

The main purpose of this study is to identify existing and emerging deficiencies along the I-155 corridor and to evaluate and prioritize improvements to address those deficiencies. The study explores multimodal issues and opportunities and considers innovative approaches available to the Tennessee Department of Transportation (TDOT) to address capacity and congestion, enhance operational efficiency, improve safety and security, expand transportation choices, and support economic growth and competitiveness.

Figure 1-1. I-155 Study Area

Figure 1-2. I-155 Fast Facts



Previous technical memoranda:

- Provided a data and information inventory for the corridor
- Assessed existing and future deficiencies and needs along the I-155 corridor
- Established goals and performance measures to assess the effectiveness of various solutions to the problems
- Filtered the I-155 universe of alternatives through a screening and prioritization process

The prioritization process evaluated solutions based on their impact on mobility and safety, potential environmental impacts, cost, and potential economic impacts. Ultimately, the prioritized solutions both resolve the identified deficiencies and have a high benefit-cost index.

2. Sources of Data

Roadway, demographic, economic and performance data were collected from numerous sources. These were supplemented by a robust program to gather input from key stakeholders and the traveling public. These data were used to identify trends in travel, employment, development, and land use that impact the future of the region. The data ultimately were evaluated to identify the key transportation deficiencies impacting travel in the I-155 corridor.

Previous Plans and Studies

TDOT has conducted a number of regional and statewide studies that have included the I-155 corridor, but this is the first study that focuses specifically on I-155. Previous studies have focused on all modes of transportation and various levels of infrastructure, from statewide to regional. Key studies, plans, and programs are shown in Figure 2-1. TDOT's State Transportation Improvement Program (STIP) was specifically reviewed to develop an understanding of the needs and opportunities that have previously been identified and to identify projects within the study area for which money has already been allocated. No programmed improvement projects other than a renovation of the Welcome Center at the Missouri border were listed.

Figure 2-1. Previous Plans and Studies — I-155

TN TDOT Department of Transportation

TDOT Plans

1. Tennessee Statewide Multimodal Freight Plan (2018)
2. Region 4 Incident Management Plan (2016)
3. State Transportation Improvement Program, 2017-2020 (2016)
4. 25-Year Long Range Transportation Policy Plan (2015)
5. State of Tennessee Strategic Highway Safety Plan (2014)
6. Mississippi River Crossing Feasibility and Location Study (2006)

Data Analysis

A large body of technical data were analyzed to develop a picture of corridor conditions. These included sources detailing roadway conditions, traffic and freight operations, safety, population and employment growth, environmental conditions, and other factors to create a "trend scenario." These data sources are shown in Figure 2-2.The trend scenario predicts existing and future conditions if current practices, plans, and policies remain unchanged. The trend scenario establishes the existing and projected transportation conditions along the I-155 corridor and serves as the baseline for identifying needs and, ultimately, proposed improvements. The 2010 and 2040 Tennessee Statewide Travel Demand Model (TSM) trend scenarios were originally developed by the TDOT in 2017 (Phase 3/Version 3). As part of this study, the trend scenarios were updated and validated based on the following:

Figure 2-2. Data Sources

TRIMS 2017 (Tennessee Roadway Information Management System)	**NPMRDS** (National Performance Management Research Data Set)	**HPMS** (Highway Performance Monitoring System)	**MPO Regional Travel Demand Models**	**USFWS** (United States Fish and Wildlife Service)
ATRI (American Transportation Research Institute)	**NHRP** (National Register of Historic Places)	**TDOT Traffic History Website**	**TSM** (Tennessee Statewide Travel Demand Model)	**Woods & Poole Economics, Inc.**
US Census Data (On the Map)	**NWI** (National Wetland Inventory)	**Transearch**	**Google Earth**	**TN Comptroller**

- Population and employment data and projections from Woods and Poole Economics, Inc.
- Projects currently programmed for construction in TDOT's STIP
- Recent Transearch freight data and projections

The study team (including TDOT and statewide MPO staff) determined the updated Phase 3/Version 3 TSM (with 2010 base year) was producing results comparable to regional models with more recent base years- creating better model efficiency.

Public / Stakeholder Input

The study's technical analyses were complemented by a robust stakeholder and public involvement effort. The data generated by outreach activities – which included public meetings, key stakeholder interviews and a public survey – was used to focus technical analysis on items that stakeholders perceive as critical, and to prioritize transportation issues to be addressed. This was complemented and enhanced by an effort to provide information to and gather input from traditionally under-represented and underserved populations.

Members of the public and stakeholders identified many areas along the interstate corridor as exhibiting transportation problems. The most frequently mentioned locations are shown in Figure 2-3 and include:

- Safety issues related to design and operations are perceived on the segment of I-155 west of Dyersburg. Several potential factors were identified by stakeholders, including the presence of snow and ice in the hilly areas with no adequate warning system, an interchange with US-412 with sharp curves that leads to truck rollovers, and the presence of cable barriers with inadequate shoulders.
- Stakeholders perceive congestion at the Lake Road interchange exacerbated by the frequent presence of farm equipment forced to use the travel lanes due to inadequate shoulder width.

3. Existing Conditions & Deficiencies

Existing and future deficiencies and needs along the I-155 corridor were identified by examining transportation issues including land use and economic development trends, highway capacity and congestion, travel demand, safety, presence of Intelligent Transportation Systems (ITS), freight, transit, and non-motorized travel.

Land Use & Economic Development

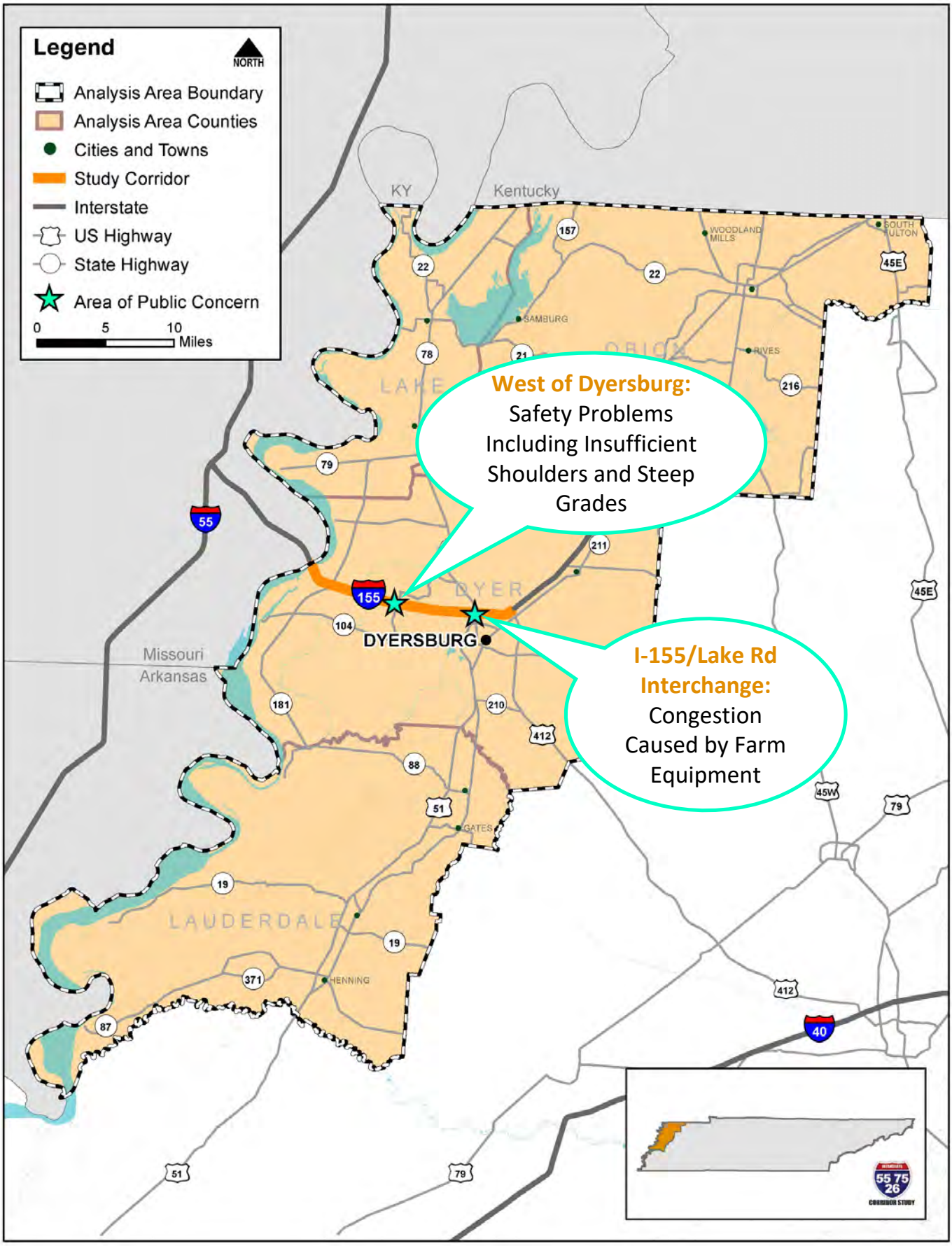
Land use, development patterns, and geographical and cultural features of the study area impact the demand for, design, and operations of transportation facilities. The locations of economic activity generators and the flows of goods and people between them are a key elements in identifying existing and future transportation needs.

Population & Employment

Study area population and employment drives travel demand in the I-155 corridor. A high-level review of population and employment projections from Woods & Poole Economics, Inc. was undertaken for the four county study area.According to Woods & Poole Economics data, these counties are expected to see a slight overall decrease in residents and an approximate 9% increase in jobs by 2040 (Figures 3-1 and 3-2). More specifically, much of the growth in the study area counties is expected to be employment-related as the area continues the development of Port of Cates Landing in Tiptonville and looks to the future construction of the I-69 corridor to improve roadway connectivity to other major markets. The future I-69 corridor is ultimately envisioned to link the Mexican and Canadian borders and has three segments in Tennessee that extend through Dyersburg, Millington, and Memphis. The completion of this corridor has the potential to increase desirability for the areas surrounding the I-155 corridor for both residents and employers. Figures 3-3 and 3-4 illustrate where the growth is expected to occur.

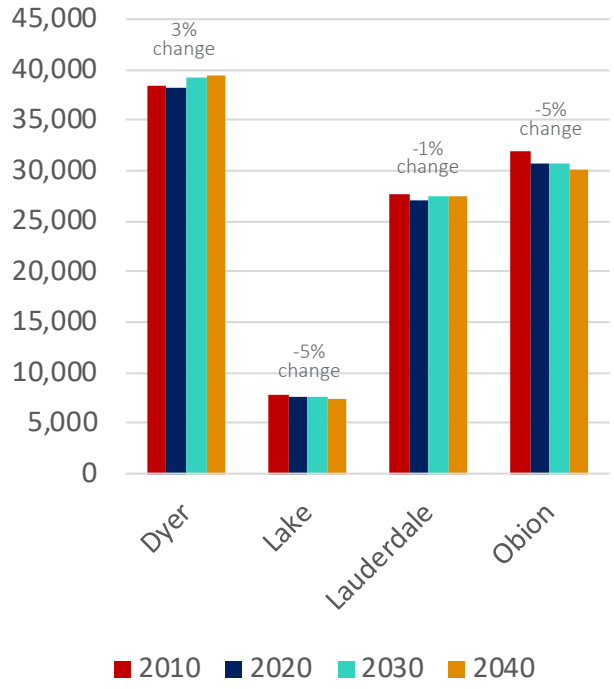
To focus on the needs of underserved populations, minority (persons identifying as other than "white alone") and low income populations – in this case persons living in poverty -- in the study area were mapped using data from the US Census Bureau's 2012-2016 American Community Survey (ACS). It should be noted that persons living in poverty represent the most extreme range of the region's low-income population. The ACS data showed the highest concentrations of minorities are found around Ripley, Henning and Union City. The highest concentrations of people in poverty are found around Dyersburg, Ripley, Union City, and in much of Lake County.

Figure 2-3. I-155 Corridor Stakeholder Priority Locations



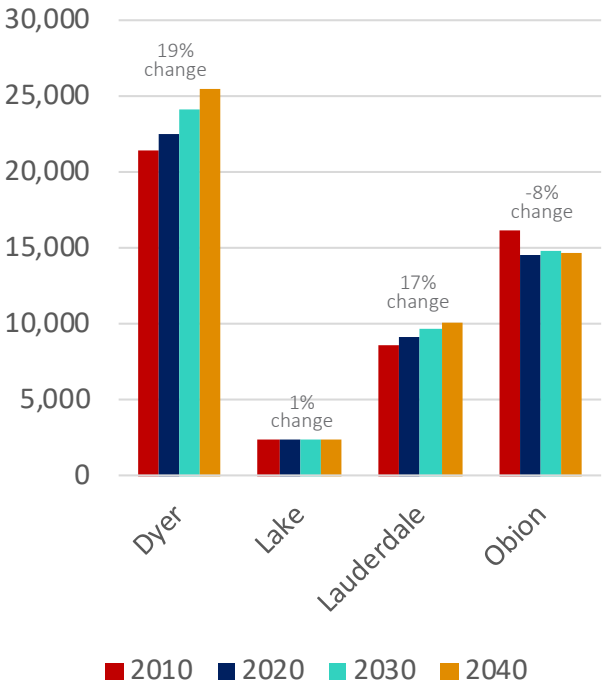
Source: TDOT Online Public Survey and I-155 Public Involvement Meeting (PIM)

Figure 3-1. County Growth Trends, Population — I-155



Source: Woods & Poole Economics, Inc., 2018

Figure 3-2. County Growth Trends, Employment – I-155

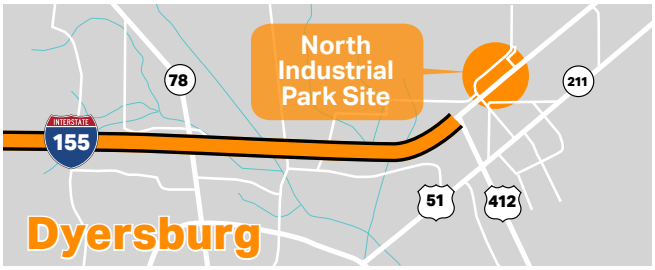


Source: Woods & Poole Economics, Inc., 2018

Land Use

Figure 3-5 shows the distribution of land use within the four-county study area. Land use composition is relatively uniform across the study area counties, with most parcels classified as agricultural. Reelfoot Lake and the Reelfoot National Wildlife Refuge in Lake County represent a relatively large area of public/semi-public land in the northwestern portion of the study area. Neither Dyer County or Dyersburg has developed a comprehensive plan, land use plan, or transportation plan to guide desired growth and development. Moderate development is anticipated along the entire corridor, with industrial growth concentrated near the eastern terminus of the freeway, centered on the Dyersburg North Industrial Park.

Figure 3-6. I-55 Industrial Park



Traffic Operations

TDOT collects and maintains Annual Average Daily Traffic (AADT) volume data on roadways across the state. Figure 3-7 shows the 2017 AADT volumes recorded in the Tennessee Roadway Information Management System (TRIMS) at four count stations along I-155. As shown, daily volumes range from 10,350 vehicles per day (VPD) (38% trucks) near the Missouri border in Dyer County, to 14,100 VPD (29% trucks) near Dyersburg. Throughout the corridor, seven to eight percent of the total daily volume occurs during the peak hours. The capacity of level, four-lane rural freeway facilities, such as I-155, ranges from 58,000 VPD to 75,000 VPD (Highway Capacity Manual 2010 Exhibit 10-9).Table 3-1 is populated with data obtained from the TSM, which provides base year (2010) daily trip information and forecasts the daily trips that will be made in 2040 based on projected growth and land use changes.

Figure 3-3. I-155 Change in Population (2010 to 2040)

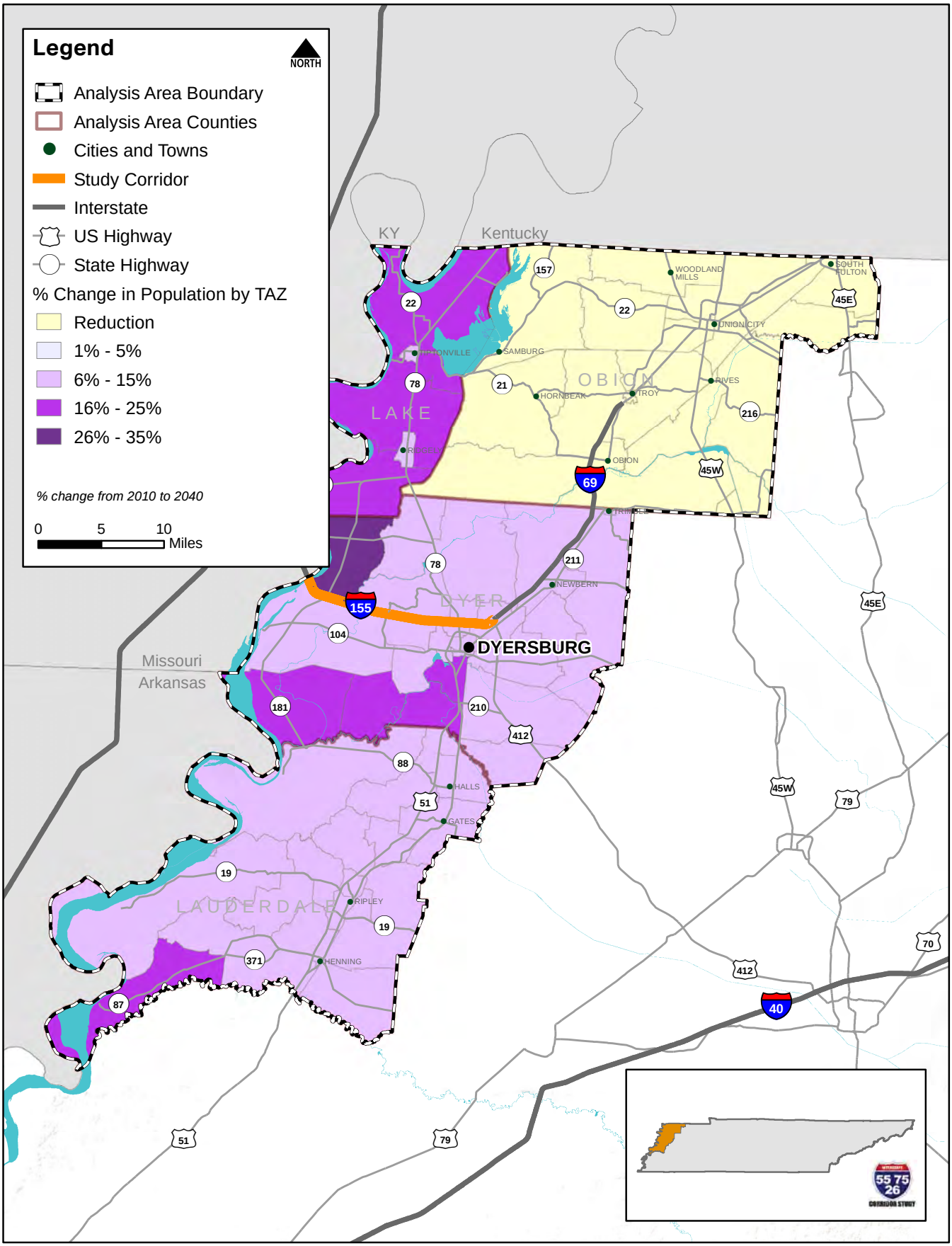


Figure 3-4. I-155 Change in Number of Jobs (2010 to 2040)

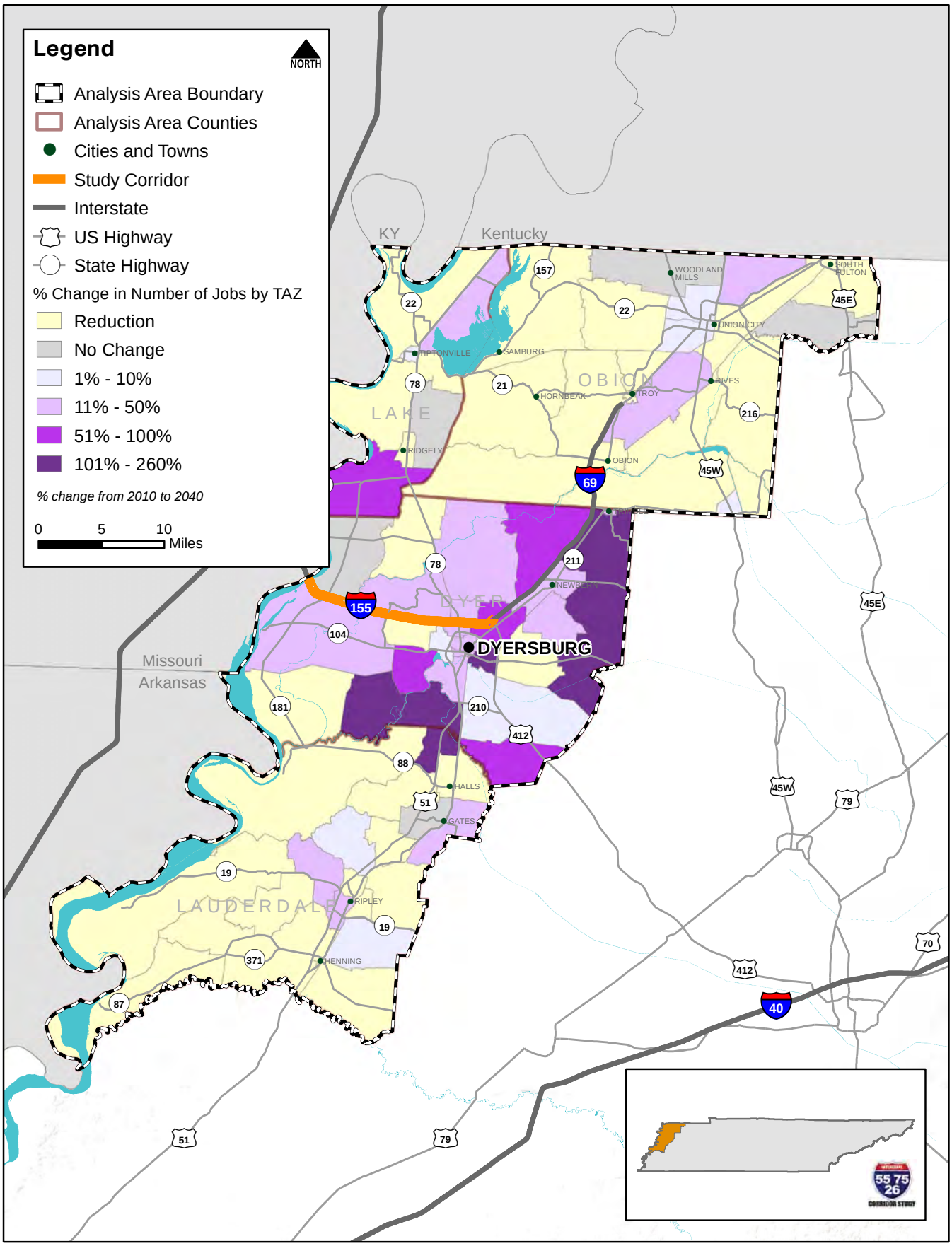


Figure 3-5. I-155 Existing Land Use

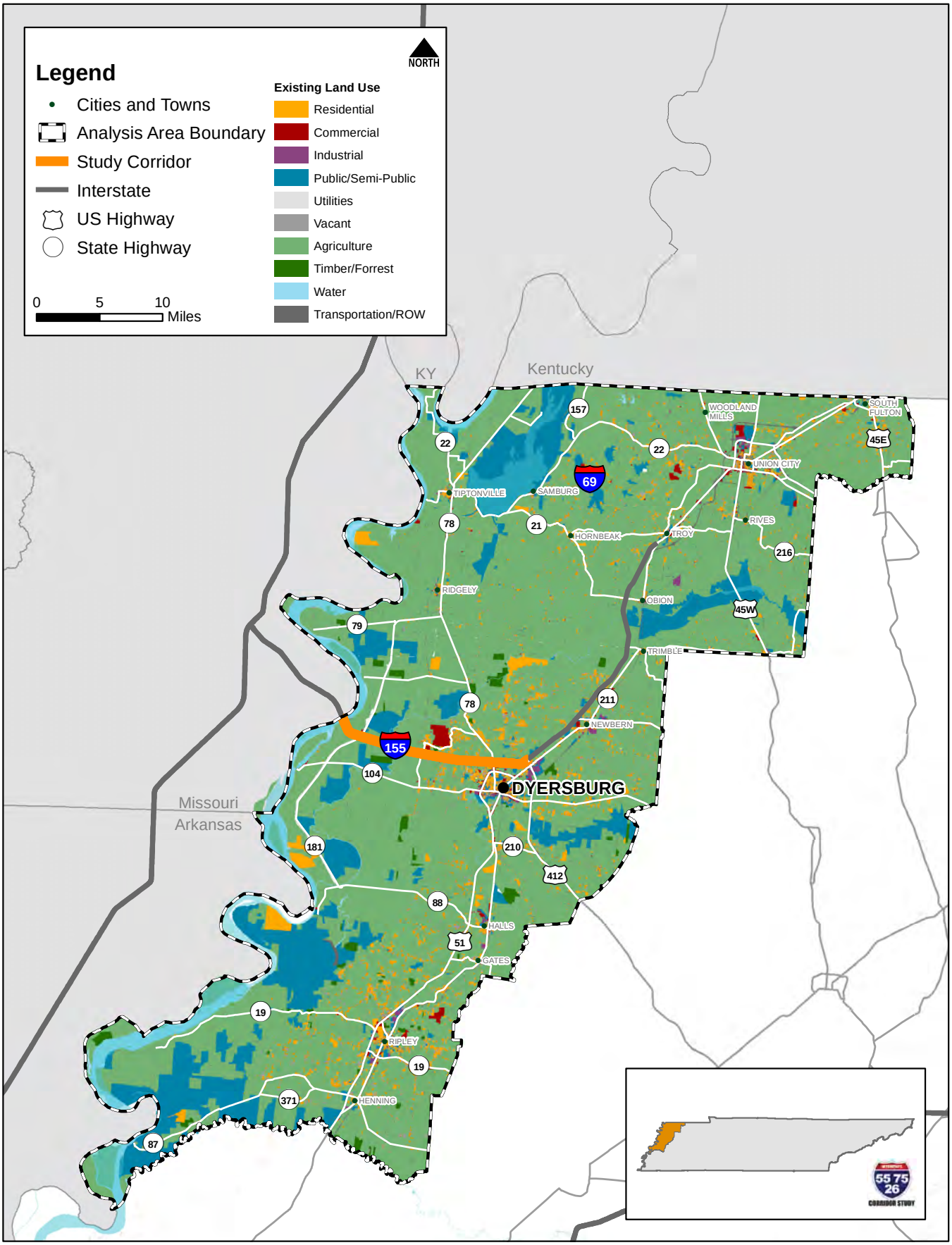
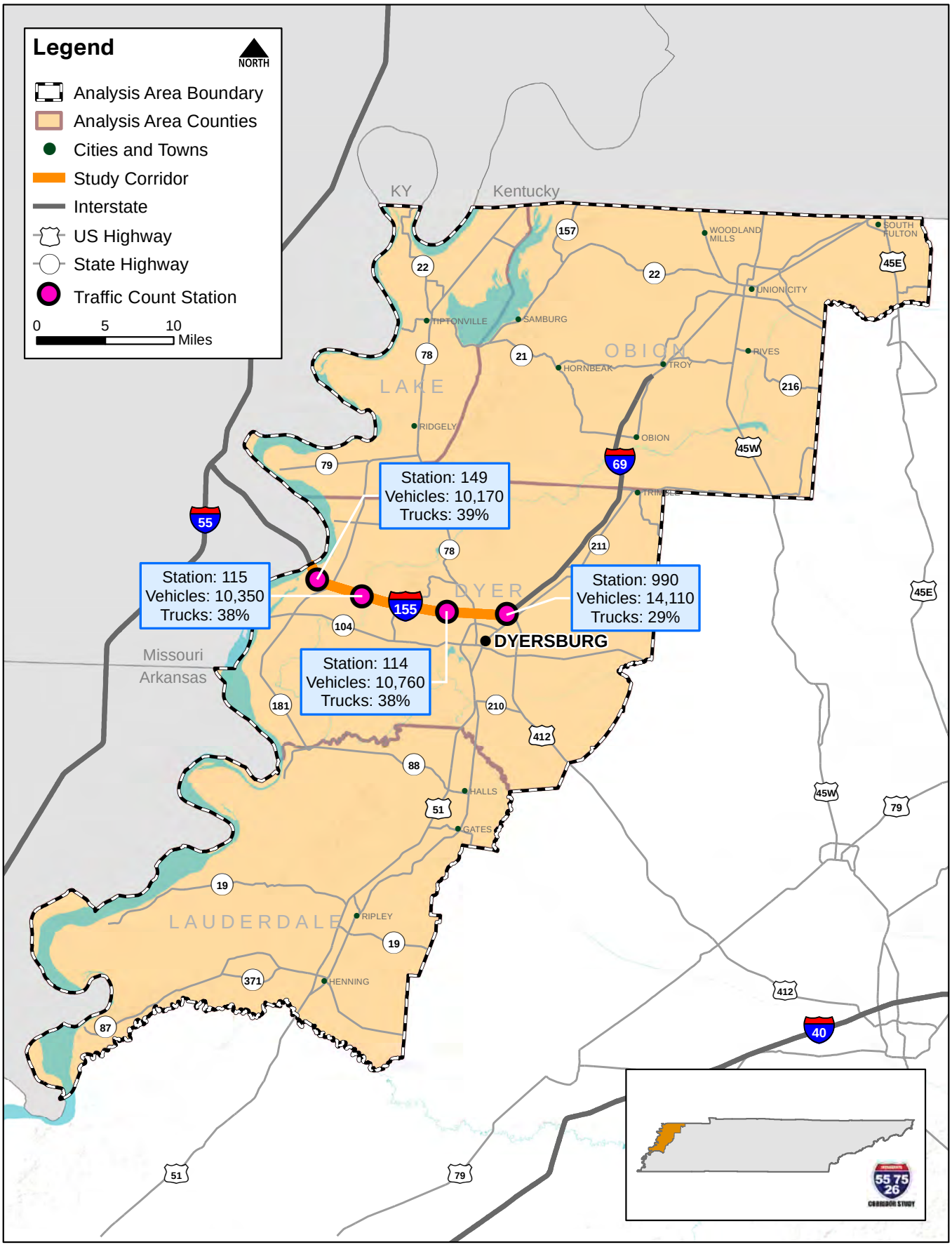


Figure 3-7. 2017 Average Annual Daily Traffic Volumes Along I-155



Source: Tennessee Roadway Information Management System (TRIMS) - 2017

As shown, total daily trips in the four-county area are expected to reach approximately 512,000 by 2040, representing a 19% increase over total trips in 2010. According to projections based on Woods & Poole data, the corresponding population and employment increases in the area are -1% and 9%, respectively.

Table 3-1. Area Daily Trip Breakdown 2010 and 2040 — I-155

	Daily Trips		
Trip Types	**2010**	**2040**	**% Change**
Personal Trips	410,700	487,700	19%
Truck Trips	19,400	24,000	23%
Total Trips	430,100	511,700	19%
Percent Truck Trips	4.5%	4.7%	

Source: Tennessee Statewide Travel Demand Model (TSM)

Highway Capacity

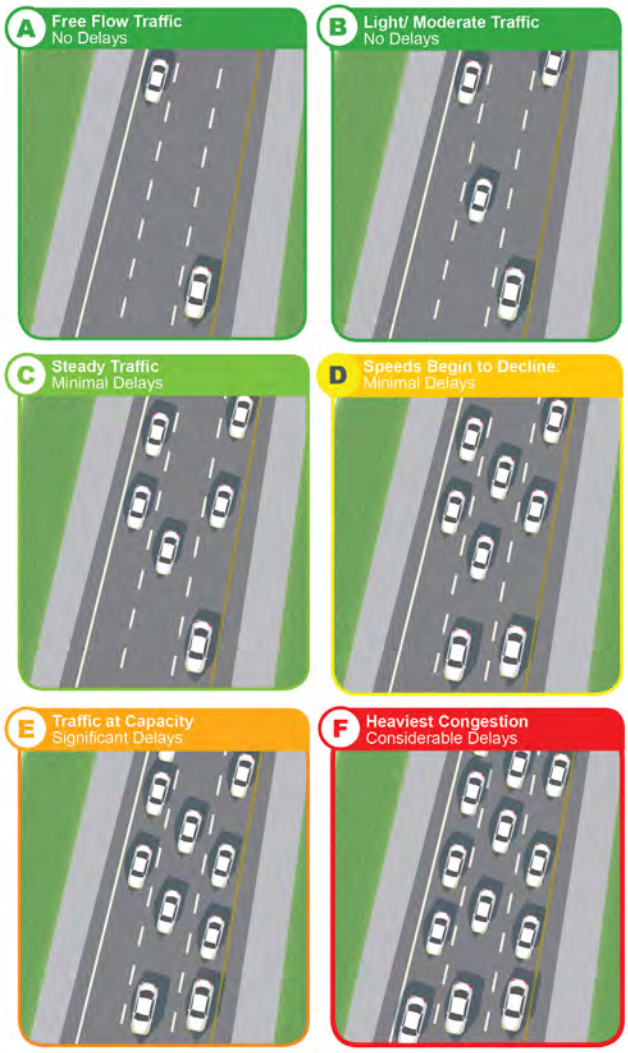
Vehicle capacity, as defined in the Highway Capacity Manual (HCM), is the maximum number of vehicles that can pass a given point during a specific period of time under prevailing roadway, traffic, and control conditions. Figure 3-8 illustrates the 2040 peak period volume-to-capacity (VC) ratios (obtained from the TSM) for each Interstate segment. Where the volume-to-capacity ratio is greater than 1.0, drivers experience poor operating conditions and high delay, represented as level-of-service (LOS) F (see Figure 3-9). According to the TSM output, I-155 currently operates very well ,at LOS A/B, and is expected to continue with good levels of service into 2040.

Transportation Systems Management & Operations (TSM&O)

ITS

Intelligent Transportation Systems provide information which improves transportation safety, operations, and mobility. TDOT's ITS program, SmartWay, utilizes cameras and sensors to monitor interstate corridors throughout Tennessee. Due to the rural nature of this corridor, no advanced SmartWay technology is present along the I-155 corridor. However, motorists can use TN 511 for weather and traffic conditions by phone, as well as the SmartWay App which provides real-time traffic information.

Figure 3-9. LOS Characteristics

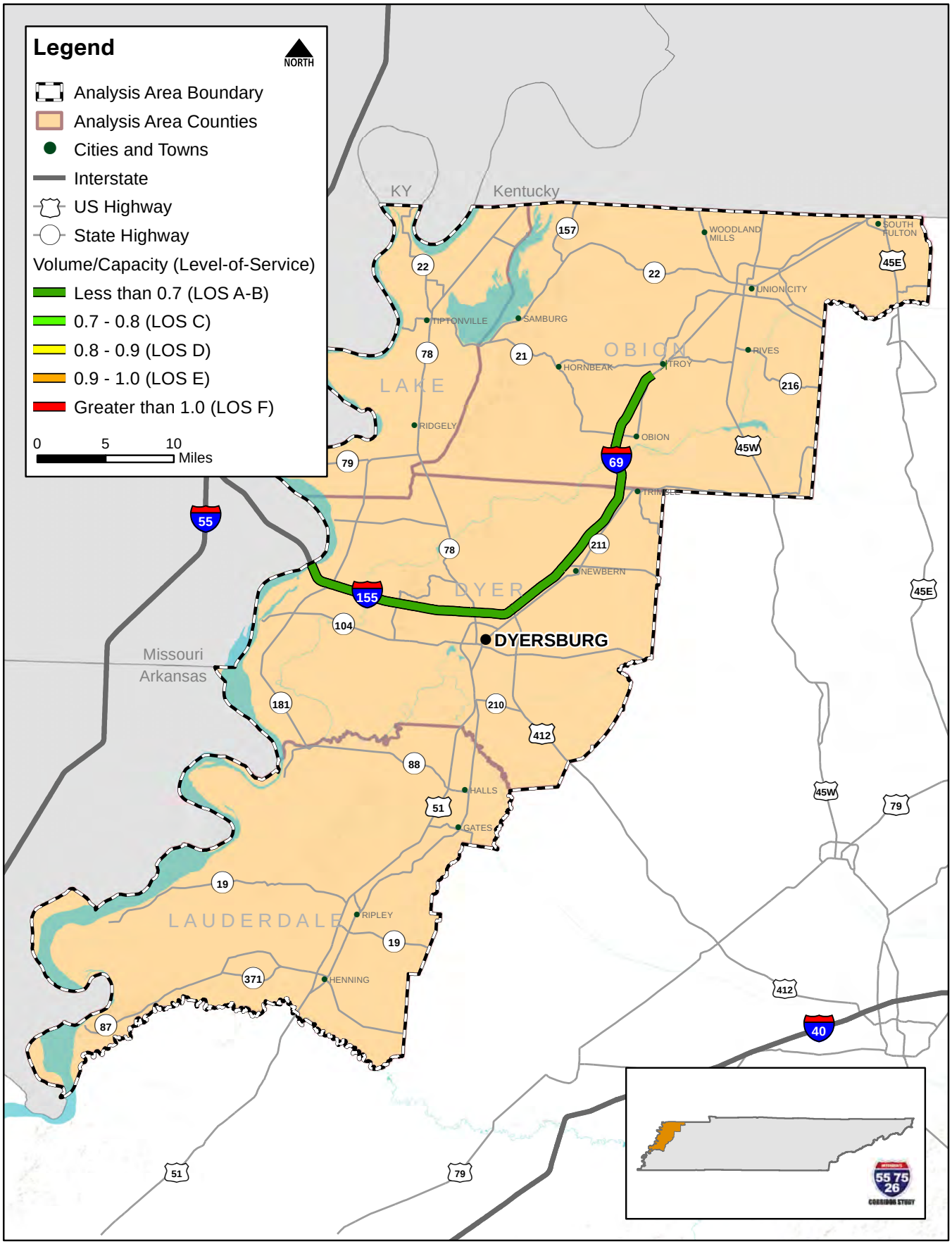


Traffic Incident Management

Responding to traffic incidents in an effective and timely manner reduces congestion, wasted fuel, and the likelihood of secondary crashes. The time it takes to respond to an incident and clear the roads is directly related to the likelihood of a secondary crash. This response time can be greatly reduced using ITS technologies, including monitored CCTV cameras, radar detectors to determine travel speeds, and DMS to direct/notify drivers. The highly coordinated incident management process requires accurate and efficient communication among numerous agencies.

TDOT's HELP program has been incorporating the latest ITS technologies and strategies since its inception in 1999. However, HELP trucks are currently not deployed on I-155. As a result, scene management and crash clearance rest solely on law enforcement and first responders.

Figure 3-8. Volume-to-Capacity Ratios/Level-of-Service (2040) — I-155



Source: Tennessee Statewide Travel Demand Model (TSM)

TDOT has established specific, regional Interstate incident management plans focusing on major incidents (those that will require total roadway closure for at least two hours). Goals of these living plans include decreased response time and planned detour routes with appropriate signing so that motorists experience minimal delay in moving toward their destinations. The plans also detail work zone traffic control and point to the regional transportation management centers as the "home base" of coordination and communication during an event. The plans are distributed to regional TDOT Maintenance and Incident Management staff so that the defined detour routes can be implemented quickly upon confirmation of an incident. The Region 4 incident management plan includes action / detour plans for I-155 incidents located between Exit 1 (Missouri I-155) and Exit 15 (SR-20 / US-412). The plan currently re-routes eastbound and westbound traffic approximately 230 miles via I-55, I-40 (MS River Crossing) and SR-202.

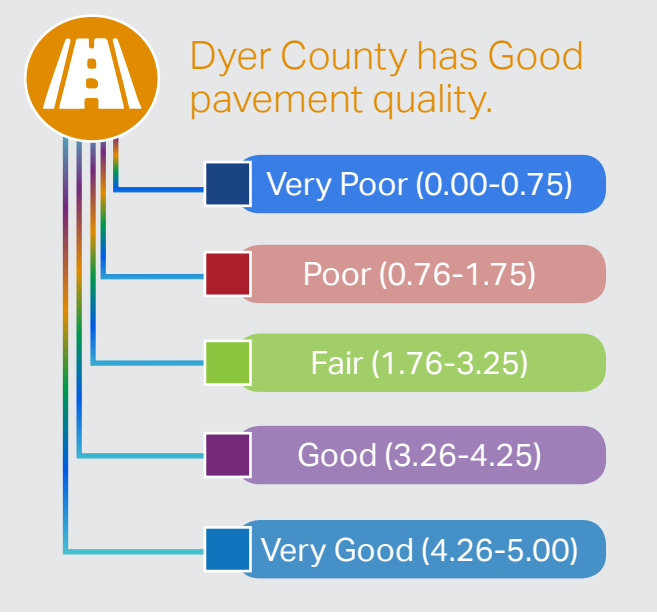
System Maintenance

Pavement

TDOT collects and maintains pavement management data for all roads included in the state's network. The Pavement Quality Index (PQI), expressed on a scale from 0-5, is the overall measure of a pavement's roughness and distress. The PQI is calculated based on both the Pavement Distress Index and the Pavement Smoothness Index, the latter of which is a function of the International Roughness Index (IRI). The IRI measures the number of vertical deviations over a section of road, and has been used as a performance measure toward goals set by the Federal Highway Administration (FHWA) since 1998. As of 2006, FHWA designated an IRI equal to 95 inches/ mile or less to be representative of a road with good ride quality.

Pavement on I-155 falls into the Good range, with a PQI of 4.068. Based on the 2017 TRIMS maintenance history (illustrated in Figure 3-11) I-155 was most recently resurfaced in 2009/2010.

Figure 3-10. Pavement Quality Index



Bridge Conditions

TDOT routinely inspects and evaluates the 19,822 structures designated as public highway bridges in the state. These include bridges owned and maintained by TDOT, as well as those owned and maintained by local governments. TDOT designates a bridge as "structurally deficient" if one or more major structural components are rated in poor condition, or if its load carrying capacity is well below current design standards. Via the Better Bridge Program, the state addressed deficiencies on 193 of the 200 structurally deficient state-owned bridges in 2013. There are no structurally deficient bridges on the I-155 corridor.

The Federal Highway Administration's Highway Bridge Replacement and Rehabilitation Program provides funds to assist states in replacing or rehabilitating deficient highway bridges located on any public road. To be eligible, a bridge must carry highway traffic, be deficient, and have a sufficiency rating of 80 or less. The sufficiency rating of an individual bridge, on a scale of 0 to 100, is based on structural adequacy and safety, serviceability and functional obsolescence, and essentiality for public use. A rating of 0 is the worst possible bridge. A sufficiency rating that is less than 50 is eligible for replacement and a sufficiency rating of less than 80 but greater than 50 is eligible for rehabilitation.

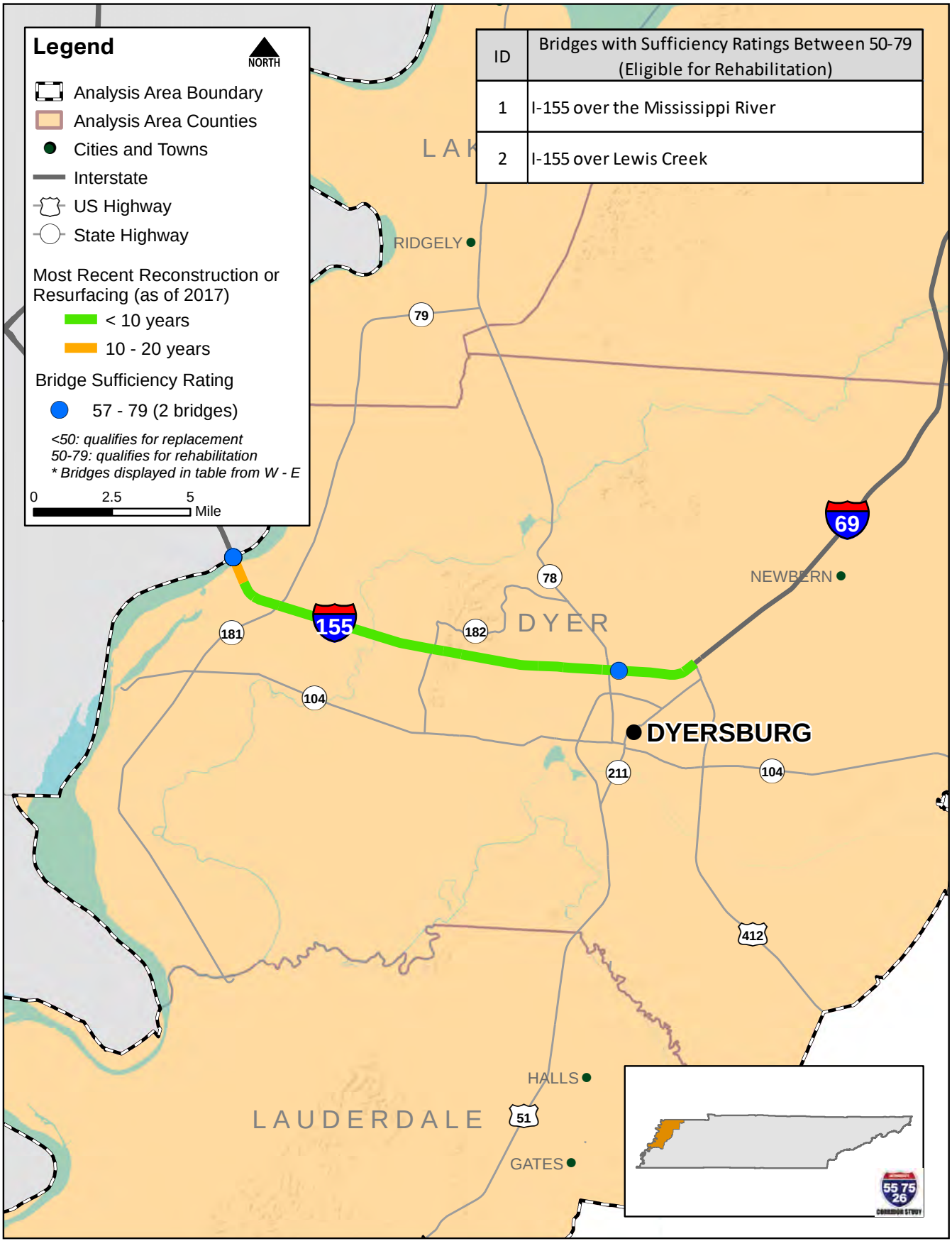
Of the 10 bridges on I-155 in the study area, there are no bridges with a sufficiency rating of less than 50. There are two bridges with ratings between 50 and 80 and the remaining eight bridges have sufficiency ratings greater than 80 (Figure 3-11).

Multimodal Facilities

Public Transportation

The I-155 corridor study area is located in an area of Tennessee with low population density. Although no fixed-route public transit is offered within the corridor area, the Northwest Tennessee Human Resource Agency (NWTHRA) Public Transportation Program offers on-demand service for residents in the area. See Figure 3-12 for a map of the NWTHRA service area. Fares can be as low as $1.00 round trip and the service

Figure 3-11. Recent Reconstruction/Resurfacing, Bridge Sufficiency Ratings — I-155



Source: Tennessee Roadway Information Management System (TRIMS) - 2017

Figure 3-12. NWTHRA Service Area

Source: NWTHRA

will transport riders as far as Memphis, Jackson, and Nashville. Services are offered from 6:00 a.m. to 6:00 p.m. Monday through Friday.

Pedestrian/Bicycle

Unless planned for ahead of time, geometric limitations created by Interstate structures often result in discontinuous pedestrian and bicycle accommodations on cross-streets through an interchange. Where bicycle lanes and sidewalk may be present on either side of the Interstate, the cross-section through the interchange may be limited to only vehicular traffic, which discourages multi-modal connectivity. Furthermore, ramp intersections often create bicycle lanes and sidewalk paths that are difficult to navigate, and in some cases unsafe. As shown in Figure 3-13 and Table 3-2, I-155 interchanges with U.S. and state routes were evaluated to assess connectivity for pedestrians and bicyclists across the Interstate. Where pedestrian and bicycle accommodations existed on the cross-street, free-flow right turns at ramp interchanges were also noted. While free-flow right turns have operational benefits, the movement allows vehicles to maintain higher rates of speed off the ramp and through the intersection, putting pedestrians and bicyclists at a disadvantage. Motorists traveling at higher speeds are less likely to yield to pedestrians and higher intersecting speeds are more difficult for bicyclists to judge and manoeuvre. AADT on the cross-roads was also noted as higher traffic volumes limit mobility for pedestrians and bicyclists.

No interchanges on I-155 feature designated bicycle or pedestrian facilities on the cross road, although SR-78 and SR-181 have paved shoulders. SR-20 and SR-78 have traffic volumes in excess of 10,000 vpd.

Transportation Demand Management

Transportation Demand Management (TDM) is a set of strategies that influence travel behavior to reduce single-occupancy vehicle travel. Ranging from ridesharing, bicycling, teleworking, taking transit, car sharing and on-demand or real-time applications, TDM strategies redistribute commuter travel across a variety of alternatives and away from daily peak periods. TDM programs represent a flexible, low-cost way to engage residents, travelers, businesses and local governments in the effort to reduce commuter travel and associated costs and impacts on the community including traffic congestion and emissions. The Statewide TDM Plan identified a number of ways regional TDM programs can support TDOT with managing mobility. They can also provide needed assistance on selected corridors when capacity is at a premium – especially during large construction projects. The I-155 corridor does not currently contain an urban area TDM program. Given the low levels of congestion on I-155, a TDM program is a low priority for this area.

Safety

Increase traffic volumes and vehicle miles traveled increase the likelihood of traffic incidents. To identify trends in potential safety issues along the I-155 corridor, five-year (2014-2018) crash data was collected from TRIMS and evaluated.

Using TDOT's traffic volumes collected in 2018, crash rates were also calculated. These rates are reported in terms of crashes per million vehicle miles traveled. Figure 3-14 shows the comparison of these rates to the statewide averages for facilities of a similar type.

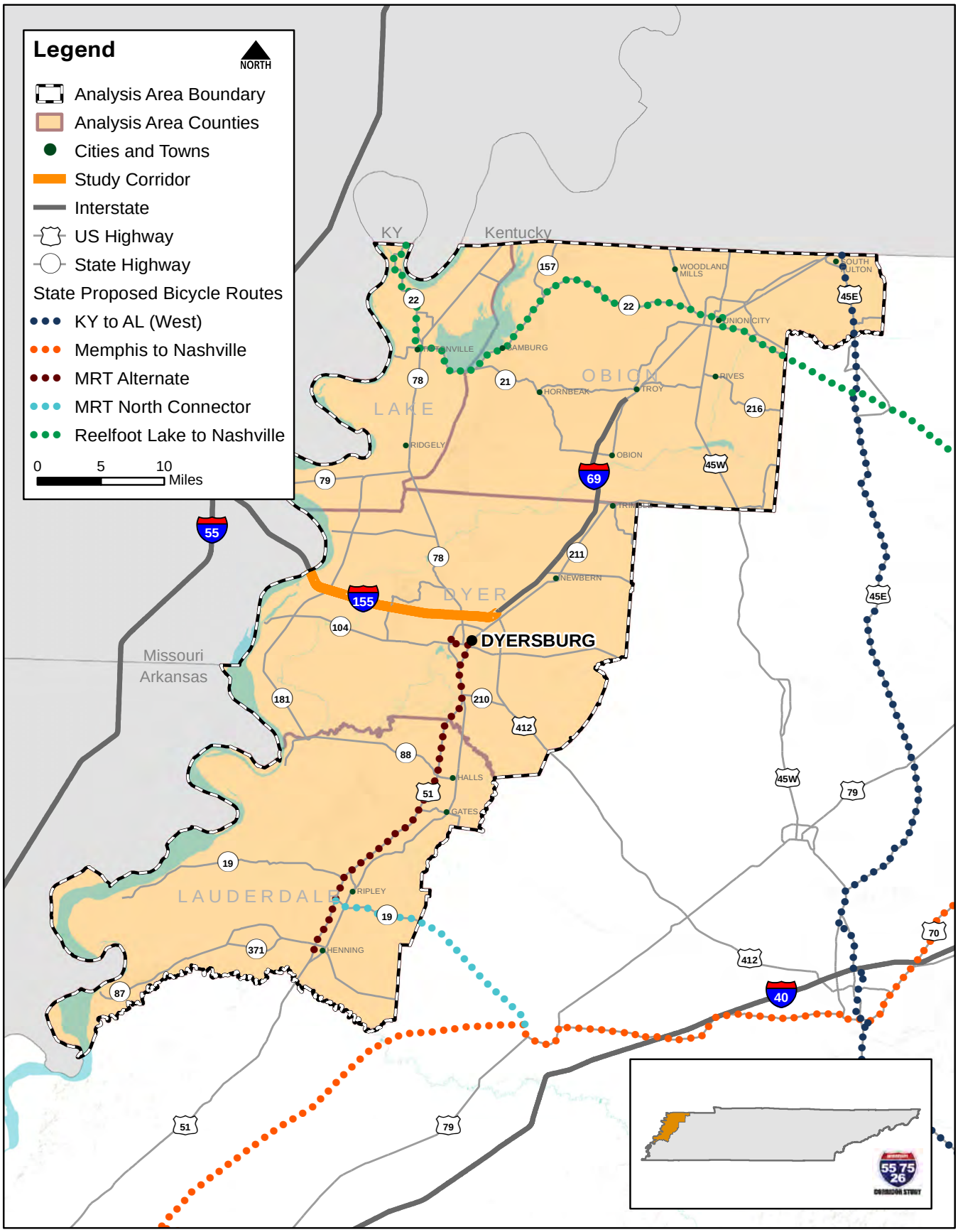
Table 3-2. Locations Where a U.S. or State Route Crosses I-155

Map Letter	State Route/U.S. Hwy Crossings	Crossroad AADT (2018)	Bicycle Lane/ Multi-Use Path?	Paved Shoulder >2'?	Sidewalk?	Free-Flow Right with Bicycle/Ped Facilities?
A	SR-20/US-412/SR-3/US-51	14,400 (W)*; 11,800 (S)**	Freeway-Style Facilities No Bicycle/Pedestrian Activity Allowed			
B	SR-78 (Lake Rd)	6,600 (N)***; 26,300 (S)	No	Yes	No	Yes
C	SR-182 (Lenox Nauvoo Rd)	1,000 (N)	No	No	No	N/A
D	SR-181 (Great River Rd)	600 (N); 700 (S)	No	Yes	No	No

* West approach; ** South approach; ***North approach

Source: TDOT Traffic History website, Google Earth

Figure 3-13. Planned State Bicycle Routes and U.S./State Route Crossings — I-155



More specifically, the statewide average crash rate is 0.528 crashes per million vehicle miles traveled for rural freeways and 1.112 crashes per million vehicle miles for urban freeways. I-155 crash rates were compared to the Tennessee statewide averages based on the following metrics:

- **Below Average**: Locations with crash rates below the statewide average
- **Average**: Locations with crash rates at or within 15 percent above the statewide average
- **Above Average**: Locations with crash rates between 15 and 100 percent above the statewide average
- **Significantly Above Average**: Locations with crash rates greater than or equal to 100 percent higher than the statewide average

Tennessee is working to reduce traffic fatalities as part of the nation's vision Toward Zero Deaths®. This vision is a highway system free of fatalities.

Areas where the crash rates were significantly above statewide averages were identified as hot spots and are shown in Figure 3-14 in red. Hot spots crash records were examined to discern if patterns indicated deficiencies that could be addressed. Table 3-3 shows the results of this analysis. In general, each of the hot spots were examined for trends in severity, prevalent collision types, non-vehicular accident events, lighting/weather conditions, relation to ramps and interchanges, as well as horizontal and vertical curvature. From these trends, potential crash factors were identified for each location, which ultimately informed the development of safety project solutions.

As shown, the predominant crash type was crashes with objects other than motor vehicles, with over half of those crashes occurring with roadway barriers such as guardrails, cable barriers, and others.

From 2014-2018, there were no pedestrian or bicyclist crashes along the I-155 study corridor or at interchange ramps.

Freight

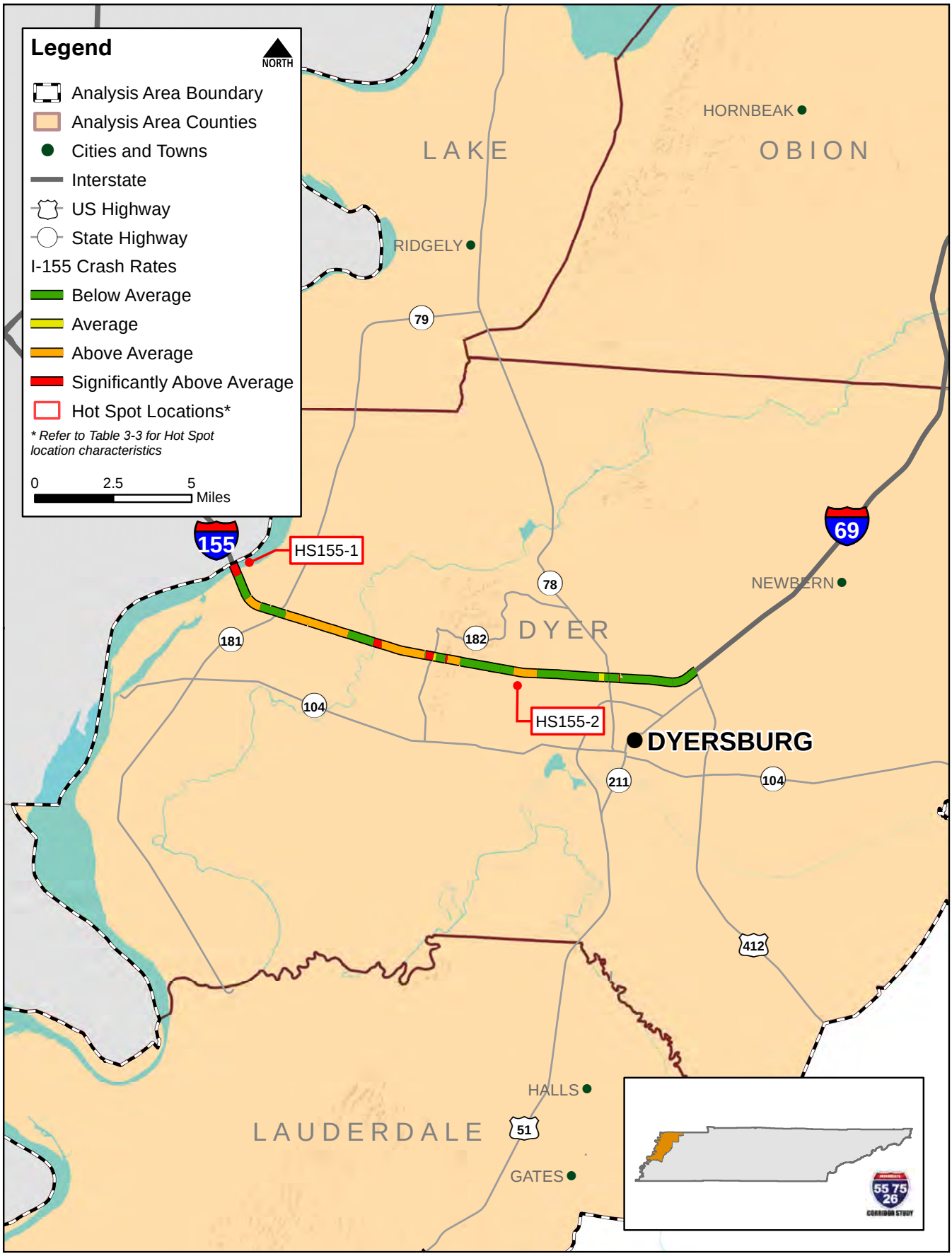
Freight movement is an important element of a regional and national economy, as more efficient modes and routes enable improved logistics and result in reduced transportation costs. These cost savings can then be reallocated to growth, providing better jobs and higher wages in the area. Truck is the primary mode of transporting freight in the I-155 corridor, accounting for nearly 88 percent of inbound and 68 percent of outbound freight in the study area in 2016. Truck volumes are expected to grow by at least 91 percent from 2010 to 2040 as shown in Figure 3-15. The corridor sees high volumes of through traffic with over five million tons annually, but notably the corridor is expected to operate at LOS A in 2040. As a result, there are no bottlenecks or anticipated challenges for truck freight in the corridor. There are opportunities nearby for using the Mississippi River to transport goods, especially grain, and there are rail and air facilities in Dyersburg. The corridor lacks many public and private truck parking facilities. In addition, there are few opportunities for commodities to divert away from truck to rail in the inbound direction, but there are more options in the outbound direction.

As noted in the Tennessee Statewide Multimodal Freight Plan (2018), a project that could impact existing freight facilities in the I-155 study area is the potential expansion of I-69. Existing facilities are shown in Figure 3-16.

Deficiencies Summary

As detailed in the previous subsections, this study identified and evaluated existing and forecast transportation deficiencies in the I-155 corridor based on extensive plans review, data analysis, and stakeholder outreach. The identified deficiencies are summarized, by mode or strategy, in Table 3-4. In addition to the location and description of each deficiency, Table 3-4 shows the source by which each deficiency was identified.

Figure 3-14. Crash Rates (2014-2018) — I-155



Source: Tennessee Statewide Travel Demand Model

Table 3-3. Hot-Spot Crash Location Characteristics – I-155

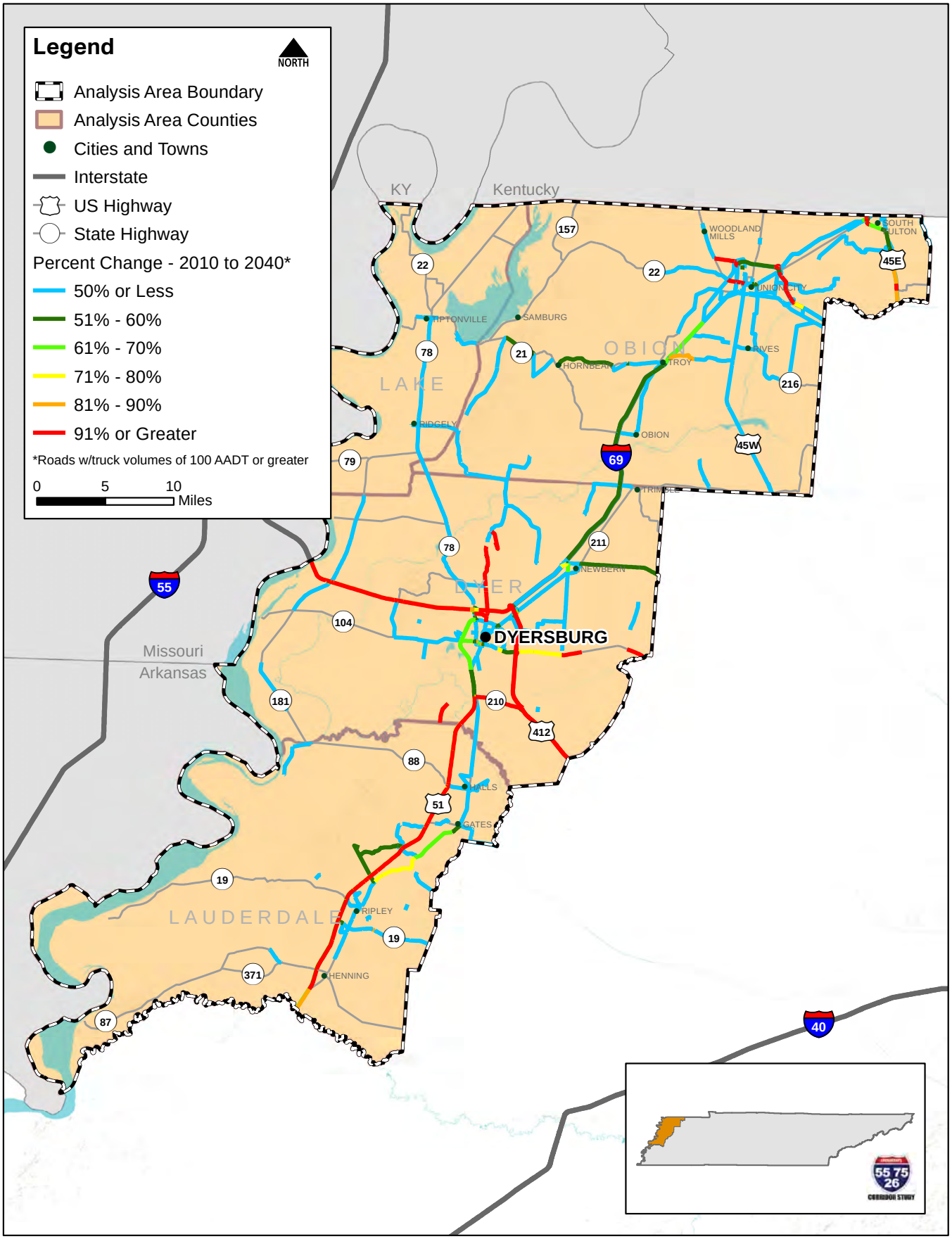
	Hot Spot ID	
	HS155-1	HS155-2
Termini	Mississippi River Bridge	SR-182 (Lenox-Nauvoo Road) - SR-78 (Lake Road)
Number of Crashes	13	8
Severity (Fatal or Injuries)	46% (6)	0%
Prevelant Collision Types	69% (9) Non-Vehicle	100% (8) Non-Vehicle
Non-Vehicle Trends	89% (8) Roadway Barrier	50% (4) Roadway Barrier
Lighting/Weather	54% (7) in Dark-Unlit Conditions 31% (4) in Rain/Snow	38% (3) in Dark-Unlit Conditions 25% (2) in Rain/Snow
Interchange Related	No	No
Curvature Issues	N/A	N/A
Potential Crash Factors	• Inadequate lighting in rural areas • Small inside shoulder width near roadway barriers	• Inadequate lighting in rural areas • Small inside shoulder width near roadway barriers • Animal crossings from nearby forested area are common throughout the corridor

Source: Tennessee Roadway Information Management System (TRIMS) - 2017

Table 3-4. Deficiencies Summary — I-155

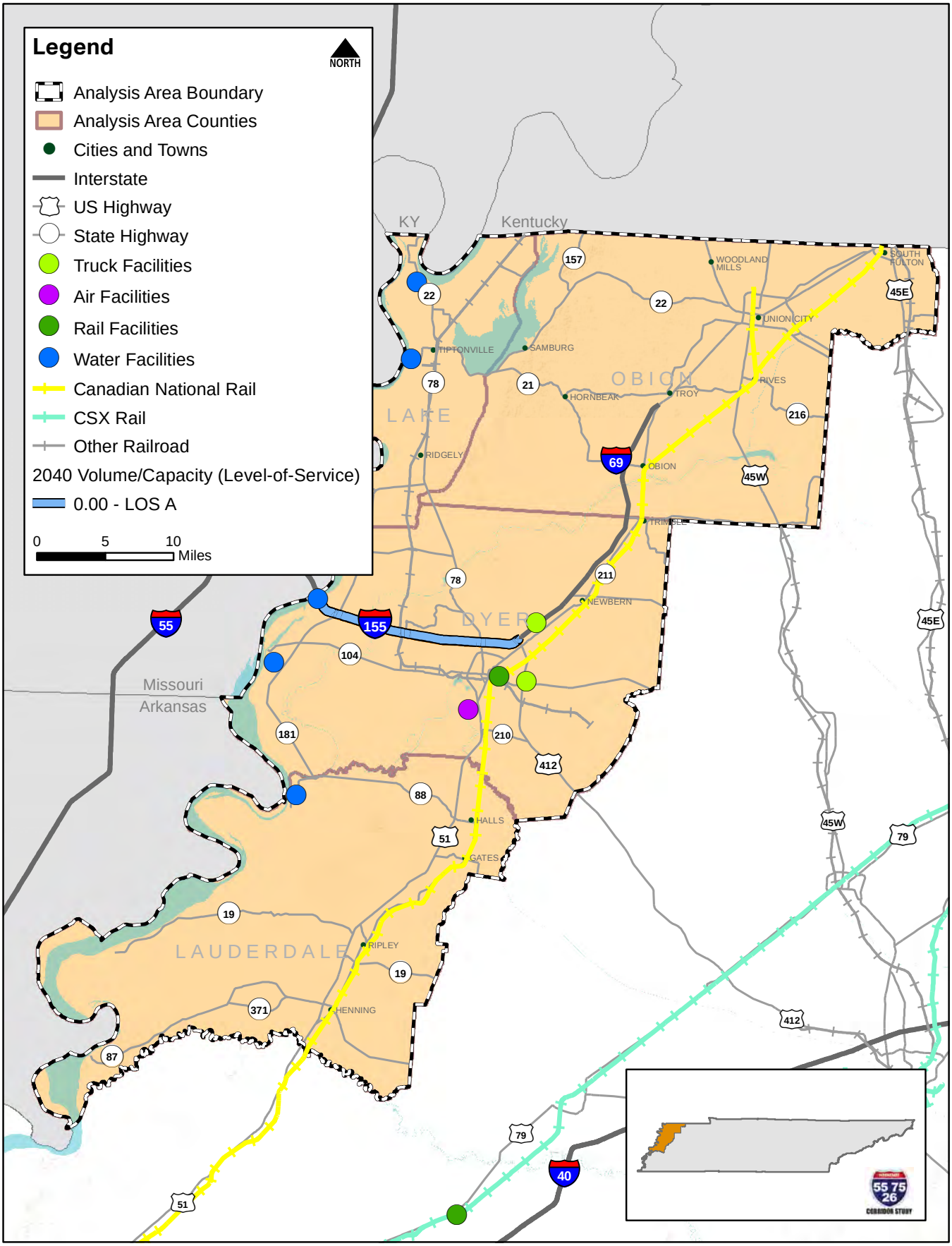
Mode/ Strategy	Location	Issues/Deficiency	Source
 Safety	I-155 west of Dyersburg	Safety and operations issues related to no warning system for snow/ice in hilly areas, inadequate shoulder widths	Public/Stakeholder
	Near Lake Road Interchange	Farm equipment uses travel lanes due to inadequate shoulder width	Public/Stakeholder
	WB Approach to Mississippi River Bridge	Inadequate lighting, small inside shoulder width near roadway barriers	Data Analysis
	SR-182 to SR-78	Inadequate lighting, small inside shoulders with roadway barriers, animal crossings from nearby forested area	Data Analysis
 TSM&O	Mississippi River Bridge	Detour plan requires 200+ miles of travel. Need to maintain operation of I-155 bridge as best as possible.	Data Analysis
 Freight	US-412 Interchange	Truck rollovers due to small ramp radii	Data Analysis, Public/ Stakeholder

Figure 3-15. Growth in Truck Volume from 2010 to 2040 — I-155



Source: Tennessee Statewide Travel Demand Model

Figure 3-16. Freight Facilities — I-155



Source: InfoUSA and Tennessee Statewide Travel Demand Model

4. Multimodal Solutions/ Universe of Alternatives

Introduction

Following the identification and analysis of corridor transportation deficiencies, the study developed goals for the corridor and performance measures used to assess the effectiveness of various solutions to those problems. A universe of alternatives, or potential solutions, was developed. The universe of alternatives was organized based on the issues each potential solution addresses, including safety, traffic congestion, freight movement, and multimodal travel. Many of the solutions may benefit more than one aspect of travel in the corridor. Ultimately, selected solutions were assembled into a Build (2040) scenario that accounted for their impacts on regional travel.

Performance Measures

Goals for potential improvements along the I-155 corridor were selected to reinforce the three strategic emphasis areas in TDOT's 25-Year Long-Range Transportation Plan: efficiency, effectiveness, and economic competitiveness. As shown in Table 4-1, the five identified goals were further developed into 12 specific objectives, intended to guide development and evaluation of possible solutions. In order to evaluate how well a potential solution satisfies an objective - and ultimately a goal - measures must be established that are data driven and comparable across the Base (2010), Trend (2040) and Build (2040) scenarios. Table 4-2 outlines the performance measures established for the I-155 corridor. As indicated, the measures fall into four categories (Traffic Operations, Safety, Operations & Maintenance, and Multimodal), which directly support the objectives identified in Table 4-1.

8 potential solutions for the I-155 corridor are discussed in this report

Highway Capacity Alternatives

Within the I-155 corridor, all segments of interstate were expected to operate at LOS C or better through 2040.

Table 4-1. Performance Goals and Objectives — I-155

Goals	Objectives		
Provide efficient and reliable travel	Improve travel times and reduce delay	Provide transportation options for people and freight	Optimize freight movement
Improve safety conditions	Reduce crash rates along the corridor – especially at identified crash "hot spots"	Implement or upgrade technologies that promote safety and effective incident management	Improve bicycle and pedestrian accommodations
Coordinate transportation investments with economic development plans	Improve interchange on/ off ramps	Coordinate with MPOs/ RPOs to determine areas where new/improved Interstate access is needed	
Invest equitably throughout the corridor	Expand transportation options for traditionally underserved populations within the corridor	Consider regional transit options	Identify areas with the greatest data-driven needs
Protect the natural environment and sensitive resources within the corridor	Identify transportation improvements that are not likely to result in major impacts to environmental, social, and cultural resources		

Table 4-2. Performance Measures — I-155

Goal	Performance Measure		Unit
Traffic Operations	Traffic on interstate operates at LOS D or better		% of interstate operating at LOS D or better
	Total Daily Vehicle Miles Traveled (VMT)		Miles (1,000s)
	Total Daily Vehicle Hours of Travel (VHT)		Hours (1,000s)
	Total Peak Hour Vehicle Hours of Delay (VHD)		Hours
	Total VMT / Trip		Miles
	Total Vehicle Minutes Traveled / Trip		Minutes
	Average Peak Hour Travel Speed	Urban Interstate	MPH
		Rural Interstate	MPH
	Congested Travel Time between key O&D Pairs along Corridor (Total)		Minutes
	Peak Hour Density at Improved Interchanges		Vehicles/Mile/Lane
	Average and Max Queues at Improved Interchanges		Feet
Safety	Crash reduction in safety "hot spots"		Above or Below Average Crash Reduction Potential
Operations & Maintenance	Bridge Condition (Sufficiency Rating)		% of bridges < 50
			50 < % of bridges < 80
	Pavement Condition (Resurfacing)		% of corridor resurfaced within the last 10 years
Multimodal	Pedestrian and Bicycle Accommodations at U.S. and State Route Interchanges		% interchanges with bike facilities
			% interchanges with ped. facilities
	Freight (Truck Parking)		# of Rest Area Spots
			# of Truck Stop Spots

Stakeholders did, however, note congestion problems near the SR-78 (Lake Road) interchange due to slow moving farm equipment. A possible solution to this issue is identified in Section 7 (Freight) of this memo: "Install appropriate signage and increase enforcement to remove farm equipment from the interstate." No other traffic operations solutions were identified for inclusion in the universe of alternatives.

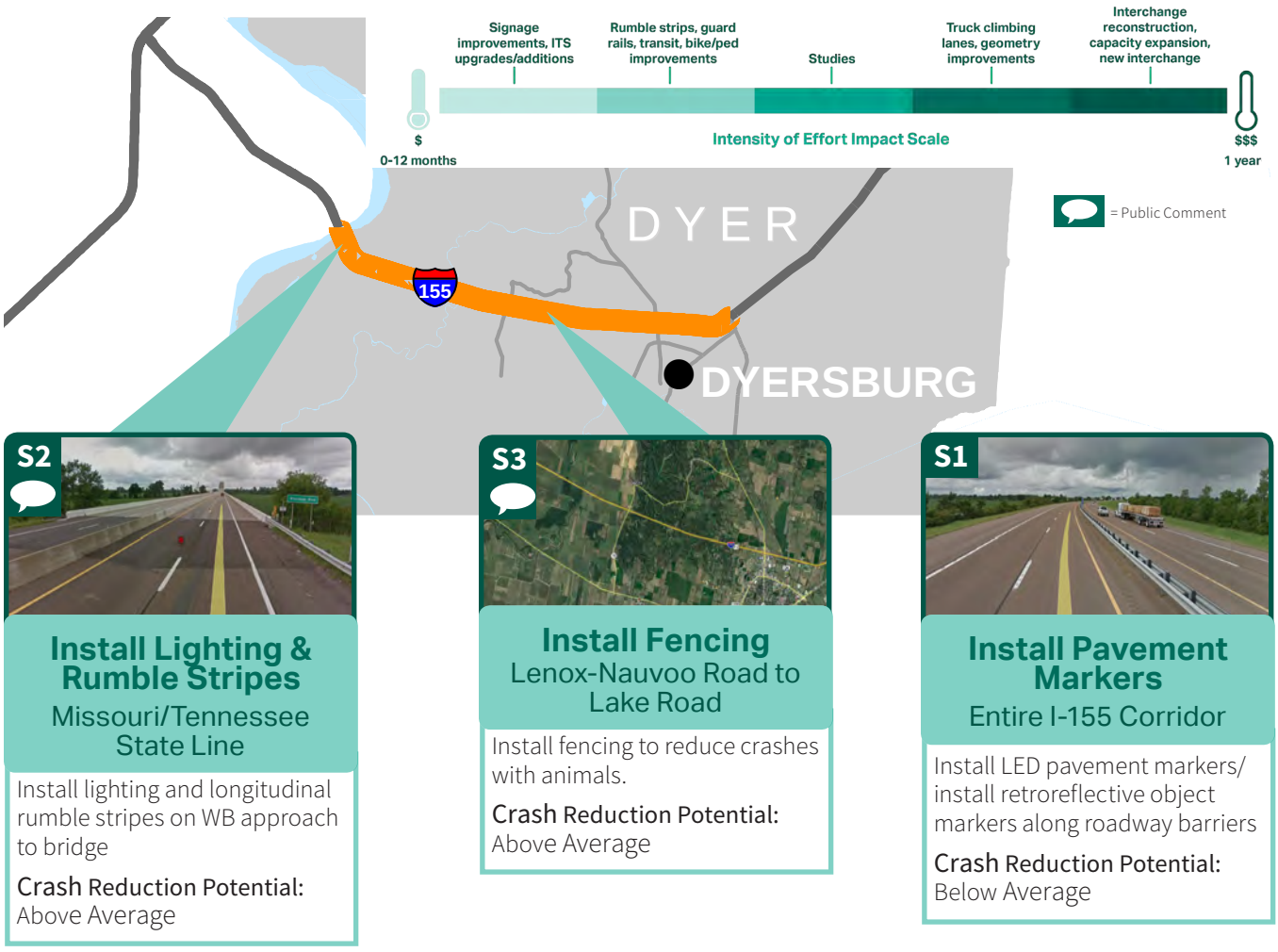
Safety Alternatives

As a first step in identifying safety solutions to address these factors along the I-155 corridor, TDOT's April 2017 IMPROVE Act was reviewed to determine if any safety-related solutions were recommended in these areas. There were no explicit safety solutions proposed as part of the IMPROVE Act on I-155. As such, the potential crash factors were reviewed for each hot spot in tandem with public comments as well as aerial and street-level photography to identify potential solutions.

In addition to identifying potential safety improvements for locations along the corridor, the crash reduction potential for each recommendation was explored through the research of Crash Modification Factors (CMFs). A CMF estimates a safety countermeasure's ability to reduce crashes and crash severity. Based on data provided by the CMF Clearinghouse, each recommendation is categorized as having above or below average crash reduction potential, specific to the I-155 corridor, where data was available. It is important to note that the reduction potential for each recommendation is only applicable to crash types that would be prevented by implementing the improvements.

Figure 4-1 depicts each safety solution and its crash reduction potential.

Figure 4-1. Potential Safety Improvements — I-155



TSM&O Alternatives

Transportation Systems Management and Operations (TSM&O) is "a set of strategies that focus on operational improvements that can maintain and even restore the performance of the existing transportation system before extra capacity is needed." Currently, traffic volumes on I-155 are well under the available capacity and motorists experience minimal delays. However, as development occurs, planners should be mindful of proactive options to mitigate congestion. One of the possible solutions outlined in other sections of this technical memorandum would also be considered a TSM&O solution:

- Freight Solution, F1: Install ITS warning system for snow, ice and inclement weather from Great River Road to Jenkinsville-Jamestown Rd.

Additional solutions were developed on a review of existing plans, public / stakeholder feedback, and field observations. These solutions are outlined in Table 4-3.

Freight Alternatives

Specific suggested freight improvements for the I-155 corridor are shown in Table 4-4. Solutions F1 and F2 were identified by stakeholders through the public outreach process. F3 is recommended based on Tennessee law (TCA55-7-205(a)) regarding farm equipment on controlled access facilities.

Truck Parking

The website www.truckstopguide.com lists one truck stop along I-155 in Tennessee with parking for 40 trucks, in addition to the 10 truck spots at the Tennessee Welcome Center. According to the FHWA Model Development for National Assessment of Commercial Vehicle Parking2, this segment of I-155 should have 12 rest area parking spots and 38 truck stop parking spots; therefore, truck parking along this corridor should be sufficient and no truck parking solutions were identified for inclusion in the universe of alternatives

Table 4-3. Potential TSM&O Improvements — I-155

ID	County	Termini (From)	Termini (To)	Description	Source of Recommended Solution
TS-1	Dyer	Mississippi River Bridge		Installation of structural impact monitoring system to identify severity of barge collisions	Public/Stakeholder
TS-2	Dyer	Mississippi River Bridge		Installation of barge sensor monitoring system	Public/Stakeholder

Table 4-4. Potential Freight Improvements — I-155

ID	County	Termini (From)	Termini (To)	Description	Source of Recommended Solution
F1	Dyer	Great River Road	Jenkinsville-Jamestown Road	ITS west of Dyersburg: Warning system for snow, ice, and inclement weather	Public/Stakeholder
F2	Dyer	West of US-412	US-51, East of US-412	US-412 Interchange: Evaluate the need to redesign interchange to reduce truck rollovers	Data Analysis and Public/Stakeholder
F3	Dyer	Mississippi River	US-412	Install appropriate signage and increase enforcement to remove farm equipment from the interstate[4]	Data Analysis

Interchange Redesigns

Traditional interstate service interchanges are variations of either a diamond or cloverleaf design. However, one drawback to cloverleaf interchanges is 39 that large trucks are more likely to roll over. This was indicated as an issue at the I-155 & US-412 interchange during the stakeholder outreach.

Parallel Corridors

The identification and use of alternative, parallel routes can be an approach to accommodate increasing traffic. The I-155 crossing of the Mississippi River is an important freight connection for this area, as demonstrated by the high percentage of truck traffic along the I-155 corridor. There are no other bridge crossings of the Mississippi River between Memphis, TN to the south and Cairo, IL to the north. The distance between Dyersburg, TN, to Cairo, IL, via I-155, I-55, and I-57 is approximately 98 miles and takes approximately 1 hour and 30 minutes; the distance via US-51 is 84 miles and takes approximately 1 hour and 40 minutes. Proper maintenance of the I-155 bridge over the Mississippi River is critical to maintaining efficient freight movement in the study area.

Driver Education and Stakeholder Engagement

In addition to the infrastructure and management strategies previously discussed, a key freight stakeholder noted several other items that can improve truck freight traffic in the State. These include driver education and stakeholder engagement regarding roadway construction. Driver education can include both truck and non-truck driving populations. Driver training programs can change truck driver behaviors to improve delivery efficiency, energy consumption, environmental impacts, and the safety of all road users.

The Tennessee Trucking Association has partnered with the Tennessee Highway Safety Office to educate students and senior citizens about sharing the road with trucks and has expressed interest in connecting with other agencies to teach the public about freight safety.

Economic Development

The Tennessee transportation system supports the economy of the state by providing access to

employment for workers and facilitating the movement of goods into, out of, and within the state. Among the goals for transportation system planning in this study is the following: Coordinate transportation system investments with economic development plans. This goal is informed by two objectives:

- Improve interchange on/off ramps.
- Coordinate with MPOs/RPOs to determine areas where new or improved Interstate access is needed.

To assess needs and develop a universe of potential actions that support economic development, the study team interviewed key stakeholders and analyzed future employment projections to determine economic development focus areas in each corridor.

Employment growth in the mostly rural I-155 corridor is expected to be modest over the next 20 years, with most jobs added at the corridor's eastern terminus in and around Dyersburg. Development of the Dyersburg North Industrial Park could add job-related travel and truck traffic on the Interstate. No additional freeway access points were identified by transportation experts at the regional planning organization.

Multimodal

The I-155 study area is not served by any fixed-route transit service and the existing rural transit service provided through the Northwest Tennessee Human resource Agency (NWTHRA) public transportation program is adequate to serve the I-155 corridor. No transit solutions were identified for inclusion in the universe of alternatives.

Given the largely rural nature of the I-155 corridor, no specific bicycle and pedestrian solutions were identified for inclusion in the universe of alternatives. As interchange reconstruction projects are needed, consideration should be given to including sidewalks, bicycle lanes and/or shared use paths at all interchanges in urban areas to facilitate safer interstate crossings for bicycles and pedestrians. In addition, if the SR-78 interchange is reconstructed, consideration should be given to removing the free-flow right turn lane as this configuration can be especially problematic for pedestrians.

The I-155 corridor does not currently contain an urban area TDM program. Given the low levels of congestion on I-155, no TDM solutions were identified for inclusion in the universe of alternatives.

Universe of Alternatives

Table 4-5 gathers these potential solutions into the total universe of alternatives for the I-155 corridor. The universe of alternatives presents a wide range of potential solutions to identified deficiencies. No solution is excluded from the universe of alternatives – it is essentially a brainstorming effort comprised of public and stakeholder ideas as well as best practices identified by planners and engineers. The list is supplemented by projects proposed in existing plans and studies.

Figure 4-2. Potential Solutions By Category — I-155

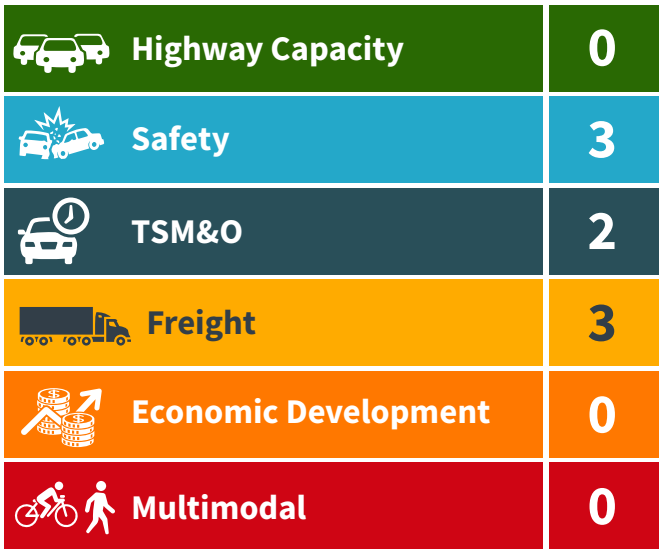


Table 4-5. Universe of Alternatives — I-155

ID		County	Termini (From)	Termini (To)	Description	Source of Recommended Solution
Highway Capacity			None Recommended			
Safety	S1	Dyer	Entire I-155 Corridor		Install LED Pavement Markers	Data Analysis
	S2	Dyer	Mississippi River Bridge		Install Lighting and Longitudinal Rumble Stripes on WB approach to Bridge	Data Analysis
	S3	Dyer	Lenox-Nauvoo Rd.	Lake Road	Install Fencing	Data Analysis
TSM&O	TS1	Dyer	Mississippi River Bridge		Installation of structural impact monitoring system to identify severity of barge collisions	Public/Stakeholder
	TS2	Dyer	Mississippi River Bridge		Installation of barge sensor monitoring system	Public/Stakeholder
Freight	F1	Dyer	Great River Rd.	Jenkinsville-Jamestown Rd.	Warning system for snow ice, and inclement weather	Public/Stakeholder
	F2	Dyer	US-412 Interchange		US-412 Interchange: Evaluate the need to redesign interchange to reduce truck rollovers	Data Analysis & Public/Stakeholder
	F3	Dyer	Mississippi River Bridge	US-412	Install appropriate signage and increase enforcement to remove farm equipment from the interstate	Data Analysis
Economic Development			None Recommended			
Multimodal			None Recommended			

5. Solutions Screening & Project Priorities

The I-155 universe of alternatives were filtered through a solutions screening and prioritization process (see Figure 5-1). This process evaluates solutions based on their impact on mobility and safety, potential environmental impacts, cost, and potential economic impacts. Ultimately, the prioritized solutions both resolve the identified deficiencies and have a high benefit/cost ratio.

Solutions Screening, Phase 1

The Phase 1 solutions screening process was intended to eliminate solutions with evident fatal flaws. To do so, each possible solution was evaluated against the following questions:

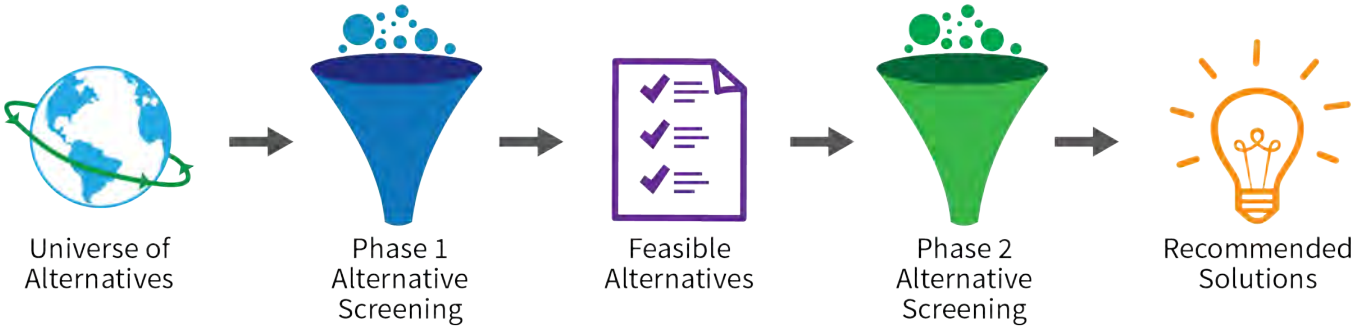
1. Does the proposed solution make sense given the identified deficiency?
2. Does the proposed solution align with other planned or programmed projects in the area?
3. Is the proposed solution supported by stakeholders and the public?
4. Does the proposed solution negatively impact environmental features such as wetlands, rare or protected species, or superfund sites?
5. Does the proposed solution negatively impact cultural features such as sensitive community populations, historic sites, public lands, or community institutions?

Figure 5-2. Solutions Passing Phase 1 Screening — I-155

Highway Capacity	0
Safety	3
TSM&O	2
Freight	3
Economic Development	0
Multimodal	0

Projects which received a "NO" response for questions 1, 2, or 3, or a "YES" response for questions 4 or 5 were eliminated and did not move forward to the Phase 2 solutions screening. Exceptions include projects where the potential is high for environmental/cultural impact mitigation. As indicated in Figure 5-2, none of the solutions were eliminated as part of the Phase 1 screening.

Figure 5-1. Solutions Screening and Prioritization Process



Solutions Screening, Phase 2

The Phase 2 alternatives screening process utilized performance measures to further refine the list of feasible alternatives. Potential solutions that passed the Phase 1 Screening were evaluated against the following questions:

1. Does the proposed solution improve level of service on the interstate corridor?
2. Does the proposed solution improve peak hour travel speeds on the interstate corridor?
3. Does the proposed solution improve travel times between key origin and destination (O&D) pairs along the corridor?
4. Does the proposed solution improve peak hour densities at the improved interchange?
5. Does the proposed solution reduce average and max queues at the improved interchange?
6. Does the proposed solution have the potential to reduce crashes in safety hot spots?
7. Does the proposed solution address deficiencies in bridges with a low sufficiency rating?
8. Does the proposed solution increase pavement quality?
9. Does the proposed solution provide for pedestrian / bicycle connectivity and safety at interchanges?
10. Does the proposed solution provide additional truck parking opportunities, particularly in urban areas?
11. Does the proposed solution have the potential to reduce vehicle miles traveled (VMT)?
12. Does the proposed solution improve incident management?
13. Does the proposed solution provide potential economic development opportunities?

Projects which received only “NO” responses were eliminated and did not move forward as feasible multimodal solutions. As indicated by Figure 5-3, all projects passed the Phase 2 screening and moved forward to project prioritization.

Prioritization Methodology

Aligning with previous TDOT multimodal corridor studies, the prioritization methodology for this study addresses coordinated construction efforts (priority given to projects that could be accomplished simultaneously at a given location) and culminates in a benefit-cost index for each project, which recognizes the relative multimodal benefit of each project compared to the estimated financial investment. Consistency with TDOT and MPO programmed projects has been maintained throughout the alternative development process, having identified such projects as part of the Trend Scenario.

The most recent TDOT multimodal corridor study introduced flexible decision-making support tool wherein weights can be applied to priority settings based on policy, programming, and political decisions. The prioritization criteria and measures for the I-155 corridor are structured in a similar fashion, such that weights can be applied by decision-makers. As indicated in Table 5-1, solutions developed for the I-155 corridor were evaluated over six categories: mobility, safety, economic development, system maintenance, implementation and cost efficiency.

Figure 5-3. Solutions Passing Phase 2 Screening — I-155

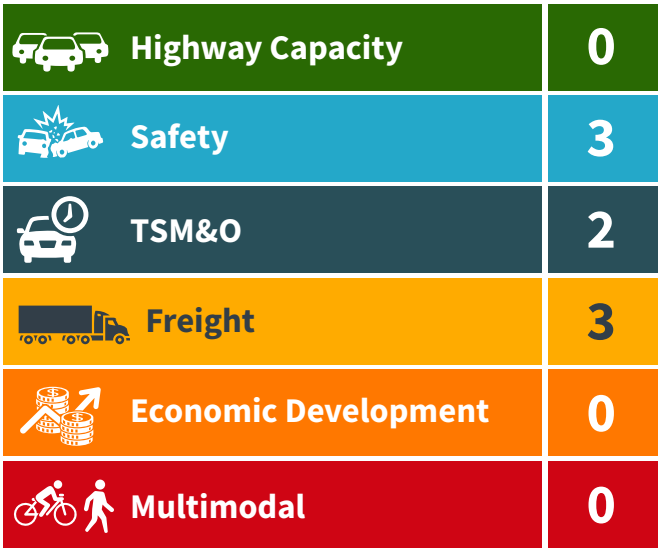


Table 5-1. Prioritization Criteria and Measures by Mode and Strategy — I-155

Mode/ Strategy	Mobility	Safety	Economic Development	System Maintenance	Implementation	Cost Efficiency
 Safety	2040 Trend	Crash Rate (Relative to Statewide Avg)	2020 Employment	Project addresses bridge deficiency (Y/N)	Cost Estimate	Benefit-Cost Index
	2040 Build VC	Project improves incident management (Y/N)	2040 Employment	Project addresses pavement deficiency (Y/N)	# of related projects	Dollar per Benefit
		Crash Reduction Potential				
 TSM&O	2040 Trend	Crash Rate (Relative to Statewide Avg)	2020 Employment	Project addresses bridge deficiency (Y/N)	# of related projects	Benefit-Cost Index
	2040 Build VC	Project improves incident management (Y/N)	2040 Employment	Project addresses pavement deficiency (Y/N)	Cost Estimate	Dollar per Benefit
 Freight	2040 Build VC	Project improves incident management (Y/N)	2020 Employment	Project addresses bridge deficiency (Y/N)	# of related projects	Benefit-Cost Index
	2040 Trend VC		2040 Employment	Project addresses pavement deficiency (Y/N)	Cost Estimate	Dollar per Benefit
	% Trucks			Provides truck parking (Y/N)		

Prioritization Criteria and Measures

Mobility

Appropriate measures for mobility differ across modes/strategies. While the volume-to-capacity (V/C) ratio is appropriate for measuring highway capacity, it does not capture mobility for bicycles and pedestrians, for example. As shown in Table 5-1, comparison of the 2040 Trend V/C ratio versus the 2040 Build V/C ratio was used as a measure of mobility for safety, TSM&O, and freight projects. Numeric scores 1, 2, and 3, were recorded based on the following thresholds, which consider the resulting change in V/C and, for freight projects, the percent trucks on the adjacent section of interstate:

Safety, TSM&O

1 = No improvement to mobility

2 = Likely improvement to mobility

3 = Definite improvement to mobility

Freight

1 = No improvement to mobility

2 = Improvement to mobility, % trucks < 20%

3 = Improvement to mobility, % trucks > 20%

Where criterion could not be measured and "N/A" was noted, engineering judgement was used to score the project's potential for mobility improvement within the applicable thresholds.

Safety

Criterion used to measure the potential safety improvement for each project also vary across mode/strategy. One measure common to all was a "yes" or "no" response to the question: "does the project improve incident management?" For freight projects, this was the only measure used for safety. Thresholds were applied as follows:

Freight

1 = N/A

2 = No

3 = Yes

Building upon hot spot calculations from Technical Memorandum 2, safety and TSM&O projects are measured by the relative crash rate as well. The impact of safety projects is further refined by the crash reduction potential, which was determined in Technical Memorandum 3. The following thresholds were applied:

TSM&O

1 = Crash rate < statewide average crash rate[1]

2 = Crash rate > statewide average crash rate; Does not improve incident management

3 = Crash rate > statewide average crash rate; Improves incident management

Safety

1 = Crash rate < statewide average crash rate

2 = Crash rate > statewide average crash rate; Below average crash reduction potential

3 = Crash rate > statewide average crash rate; Above average crash reduction potential OR Improves incident management

Where criterion could not be measured and "N/A" was noted, engineering judgement was used to score the project's potential for safety improvement within the applicable thresholds.

Economic Development

The economic development potential of each project was measured by the projected change in employment from 2020 to 2040 within three miles of each project. Employment projections were obtained via the TSM and by traffic analysis zones. The following thresholds were used to score each project.

Safety, TSM&O, Freight

1 = 10-20% increase

2 = 20-25% increase

3 = 25%+ increase

System Maintenance

System maintenance was added as a measure for the I-155 corridor prioritization to recognize opportunities where projects will also address existing bridge and/or pavement deficiencies. The following thresholds were used to score each project, given "yes" or "no" responses to the questions "project addresses bridge deficiency?" and "project addresses pavement deficiency?'. For freight projects, an additional "yes" / "no" question was added: "project provides truck parking?"

Safety, TSM&O

1 = No to both

2 = Yes to one

3 = Yes to both

Freight

1 = No to all

2 = Yes to one

3 = Yes to all

Implementation

The implementation measure was included to give priority to projects that could be constructed or initiated in conjunction with other projects, thus conserving the time and money associated with multiple, individual contracts. Figure 5-4 illustrates the relative proximity of the multimodal solutions prioritized for the I-155 corridor. The following thresholds were utilized to score the implementation of each project:

Safety, TSM&O, Freight

1 = 0 overlapping projects

2 = 1 or 2 overlapping projects

3 = 3+ overlapping projects

Cost Efficiency

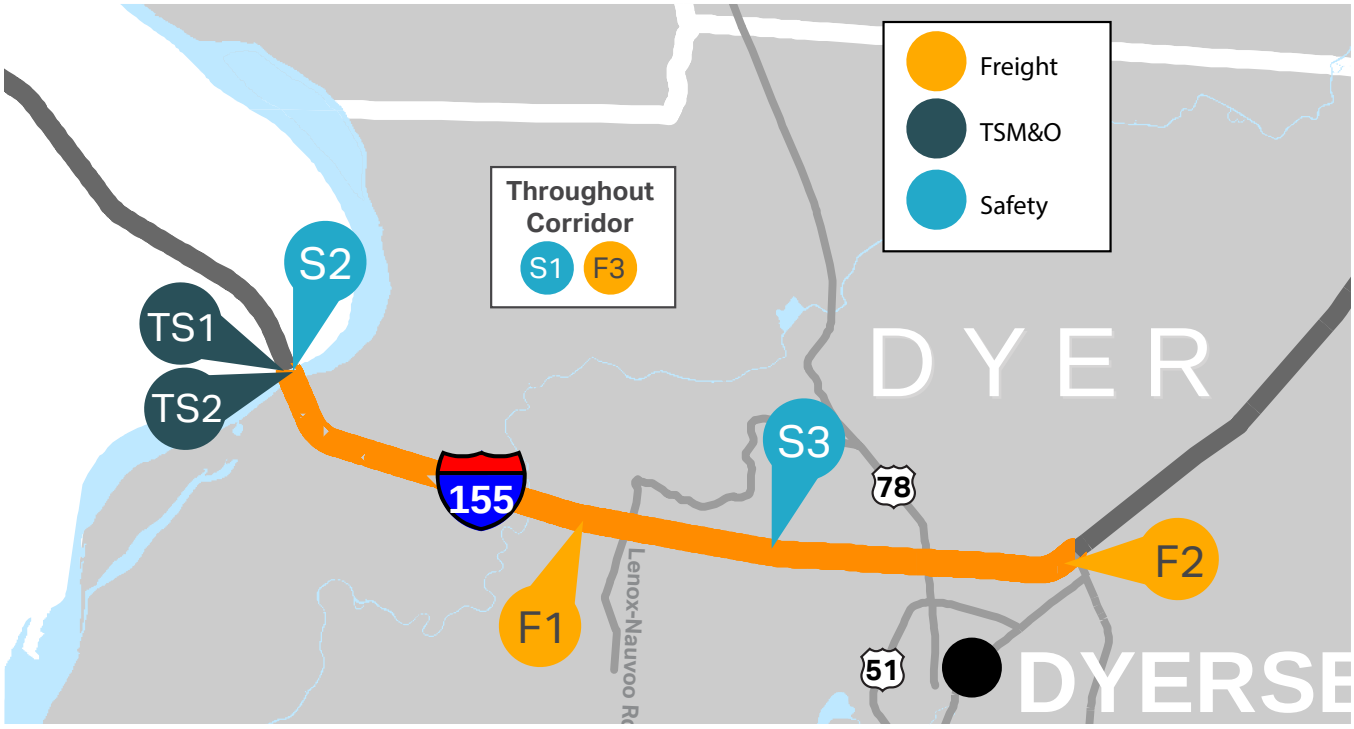
For the I-155 corridor project prioritization, a benefit-cost index and a dollar-per-benefit was calculated for each solution. These measures which capture the benefit of each prioritization criteria and compare the total relative benefit to the estimated project cost. Specifically, the score assigned to each of the five prioritization criteria were summed to represent the total relative benefit of each project. To calculate the benefit-cost index, this total relative benefit was divided by the cost (in millions) estimated for each project. The benefit-per-dollar is simply the total benefit divided by the cost estimate. Note that cost estimates were prepared for solutions that recommend further study. However, because the total benefit represents the potential of the associated capital improvement, no direct benefit-cost index or dollar-per-benefit was calculated for these solutions.

Project Rankings

When evaluated side-by-side, the total benefit score, benefit-cost index, and dollar-per-benefit indicate projects with high benefit that can be implemented with smaller financial investment. The project rankings are discussed per mode/strategy below. Tables 5-1 through 5-3 of Technical Memorandum 4 detail the prioritization effort and rank the projects by the total benefit score, which ranges from 5 (lowest) to 15 (highest).

1- The statewide average crash rate for rural interstate facilities is 0.528 and 1.112 for urban interstates.

Figure 5-4. Relative Proximity of Multimodal Solutions — I-155



Project Rankings by Mode and Strategy

Safety

Safety solution S2 received the highest total benefit score. Installation of lighting and longitudinal rumble stripes on the westbound approach to the Mississippi River Bridge has an above average crash reduction potential and is one of several recommended projects related to the Mississippi River Bridge. Installation of LED pavement markers (S1) has a high benefit-cost index due to the low cost associated with the improvement; however, the total benefit score is on the lower end.

TSM&O

Both TSM&O solutions have a similar total benefit, offering crash reduction potential and improved incident management in safety hot spot areas. The cost associated with each is relatively low, resulting in higher benefit-cost indexes.

Freight

Of the three freight solutions that passed the Phase 2 screening, F1 (warning system for snow, ice and inclement weather) scored the highest total benefit. The benefit-cost indexes for F2 and F3 are much higher due to the low associated costs; however, the total benefit for these improvements is lower.

6. Key Findings

The prioritized solutions address the key corridor transportation deficiencies identified by stakeholders and through data analysis.

As a result of the structure of the project prioritization system, all projects have a potential total benefit range of 5-15 and can therefore be compared across modes/strategies. Table 6-1 tabulates all solutions for the I-155 corridor, sorted by total benefit score. Solutions which recommend studies are shown in Table 6-2.

Use of Table 6-1 in conjunction with Figure 5-4 can be used to inform decisions on fund allocation and construction packages. As mentioned previously, weights can easily be applied to the prioritization criteria in Tables 5-1 through 5-3 of Technical Memorandum 4 to adjust for policy, programming, and political decisions.

Finally, Table 6-3 summarizes the performance benefits of the of the collective solutions recommended for the

Table 6-1. Project Ranking Across all Modes/Strategies — I-155

ID	Project Description	Termini	Cost Efficiency			
			Total Benefit	Cost Estimate	Benefit Cost Index	Dollar per Benefit
S2	Install lighting and longitudinal rumble stripes on WB approach to bridge	Mississippi River Bridge	9	$394,000	22.8	$43,800
F1	Install warning system for snow, ice, and inclement weather	Great River Rd to Jenkinsville-Jamestown Rd	9	$250,000	36.0	$27,800
S1	Install LED pavement markers	Entire Corridor	8	$112,000	71.4	$14,000
S3	Install fencing	Lenox-Nauvoo Rd to Lake Rd	8	$573,000	14.0	$71,600
TS1	Installation of structural impact monitoring system to identify severity of barge collisions	Mississippi River Bridge	8	$50,000	160.0	$6,250
TS2	Installation of barge sensor monitoring system	Mississippi River Bridge	8	$200,000	40.0	$25,000
F3	Install appropriate signage and increase enforcement to remove farm equipment from the interstate	Mississippi River Bridge to US-412	7	$18,200	384.6	$2,600

Table 6-2. Project Ranking Across all Modes/Strategies (Studies) — I-155

ID	Project Description	Termini	Cost Efficiency			
			Total Benefit	Cost Estimate	Benefit Cost Index	Dollar per Benefit
F2	Evaluate the need to redesign interchange due to truck rollovers	US-412 Interchange	7	$25,000	N/A	N/A

Table 6-3. Performance Measure Summary — I-155

Goal	Performance Measure		Unit	Base (2010)	Trend (2040)	Build 2040	% Change (Base vs Trend)	% Change (Trend vs Build)
Traffic Operations	Traffic on interstate operates at LOS D or better		% of interstate operating at LOS D or better	100	100	100	0	0
	Total Daily Vehicle Miles Traveled (VMT)		Miles (1,000s)	2,430	3,058	3,058	26	0
	Total Daily Vehicle Hours of Travel (VHT)		Hours (1,000s)	55	67	67	20	0
	Total Peak Hour Vehicle Hours of Delay (VHD)		Hours	1.7	2.0	2.0	2	0
	Total VMT / Trip		Miles	5.65	5.98	5.98	6	0
	Total Vehicle Minutes Traveled / Trip		Minutes	7.70	7.80	7.80	1	0
	Average Peak Hour Travel Speed	Urban Interstate	MPH	76	76	76	0	0
		Rural Interstate	MPH	76	76	76	0	0
	Congested Travel Time between key O&D Pairs along Corridor (Total)		Minutes	48	49	49	2	0
	Peak Hour Density at Improved Interchanges		Vehicles/Mile/Lane	See “Traffic Operations Memo”				
	Average and Max Queues at Improved Interchanges		Feet	See “Traffic Operations Memo”				
Safety	Crash reduction in safety “hot spots”		Above or Below Average Crash Reduction Potential	See “Safety Recommendations”				
Operations & Maintenance	Bridge Condition (Sufficiency Rating)		% of bridges < 50	0	0	0	N/A	N/A
			50 < % of bridges < 80	20[2]	10[1]	10	N/A	N/A
	Pavement Condition (Resurfacing)		% of corridor resurfaced within the last 10 years	95[2]	95	95	N/A	N/A
Multimodal	Pedestrian and Bicycle Accommodations at U.S. and State Route Interchanges		% interchanges with bike facilities	0	0	0	N/A	N/A
			% interchanges with ped. facilities	0	0	0	N/A	N/A
	Freight (Truck Parking)		# of Rest Area Spots	10	10	10	N/A	N/A
			# of Truck Stop Spots	40	40	40	N/A	N/A

1- Per TDOT Structures Division, no repair projects are ongoing or scheduled for I-155. Review of 2018-Feb 2020 TDOT Bid lettings included repair of I-155 Bridge over Mississippi River ($13.5 million). Assumed this improved sufficiency rating to 80+.
2- Based on 2017 TRIMS data

I-75 Corridor

▶ Final Report

Table of Contents

Tables

Figures

Figures cont.

I-75 Corridor

1. Introduction

The I-75 corridor serves as a backbone for economic development and growth in east central Tennessee. As population and employment grow and redevelopment changes the face of the region, new travel demands place pressure on the Interstate as well as parallel and intersecting highways. This results in increased traffic congestion, travel times, and conflicts, which impact the corridor's ability to sustain future growth.

Interstate 75 is a major north-south route connecting Miami, Florida to Sault Ste. Marie, Michigan at the Canadian border. The length of the Tennessee portion of the I-75 corridor is approximately 162 miles, beginning in Jellico at the Kentucky/Tennessee border and terminating at the Georgia/Tennessee border in Chattanooga. The corridor traverses two large metropolitan areas: Knoxville and Chattanooga.

The project analysis area is shown in Figure 1-1; it includes Anderson, Blount, Bradley, Campbell, Hamilton, Knox, Loudon, McMinn, Meigs, Monroe, Polk, Rhea, Roane, and Scott counties.

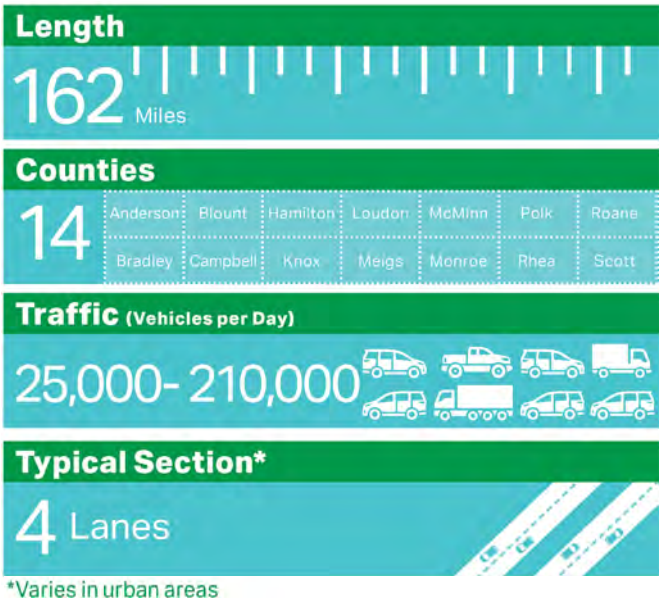
The main purpose of this study is to identify existing and emerging deficiencies along the I-75 corridor and to evaluate and prioritize improvements to address those deficiencies. The study explores multimodal issues and opportunities and considers innovative approaches available to the Tennessee Department of Transportation (TDOT) to address capacity and congestion, enhance operational efficiency, improve safety and security, expand transportation choices, and support economic growth and competitiveness.

Previous technical memoranda:

- Provided a data and information inventory for the corridor
- Assessed existing and future deficiencies and needs along the I-75 corridor
- Established goals and performance measures to assess the effectiveness of various solutions to the problems
- Filtered the I-75 universe of alternatives through a screening and prioritization process

The prioritization process evaluated solutions based on their impact on mobility and safety, potential environmental impacts, cost, and potential economic impacts. Ultimately, the prioritized solutions both resolve the identified deficiencies and have a high benefit-cost index.

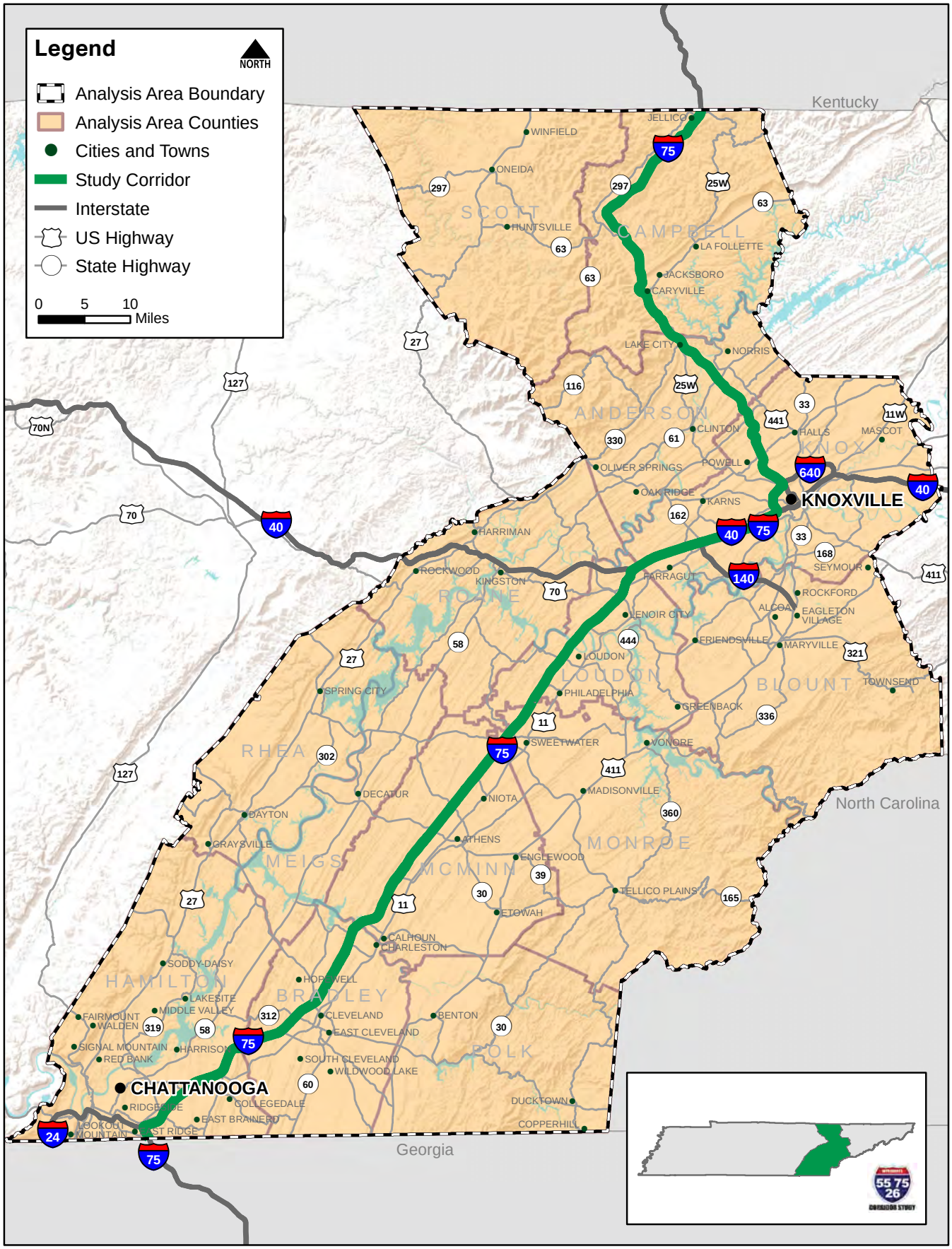
Figure 1-2. I-75 Fast Facts



*Varies in urban areas

The I-75 corridor is being studied as part of a larger corridor study that also includes I-55, I-155, and I-26.

Figure 1-1. I-75 Study Area



2. Sources of Data

Roadway, demographic, economic and performance data were collected from numerous sources. These were supplemented by a robust program to gather input from key stakeholders -- such as metropolitan planning organizations, business groups, and large institutions -- and the traveling public. These data were used to identify trends in travel, employment, development, and land use that impact the future of the region. The data ultimately were evaluated to identify the key transportation deficiencies impacting travel in the I-75 corridor.

Previous Plans and Studies

Many agencies have conducted studies and developed a variety of plans for the I-75 study area. Key studies, plans, and programs (shown in Figure 2-1) were reviewed to develop an understanding of the corridor and the needs and opportunities that have been previously identified. TDOT's State Transportation Improvement Program (STIP), and regional/ metropolitan improvement plans were specifically reviewed to develop an understanding of the needs and opportunities that have previously been identified and to identify projects within the study area for which money has already been allocated. These programmed projects are shown in Table 2-1 and Figure 2-2 and 2-3.

Figure 2-1. Previous Plans and Studies

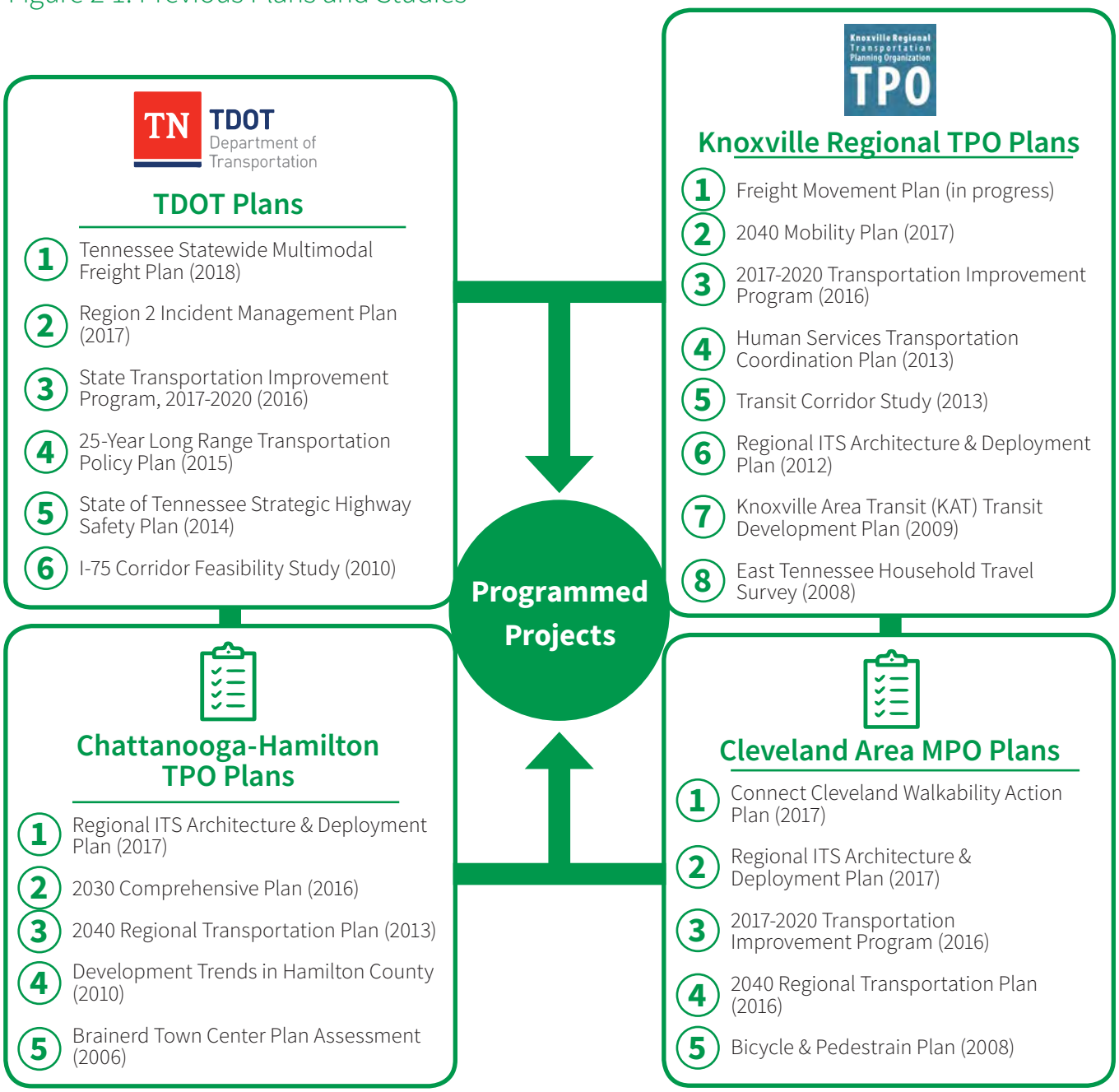


Table 2-1. Corridor Programmed Projects — I-75

	Figure 2-2/2-3 ID	Route and Project Limits	Improvement	Cost	Year	Lead Agency/ Funding Type	TIP# or STIP#
Cleveland MPO FY 2017-2020 TIP	1	Adkisson Dr (Norman Chapel Rd to Paul Huff Pkwy)**	Widen from 2 to 3 lanes	$3,000,000	2019-2020	City of Cleveland/ U-STBG	TIP # 2013-05
	2	Cleveland MPO Area	Transit operations	$5,700,000	2017-2020	CUATS/5307	TIP # 2017-02
			Transit capital purchases	$551,000	2017-2019	CUATS/5310/5339	TIP # 2017-03
	3	I-75 From Near Interchange 33 (SR-308) to Near Bradley/ McMinn Co Line	Widen I-75 from 4 lanes to 6	$26,624,000	201-2020	IMPROVE ACT	TIP #1733025
Chattanooga TPO FY2017 - 2020 TIP	4	ADA Paratransit	Non-Fixed-Route ADA Paratransit Services	$1,600,000	2017-2020	CARTA/5307	TIP # CPARATRANSIT
	5	SR-317 (Adamson Cir to west of Bonnyshire Dr)**	Widen from 2 to 4 lanes	$20,700,000	2019	TDOT/NHPP	TIP # 33050
	6	Goodwin Rd (Gunbarrel Rd to Hamilton Place Blvd)	New 4 lane roadway	$19,091,000	2018-2020	Chattanooga/ STBG-M	TIP # GOODWIN
	7	I-75 from north of SR-2 to near SR-311	Widen from 4 to 6 lanes	$116,900,000	2017-2020	TDOT (IMPROVE Act)	TIP # 1733025
	8	I-75 at Hamilton Place Mall Interchange	Interchange Improvements - Expand to Full-Access Facility	$49,500,000	2017-2020	TDOT (IMPROVE Act)	TIP # 1733015
	9	I-75 at I-24	Interchange Improvements - Widen I-75 and I-24, New Bridges	$149,700,000	2017-2020	TDOT (IMPROVE Act)	TIP # 33020
Knoxville Regional TPO FY 2017 - 2020 TIP	10	Papermill Dr (Weisgarber Rd to Kingston Pk)	Reconstruct with turn lanes and bicycle/ped facilities	$18,492,000	2020	City of Knoxville/ L-STBG	TIP # 17-2017-015
	11	Farragut Advanced Traffic Management System Phase 1	Upgrade signal system to centrally controlled system	$2,925,000	2017-2019	Town of Farragut/ CMAQ	TIP # 17-2017-024
	12	KAT Route 22	BRT bus stops/ Passenger Information Systems	$6,395,000	2017-2019	City of Knoxville/ CMAQ	TIP # 17-2017-028
	12	TPO PlanningArea - Section 5307 Funds	Transit funding	$34,246,000	2017-2020	City of Knoxville/ Section 5307	TIP # 17-2017-200
	12	TPO Planning Area - Section 5310 Funds	Transit funding	$4,543,000	2017-2020	TPO/MPC/Section 5310	TIP # 17-2017-201
	12	City of Knoxville - Section 5339 Funds	Transit funding	$3,050,000	2017-2020	City of Knoxville/ Section 5339	TIP # 17-2017-202
	12	TPO Planning Area - Smart Trips Ridesharing Program	Rideshare operation	$494,000	2018-2020	TPO/MPC/CMAQ	TIP # 17-2017-209
	13	I-75 from near SR-131 to near SR-170 (Raccoon Valley Rd)**	Widen from 4 to 6 lanes	$98,000,000	2017-2020	TDOT (IMPROVE Act)	TIP # 17-2017-056
	14	I-75 Interchange at I-640/I-275 (Sharps Gap)**	Interchange Reconstruction	$88,000,000	2017-2020	TDOT (IMPROVE Act)	17-2017-038

Table 2-1. Corridor Programmed Projects — I-75 (cont.)

	Figure 2-2/2-3 ID	Route and Project Limits	Improvement	Cost	Year	Lead Agency/ Funding Type	TIP# or STIP#
TN STIP FY 2017 - 2020	15	SR-63 (SR-297 to west of Stinking Creek Rd) (Campbell County)	Construct truck climbing lane and intersection improvements	$6,025,000	2019	TDOT/STBG	STIP # 1707015
	16	I-75 from Near MM 135 to Near MM 160 (SR-9)	ITS Expansion	$11,400,000	2019	TDOT/NHPP	STIP # 1707040
	17	Interchange at SR-30 and SR-305	Interchange improvements	$2,000,000	2017-2018	TDOT/NHPP	STIP #1754005
	18	I-75 from near MM109.6 to near SR-61	ITS Expansion	$3,600,000	2017-2020		00471075176
	19	I-75 at SR-61 Interchange	Install ITS Instrumentation + Communications	$500,000			17011075444

** These projects are modeled in the 2040 trend scenario.
Source: Cleveland MPO, Chattanooga TPO and Knoxville Regional TPO FY2017-2020 TIPs; Tennessee FY2017-2020 STIP
L-STBG = Local Surface Transportation Block Grant
CMAQ = Congestion Mitigation and Air Quality Improvement
MPC = Knoxville-Knox County Planning Commission (formerly known as Metropolitan Planning Commission)
NHPP = National Highway Performance Program

Data Analysis

A large body of technical data were analyzed to develop a picture of corridor conditions. These included sources detailing roadway conditions, traffic and freight operations, safety, population and employment growth, environmental conditions, and other factors to create a "trend scenario." These data sources are shown in Figure 2-4.

Figure 2-4. Data Sources

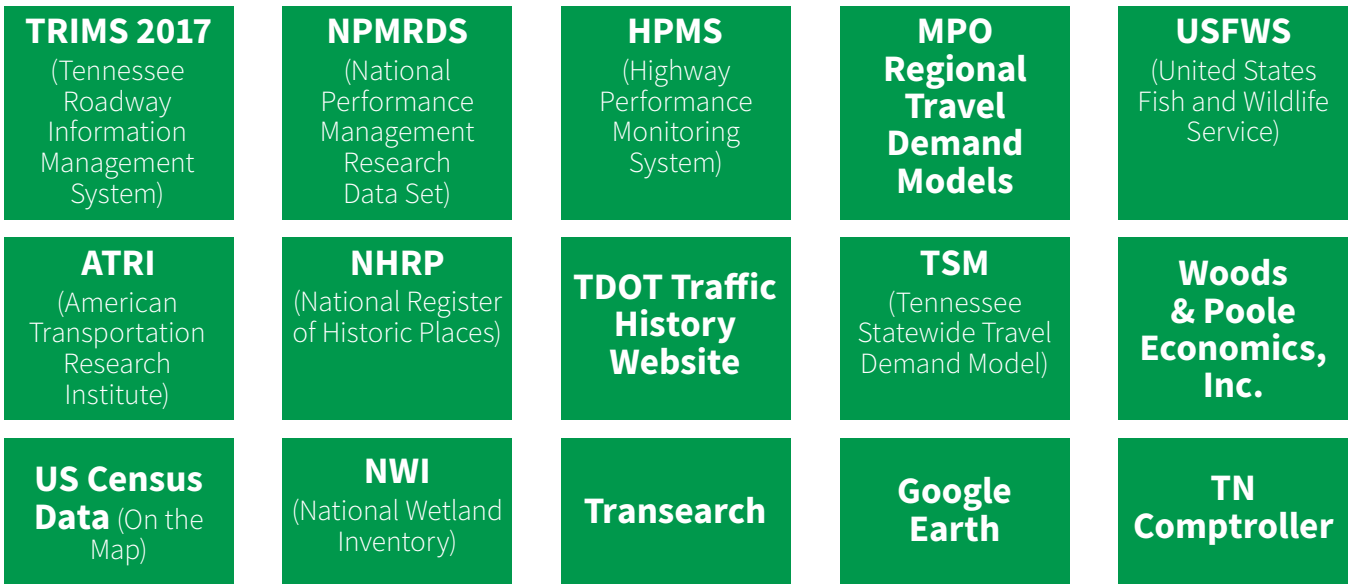
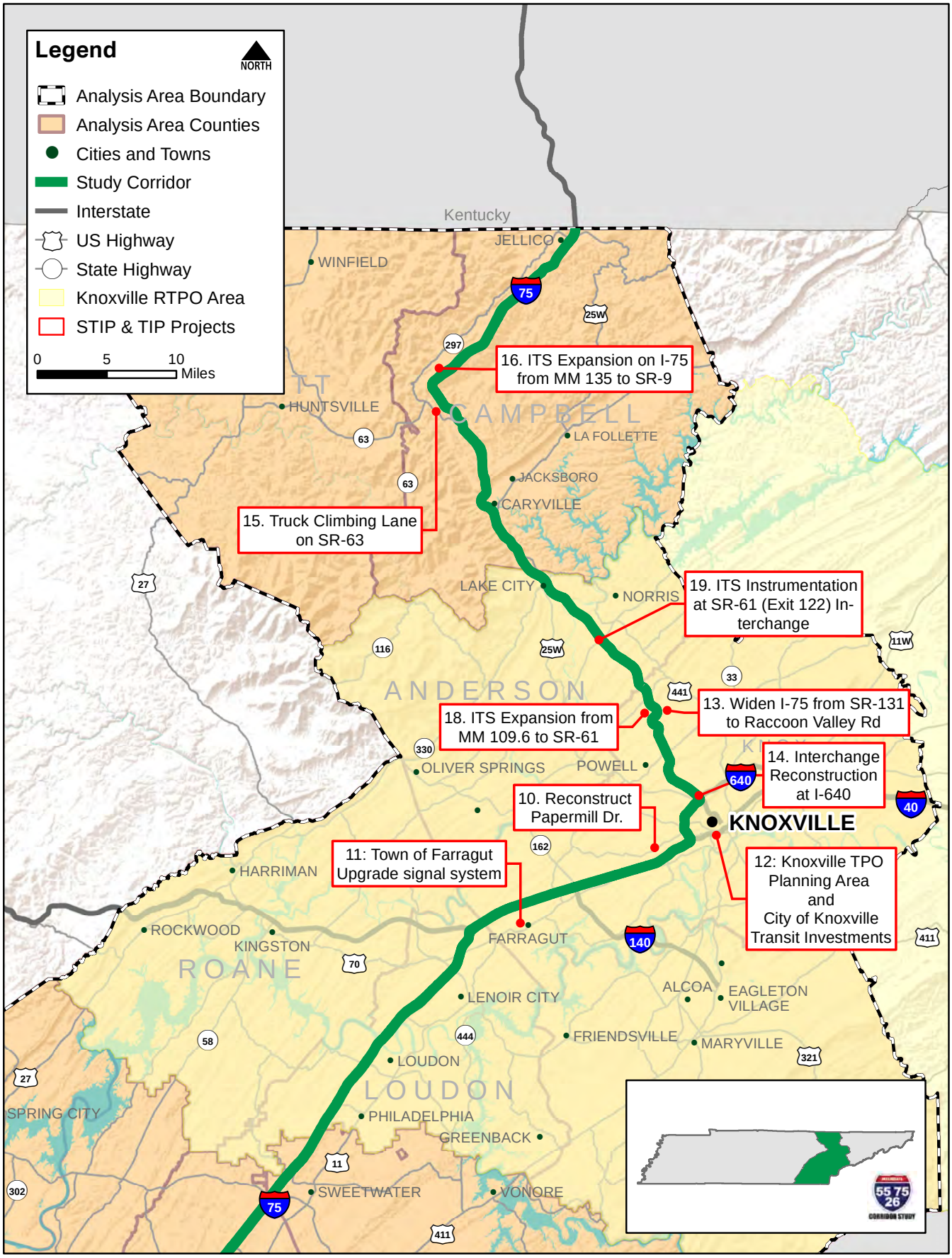
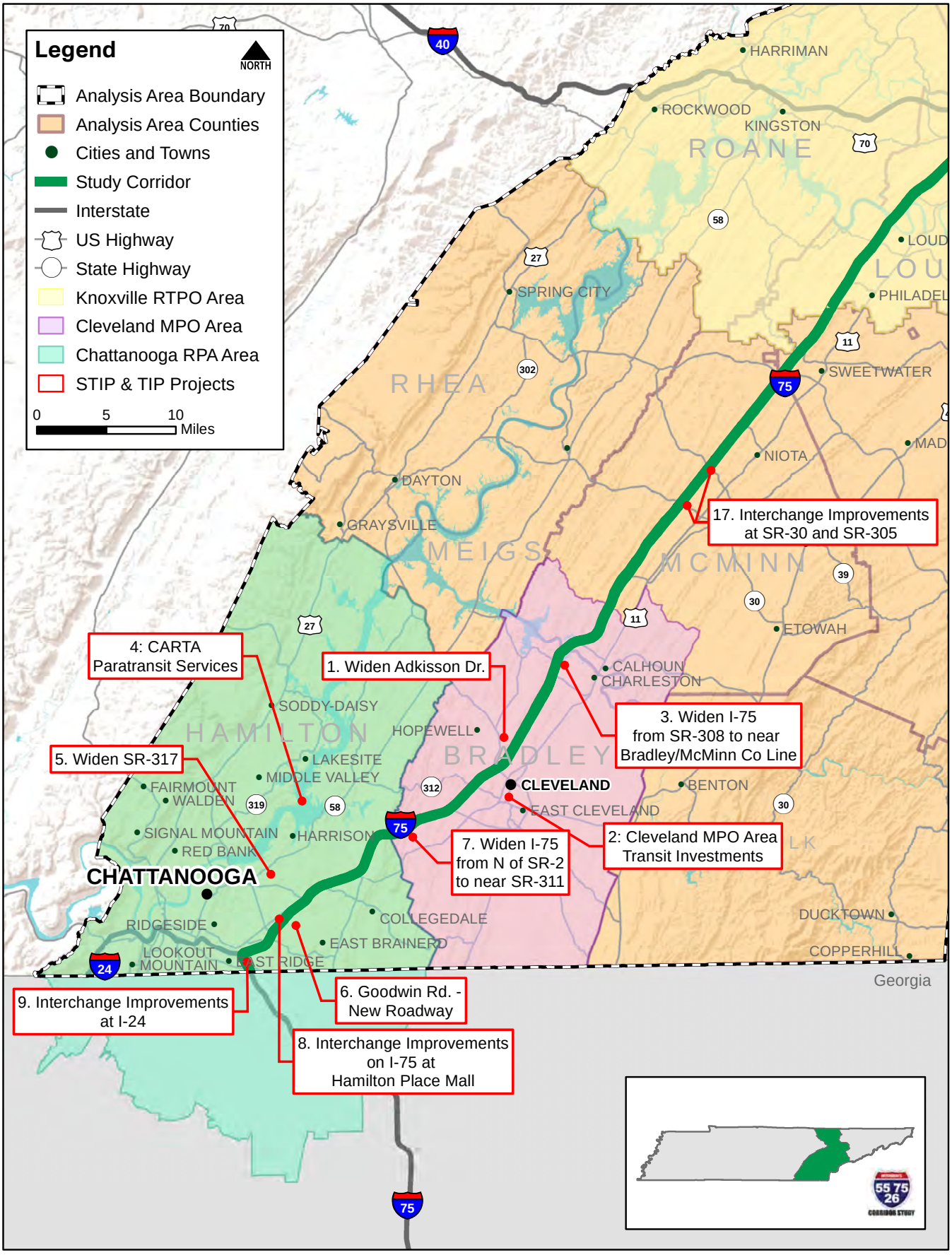


Figure 2-2. Corridor Programmed Projects* — I-75 (north)



Source: Cleveland MPO, Chattanooga TPO and Knoxville Regional TPO FY2017-2020 TIPs; Tennessee's FY2017-2020 STIP

Figure 2-3. Corridor Programmed Projects — I-75 (south)



Source: Cleveland MPO, Chattanooga TPO and Knoxville Regional TPO FY2017-2020 TIPs; Tennessee's FY2017-2020 STIP

The trend scenario predicts existing and future conditions if current practices, plans, and policies remain unchanged. The trend scenario establishes the existing and projected transportation conditions along the I-75 corridor and serves as the baseline for identifying needs and, ultimately, proposed improvements. The 2010 and 2040 Tennessee Statewide Travel Demand Model (TSM) trend scenarios were originally developed by the TDOT in 2017 (Phase 3/Version 3). As part of this study, the trend scenarios were updated and validated based on the following:

- Population and employment data and projections from Woods and Poole Economics, Inc.
- Projects currently programmed for construction in TDOT's STIP
- Projects currently programmed for construction in the Cleveland Metropolitan Planning Organization (MPO) Transportation Improvement Program (TIP) the Chattanooga Transportation Planning Organization's (TPO) FY 2017-2020 TIP, and the Knoxville Regional TPO's FY 2017-2020 TIP
- Recent MPO travel demand model projections of socioeconomic data, traffic volumes, and travel times
- Recent Transearch freight data and projections

The study team (including TDOT and statewide MPO staff) determined the updated Phase 3/Version 3 TSM (with 2010 base year) was producing results comparable to regional models with more recent base years- creating better model efficiency.

Public / Stakeholder Input

The study's technical analyses were complemented by a robust stakeholder and public involvement effort. The data generated by outreach activities – which included public meetings, key stakeholder interviews and a public survey – was used to focus technical analysis on items that stakeholders perceive as critical, and to prioritize transportation issues to be addressed. This was complemented and enhanced by an effort to provide information to and gather input from traditionally under-represented and underserved populations.

Members of the public and stakeholders identified many areas along the interstate corridor as exhibiting transportation problems. As shown in Figure 2-5, four locations were called out as being especially problematic:

- I-75/275/640 interchange
  - Located on the north side of Knoxville, this location is perceived as experiencing congestion and safety problems
- I-75/Campbell Station Road interchange
  - Experiences flooding and heavy truck traffic.
- Shared segment of I-40 and I-75
  - Experiences frequent congestion
- I-24/I-75 interchange
  - The site of regular congestion

3. Existing Conditions & Deficiencies

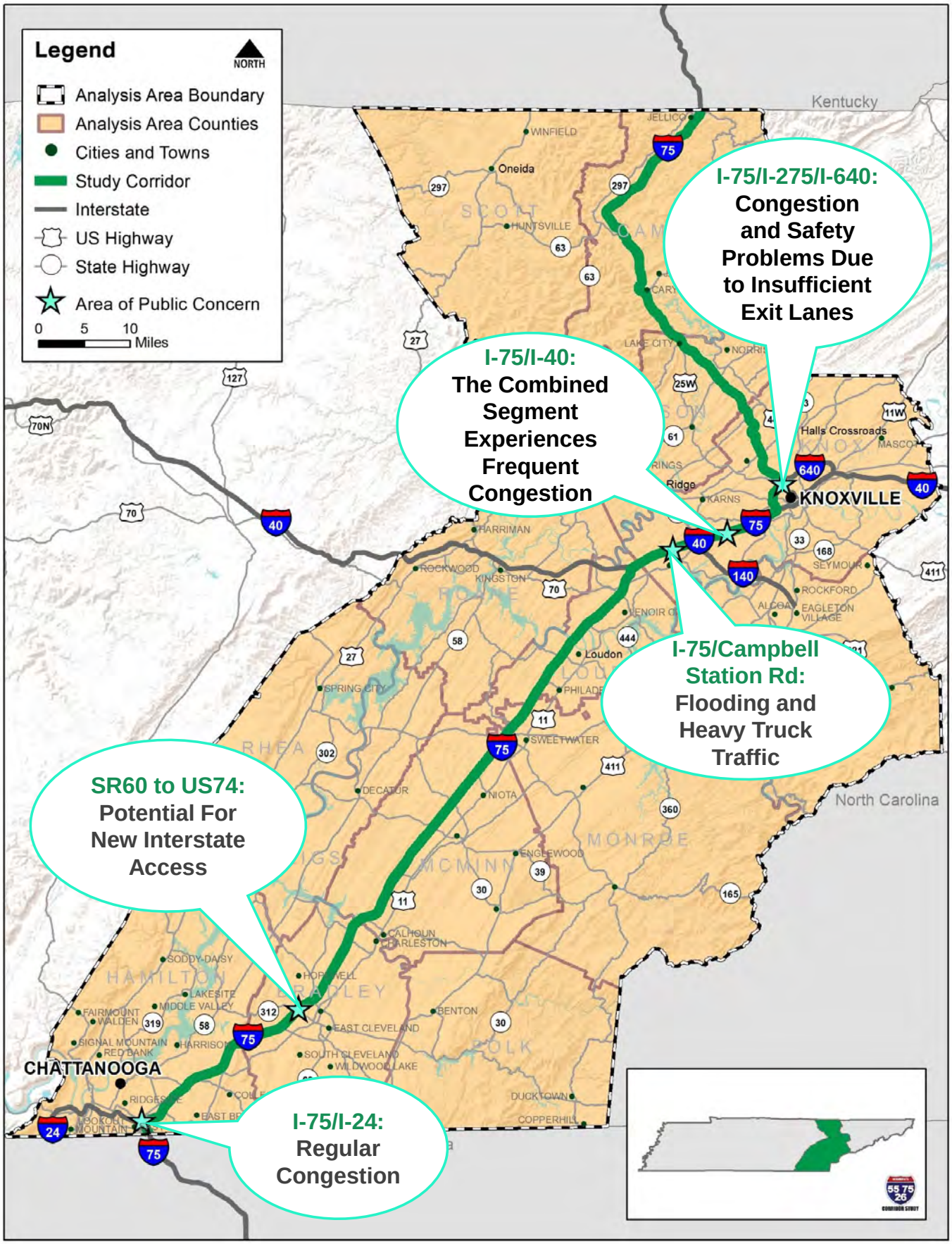
Existing and future deficiencies and needs along the I-75 corridor were identified by examining transportation issues including land use and economic development trends, highway capacity and congestion, travel demand, safety, presence of Intelligent Transportation Systems (ITS), freight, transit, and non-motorized travel.

Land Use & Economic Development

Land use, development patterns, and geographical and cultural features of the study area impact the demand for, design, and operations of transportation facilities. The locations of economic activity generators and the flows of goods and people between them are a key elements in identifying existing and future transportation needs.

Figure 3-1. Land Use and Economic Development

Figure 2-5. I-75 Corridor Stakeholder Priority Locations

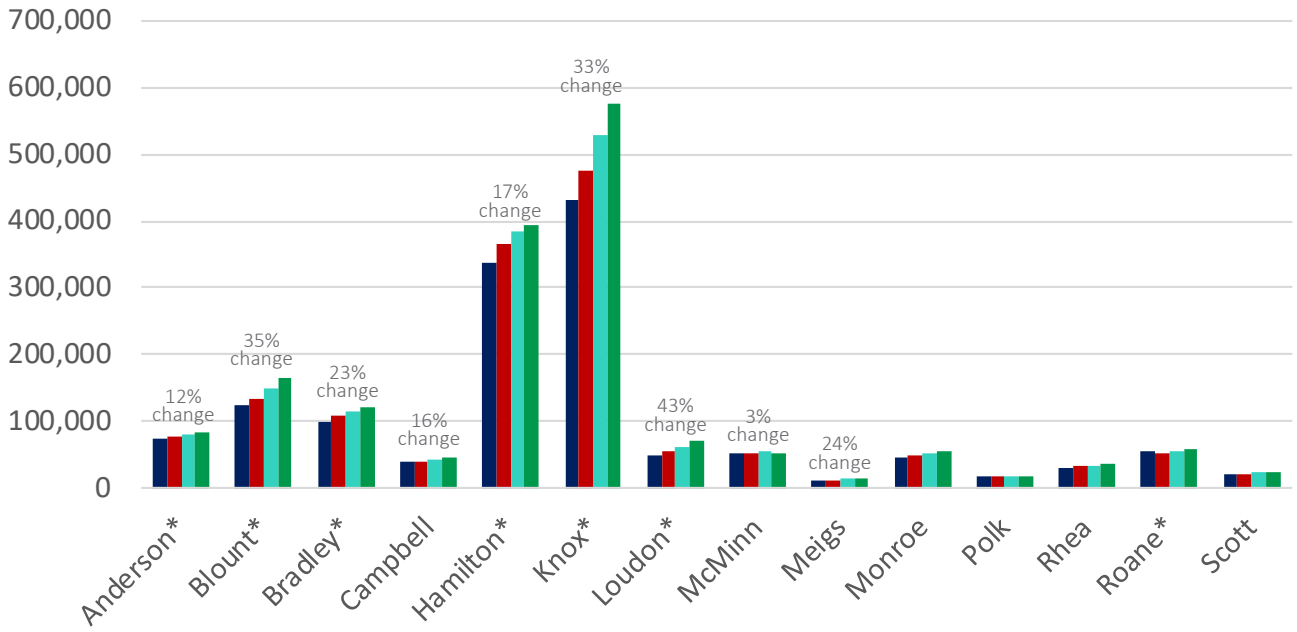


Source: TDOT Online Public Survey and I-75 Public Involvement Meeting (PIM)

Population & Employment

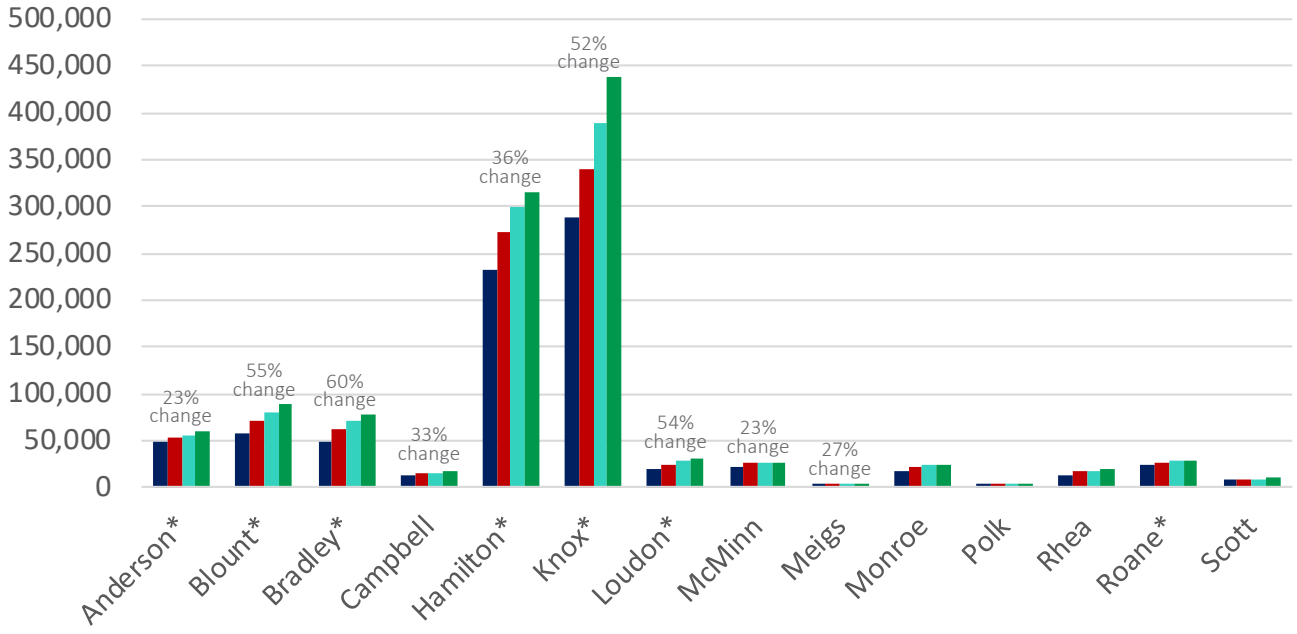
Study area population and employment drives travel demand in the I-75 corridor. A high-level review of population and employment projections from Woods & Poole Economics, Inc. was undertaken for the fourteen county study area. According to Woods & Poole Economics data, these counties are expected to see an additional 331,000 residents and 346,000 jobs by 2040. This represents a 24% increase in people and 43% increase in employment since 2010. Of this growth, those counties that are located within a metropolitan planning organization (MPO) area, are expected to see over 90% of the study area's growth. Figures 3-2 and 3-3 show the population and growth trends per county. Figures 3-4 and 3-5 illustrate where the growth is expected to occur.

Figure 3-2. County Growth Trends, Population — I-75



*County located within an MPO area
Source: Woods & Poole Economics, Inc., 2018 2010 2020 2030 2040

Figure 3-3. County Growth Trends, Employment – I-75



*County located within an MPO area
Source: Woods & Poole Economics, Inc., 2018 2010 2020 2030 2040

Figure 3-4. I-75 Change in Population (2010 to 2040)

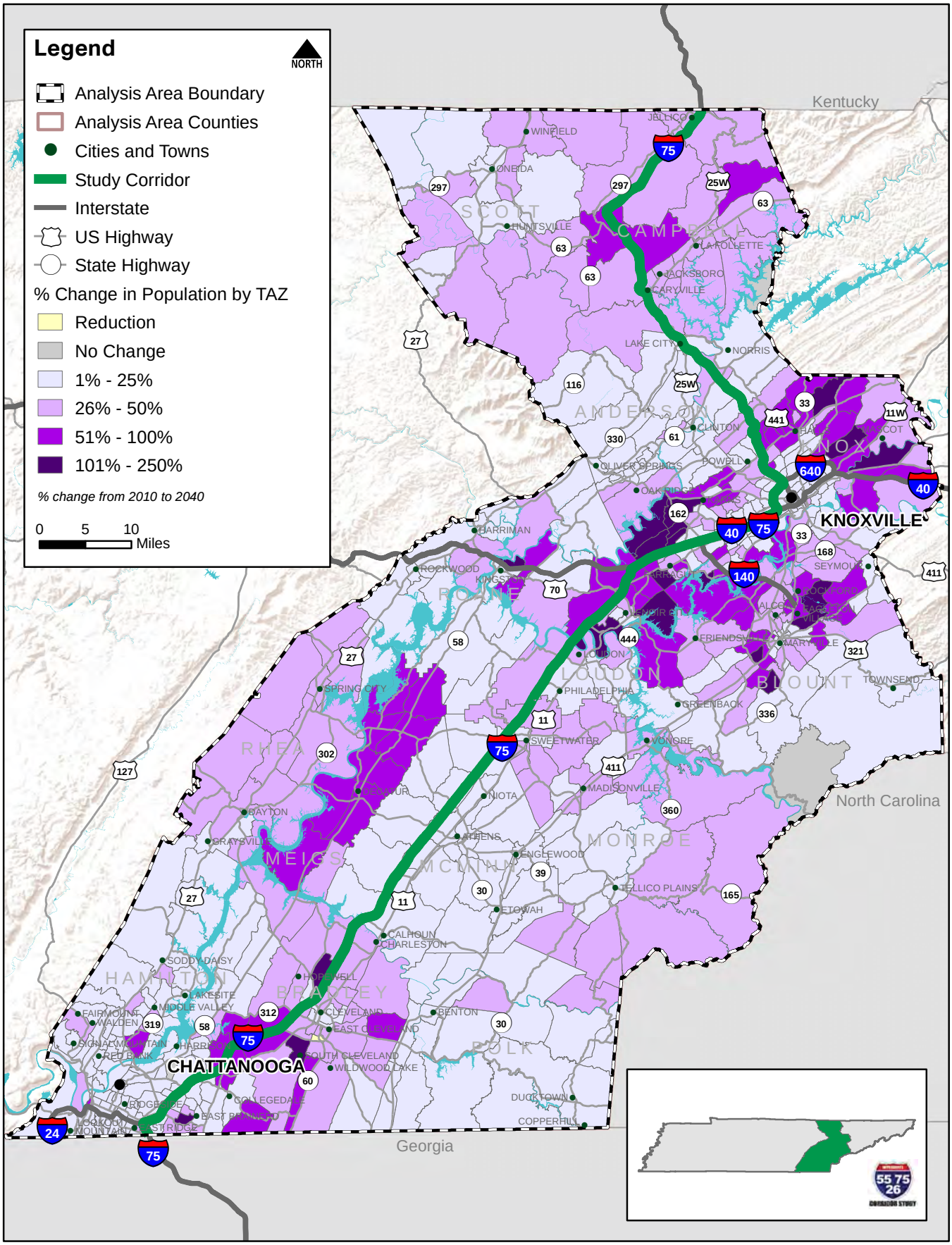
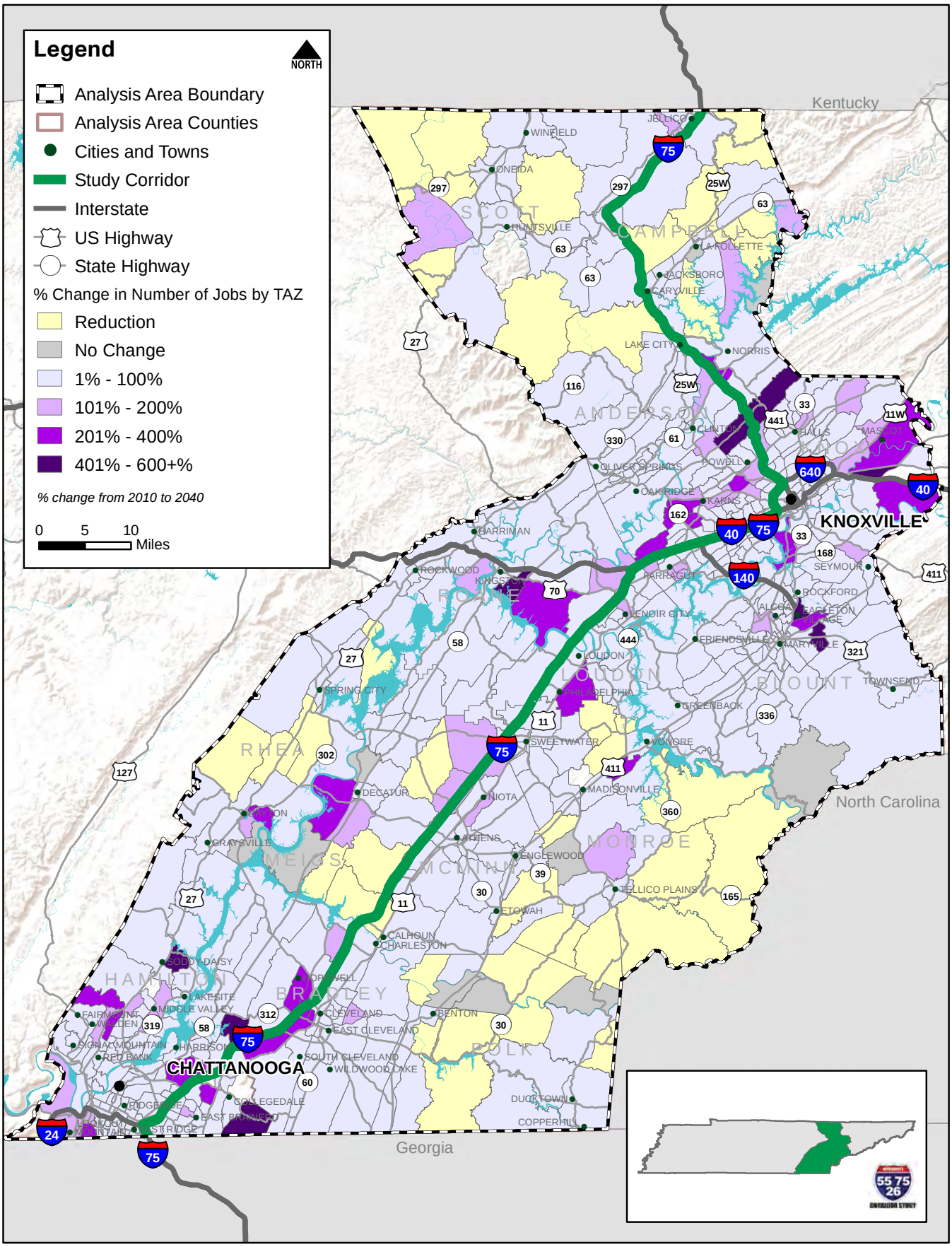


Figure 3-5. I-75 Change in Number of Jobs (2010 to 2040)



To focus on the needs of underserved populations, minority (persons identifying as other than "white alone") and low income populations – in this case persons living in poverty -- in the study area were mapped using data from the US Census Bureau's 2012-2016 American Community Survey (ACS). It should be noted that persons living in poverty represent the most extreme range of the region's low-income population.

The ACS data showed the highest concentrations of minorities are found around Knoxville, Chattanooga, and southeastern Blount county. The highest concentrations of people in poverty are found around Knoxville, Chattanooga, and Cleveland.

Land Use

Existing development patterns and in-progress plans will direct much of the forecasted population and employment growth over the next 20 years. The existing land use composition is fairly consistent across the fourteen counties, albeit with different patterns in the rural and urban areas. Knox, Bradley, and Hamilton Counties, each of which is part of a Metropolitan Planning Organization, generally have a higher proportion of residential uses compared to the rural counties, which have a higher proportion of agricultural lands. Some of the larger municipalities and counties within the corridor study area have undertaken the development of a comprehensive plan, land use plan, or a land use and transportation plan which addresses existing land use conditions within their jurisdictions and desired growth and development within their community. These plans lay the foundation for desired growth and development and ultimately affect the distribution of transportation resources. Notable comprehensive plans in the study area include those for Chattanooga (2016), Collegdale (2016), Farragut (2012), Knoxville (2018), Bradley County (2013), and Hamilton County (2016).

Future growth is expected to occur primarily near the urban areas of Knoxville, Cleveland, and Chattanooga.

As shown in Figure 3-6, areas that currently have the highest amount of development activity continue to attract the greatest interest in future growth. These areas are largely within the major urban areas of Knoxville, Cleveland, and Chattanooga. While Knox County is seeing a relatively steady amount of growth near the I-75 corridor, areas to the north and south of Knox County have the greater potential for future growth. In Bradley County, the interchanges at US-64 and SR-308 (Lauderdale Memorial Highway) are anticipated to see the greatest employment growth. In Hamilton County, much like Knox County, growth appears to be evenly dispersed, although the Volkswagen Drive interchange, which serves Volkswagen Chattanooga and Enterprise South, and SR-153, which provides access to the Chattanooga Airport and areas north of Hamilton County, will likely see the greatest amount of future growth and development.

Traffic Operations

TDOT collects and maintains Annual Average Daily Traffic Volume (AADT) data on roadways across the state. Figure 3-7 shows the 2017 AADT volumes recorded in the Tennessee Roadway Information Management System (TRIMS) at 20 count stations along I-75. As shown, daily traffic volumes are highest on the shared I-40 / I-75 segment through Knoxville (210,400 vehicles per day) and near the Georgia state line in Chattanooga (129,800 vehicles per day). Near the Kentucky border in Campbell County, volumes decrease to approximately 25,400 vehicles per day (VPD). For reference, the capacity of four lane rural freeway facilities, such as I-75 in McMinn County, ranges from 52,000 VPD to 67,000 VPD (Highway Capacity Manual 2010 Exhibit 10-8 and 10-9). Six-lane urban freeways carry 106,000 to 138,000 VPD.

The number of travel lanes and speed limit vary throughout the corridor, in relation to the adjacent land uses. As shown in Table 3-1, the majority of the corridor provides four travel lanes and a speed limit between 65 and 70 miles per hour.

Table 3-2 is populated with data obtained from the TSM, which provides base year (2010) daily trip information and forecasts the daily trips that will be made in 2040 based on projected growth and land use changes. As shown, total daily trips in the 14-county area are expected to reach 10.5 million by 2040, representing a 36% increase over total trips in 2010. According to projections based on Woods & Poole data, the corresponding population and employment increases in the area are 24% and 43%, respectively.

Total daily trips are expected to increase 36% between 2010 and 2040.

Vehicle capacity, as defined in the Highway Capacity Manual (HCM), is the maximum number of vehicles that can pass a given point during a specific period of time under prevailing roadway, traffic, and control conditions.

Figure 3-6. I-75 Existing Land Use

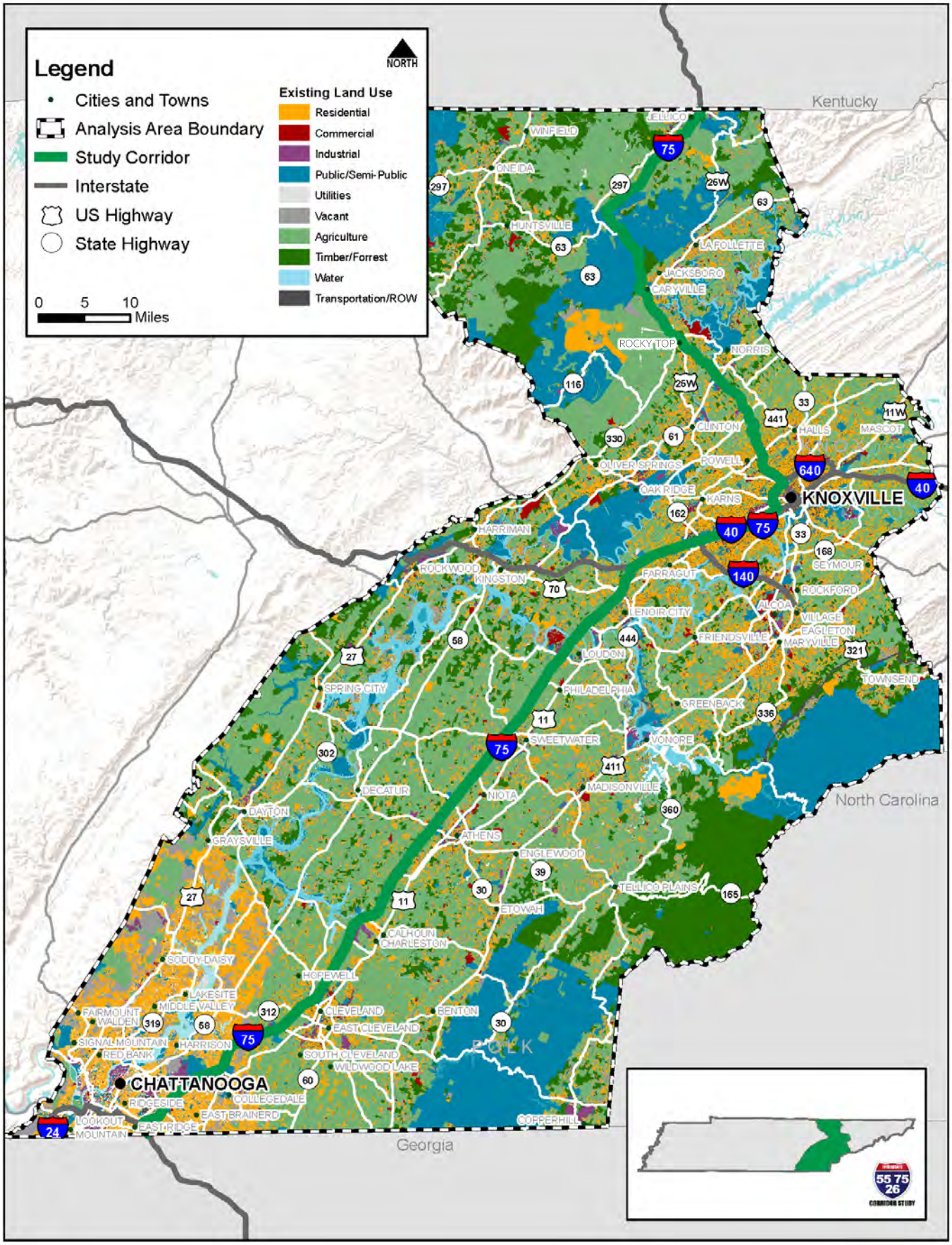
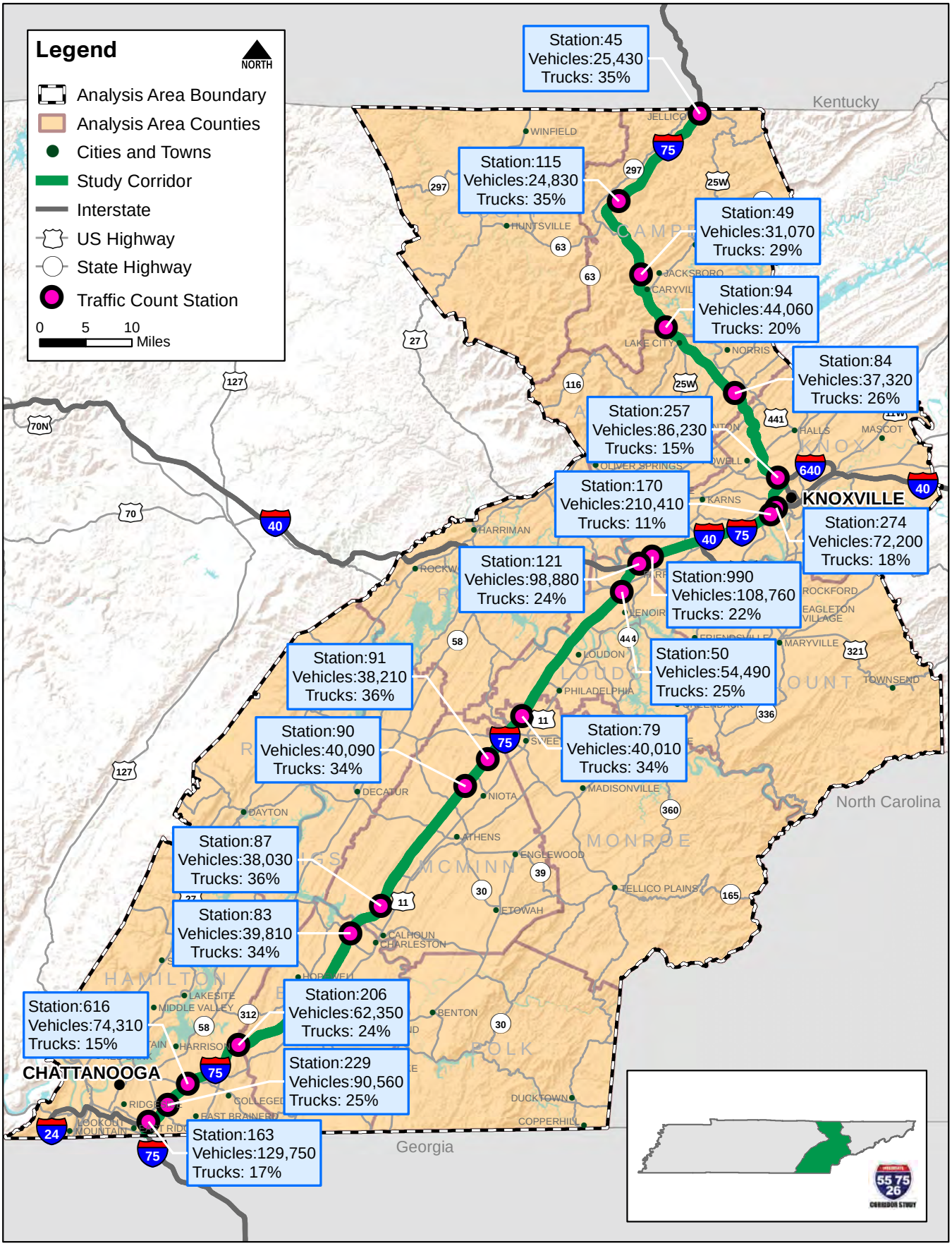


Figure 3-7. 2017 Average Annual Daily Traffic Volumes Along I-75



Source: Tennessee Roadway Information Management System (TRIMS) - 2017

Table 3-1. Roadway Characteristics by County – I-75

County	# of Travel Lanes	Land Use	Speed Limit (mph)
Hamilton	4-8	Commercial	55-65
Bradley	4	Rural	70
Mcminn	4	Rural	70
Monroe	4	Rural	70
Loudon	4	Rural	70
Loudon (I-40/ I-75 Section)	6	Rural	65
Knox (I-40/I-75 Section)	6-8	Commercial	55-65
Knox	4-6	Commercial & Rural	55-65
Anderson	4	Rural	65
Campbell	4	Rural	65-70

Source: Tennessee Roadway Information Management System (TRIMS) - 2017

Table 3-2. Area Daily Trip Breakdown 2010 and 2040 – I-75

	Daily Trips		
Trip Types	2010	2040	% Change
Personal Trips	7,425,300	10,135,600	37%
Truck Trips	298,600	397,200	33%
Total Trips	**7,723,900**	**10,532,800**	**36%**
Percent Truck Trips	4%	4%	

Source: Tennessee Statewide Travel Demand Model (TSM)

Figure 3-8 illustrates the 2040 peak period volume-to-capacity (VC) ratios (obtained from the TSM) for each Interstate segment. Where the volume-to-capacity ratio is greater than 1.0, drivers experience poor operating conditions and high delay, represented as level-of-service (LOS) F (see Figure 3-9). The majority of the I-75 corridor currently operates well with LOS A, B and C. Exceptions are as follows:

- Shared I-40/I-75 segment west of Knoxville
- I-75/I-640 interchange area in Knoxville
- I-75/SR-131 interchange area north of Knoxville
- I-75 segment between US-74 and near US-11 (Lee Hwy) south of Cleveland
- I-75/SR-153 & SR-320 interchange areas near Chattanooga
- I-24/I-75 interchange area in Chattanooga

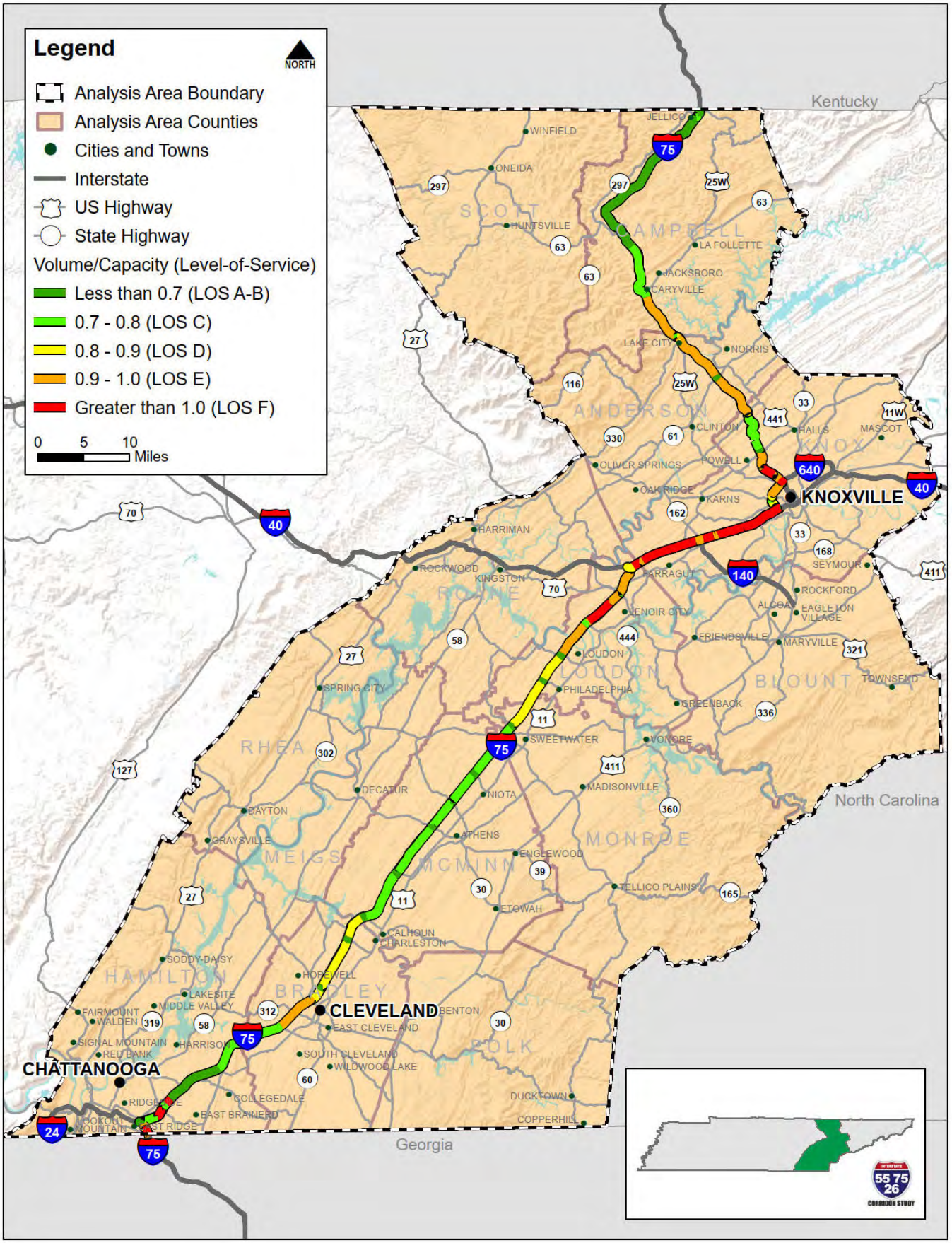
By 2040, many rural segments of I-75 are expected to experience increased congestion, notably segments in Loudon and Bradley counties, as well as Anderson County and southern Campbell County. Note that existing congestion between US-74 and US-11 south of Cleveland is resolved due to a programmed widening project. As shown in Figure 3-8, volumes on seven multi-mile sections of I-75 are expected to be near or exceed capacity by 2040:

- I-75 between the US-64 bypass and SR-60 (Bradley County, 4.54 miles)
- I-75 between SR-72 and I-40 (Loudon County, 12.72 miles)
- I-40/I-75 between I-40 and I-640 (Knox County, 17.39 miles)
- I-75 between Western Avenue and I-275 (Knox County, 2.25 miles)
- I-75 between Callahan Drive and SR-131 (Knox County, 1.72 miles)
- I-75 between SR-170 and US-441 (Knox/Anderson County, 11.33 miles)
- I-75 between US-441 and SR-63 (Anderson/ Campbell counties, 6.35 miles)

The shared segment of I-40/I-75 in Knox County will be evaluated as part of TDOT's ongoing I-40/I-81 Multimodal Corridor Study.

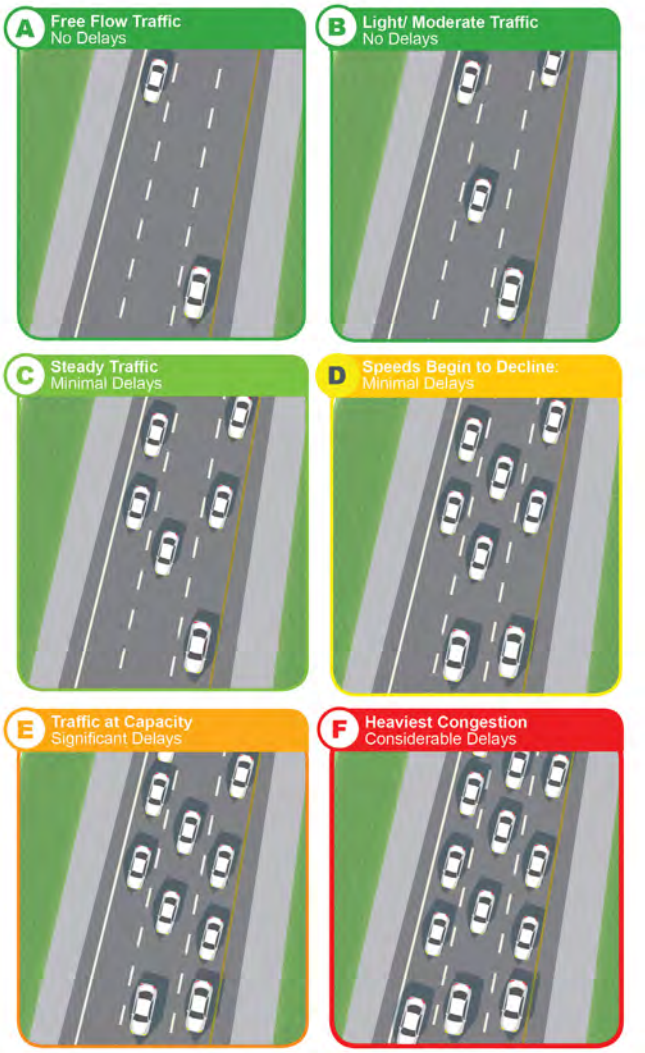
According to the TSM Trend analysis output, volumes at three additional spot locations were projected to exceed capacity by 2040:

Figure 3-8. Volume-to-Capacity Ratios/Level-of-Service (2040) — I-75



Source: Tennessee Statewide Travel Demand Model (TSM)

Figure 3-9. LOS Characteristics



- I-75, between the I-24/I-75 interchange and the Georgia state line, Hamilton County
  - Modifications to the I-75 /I-24 interchange are currently under construction. These modifications include improvements to I-75 between I-24 and Ringgold Road. However, through the Ringgold Road interchange and south to the Georgia state line, I-75 will maintain the existing three travel lanes in each direction. Projected 2040 traffic volumes will exceed the capacity of this six-lane cross-section.
  - I-75, between SR-153 and SR-320, Hamilton County
    - The I-75/SR-320 interchange provides two, adjacent cloverleaf movements for the northbound I-75 on- and off-ramps. This creates a weaving area of approximately 620 feet on I-75. Congestion caused by slow moving traffic near these ramps is compounded by that caused by merge/weave areas associated with SR-153 interchange ramps, less than one mile to the north. The SR-153 interchange is a system-to-system interchange and provides a collector-distributor road southbound from SR-153 to SR-320. Future volumes are expected to exceed capacity between these interchanges, most evidently in the southbound direction
- I-75, between Merchants Drive and Callahan Drive, Knox County
  - I-75 currently provides three travel lanes in each direction between Merchants Drive and Callahan Drive, a distance of approximately 1.75 miles. Field observations of queuing on I-75 northbound between SR-131 and Merchants Drive support TSM projections of capacity issues on this segment of interstate.

Note that during the January 16, 2020 public meeting, a stakeholder also identified the need for improvements to the southbound I-75 off-ramp at Shallowford Road, which they stated routinely queues onto the interstate. The currently programmed project at the Hamilton Place Mall interchange includes modifications to the Shallowford Road interchange, which will address this ramp queue issue.

Spillover Effect

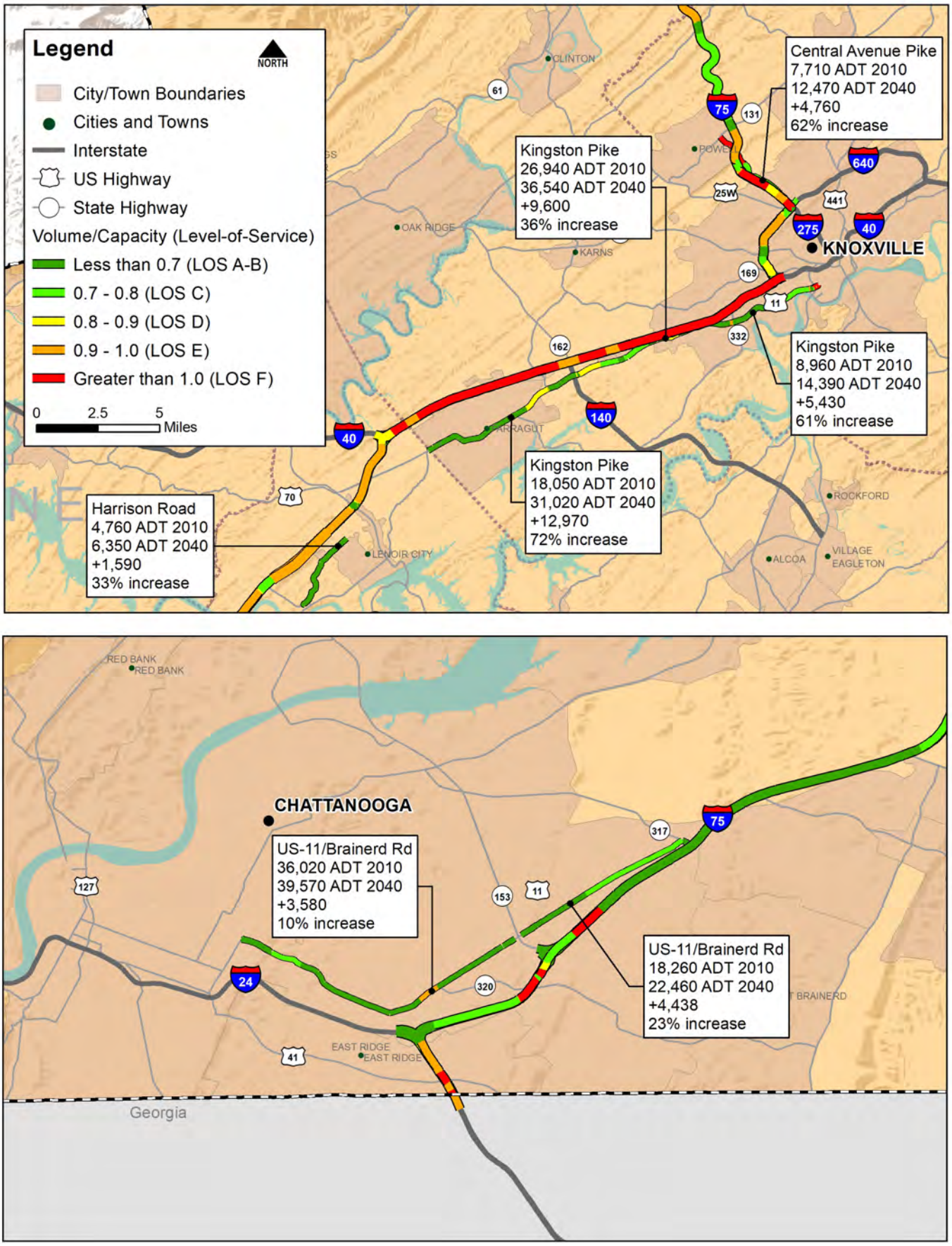
Figure 3-10 identifies streets that are likely to receive spillover traffic as the segments noted above experience more and more congestion. Of these spillover streets, sections of the following are expected to operate at LOS E or F in 2040:

- Central Avenue Pike
- US-11/Brainerd Road

Bottleneck Locations

Existing bottlenecks on I-75 at I-640 and at I-24 are being addressed through programmed projects to reconstruct these interchanges. The projects will improve safety and provide additional capacity for throughput. However, volumes on adjacent segments of Interstate are expected to exceed the capacity, resulting in queuing and therefore recurring congestion through these interchanges. Additional bottlenecks on I-75 near the SR-153 and SR-320 interchanges are most likely a result of tight weave movements at the SR-153 interchange combined with the proximity of the

Figure 3-10. Spillover Effect (2040) — I-75



Source: Tennessee Statewide Travel Demand Model (TSM)

SR-320 and Hamilton Place interchanges. Finally, the Tennessee Freight Plan identified potential bottleneck locations in Campbell County between mile markers 6.32 and 9.43, north of US-25W and on I-75/I-40 in Knox County, east of Everett/Watt Road to I-275.

Transportation Systems Management & Operations (TSM&O)

ITS

Intelligent Transportation Systems provide information which improves transportation safety, operations, and mobility. TDOT's ITS program, SmartWay, utilizes cameras and sensors to monitor interstate corridors throughout Tennessee. TDOT's SmartWay system relies on evolving technology, as well as teams of operators and technicians who monitor the technical systems and provide hands-on assistance through the state's HELP program. Four transportation management centers (TMCs) located across the state anchor the systems operations and communication. From these locations, operators oversee 551 cameras, 183 message signs, 1,107 roadway detection systems and 49 video detection systems across the state. They also maintain communication with the public via messages on dynamic message signs, TN 511 updates, and the SmartWay website. Figure 3-11 and Table 3-3 shows the ITS inventory along the I-75 corridor.

In response to numerous fog-related, severe and fatal crashes on I-75 near the Bradley-McMinn county line, TDOT installed a fog detection and warning system in 1993. This system, which includes forward-scatter visibility sensors, microwave radar vehicle detectors, 21 Closed Circuit Television (CCTV) cameras, six warning signs with flashing beacons, 10 changeable speed limit signs, 10 Digital Message Signs (DMS), and two Highway Advisory Radio (HAR) transmitters, warns drivers within an eight-mile segment of dangerous weather conditions. The Federal Highway Administration (FHWA) has recognized this low visibility warning system as a national best practice for road weather management[1].

Traffic Incident Management

Responding to traffic incidents in an effective and timely manner reduces congestion, wasted fuel, and the likelihood of secondary crashes. The time it takes to respond to an incident and clear the roads is directly related to the likelihood of a secondary crash. This response time can be greatly reduced using ITS technologies, including monitored CCTV cameras, radar detectors to determine travel speeds, and DMS to direct/notify drivers. The highly coordinated incident management process requires accurate and efficient communication among numerous agencies.

TDOT's HELP program, which has been incorporating the latest ITS technologies and strategies since its inception in 1999, has expanded to cover I-75 from the Georgia state line in Chattanooga to SR-2 and from Watt Road on I-40/I-75 to the I-75/ I-275/US-25W interchange northwest of Knoxville. TDOT has also established specific, regional Interstate incident management plans focusing on major incidents (those that will require total roadway closure for at least two hours). Goals of these living plans include decreased response time and planned detour routes with appropriate signing so that motorists experience minimal delay in moving toward their destinations. The plans also detail work zone traffic control and point to the regional transportation management centers as the "home base" of coordination and communication during an event. The plans are distributed to regional TDOT Maintenance and Incident Management staff so that the defined detour routes can be implemented quickly upon confirmation of an incident. The Region 1 incident management plan was last updated in 2018. The Region 2 incident management plan was last updated in 2017[2].

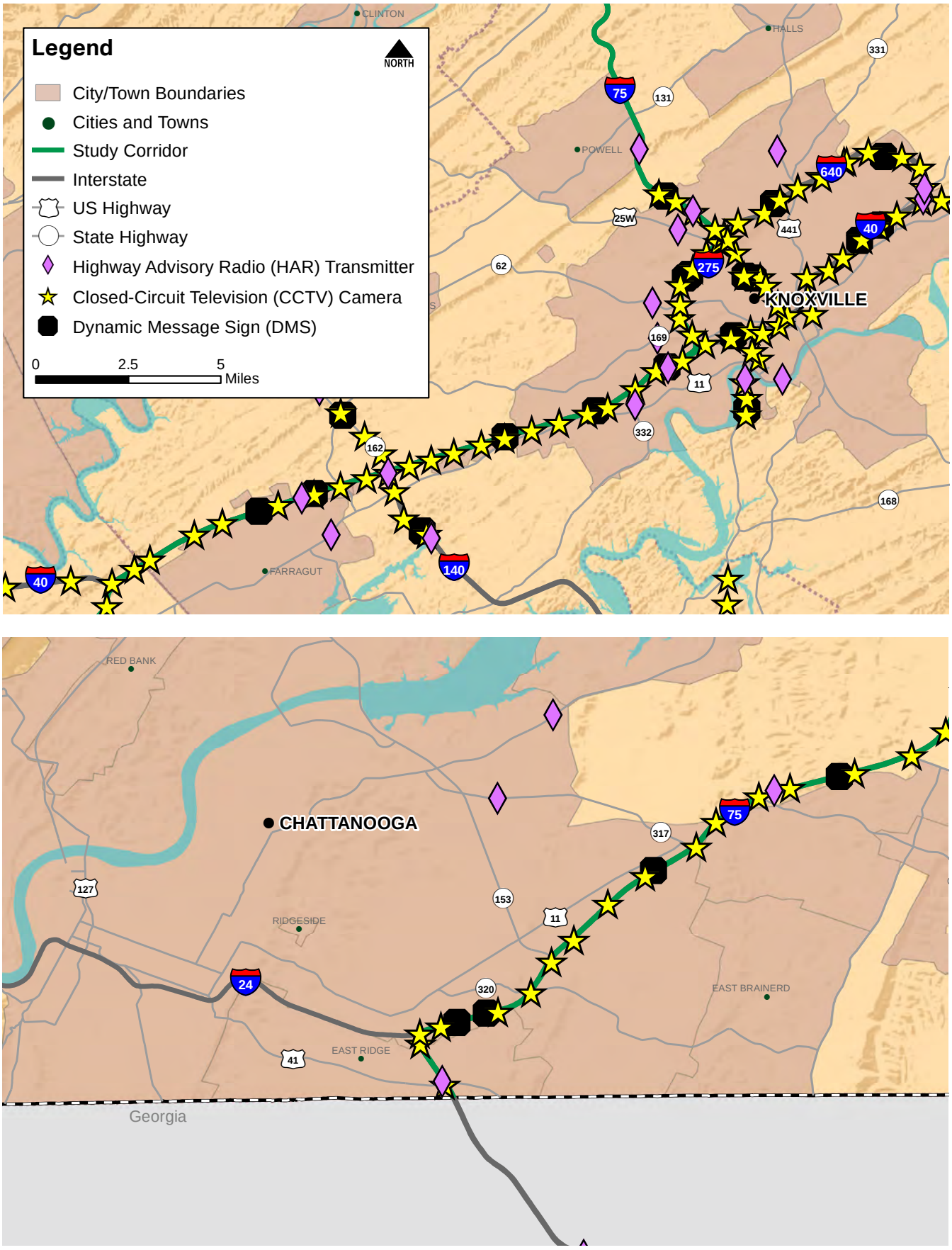
Table 3-3. ITS Resources – I-75

ITS Resource	Count
TMC Operators*	41
HELP Operators*	34
HELP Vehicles*	40
IT Technicians*	5
Interstate Miles (SmartWay)	112
Closed Circuit Television (CCTV) Cameras	81
Speed Detectors	140
Dynamic Message Signs (DMS)	26
HIghway Advisory Radio (HAR) Transmitters	8
HAR Signs w/Beacons	12

*Applies to greater Knoxville and Chattanooga areas, not just to I-75.

1- https://ops.fhwa.dot.gov/weather/
2- https://www.tn.gov/tdot/traffic-operations-division/transportation-management-office/interstate-incident-management-plan.html

Figure 3-11. Intelligent Transportation System Components — I-75



Source: Tennessee Department of Transportation

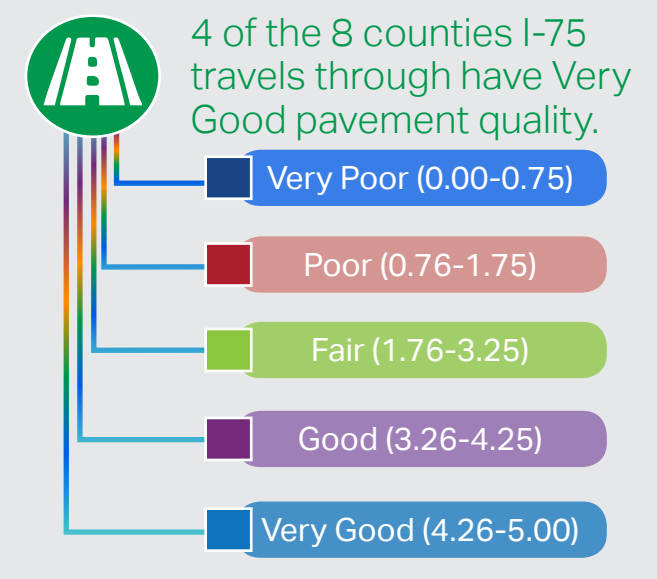
System Maintenance

Pavement

TDOT collects and maintains pavement management data for all roads included in the state's network. The Pavement Quality Index (PQI), expressed on a scale from 0-5, is the overall measure of a pavement's roughness and distress. The PQI is calculated based on both the Pavement Distress Index and the Pavement Smoothness Index, the latter of which is a function of the International Roughness Index (IRI). The IRI measures the number of vertical deviations over a section of road, and has been used as a performance measure toward goals set by the Federal Highway Administration (FHWA) since 1998. As of 2006, FHWA designated an IRI equal to 95 inches/ mile or less to be representative of a road with good ride quality.

With exception to I-75 in Hamilton County, greater than 87 percent of the roadway miles on I-75 have good ride quality. According to TDOT's 2017 Pavement Management Report, 91% of Interstates in Tennessee have a Good or Very Good pavement quality index (PQI). The majority of Interstate 75 falls into the Good range, with portions in Bradley, McMinn, Monroe and Anderson counties ranking in the Very Good range. Based on TRIMS maintenance history (as of 2017), illustrated in Figure 3-13, segments of I-75 in Hamilton, Loudon, and Knox counties have not been resurfaced since the late 1990s/early 2000s. More detailed pavement information for specific sections of I-75 is provided in Table 5-1 of Technical Memorandum 2.

Figure 3-12. Pavement Quality Index



Bridge Conditions

TDOT routinely inspects and evaluates the 19,822 structures designated as public highway bridges in the state. These include bridges owned and maintained by TDOT, as well as those owned and maintained by local governments. TDOT designates a bridge as "structurally deficient" if one or more major structural components are rated in poor condition, or if its load carrying capacity is well below current design standards. As shown on Figure 3-13, TDOT has identified four structurally deficient bridges along I-75, including the bridge over the Tennessee River in Loudon County, the bridge over East Wolf Valley Road in Anderson County, and the dual bridges over Bruce Gap Road in Campbell County.

FHWA's Highway Bridge Replacement and Rehabilitation Program (HBRRP) provides funds to assist states in replacing or rehabilitating deficient highway bridges located on any public road. To be eligible, a bridge must carry highway traffic, be deficient, and have a sufficiency rating of 80 or less. The sufficiency rating of an individual bridge, on a scale of 0 to 100, is based on structural adequacy and safety, serviceability and functional obsolescence, and essentiality for public use. A rating of 0 is the worst possible bridge. A sufficiency rating that is less than 50 is eligible for replacement and a sufficiency rating of less than 80 but greater than 50 is eligible for rehabilitation.

Of the 178 bridges on I-75 in the study area, 54 had sufficiency ratings low enough to be eligible for rehabilitiation under the FHWA's HBRRP. No bridges had sufficiency ratings low enough to be eligible for replacement.

Multimodal Facilities

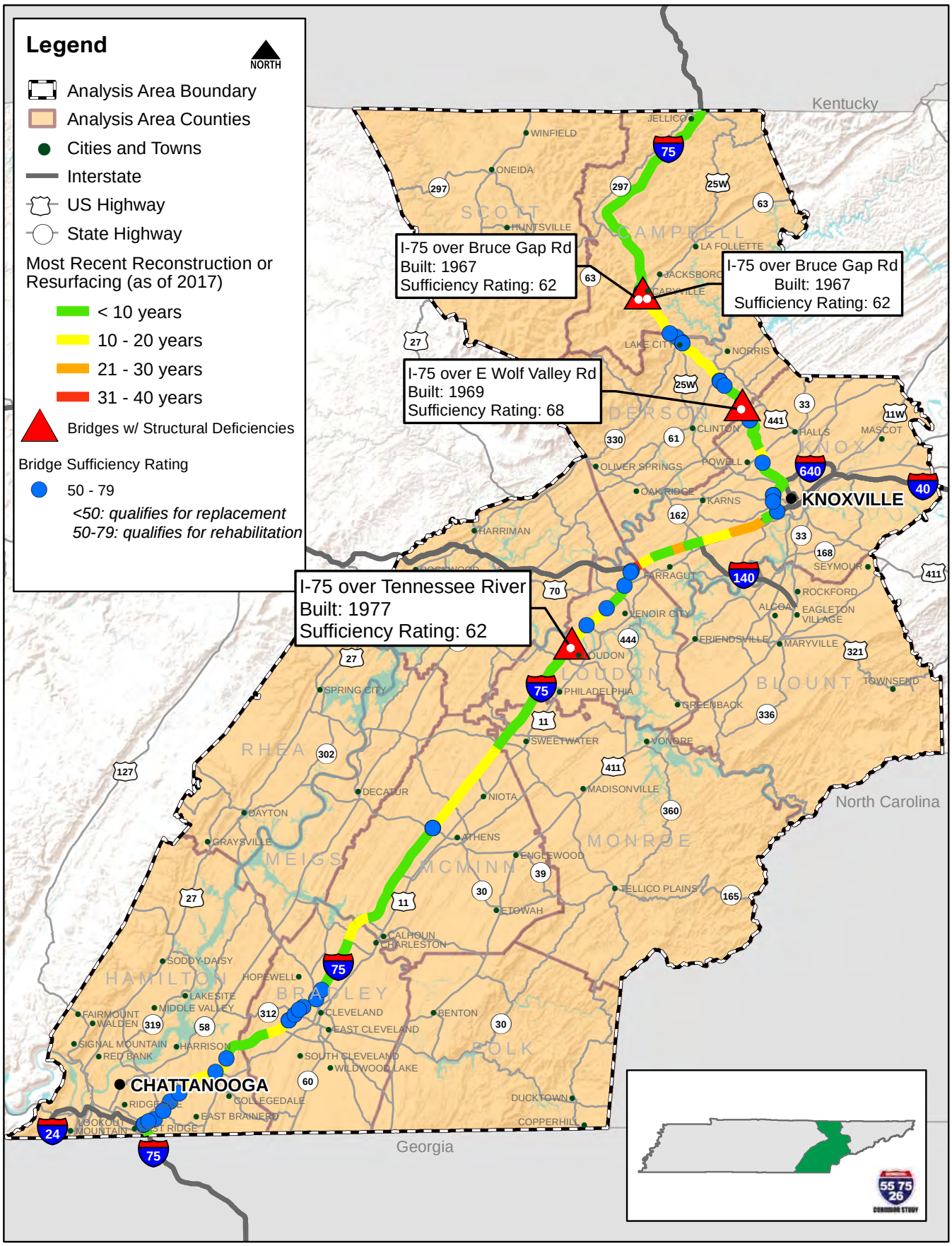
Public Transportation

The I-75 study area is served by three transit agencies:

- KAT (Knoxville Area Transit)
- CARTA (Chattanooga Area Regional Transportation Authority)
- CUATS (Cleveland Urban Area Transit System)

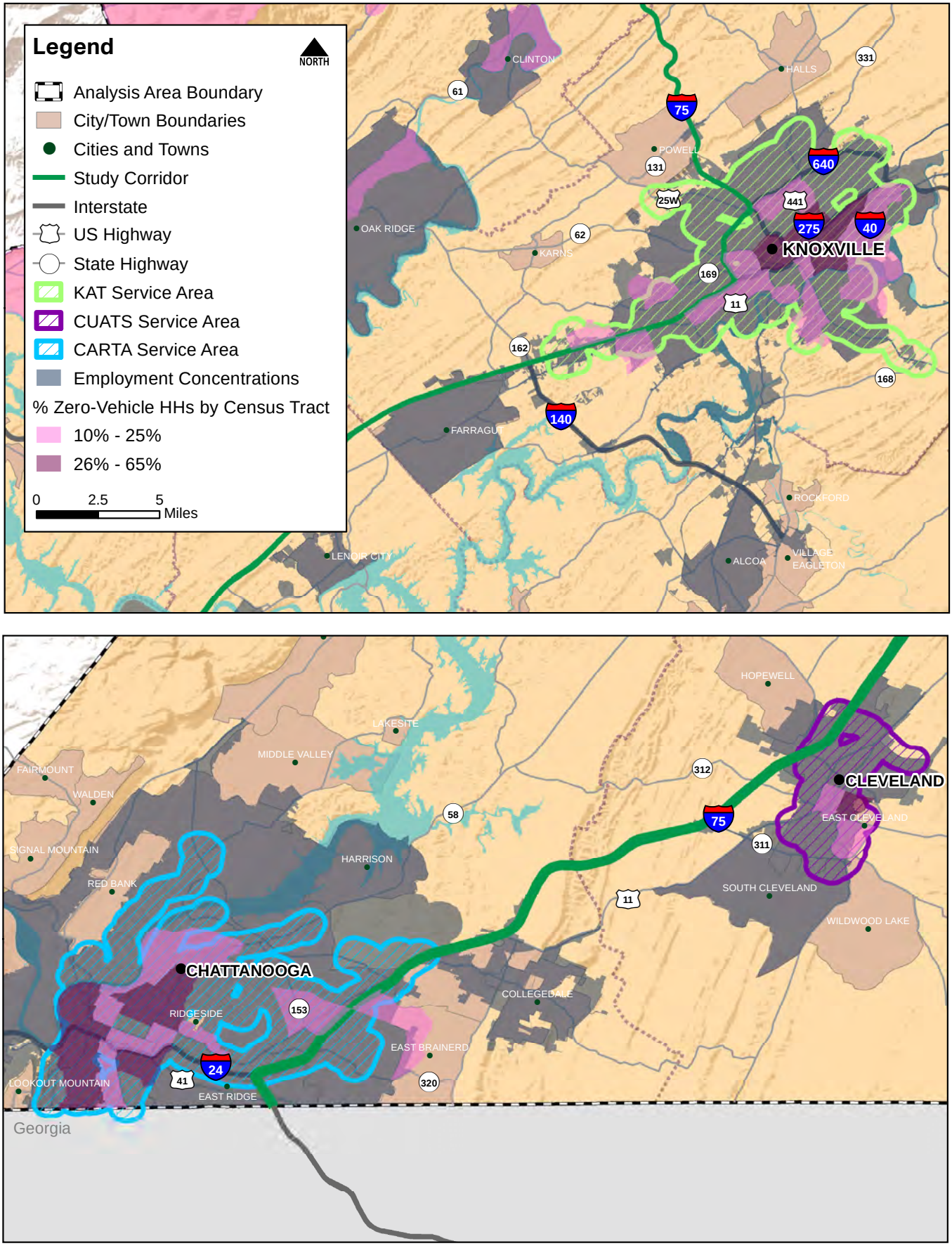
All three transit agencies offer several fixed bus routes, two offer on-demand, paratransit service and one offers a free downtown trolley service. Despite three different transit agencies, a vast majority of the I-75 corridor is without mass transit. The existing transit agencies serve local residents but miss regional connections for commuters. Figure 3-14 displays the service area for all three transit operations in the I-75 corridor study area in addition to areas of high employment concentration. While transit coverage is good in urban areas, the map displays the lack of regional connections and missed opportunities to dense employment areas that would be valuable for commuters.

Figure 3-13. Recent Reconstruction/Resurfacing, Bridge Sufficiency Ratings — I-75



Source: Tennessee Roadway Information Management System (TRIMS) - 2017

Figure 3-14. Transit Operations — I-75



Sources: U.S. Census Bureau, Knoxville Area Transit, Cleveland Urban Area Transit System, Chattanooga Area Regional Transportation Authority

In addition to the five fixed bus routes, CUATS offers an on-demand paratransit service. CUATS service operates Monday – Friday from 6:00am – 7:00pm and is closed on major holidays. Each route operates one bus at a time and takes an hour to complete the route, meaning wait times between buses are 60 minutes. While CUATS serves the City of Cleveland well, no routes extend beyond the city limits and no commuter routes between Chattanooga and Cleveland currently exist. Cleveland Urban Area Metropolitan Planning Organization's 2040 Regional Transportation Plan notes that a large portion of Cleveland's residents commute to Chattanooga for work[4].

Park-and-Ride Lots

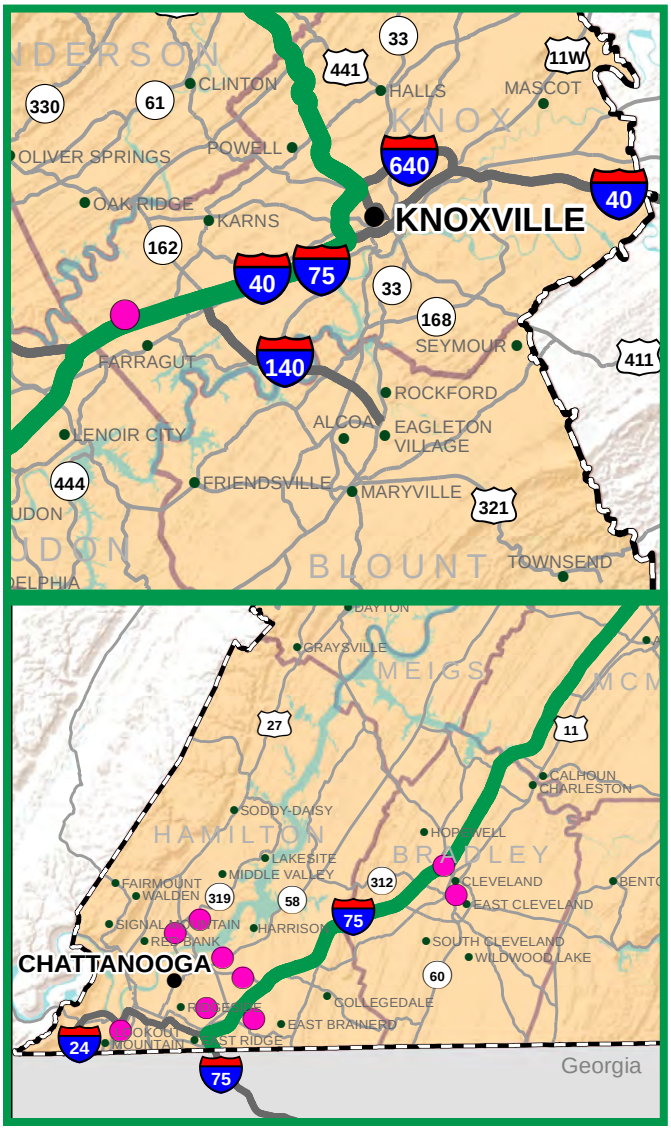
Chattanooga Area Regional Transportation Authority (CARTA) provides park-and-ride locations at points along fixed bus routes throughout the region. Users can park their vehicle in an existing parking lot for free and get on a CARTA bus to start or end their journey. The park-and-ride model allows users from outside of the CARTA service area to take advantage of the bus system. This could help reduce congestion on I-75 (see Figure 3-15).

Knoxville and Cleveland could initiate a similar system as CARTA's model takes advantage of existing parking lots and therefore, avoids maintenance and other associated costs. Park-and-Ride lots could also help serve the greater I-75 corridor.

Pedestrian/Bicycle

Unless planned for ahead of time, geometric limitations created by Interstate structures often result in discontinuous pedestrian and bicycle accommodations on cross-streets through an interchange. Where bicycle lanes and sidewalk may be present on either side of the Interstate, the cross-section through the interchange may be limited to only vehicular traffic, which discourages multi-modal connectivity. Furthermore, ramp intersections often create bicycle lanes and sidewalk paths that are difficult to navigate, and in some cases unsafe. As shown in Figures 3-16 and 3-17 and Tables 3-3 and 3-4, I-75 interchanges with U.S. and state routes were evaluated to assess connectivity for pedestrians and bicyclists across the Interstate. Where pedestrian and bicycle accommodations existed on the cross-street, free-flow right turns at ramp interchanges were also noted. While free-flow right turns have operational benefits, the movement allows vehicles to maintain higher rates of speed off the ramp and through the intersection, putting pedestrians and bicyclists at a disadvantage. Motorists traveling at higher speeds are less likely to yield to pedestrians and higher intersecting speeds are more difficult for bicyclists to judge and maneuver. AADT on the cross-roads was also noted as higher traffic volumes limit mobility for pedestrians and bicyclists.

Figure 3-15. Park-and-Ride Lot — I-75

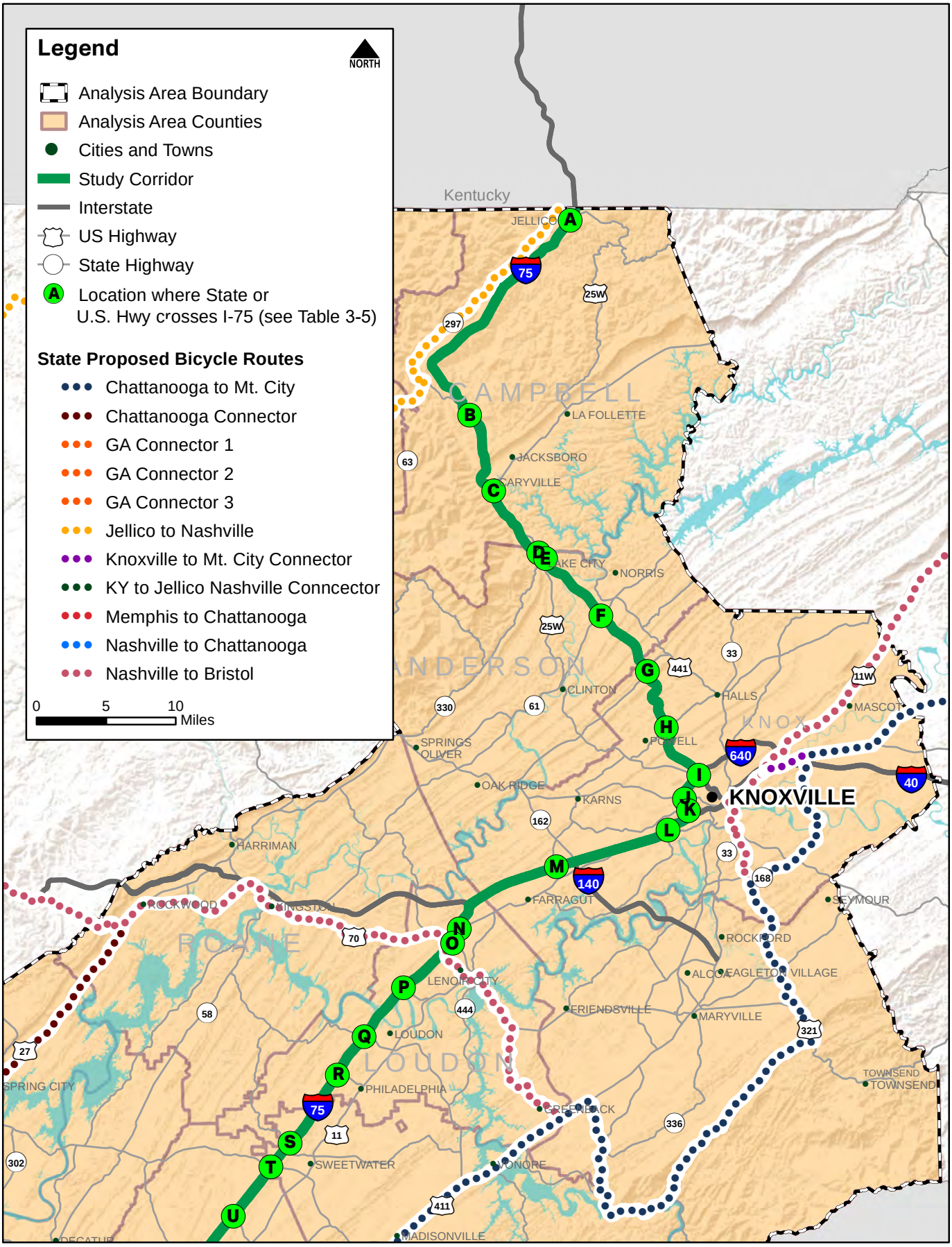


Source: https://www.townoffarragut.org/253/Transportation-Commuters (Knoxville); Chattanooga Area Regional Transportation Authority

Planned U.S. Bicycle Routes and TDOT State Bicycle Routes exist adjacent to and intersecting I-75. These routes will be designated on U.S. and state routes with paved shoulders and marked with signs. In most cases, these routes will not augment local or intercity connections significantly.

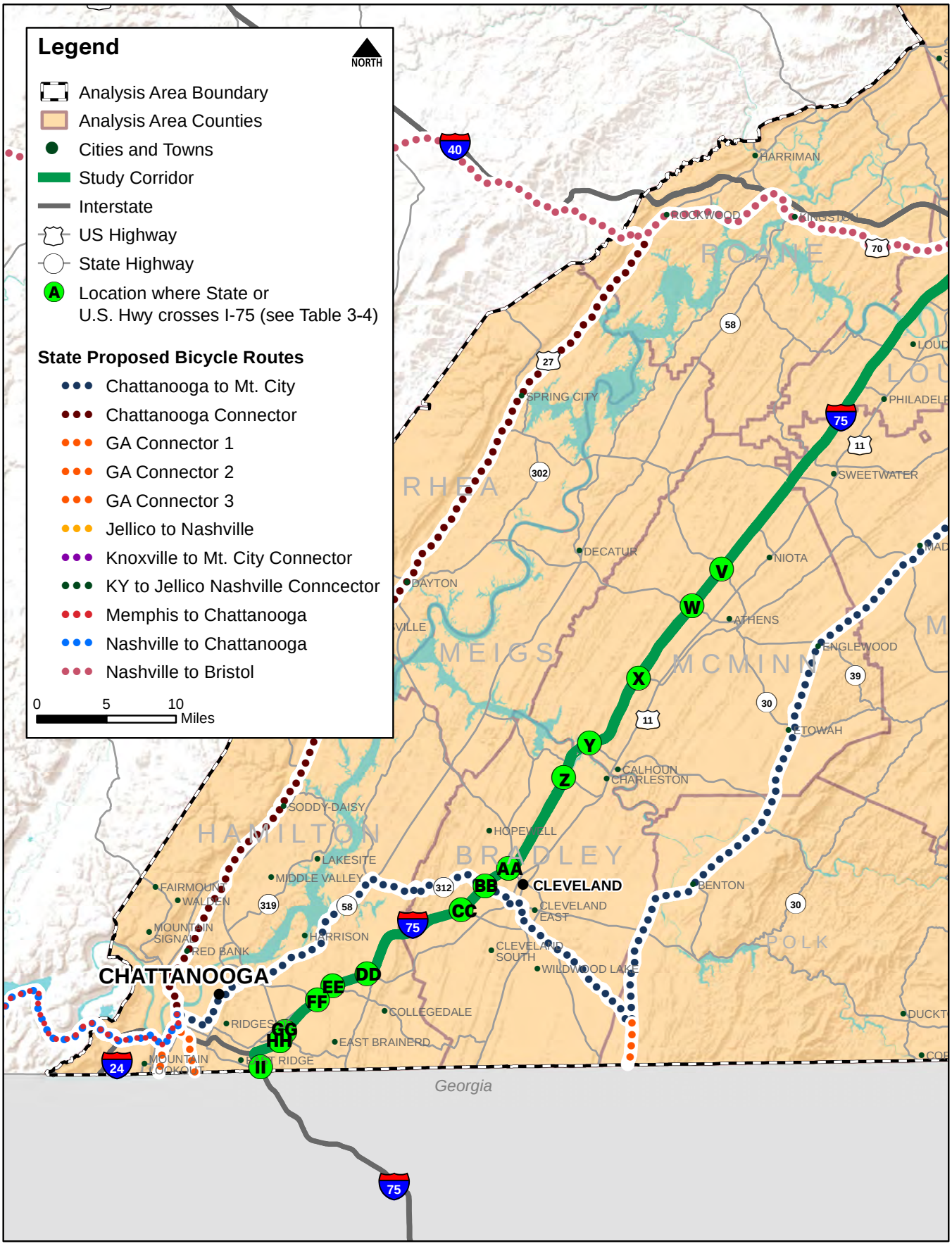
At two U.S. or state route interchanges along I-75 (SR-2 and SR-317), no paved shoulder, wide outside lane or bicycle lane is available for bicyclists. Sidewalk is provided through only three U.S. or state route interchanges (SR-62, SR-169, and SR-332), and free-flow right turns from ramps exist at one interchange where pedestrian accommodations are provided (SR-131).

Figure 3-16. Planned State Bicycle Routes and U.S./State Route Crossings (north) — I-75



Source: Tennessee Department of Transportation

Figure 3-17. Planned State Bicycle Routes and U.S./State Route Crossings (south) — I-75



Source: Tennessee Department of Transportation

Table 3-4. Locations Where a U.S. or State Route Crosses (south) I-75

Map Letter	State Route/U.S. Hwy Crossings	Crossroad AADT (2018)	Bicycle Lane/ Multi-Use Path?	Paved Shoulder >2'?	Sidewalk?	Free-Flow Right with Bicycle/Ped Facilities?
W	SR-30/Decatur Pike	11,000 (W) 20,100 (E)	No	Yes	No	No
X	SR-39/Riceville Decatur Rd	4,300 (E)	No	Yes	No	No
Y	SR-163/Lamontville Rd	1,900 (W) 2,800 (E)	No	Yes	No	No
Z	SR-308/Lauderdale Memorial Hwy	2,500 (W) 5,000 (E)	No	Yes	No	N/A
AA	SR-60/Georgetown Rd NW	13,000 (NW) 30,500 (SE)	No	Yes	No	N/A
BB	SR-312/Harrison Pike	5,400 (NW) 8,000 (SE)	No	Yes	No	N/A
CC	SR-311/US-74/Pleasant Grove Rd	21,500 (SE)	No	Yes	No	No
DD	SR-2/US-11/Lee Hwy	34,400 (E)	No	Yes	No	No
EE	SR-317 (EB)/SR-378/Apison Pike	9,200 (W) 19,300 (E)	No	Yes	No	No
FF	SR-317 (WB)/Bonny Oaks Dr	24,400 (W) 10,100 (E)	No	Yes	No	No
GG	SR-153	77,800 (W)	No	Yes	No	No
HH	SR-320/Brainerd Rd	14,900 (W) 46,700 (E)	No	Yes	No	No
II	SR-8/Ringgold Rd	25,400 (W) 10,500 (E)	No	Yes	No	No

* West approach; **East approach

Source: TDOT Traffic History website, Google Earth

Table 3-5. Locations Where a U.S. or State Route Crosses (north) I-75

Map Letter	State Route/U.S. Hwy Crossings	Crossroad AADT (2018)	Bicycle Lane/ Multi-Use Path?	Paved Shoulder >2'?	Sidewalk?	Free-Flow Right with Bicycle/Ped Facilities?
A	SR-9/US-25W/5th St	5,700 (W)* 3,200 (E)**	No	Yes (one side)	No	No
B	SR-63/Howard Baker Hwy	6,600 (W)	No	Yes	No	No
C	SR-9/US-25W/Veterans Memorial Hwy	19,700 (E)	No	Yes	No	No
D	SR-9/US-25W/Main St	No counts	No	Yes	No	No
E	SR-71/Norris Frwy	1,900 (W)	No	Yes	No	No
F	SR-61/N Charles G Seivers Blvd	26,300 (W) 20,900 (E)	No	Yes	No	No
G	SR-170/Raccoon Valley Dr	No counts	No	Yes	No	No
H	SR-131/E Emory Rd	26,300 (W) 20,900 (E)	No	Yes	No (sidewalks beyond interchange)	N/A
I	SR-9/US-25W	28,000 (W)	No	Yes	No	No

Table 3-5. Locations Where a U.S. or State Route Crosses (north) I-75 cont.

Map Letter	State Route/U.S. Hwy Crossings	Crossroad AADT (2018)	Bicycle Lane/ Multi-Use Path?	Paved Shoulder >2'?	Sidewalk?	Free-Flow Right with Bicycle/Ped Facilities?
J	SR-62/Western Ave	44,900 (W) 16,000 (E)	No	No	Yes (one side)	No
K	SR-169/Middlebrook Pike	14,200 (E)	No	No	Yes (one side)	N/A
L	SR-332	26,200 (S)***	No	Yes (one side)	Yes (one side - stops at interchange)	No
M	SR-131/Lovell Rd	17,500 (N)**** 36,400 (S)	No	Yes	No (sidewalks beyond interchange/ overpass)	Yes (pedestrian only)
N	SR-2/Kingston Pike	No counts	No	No	No	N/A
O	SR-73/US-321	16,200 (W) 29,000 (E)	No	Yes	No	No
P	SR-324/Sugarlimb Rd SR-72/Loudon Hwy	5,300 (W) 7,400 (E)	No	Yes	No	No
Q	SR-72/Loudon Hwy	4,500 (W) 13,100 (E)	No	Yes	No	No
R	SR-323/Pond Creek Rd	600 (W) 1,900 (E)	No	Yes	No	No
S	SR-322/Oakland Rd	1,700 (W) 4,400 (E)	No	Yes	No	No
T	SR-68	1,700 (W) 4,400 (E)	No	Yes	No	No
U	SR-309/Union Grove Rd	1,700 (E)	No	Yes	No	No
V	SR-305/Mt Verd Rd	5,100 (W)* 9,100 (E)**	No	Yes	No	No

* West approach; **East approach
*** South approach, **** North approach

Source: TDOT Traffic History website, Google Earth

Passenger Air and Rail Services

As shown in Figure 3-18, three airports are located along the I-75 corridor, including the Chattanooga Airport, McGhee Tyson Airtort, and the Monroe County Airport. The McGhee Tyson Airport (TYS) is a public and military airport; it is served by several major airlines, and employs nearly 3,000 people.[3] The airport has two runways and is located south of Knoxville and south of the I-75 corridor. Nearly 2 million passengers went through the airport in 2017.[4] The Chattanooga Airport (CHA) is located a few miles east of Chattanooga and located just west of the I-75 corridor. The airport has two runways and is served by several major airlines. Finally, the Monroe County Airport (MNV), the smallest of the three with only one runway is located a few miles east of the I-75 corridor in Madisonville, TN. None of the airports is accessed directly from I-75.

Currently, no fixed rail transit services exist within the I-75 study area.

Transportation Demand Management

Transportation Demand Management (TDM) is a set of strategies that influence travel behavior to reduce single-occupancy vehicle travel. Ranging from ridesharing, bicycling, teleworking, taking transit, car sharing and on-demand or real-time applications, TDM strategies redistribute commuter travel across a variety of alternatives and away from daily peak periods. TDM programs represent a flexible, low-cost way to engage residents, travelers, businesses and local governments in the effort to reduce commuter travel and associated costs and impacts on the community including traffic congestion and emissions. The Statewide TDM Plan identified a number of ways regional TDM programs

3- Chattanooga-Hamilton County/North Georgia 2045 Regional Transportation Plan Update. Accessed 03/11/2019. https://drive.google.com/file/d/1e0PtFWlSnWrkIApDigTFjhhmuGeN7GhX/view
4- Cleveland Urban Area MPO 2040 Regional Transportation Plan. Accessed 3/20/2019. http://clevelandtn.gov/DocumentCenter/View/995

can support TDOT with managing mobility. They can also provide needed assistance on selected corridors when capacity is at a premium – especially during large construction projects. Within the study area, two local partners are responsible for program implemenation. Chattanooga's Green Commuter Program and Knoxville's Smart Trips.

Figure 3-18. I-75 Airports

Safety

Increase in traffic volumes and vehicle miles traveled increase the likelihood of traffic incidents. To identify trends in potential safety issues along the I-75 corridor, five-year (2014-2018) crash data was collected from TRIMS and evaluated.

Using TDOT's traffic volumes collected in 2018, crash rates were also calculated. These rates are reported in terms of crashes per million vehicle miles traveled. Figure 3-19 shows the comparison of these rates to the statewide averages for facilities of a similar type. More specifically, the statewide average crash rate is 0.528 crashes per million vehicle miles traveled for rural freeways and 1.112 crashes per million vehicle miles for urban freeways. I-75 crash rates were compared to the Tennessee statewide averages based on the following metrics:

- **Below Average**: Locations with crash rates below the statewide average
- **Average**: Locations with crash rates at or within 15 percent above the statewide average
- **Above Average**: Locations with crash rates between 15 and 100 percent above the statewide average
- **Significantly Above Average**: Locations with crash rates greater than or equal to 100 percent higher than the statewide average

Areas where the crash rates were significantly above statewide averages were identified as hot spots and are shown in Figure 3-19 in red.

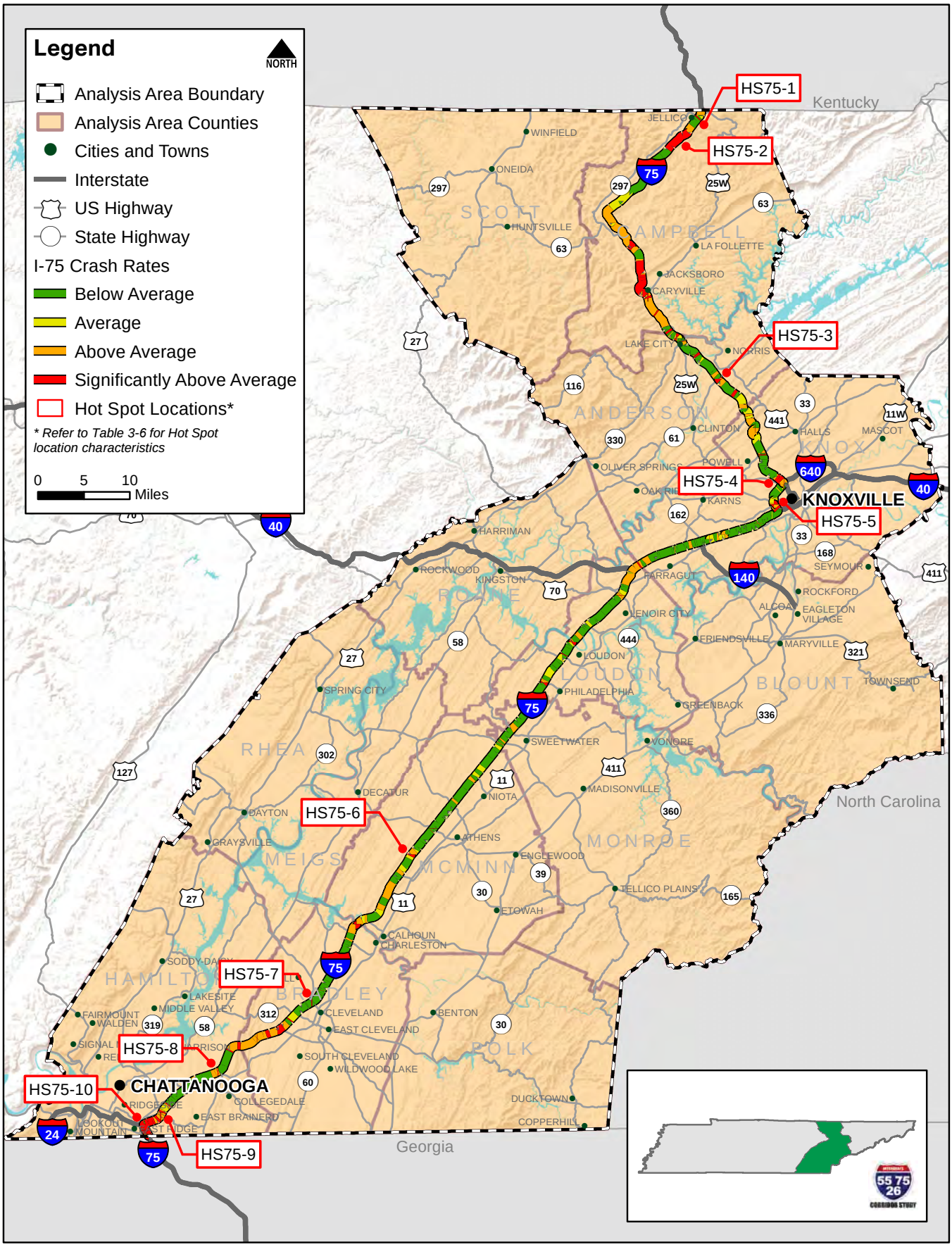
During a field review, several safety issues related to geometry were observed:

- At US-324, the westbound right-turn onto the northbound I-75 on-ramp has a steep downgrade and sharp right turn. The US-324 on-ramp also has a short merge on an upgrade. Truck traffic was also observed at this interchange.
- At the I-75 northbound exit to US-321, there is a steep downgrade with a short deceleration to a 30 mile per hour ramp.
- The Campbell Station Road eastbound exit from I-75 does not have a deceleration lane, only a tapered lane, making it difficult for cars to slow down quickly when leaving I-75.
- The I-75 and Careyville interchange (Exit 134) is a series of short, curvy ramps, including slip ramps.
- Weaving caused by two loop ramps at the US-25W interchange near Jellico.

Hot spots crash records were examined for each hot spot to discern if any patterns indicated deficiencies that could be addressed. Table 3-6 shows the results of this analysis. In general, each of the hot spots were examined for trends in severity, prevalent collision types, non-vehicular accident events, lighting/weather conditions, relation to ramps and interchanges, as well as horizontal and vertical curvature. From these trends, potential crash factors were identified for each location, which ultimately informed the development of safety project solutions.

To determine the impact of I-75 on non-motorized safety in the study area, pedestrian and bicyclist crashes within 500 feet of I-75 ramps were analyzed for the five-year period spanning 2014-2018. In total, there were 36 non-motorized crashes involving 10 bicyclists and 26 pedestrians. Of these, three crashes resulted in a fatality and 23 crashes resulted in an injury or possible injury. Geographically, nine of the crashes occurred in Hamilton County, three in Bradley County, one in McMinn County, and 17 in Knox County.

Figure 3-19. Crash Rates (2014-2018) — I-75



Source: Tennessee Statewide Travel Demand Model

Table 3-6. Hot-Spot Crash Location Characteristics – I-75

	Hot Spot ID				
	HS75-1	**HS75-2**	**HS75-3**	**HS75-4**	**HS75-5**
Termini	South 5th Street	Jellico Mountain Area	Charles G. Sevier Highway	Merchants Drive to I-640 Interchange	Western Avenue
Number of Crashes	269	476	30	307	121
Severity (Fatal or Injuries)	26% (71)	19% (90)	20% (6)	17% (53)	18% (22)
Prevelant Collision Types	75% (202) Non-Vehicle 12% (32) Rear-End	48% (230) Non-Vehicle 26% (124) Rear-End 18% (85) Sideswipe	43% (13) Non-Vehicle 33% (10) Rear-End	71% (217) Rear-End 13% (41) Sidewsipe	14% (17) Non-Vehicle 74% (89) Rear-End
Non-Vehicle Trends	59% (120) Roadway Barrier	55% (127) Roadway Barrier	38% (5) Roadway Barrier	N/A	59% (10) Roadway Barrier
Congestion Trends	N/A	N/A	50% (5) of Rear-End Crashes Occurred During Peak Periods	57% (123) of Rear-End Crashes Occurred During Peak Periods	69% (61) of Rear-End Crashes Occurred During Peak Periods
Truck Trends	N/A	12% (59) of Crashes Involved Heavy Vehicles	N/A	N/A	N/A
Lighting/ Weather	19% (50) in Dark-Unlit Conditions 77% (206) in Rain/Snow	22% (107) in Dark-Unlit Conditions 26% (122) in Rain/Snow	17% (5) in Dark-Unlit Conditions	18% (55) in Rain/Snow	24% (21) in Rain/Snow
Interchange Related	N/A	N/A	23% (7)	20% (60)	14% (17)
Curvature Issues	Horiz.: 41% (110) Grade: 4% average	Horiz.: 39% (184) Grade: 3% average	Horiz.:100% (30) Grade: 1% average	Horiz.: 5% (15) Grade: 2% average	Horiz.: 51% (62) Grade: 3% average
Potential Crash Factors	• Limited visibility of roadway barriers in inclement weather • Small inside shoulder width near roadway barriers • Steep grades may cause speeding and loss of control in inclement weather	• Limited visibility of roadway barriers in inclement weather • Small inside shoulder width near roadway barriers • Steep grades may cause speeding and loss of control in inclement weather	• Peak-Hour congestion	• Peak-Hour congestion	• Peak-Hour congestion in AM specifically • Potential weaving issues for vehicles entering on Western Avenue heading SB to I-40/I075 interchange

Table 3-6. Hot-Spot Crash Location Characteristics – I-75 cont.

	Hot Spot ID				
	HS75-6	**HS75-7**	**HS75-8**	**HS75-9**	**HS75-10**
Termini	McMinn County Rest Area	Georgetown Road	US-64	East Brainerd Road	I-24/I-75 Interchange
Number of Crashes	15	14	145	332	1,695
Severity (Fatal or Injuries)	33% (5)	0%	21% (31)	15% (51)	17% (295)
Prevelant Collision Types	73% (11) Non-Vehicle	43% (6) Non-Vehicle 21% (3) Angle 36% (5) Rear-End	43% (62) Non-Vehicle 34% (49) Rear-End 14% (21) Sideswipe	16% (54) Non-Vehicle 39% (129) Rear-End 28% (92) Sideswipe	18% (300) Non-Vehicle 53% (901) Rear-End 17% (293) Sideswipe
Non-Vehicle Trends	36% (4) Roadway Barrier 55% (6) Vegetation/ Embankment	N/A	73% (45) Roadway Barrier	33% (18) Roadway Barrier	49% (146) Roadway Barrier
Congestion Trends	N/A	60% (3) of Rear-End Crashes Occurred During Peak Periods	45% (22) of Rear-End Crashes Occurred During Peak Periods	50% (65) of Rear-End Crashes Occurred During Peak Periods	47% (427) of Rear-End Crashes Occurred During Peak Periods
Truck Trends	N/A	N/A	10% (15) of Crashes Involved Heavy Vehicles	N/A	5% (93) of Crashes Involved Heavy Vehicles
Lighting/ Weather	33% (5) in Dark-Unlit Conditions	21% (3) in Rain/Snow	23% (33) in Dark-Unlit Conditions 20% (29) in Rain/Snow	21% (69) in Rain/Snow	23% (384) in Rain/Snow
Interchange Related	N/A	71% (10)	28% (40)	17% (57)	N/A
Curvature Issues	Horiz.: 100% (15)	N/A	Horiz.:51% (74) Grade: 2% average	Horiz.: 72% (238) Grade: 2% average	Horiz.: 25% (417) Grade: 2% average
Potential Crash Factors	• Reduced visibility in horizontal curve/ exit ramp during inclement weather and at night	• Small radii for exit ramps	• Peak-Hour congestion • Merging conflicts on entry ramps	• Peak-Hour congestion • Merging/Weaving conflicts on entry ramps in short distance between I-25/I-75 split and East Brainerd Road	• Peak-Hour congestion at I-24/I-75 split

Freight

Freight movement is an important element of a regional and national economy, as more efficient modes and routes enable improved logistics and result in reduced transportation costs. These cost savings can then be reallocated to growth, providing better jobs and higher wages in the area. The existing and future freight flows in the region were analyzed using the most current available data and existing conditions.

The I-75 corridor is part of the larger I-75 corridor that connects the termini of Detroit, MI in the north to Tampa, FL in the south and points in between including Atlanta, GA, Lexington, KY, Cincinnati, OH, and Toledo, OH. In addition, the corridor is in the middle of "auto alley," a route along which automobile production and support services have been established for decades in the US. The region benefits from its proximity to other automobile manufacturing industries, high quality highways, access to labor pools, and other domestic auto production facilities along the I-75 corridor[7]. The automobile industry is just-in-time and depends highly on trucking. Figure 3-20 shows the expected growth in truck volume throughout the corridor. As shown, I-75 north of Lenoir City will see the highest percentage change in growth.

The major air, rail, truck, and maritime facilities in the corridor area as well as the anticipated 2040 volume-to-capacity ratios along I-75 are shown in Figure 3-21. As shown, the areas south of Knoxville are the most congested in the corridor. Sections near Chattanooga are also congested, and approximately half of the corridor is expected to have a level-of-service (LOS) of D or worse, indicating high volumes of truck and auto traffic on I-75.

As noted in the Tennessee Statewide Multimodal Freight Plan (2018), changes to the I-75 corridor study area are recommended in the form of new or expanded freight facilities including a potential new intermodal facility in Knoxville and improvements to the Chickamuga Lock on the Tennessee River in Chattanooga.

A. NS Intermodal Facility in Knoxville: There is potential for a new NS intermodal facility located in Knoxville. As described in the Tennessee Freight Plan, the facility is being studied and would likely be located in the Knoxville region (in the New Market area of Jefferson County), serving as an option for trucks to divert to rail along the I-75 corridor.

B. Chickamauga Lock: If the Chickamauga Lock, located seven miles north of Chattanooga on the Tennessee River, closes, truck traffic on I-75 would increase. The lock requires extensive maintenance because of a concrete aggregate problem that, if not addressed, will result in the lock closing. A lock expansion project is underway, but could continue to be delayed due to a lack of funding. Construction of Phase 1 was completed in 2007 but further construction was delayed due to a lack of funding. The next phase was substantially completed in January 2019, and while the final phase of the project is not in the President's 2019 budget, it could be finished by 2024 if funding is secured[8].

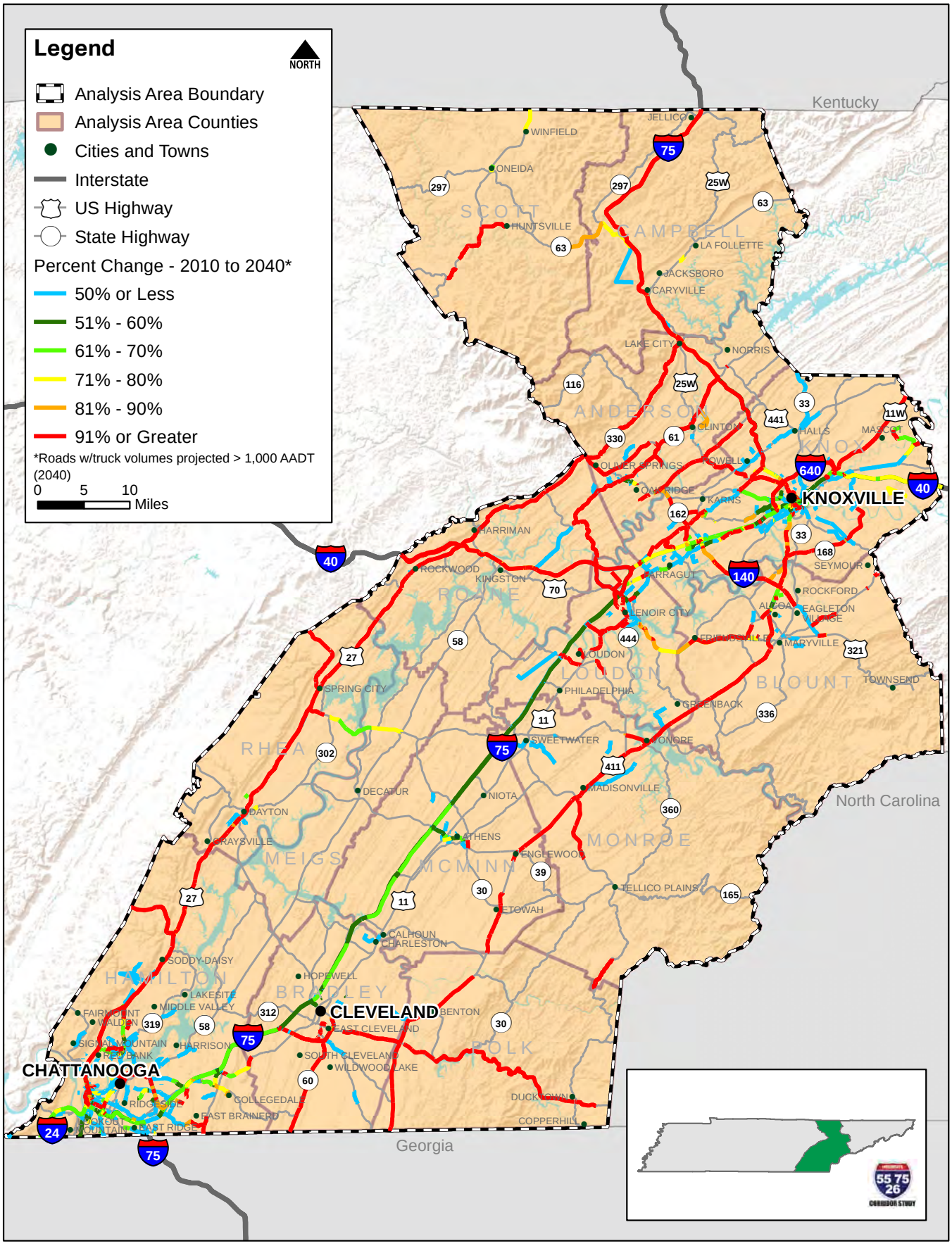
C. Bottleneck Locations: The Tennessee Freight Plan lists 32 potential bottleneck locations based on LOS and truck speed data. Two of the locations are on the I-75 corridor. One bottleneck is in Campbell County between mile markers 6.32 and 9.43 north of US-25W. The second bottleneck is on I-75/I-40 in Knox County east of Everett/Watt Road to I-275. During a field review of I-75, an observation was made that a truck climbing lane near MM 132, south of Careyville, could be beneficial.

Deficiencies Summary

As detailed in the previous subsections, this study identified and evaluated existing and forecast transportation deficiencies in the I-75 corridor based on extensive plans review, data analysis, and stakeholder outreach. The identified deficiencies are summarized, by mode or strategy, in Table 3-7. In addition to the location and description of each deficiency, Table 3-7 shows the source by which each deficiency was identified.

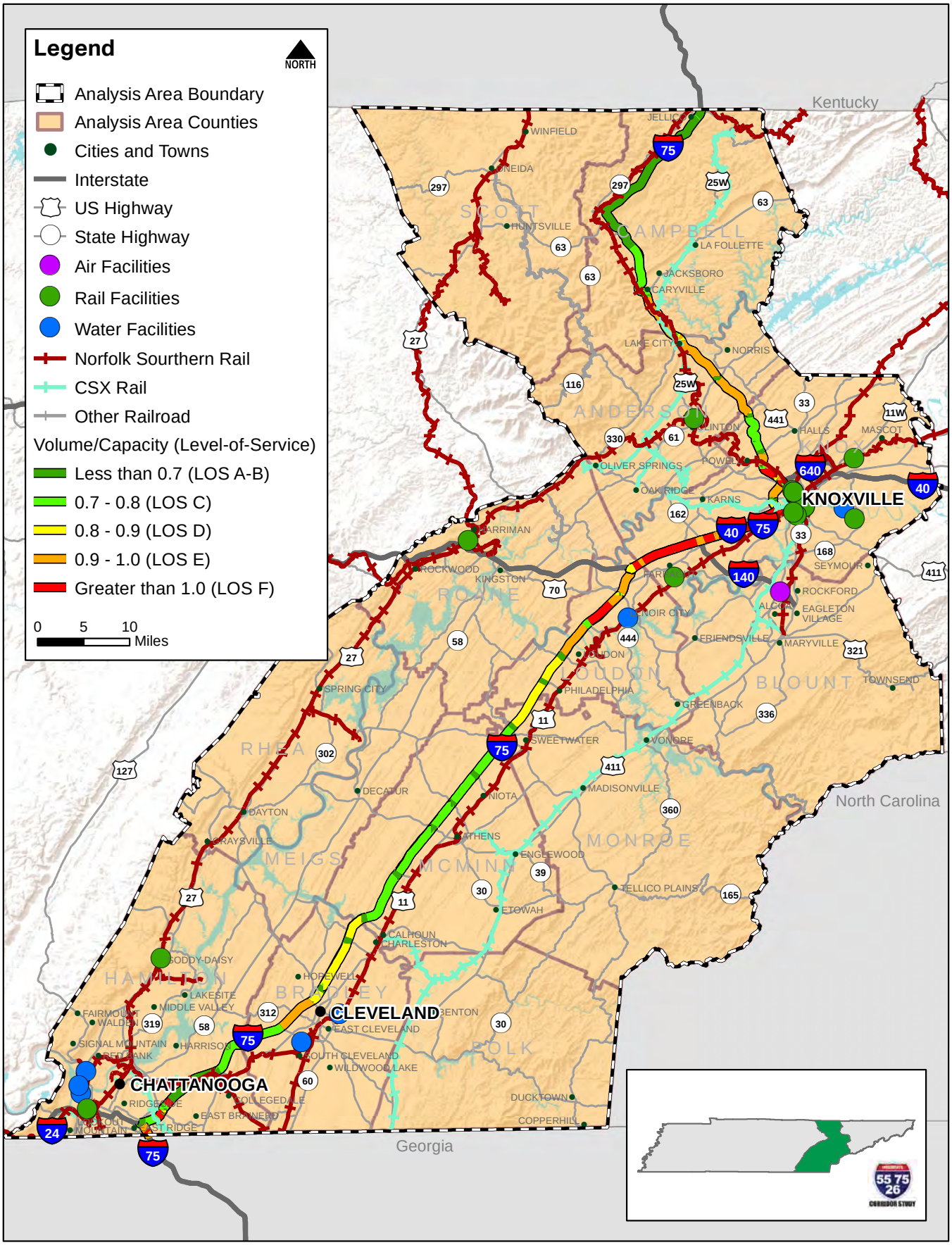
7- Cuneo et al, Area Development, "The Changing Geography of the American Auto Industry," 2014, https://www.areadevelopment.com/Automotive/Advanced-Industries-2014/changing-geography-of-american-auto-industry-2262541.shtml
8- US Army Corps of Engineers, Chickamauga Lock Replacement Project, https://www.lrn.usace.army.mil/Missions/Current-Projects/Construction/Chickamauga-Lock-Replacement-Project/

Figure 3-20. Growth in Truck Volume from 2010 to 2040 — I-75



Source: Tennessee Statewide Travel Demand Model

Figure 3-21. Freight Facilities — I-75



Source: InfoUSA and Tennessee Statewide Travel Demand Model

Table 3-7. Deficiencies Summary — I-75

Mode/ Strategy	Location	Issue/Deficiency	Source
Highway Capacity	I-640 Interchange, Knox County*	Congestion and safety problems	Data Analysis, Public/ Stakeholder
	Campbell Station Road Interchange, Knox County**	Flooding and heavy truck traffic	Data Analysis, Public/ Stakeholder
	Share I-40/I-75 west of Knoxville**	Routinely congested	Data Analysis, Public/ Stakeholder, TN Freight Plan
	I-24 Interchange, Hamilton County*	Routinely congested	Data Analysis, Public/ Stakeholder
	US-74 to US-11, Bradley County*	Existing capacity issues	Data Analysis
	SR-131 Interchange, Knox County*	Existing capacity issues	Data Analysis
	SR-153 to SR-320	Existing capacity issues	Data Analysis
	US-64 bypass to SR-60, Bradley County	Forecasted capacity issues	Data Analysis
	SR-72 to I-40, Loudon County	Forecasted capacity issues	Data Analysis
	Western Ave to I-275, Knox County	Forecasted capacity issues	Data Analysis
	Callahan Dr to SR-131, Knox County	Forecasted capacity issues	Data Analysis
	SR-170-US-441, Knox/Anderson Counties	Forecasted capacity issues	Data Analysis
	US-441 to SR-63, Anderson/ Campbell Counties	Forecasted capacity Issues	Data Analysis
	Ringgold Road to GA state line (Hamilton County)	Forecasted capacity Issues	Data Analysis
	Merchants Dr to Callahan Dr, Knox County	Forecasted capacity Issues	Data Analysis
	Brainerd Rd (Hamilton County) and Central Avenue Pike (Knox County)	Sections of these spillover streets forecasted to have capacity issues	Data Analysis
Safety	US-321 Interchange, Loudon County	NB exit has steep downgrade with short decel lane to a 30 mph ramp	Field Review, Public/ Stakeholder
	US-324 Interchange, Loudon County	WB right turn onto NB on-ramp has steep downgrade and sharp right turn	Field Review
	SR-63 (Careyville) Interchange, Campbell County	Series of short, curvy ramps, including slip ramp	Field Review
	US-25W Interchange near Jellico, Campbell County	Weaving caused by two loop ramps	Field Review
	Jellico Mountain Area, Campbell County	Limited visibility of roadway barriers in inclement weather; small inside shoulders, steep grades	Data Analysis
	Charles Sevier Hwy Interchange, Anderson County	Congestion-related crashes	Data Analysis
	Merchants Dr to I-640 Interchange, Knox County	Congestion-related crashes	Data Analysis

*Deficiencies addressed via programmed projects.

*Deficiencies to be addressed as part of TDOT's ongoing I-40/I-81 Multimodal Corridor Study

Table 3-7. Deficiencies Summary — I-75 cont.

Mode/ Strategy	Location	Issue/Deficiency	Source
Safety	Western Ave Interchange, Knox County	Congestion-related crashes; weaving issues SB between Western Ave and I-40/I-75 interchange	Data Analysis, Public/Stakeholder
	McMinn County Rest Area	Reduced visibility in horizontal curve/exit ramp during inclement weather and at night	Data Analysis
	Georgetown Rd Interchange, Bradley County	Small radii for exit ramp	Data Analysis
	US-64 Interchange, Bradley County	Congestion-related crashes, merging conflicts on entry ramps	Data Analysis
	East Brainerd Rd Interchange, Hamilton County	Congestion-related crashes, merging/weaving conflicts on entry ramp between I-24/I-75 split and East Brainerd Rd	Data Analysis
TSM&O	Throughout Corridor	Improved / Expanded ITS measures to address congestion, safety, and incident management needs	Data Analysis
Freight	Mile marker 6.32 to 9.43, Campbell County	Potential freight bottleneck	TN Freight Plan
	Hamilton County	Pavement needs resurfacing	Data Analysis
	Bridge over TN River, Loudon County	Designated as structurally deficient	Data Analysis
	Bridge over E Wolf Valley Rd, Anderson County	Designated as structurally deficient	Data Analysis
	Bridges over Bruce Gap Rd, Campbell County	Designated as structurally deficient	Data Analysis
	Hamilton County	Need for overnight truck parking	Data Analysis
Multimodal	Hamilton, Bradley, Knox County areas	Lack of regional transit service for commuters	Data Analysis
	U.S. & S.R. Interchanges as well as the Shallowford Rd interchange	Lack of bike/ped connectivity on cross-roads through interchanges	Data Analysis
	Knox County	Only one park-and-ride lot	Data Analysis
Economic Development	US-64 Interchange, Bradley County	Large employment growth area. Need for new interstate access in Cleveland area	Data Analysis, Public/ Stakeholder

*Deficiencies addressed via programmed projects.

*Deficiencies to be addressed as part of TDOT's ongoing I-40/I-81 Multimodal Corridor Study

4. Multimodal Solutions/ Universe of Alternatives

Introduction

Following the identification and analysis of corridor transportation deficiencies, the study developed goals for the corridor and performance measures used to assess the effectiveness of various solutions to those problems. A universe of alternatives, or potential solutions, was developed. The universe of alternatives was organized based on the issues each potential solution addresses, including safety, traffic congestion, freight movement, and multimodal travel. Many of the solutions may benefit more than one aspect of travel in the corridor. Ultimately, selected solutions were assembled into a Build (2040) scenario that accounted for their impacts on regional travel.

Performance Measures

Goals for potential improvements along the I-75 corridor were selected to reinforce the three strategic emphasis areas in TDOT's 25-Year Long-Range Transportation Plan: efficiency, effectiveness, and economic competitiveness. As shown in Table 4-1, the five identified goals were further developed into 12 specific objectives, intended to guide development and evaluation of possible solutions. In order to evaluate how well a potential solution satisfies an objective - and ultimately a goal - measures must be established that are data driven and comparable across the Base (2010), Trend (2040) and Build (2040) scenarios. Table 4-2 outlines the performance measures established for the I-75 corridor. As indicated, the measures fall into four categories (Traffic Operations, Safety, Operations & Maintenance, and Multimodal), which directly support the objectives identified in Table 4-1.

43 potential solutions for the I-75 corridor are discussed in this report

Highway Capacity Alternatives

Possible solutions to be considered at the 10 capacity-deficient locations identified in Section 3 of this report

Table 4-1. Performance Goals and Objectives — I-75

Goals	Objectives		
Provide efficient and reliable travel	Improve travel times and reduce delay	Provide transportation options for people and freight	Optimize freight movement
Improve safety conditions	Reduce crash rates along the corridor – especially at identified crash "hot spots"	Implement or upgrade technologies that promote safety and effective incident management	Improve bicycle and pedestrian accommodations
Coordinate transportation investments with economic development plans	Improve interchange on/ off ramps	Coordinate with MPOs/ RPOs to determine areas where new/improved Interstate access is needed	
Invest equitably throughout the corridor	Expand transportation options for traditionally underserved populations within the corridor	Consider regional transit options	Identify areas with the greatest data-driven needs
Protect the natural environment and sensitive resources within the corridor	Identify transportation improvements that are not likely to result in major impacts to environmental, social, and cultural resources		

Table 4-2. Performance Measures — I-75

Goal	Performance Measure		Unit
Traffic Operations	Traffic on interstate operates at LOS D or better		% of interstate operating at LOS D or better
	Total Daily Vehicle Miles Traveled (VMT)		Miles (1,000s)
	Total Daily Vehicle Hours of Travel (VHT)		Hours (1,000s)
	Total Peak Hour Vehicle Hours of Delay (VHD)		Hours
	Total VMT / Trip		Miles
	Total Vehicle Minutes Traveled / Trip		Minutes
	Average Peak Hour Travel Speed	Urban Interstate	MPH
		Rural Interstate	MPH
	Congested Travel Time between key O&D Pairs along Corridor (Total)		Minutes
	Peak Hour Density at Improved Interchanges		Vehicles/Mile/Lane
	Average and Max Queues at Improved Interchanges		Feet
Safety	Crash reduction in safety "hot spots"		Above or Below Average Crash Reduction Potential
Operations & Maintenance	Bridge Condition (Sufficiency Rating)		% of bridges < 50
			50 < % of bridges < 80
	Pavement Condition (Resurfacing)		% of corridor resurfaced within the last 10 years
Multimodal	Pedestrian and Bicycle Accommodations at U.S. and State Route Interchanges		% interchanges with bike facilities
			% interchanges with ped. facilities
	Freight (Truck Parking)		# of Rest Area Spots
			# of Truck Stop Spots

are shown in Figures 4-1 and 4-2. For each of the seven, independent multi-mile segments (C1-C7) the need is clearly additional capacity; therefore, further analyses of widening options was conducted using the TSM. Operations between I-75 and the Georgia state line and between Merchants Drive and Callahan Drive involve more complicated ramp intersections, weaving and merge/diverge movements; therefore, HCS and Synchro were used to measure traffic operations under the 2040 Trend and Build conditions. Due to insufficient availability of traffic data, further operational analysis of the SR-320 to SR-153 segment was deferred to future study. The recommendation (C9) was moved forward in the Universe of Alternatives as "Evaluate options for increasing capacity and improving merge/diverge and weave areas between the SR-320 and SR-153 interchanges."

Note that the conceptual planning and preliminary design phases of all interchange improvements recommended in this report should incorporate pedestrian and bicycle planning.

Safety Alternatives

As a first step in identifying safety solutions to address these factors along the I-75 corridor, TDOT's April 2017 IMPROVE Act was reviewed to determine if any safety-related solutions were recommended in these areas. There were no explicit safety solutions proposed as part of the IMPROVE Act on I-75. However, there are a number of other types of projects along the corridor including, severe weather detection systems, ITS expansions, truck climbing lanes, as well as various interchange and corridor capacity improvements. With the location of these projects in mind, the potential crash factors were reviewed for each hot spot in tandem with public comments as well as aerial and street-level photography to identify potential solutions.

Figure 4-1. Potential Traffic Operations Improvements — I-75 (north)

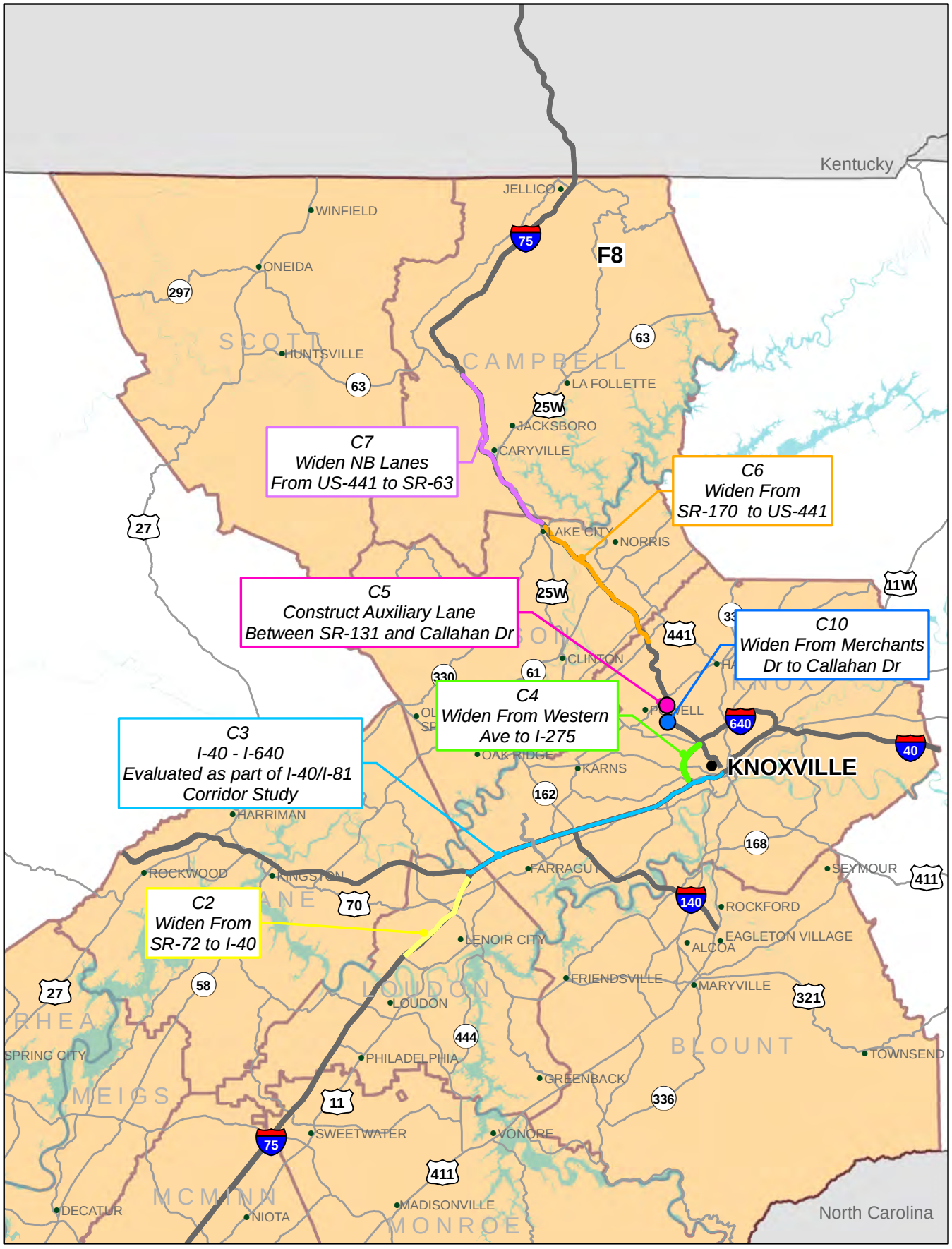
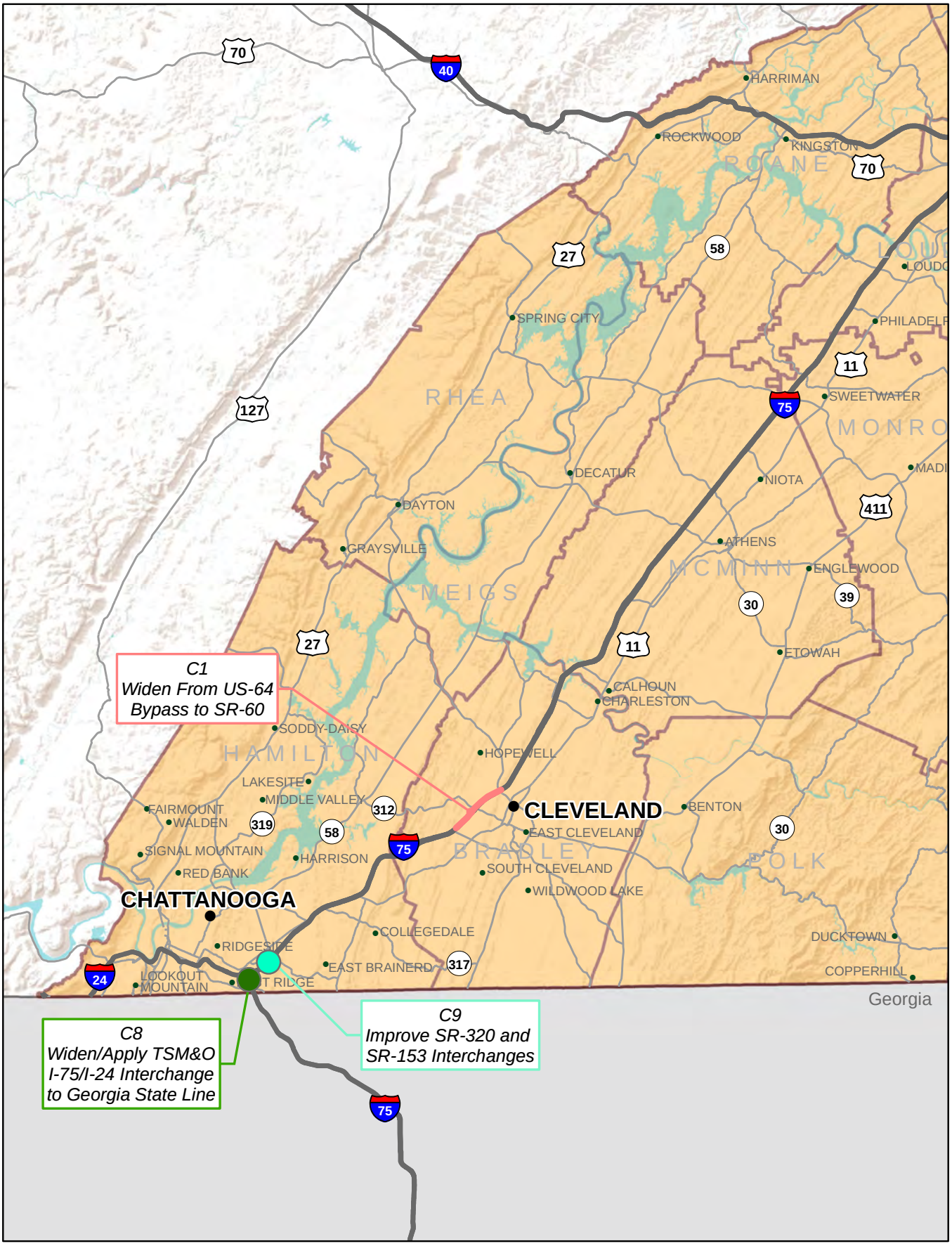


Figure 4-2. Potential Traffic Operations Improvements — I-75 (south)



It is important to note that there are some hot spots identified in Section 3 of this report that do not have a corresponding recommendation here. This primarily occurs in locations where no apparent crash trends or solutions were identifiable with the available data, when a relatively recent roadway improvement had been made in the vicinity of the hot spot, or when a major capacity project is being undertaken in the hot spot that will improve safety in the area.

HS75-4, which is located in Knox County and includes the portion of I-75 from Merchants Drive to I-640 Interchange, is under review through TDOT's Interchange Access Request (IAR) process. It was assumed that the analysis of the I-75/I-640 interchange would result in both capacity and safety improvements to this section of the corridor.

HS75-8, which is located in Bradley County and includes the interchange at US-64/74, has undergone recent improvements to the ramps and may also be impacted with TDOT's planned widening of I-75, as programmed in the Cleveland MPO TIP.

HS75-10 includes the portion of I-75 near the I-24 interchange in Chattanooga. This interchange is currently under construction to address capacity- and safety-related issues; therefore, no additional recommendations are made in this location.

In addition to the analysis of crash hot spots, a field review of the I-75 corridor was undertaken to identify potential safety issues. Where crash data supported an observed safety issue and where no improvements are currently planned, additional recommendations were made to address these deficiencies.

The crash reduction potential for each recommendation was explored through the research of Crash Modification Factors (CMFs). A CMF estimates a safety countermeasure's ability to reduce crashes and crash severity. Based on data provided by the CMF Clearinghouse, each recommendation is categorized as having above or below average crash reduction potential, specific to the I-75 corridor, where data was available. It is important to note that the reduction potential for each recommendation is only applicable to crash types that would be prevented by implementing the improvements.

Figures 4-3a, 4-3b, and 4-4 depict each safety solution and its crash reduction potential.

TSM&O Alternatives

Transportation Systems Management and Operations (TSM&O) is "a set of strategies that focus on operational improvements that can maintain and even restore the performance of the existing transportation system before extra capacity is needed." Based on the definition of TSM&O, the I-75 corridor is a prime candidate for such strategies; for most of the corridor, levels of service are currently such that motorists experience congestion, but not yet significant delays.

Several of the possible solutions outlined in other sections of this technical memorandum would also be considered TSM&O solutions:

- Multimodal Solution, BP1: Consider a study to identify bicycle and pedestrian connectivity and safety improvements at existing U.S. and State Route interchanges.
- Multimodal Solution, BP2: Construct Midtown Pathway along Brainerd Rd between Spring Creek Road and Greenway View Drive.
- Multimodal Solution, BP2: Construct pedestrian/bike trail connection providing access from Camp Jordan Park facilities to those west of I-75.

Additional solutions were developed via review of existing plans, public / stakeholder feedback, and field observations. Note that the City of Chattanooga Department of Transportation also offered specific TSM&O solutions in a letter to TDOT Office of Community Transportation in November 2019. The combined TSM&O solutions identified for the I-75 Corridor are outlined in Figure 4-5.

Freight Alternatives

Potential options for improving freight mobility include infrastructure improvements, such as truck climbing lanes and interchange redesigns, as well as management and operation strategies, such as truck parking and communication strategies. Suggested freight improvements for the I-75 corridor are shown in Figures 4-6 and 4-7 and discussed as needed below.

Truck Parking

Truck parking is a critical component of supply chain operations. Hours of service rules state that drivers must stop after 14 hours; therefore, it is important that drivers are offered a selection of locations throughout their journey where they can rest and possibly eat, shower, or sleep overnight. Without proper rest, drivers risk fines and crashes, jeopardizing the safety of all road users, especially in mountainous corridors like I-75. Drivers often spend the last hour of their driving time looking for a place to park. In the absence of available truck parking, trucks often stop on highway on- and off-ramps, which is both unsafe and illegal.

The I-75 Welcome Centers at the Tennessee/Georgia and Tennessee/Kentucky state lines have 12 truck parking spots each. The rest areas in Athens (north and southbound) have 74 spots. Other nearby rest areas include the Georgia Visitor Center on I-75 south with 24 spots and the Kentucky Welcome Center on I-75 north with 23 spots. It should be noted that parking at welcome centers and rest areas in Tennessee is limited to 2 hours maximum, with no overnight parking. The website www.truckstopguide.com lists 13 truck stops along I-75 in Tennessee, nine of which have overnight parking, with a total of 1,161 truck parking spots.

Figure 4-3a. Potential Safety Improvements — I-75 (north)

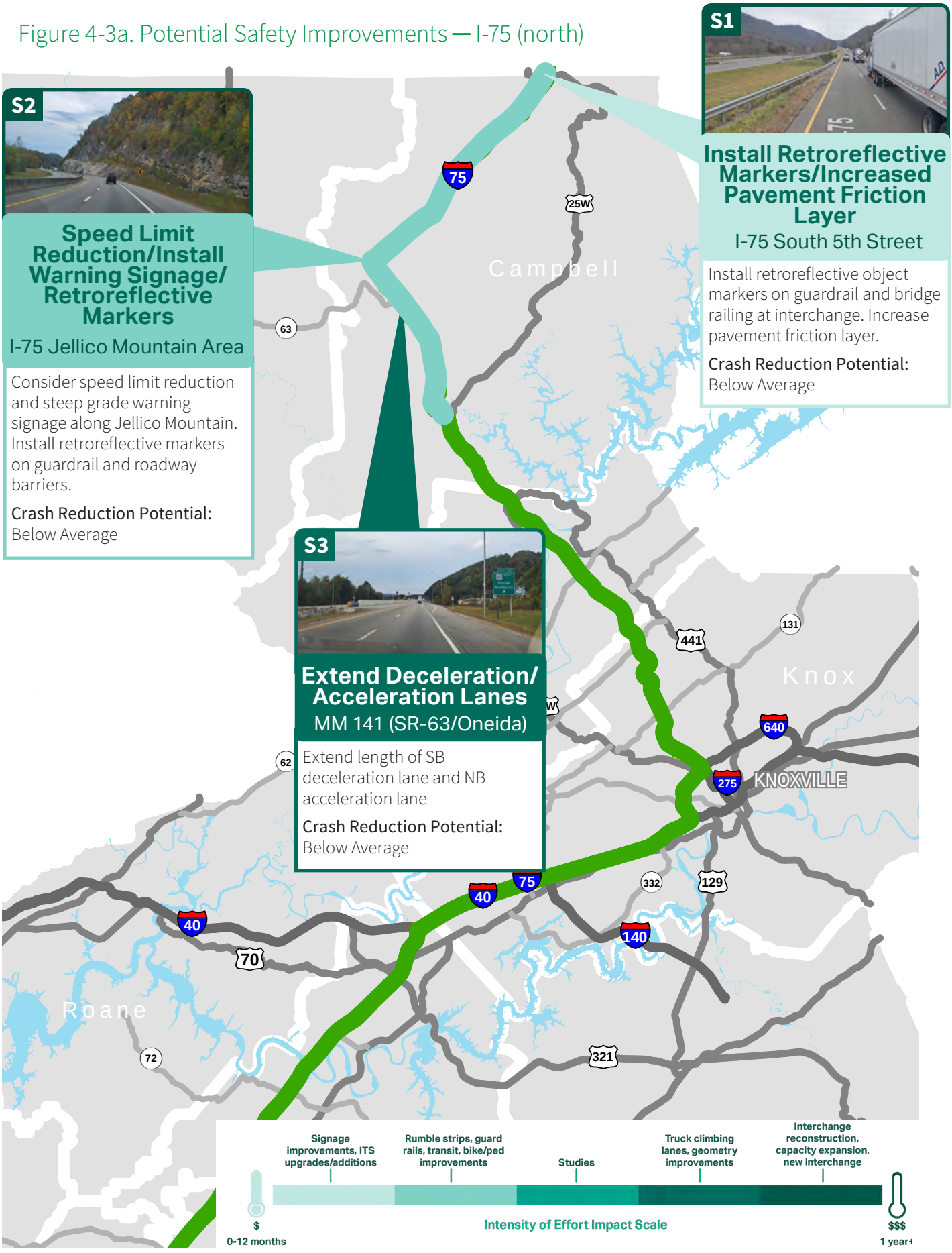


Figure 4-3b. Potential Safety Improvements — I-75 (north)

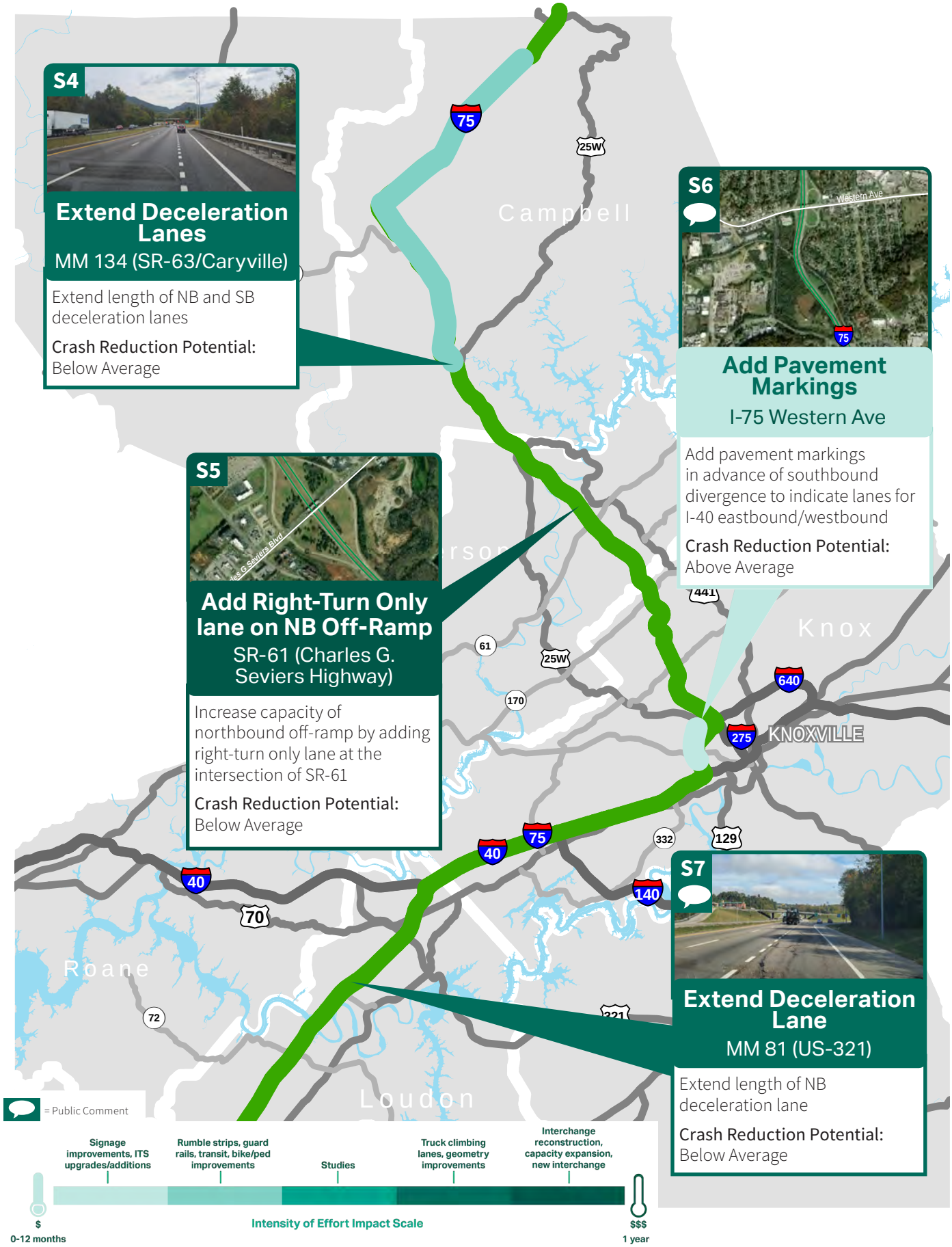


Figure 4-4. Potential Safety Improvements — I-75 (south)

Figure 4-5. Potential TSM&O Solutions — I-75

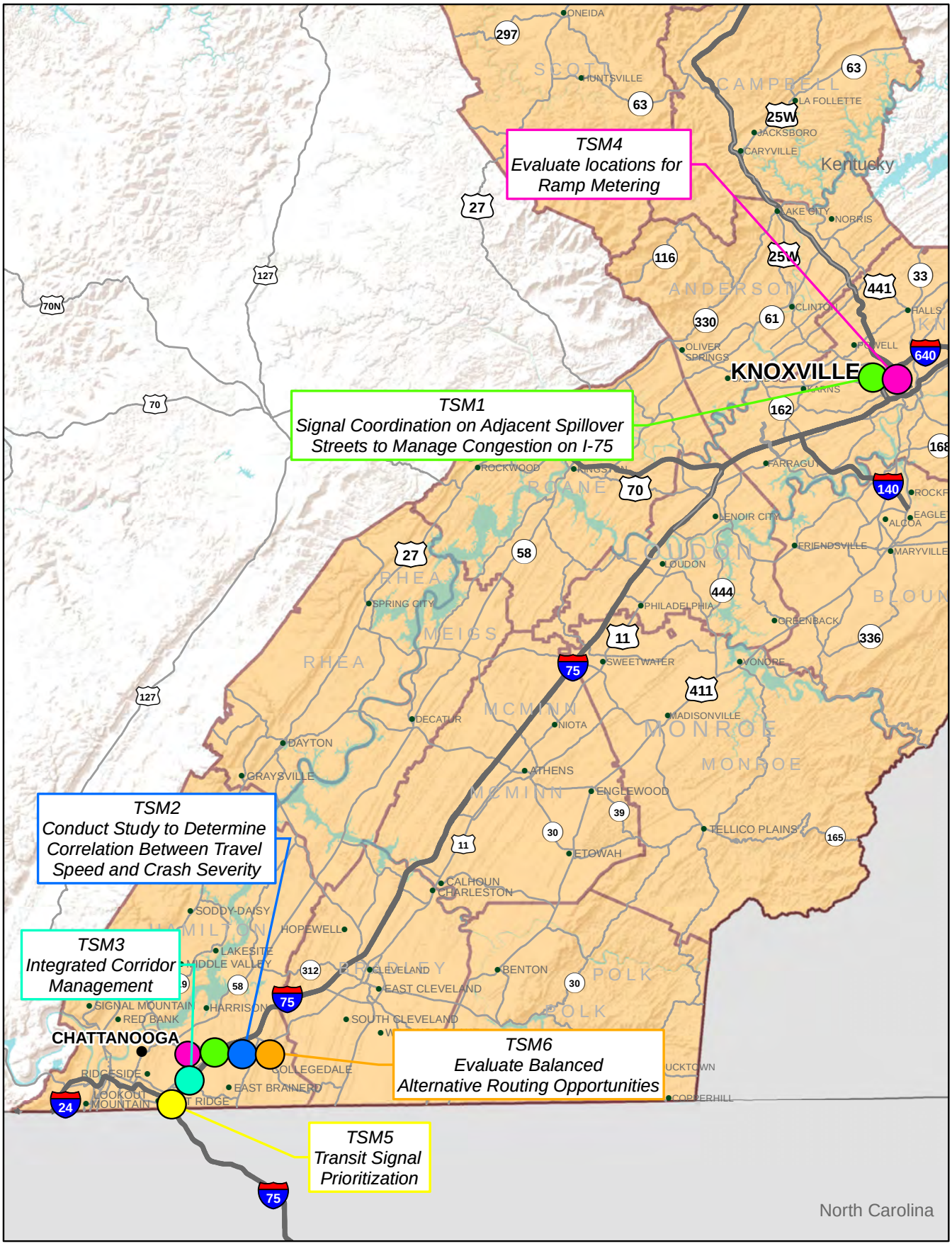


Figure 4-6. Potential Freight Improvements — I-75 (north)

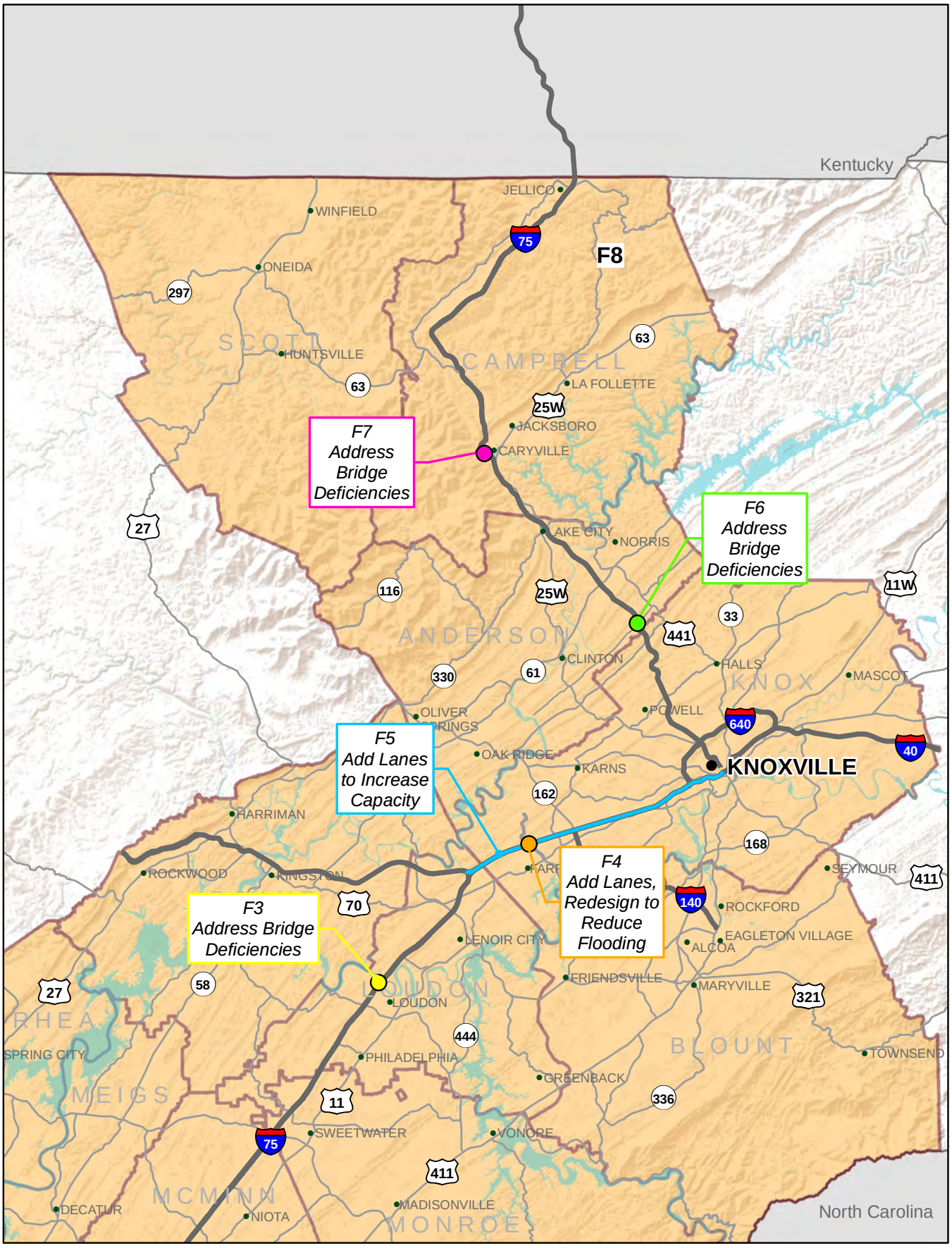
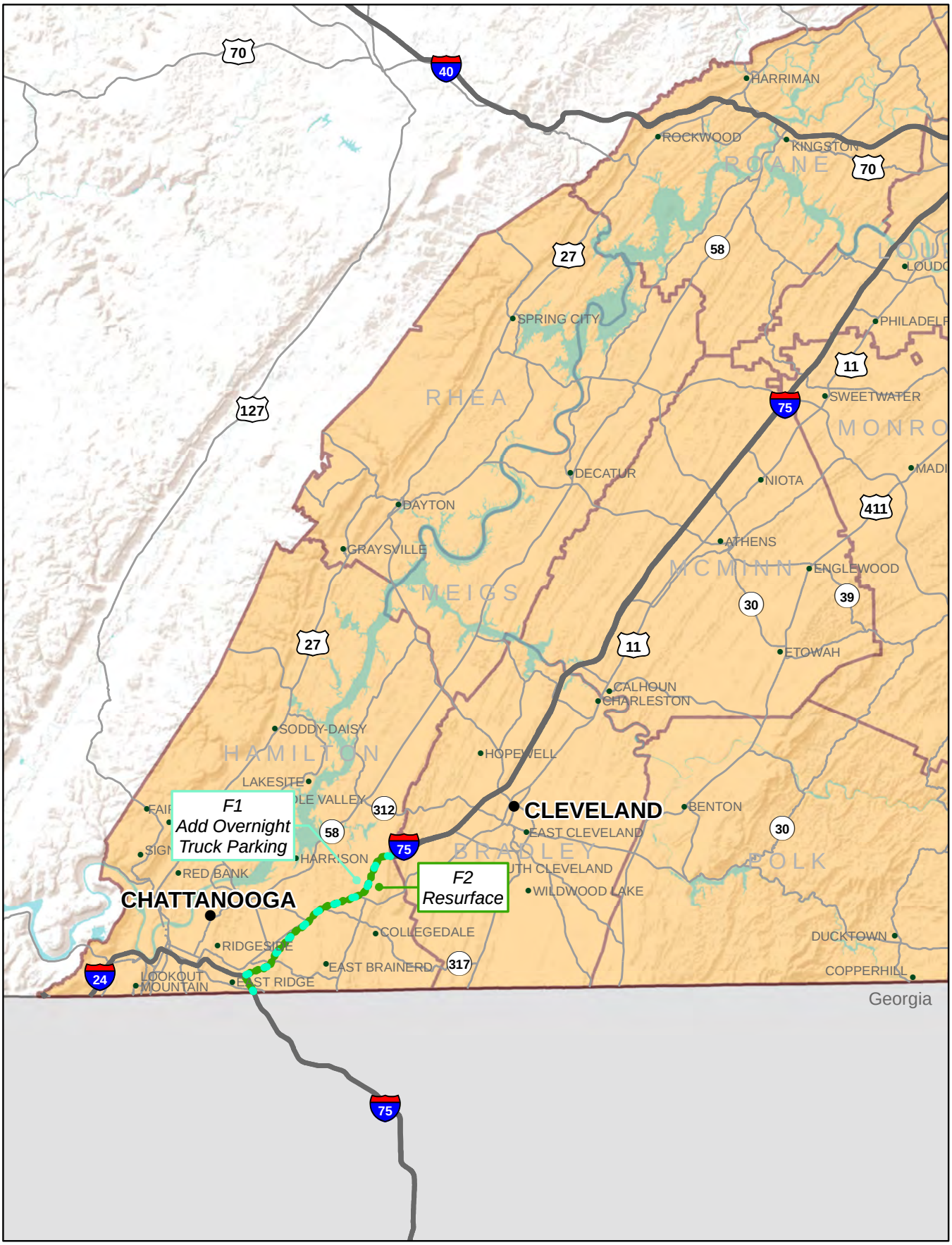


Figure 4-7. Potential Freight Improvements — I-75 (south)



While five are located in Knoxville (861 spots along the shared I-75/I-40 corridor), none are in Chattanooga. The closest I-75 truck stop with overnight parking to Chattanooga is at Exit 20 in Cleveland with 75 spots.

Truck Climbing Lanes

Large commercial vehicles are extremely sensitive to changes in grade. Research has shown that the frequency of collisions increases dramatically when vehicles traveling more than 10 mph below the average traffic speed are present in the traffic stream. When the length of the ascending grade is not long enough for trucks to maintain speeds within 10 mph of the average traffic speed, climbing lanes can relieve some conflict by allowing slower vehicles to move out of the primary traffic lanes thereby increasing the level of service for the highway. Longer acceleration and deceleration lanes at interstate on- and off-ramps can provide analogous benefits.

It should also be noted that according to the Knoxville TPO, the Loudon County representative has recently introduced to the TPO Technical Committee the need for a truck-climbing lane on I-75 northbound north of U.S. 321. Evaluation of a truck climbing lane at this location should be included in further analyses of Capacity solution C2.

Parallel Corridors

The identification and use of alternative, parallel routes can be an approach to accommodate increasing traffic. One alternative route exists along the corridor that allows travelers to bypass Knoxville when traveling between Chattanooga and the Kentucky state line via US-27. Depending on the starting point within Chattanooga, drivers can save 10 to 15 miles, although it adds about 20 minutes of travel time. However, in general, diverting truck traffic from interstate highways to lower order roads will increase potential safety problems, pavement wear, and traffic disruption.

Driver Education and Stakeholder Engagement

In addition to the infrastructure and management strategies previously discussed, a key freight stakeholder noted several other items that can improve truck freight traffic in the State. These include driver education and stakeholder engagement regarding roadway construction. Driver education can include both truck and non-truck driving populations. Driver training programs can change truck driver behaviors to improve delivery efficiency, energy consumption, environmental impacts, and the safety of all road users.

The Tennessee Trucking Association has partnered with the Tennessee Highway Safety Office to educate students and senior citizens about sharing the road with trucks and has expressed interest in connecting with other agencies to teach the public about freight safety.

Economic Development

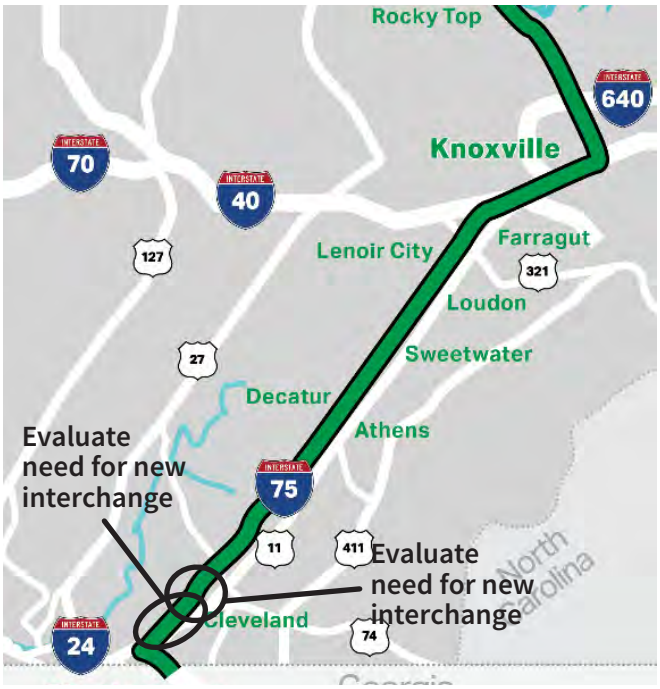
The Tennessee transportation system supports the economy of the state by providing access to employment for workers and facilitating the movement of goods into, out of, and within the state. Among the goals for transportation system planning in this study is the following: Coordinate transportation system investments with economic development plans. This goal is informed by two objectives:

- Improve interchange on/off ramps.
- Coordinate with MPOs/RPOs to determine areas where new or improved Interstate access is needed.

Stakeholder input was collected specific to economic development potential along the corridor, including areas that may benefit from additional Interstate access points in the future. Studies of these areas that may be subject to development pressure were included in the universe of potential solutions. Other potential solutions that impact regional economic development are included in the capacity, safety, operations, and freight sections of this report.

In the southern end of the corridor, it was noted that the growing area between Ooltewah and Cleveland may demand additional access points on I-75 in Bradley County. Specifically, needs exist between Ooltewah and Cleveland and between US-64/US-74 and SR-60 in Cleveland (note that White Oak Mountain separates the two areas). As shown in Figure 4-8, evaluation of new

Figure 4-8. Potential Economic Development Improvements — I-75



interchange access points could assess the existing overpasses at Ooltewah-Georgetown Road and at SR-312 in Cleveland.

Multimodal

While driving is the mode of choice throughout the I-75 corridor, it is important to ensure that multimodal transportation options exist. As discussed in Section 3 of this report, there are several deficiencies along I-75 including missed regional transit connections between Cleveland and Chattanooga and Knoxville and outlying suburbs. Meaningful transportation choices provide mobility opportunities for all users and can help alleviate user congestion along I-75. A complete multimodal network includes transit, bicycle and pedestrian infrastructure, and additional resources including park-and-ride facilities that promote carpooling and transit use.

Potential transit and bicycle/pedestrian solutions recommended for the I-76 corridor include:

- T9: Knoxville Regional Transit Authority – The creation of a regional transit authority in the greater Knoxville area would allow inter-county transit services to occur more easily. Knoxville is growing in population and employers are expanding beyond Knox County, in order to provide transit access to employment concentrations, transit service will need to extend beyond Knox County.
- T10: Solway Park-and-Ride – The creation of a park-and-ride facility north of Knoxville will help alleviate forecasted congestion along I-75 and will serve commuters and residents of the greater Knoxville region.
- T13: Route 4 / I-75 Express Extension – Extending one of CARTA's existing transit routes further north on I-75 will help alleviate congestion on I-75 and better serve Chattanooga's growing population.
- T21: Regional Transit Access - Consider conducting a study to determine the feasibility of a commuter route between Cleveland and Chattanooga. The two cities are roughly 30 miles apart and analysis shows there are a number of commuters who currently rely on using I-75. By offering a commuter route, congestion on I-75 could be alleviated. Regional transit access would likely require implementation of a Regional Transit Authority. It should be noted that the Cleveland MPO's 2017-2020 TIP was amended to include a CMAQ-funded Cleveland-Chattanooga Commute Hub (2017-08) which would include buses (operated by SETHRA) to serve as a link to the CARTA transit system. Acknowledging potential limitations with CMAQ funding, the Commute Hub project should be considered as part of the T21 study.
- BP1: Conduct a study to propose bicycle and pedestrian connectivity and safety improvements at existing U.S. and state route interchanges. Further bicycle and pedestrian study should consider the following measures:
  - In-field, geometric analysis:
    - Average pedestrian crossing distance
    - Whether motor vehicles cross through crosswalks using free flow or slip lanes
    - Average buffer distance from traffic flow
    - Sidewalk width
    - Bicycle facility width
    - Existence of vertical buffers for pedestrians or cyclists
    - Land Use Analysis (rural, rural town, suburban, urban core)
    - Evaluation of Adjacent Infrastructure
    - Detailed review of pedestrian and bicycle-related crashes within 0.5 miles of an interchange

  Studies could further be expanded to include all interchanges and identify locations where new pedestrian/bicycle crossings may be appropriate.
- BP2: Stakeholders requested inclusion of proposed midtown pathway along Brainerd Road from Spring Creek Road to Greenway View Drive.
- BP3: Stakeholders requested inclusion of a trail connector between facilities west of I-75 and Camp Jordan Park, near the I-75/I-24 split. This trail would require crossing of I-75.

Universe of Alternatives

Table 4-3 gathers these potential solutions into the total universe of alternatives for the I-75 corridor. The universe of alternatives presents a wide range of potential solutions to identified deficiencies. No solution is excluded from the universe of alternatives – it is essentially a brainstorming effort comprised of public and stakeholder ideas as well as best practices identified by planners and engineers. The list is supplemented by projects proposed in existing plans and studies.

Figure 4-9. Potential Solutions By Category — I-75

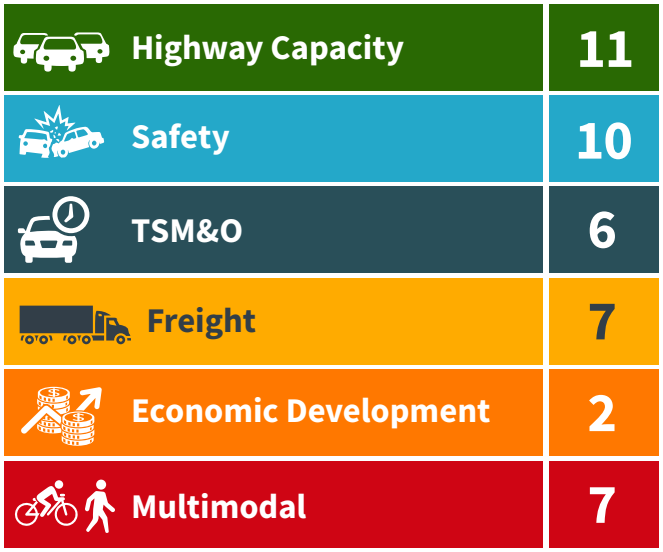


Table 4-3. Universe of Alternatives — I-75

	ID	County	Termini (From)	Termini (To)	Description	Source of Recommended Solution
Highway Capacity	C1	Bradley	US-64 Bypass/US-74	SR-60	Widen existing four lane section	Data Analysis
	C2	Loudon	SR-72	I-40	Widen existing four lane section	Data Analysis/I-75 Corridor Feasibility Study
	C3	Knox	I-40	I-640	(Evaluated as part of I-40/I-81 Corridor Study)	Data Analysis
	C4	Knox	Western Ave	I-275	Widen existing six lane section	Data Analysis
	C5	Knox	Callahan Drive	SR-131	Construct auxiliary lane NB between interchanges	Data Analysis
	C6	Knox / Anderson	SR-170	US-441	Widen existing four lane section; consider truck climbing lanes	Data Analysis, TN Freight Plan (2018), I-75 Corridor Feasibility Study
	C7	Anderson / Campbell	US-441	SR-63	Widen NB lanes; consider truck climbing lanes	Data Analysis
	C8	Hamilton	I-75/I-24 Interchange	Georgia State Line	Widen / Apply TSM&O and/or Arterial Management Strategies to address forecasted congestion	Data Analysis, TN Freight Plan (2018), Cratt-Hamilton Co/N. Georgia 2045 RTP Update

Table 4-3. Universe of Alternatives — I-75 cont.

	ID	County	Termini (From)	Termini (To)	Description	Source of Recommended Solution
Highway Capacity	C9	Hamilton	Near SR-320 and SR-153 Interchanges		Evaluate options for increasing capacity and improving merge/diverge and weave areas between the SR-320 and SR-153 interchanges.	Data Analysis
	C10	Knox	Merchants Drive	Callahan Drive	Widen northbound to create auxiliary lane	Data Analysis
	C11	Hamilton	Shallowford Rd Interchange		Evaluate ramp queue on southbound I-75 off-ramp.	Public/ Stakeholder
Safety	S1*	Campbell	South 5th Street Interchange		Install retroreflective markers and increased pavement friction layer	Data Analysis
	S2*	Campbell	Jellico Mountain Area		Speed limit reduction/warning signage/ retroreflective markers	Data Analysis
	S3	Campbell	SR-63 (Oneida) Interchange		Extend length of SB deceleration and NB acceleration lanes	Data Analysis
	S4	Campbell	SR-63 (Caryville) Interchange		Extend length of NB and SB deceleration lanes	Data Analysis
	S5	Anderson	SR-61 (Charles G Seivers Blvd) Interchange		Add right-turn only lane on NB off-ramp	Data Analysis
	S6	Knox	Western Ave Interchange		Add pavement markings to indicate lanes for I-40 junction	Public/ Stakeholder
	S7	Loudon	US-321 Interchange		Extend length of NB deceleration lane	Public/ Stakeholder
	S8	McMinn	McMinn County Rest Area		Install additional lighting on NB exit ramp	Data Analysis
	S9	Bradley	SR-60 Interchange		Increase length of NB and SB deceleration lanes/Install advanced signage for NB off-ramp	Data Analysis
	S10	Hamilton	SR-320 (Brainerd Rd) Interchange		Install advanced signage and increase capacity of NB exit ramp / Modify interchange to remove weave caused by loop ramps	Data Analysis
TSM&O	TS1	Hamilton / Knox	Brainerd Rd, Shallowford Rd, Harrison Rd, Kingston Pk, Central Ave Pk		Signal coordination on adjacent spillover streets to manage on- and off-ramp congestion	Public/ Stakeholder
	TS2	Hamilton	I-75 and adjacent, parallel arterials		Conduct study to evaluate correlation between travel speed and crash severity.	Public/ Stakeholder
	TS3	Hamilton	Ringgold Rd	Shallowford Rd	Integrated Corridor Management (with real-time technology platform)	Public/ Stakeholder
	TS4	Hamilton / Knox	Urban areas of Chattanooga and Knoxville		Evaluate locations that would benefit from ramp metering and queue detection systems.	Public/ Stakeholder
	TS5	Hamilton	Ringgold Rd		Transit Signal Prioritization	Public/ Stakeholder
	TS6	Hamilton	Throughout		Evaluate balanced alternative routing opportunities	Public/ Stakeholder

Table 4-3. Universe of Alternatives — I-75 cont.

	ID	County	Termini (From)	Termini (To)	Description	Source of Recommended Solution
Freight	F1	Hamilton	Georgia State Line	Bradley County Line	Add overnight truck parking in or near Chattanooga	Data Analysis
	F2	Hamilton	Georgia State Line	Bradley County Line	Resurface so that at least 90% of the corridor has good ride quality	Data Analysis
	F3	Loudon	Tennessee River Bridge		Address bridge deficiency to maintain appropriate load carrying capacity	Data Analysis
	F4	Knox	Campbell Station Road Interchange		Add lanes; Redesign interchange to reduce flooding	Tennessee Freight Plan (2018 amended 2019)
	F5	Knox	I-40	I-275	Add lanes	Tennessee Freight Plan (2018 amended 2019)
	F6	Anderson	East Wolf Valley Road Interchange		Address bridge deficiency to maintain appropriate load carrying capacity	Data Analysis
	F7	Campbell	Bruce Gap Road Bridge		Address bridge deficiencies to maintain appropriate load carrying capacity	Data Analysis
Economic Development	ED1	Bradley	SR-60	SR-74	Evaluate need for additional interstate access point to accommodate economic growth	Public/ Stakeholder
	ED2	Hamilton	Ooltewah	Cleveland	Evaluate need for new interchange to accommodate growth between Ooltewah and Cleveland (consider existing overpass for Ooltewah/ Georgetown Rd)	Public/ Stakeholder
Multimodal	T9	Knox	Throughout Network		Establish a Regional Transit Authority to provide inter-county transit service	Knoxville Regional Transit Corridor Study
	T10	Anderson	TVA Boat Launch along SR-170		Improve and expand parking area at TVA boat launch for park-and-ride opportunities	Mobility 2040: Connecting People and Places
	T13	Hamilton	Hamilton Place	Lee Highway Interchange Park-and-Ride	Extend CARTA Express Route 4	Chattanooga-Hamilton County/ North Georgia 2045 Regional Transportation Plan Update
	T21	Hamilton / Bradley	Throughout Network		Study commuter route between Chattanooga and Cleveland. Regional transit access would likely require implementation of a Regional Transit Authority.	Data Analysis
	BP1	All	Throughout Network		Study to propose bike/ped connectivity and safety at existing U.S. and S.R. interchanges, as well as the Shallowford Rd interchange	Data Analysis
	BP2	Hamilton	Spring Creek Road	Greenway View Drive	Midtown Pathway (Along Brainerd Road)	Public/ Stakeholder
	BP3	Hamilton	Facilities west of I-75	Camp Jordan Park	Trail connector	Public/ Stakeholder

*2017 TDOT Road Safety Audit (PIN 125015.00) recommended improvements to I-75 from the Kentucky State Line to the Rarity Mountain Interchange. Recommendations included median drainage improvements, re-lensing existing pavement markers, additional LED pavement markers, median barrier delineation, and warning signage. Recommended improvements are currently in the Design Phase.

5. Solutions Screening & Project Priorities

The I-75 universe of alternatives were filtered through a solutions screening and prioritization process (see Figure 5-1). This process evaluates solutions based on their impact on mobility and safety, potential environmental impacts, cost, and potential economic impacts. Ultimately, the prioritized solutions both resolve the identified deficiencies and have a high benefit/cost ratio.

Solutions Screening, Phase 1

The Phase 1 solutions screening process was intended to eliminate solutions with evident fatal flaws. To do so, each possible solution was evaluated against the following questions:

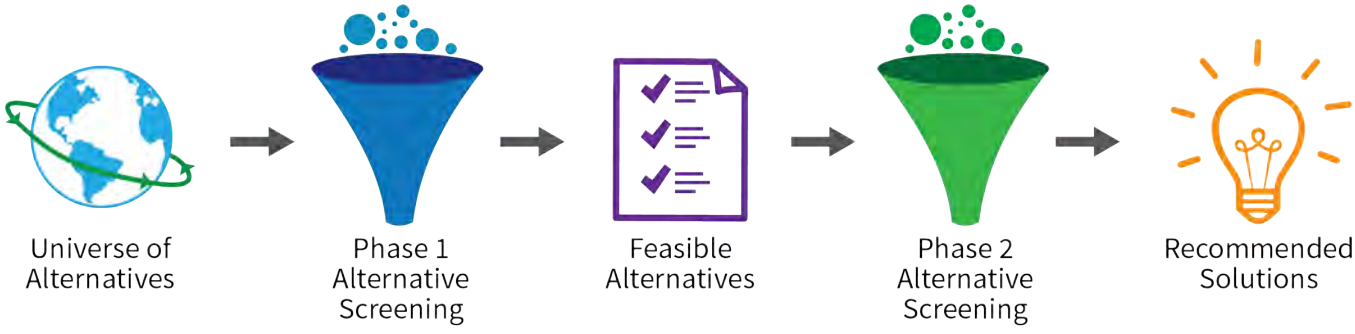
1. Does the proposed solution make sense given the identified deficiency?
2. Does the proposed solution align with other planned or programmed projects in the area?
3. Is the proposed solution supported by stakeholders and the public?
4. Does the proposed solution negatively impact environmental features such as wetlands, rare or protected species, or superfund sites?
5. Does the proposed solution negatively impact cultural features such as sensitive community populations, historic sites, public lands, or community institutions?

Projects which received a "NO" response for questions 1, 2, or 3, or a "YES" response for questions 4 or 5 were eliminated and did not move forward to the Phase 2 solutions screening. Exceptions include projects where the potential is high for environmental/cultural impact mitigation. As shown in Figure 5-2 nine of the solutions were eliminated as part of the Phase 1 screening. Freight solutions F4 and F5 and capacity solution C3 will be evaluated as part of TDOT's I-40/I-81 multimodal corridor study and therefore will not be considered here. Safety solution S1 has already been included in recommendations resulting from a 2017 Road Safety Audit of I-75 in the Jellico Mountain Area. Multimodal solution T10 and TSM&O solution TS5 do not directly impact I-75. Multimodal solution BP2 was added to the Chattanooga TIP in 2017 with TAP-S funding and is therefore considered a programmed project. Capacity solution C11 will be included as part of the programmed improvements to the Hamilton Place Mall interchange. Finally, Multimodal solution T13 does not align with CARTA's recent ReDesign study. This recommendation was eliminated and Multimodal solution T21 was updated to add that regional transit access would likely require implementation of a Regional Transit Authority in the Chattanooga area.

Figure 5-2. Solutions Passing Phase 1 Screening — I-75

Highway Capacity	9
Safety	9
TSM&O	5
Freight	5
Economic Development	2
Multimodal	4

Figure 5-1. Solutions Screening and Prioritization Process



Solutions Screening, Phase 2

The Phase 2 alternatives screening process utilized performance measures to further refine the list of feasible alternatives. Potential solutions that passed the Phase 1 Screening were evaluated against the following questions:

1. Does the proposed solution improve level of service on the interstate corridor?
2. Does the proposed solution improve peak hour travel speeds on the interstate corridor?
3. Does the proposed solution improve travel times between key origin and destination (O&D) pairs along the corridor?
4. Does the proposed solution improve peak hour densities at the improved interchange?
5. Does the proposed solution reduce average and max queues at the improved interchange?
6. Does the proposed solution have the potential to reduce crashes in safety hot spots?
7. Does the proposed solution address deficiencies in bridges with a low sufficiency rating?
8. Does the proposed solution increase pavement quality?
9. Does the proposed solution provide for pedestrian / bicycle connectivity and safety at interchanges?
10. Does the proposed solution provide additional truck parking opportunities, particularly in urban areas?
11. Does the proposed solution have the potential to reduce vehicle miles traveled (VMT)?
12. Does the proposed solution improve incident management?
13. Does the proposed solution provide potential economic development opportunities?

Projects which received only “NO” responses were eliminated and did not move forward as feasible multimodal solutions. As indicated by Figure 5-3, all projects passed the Phase 2 screening and were moved forward to project prioritization.

Prioritization Methodology

Aligning with previous TDOT multimodal corridor studies, the prioritization methodology for this study addresses coordinated construction efforts (priority given to projects that could be accomplished simultaneously at a given location) and culminates in a benefit-cost index for each project, which recognizes the relative multimodal benefit of each project compared to the estimated financial investment. Consistency with TDOT and MPO programmed projects has been maintained throughout the alternative development process, having identified such projects as part of the Trend Scenario.

The most recent TDOT multimodal corridor study introduced flexible decision-making support tool wherein weights can be applied to priority settings based on policy, programming, and political decisions. The prioritization criteria and measures for the I-75 corridor are structured in a similar fashion, such that weights can be applied by decision-makers. As indicated in Table 5-1, solutions developed for the I-75 corridor were evaluated over six categories: mobility, safety, economic development, system maintenance, implementation and cost efficiency, as detailed here.

Figure 5-3. Solutions Passing Phase 2 Screening — I-75

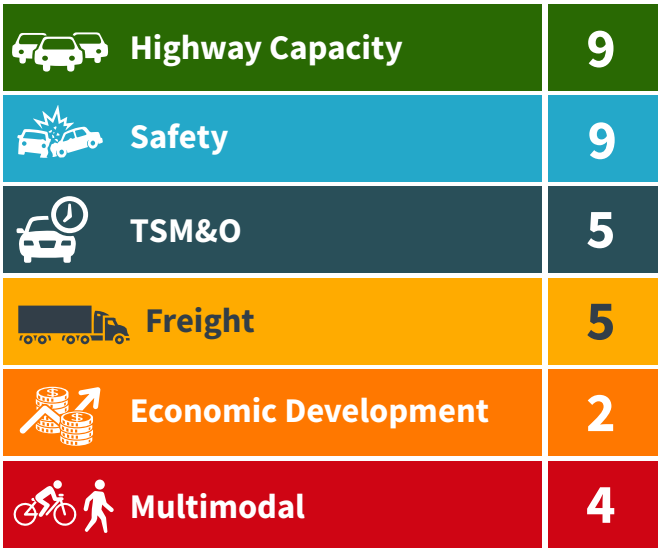


Table 5-1. Prioritization Criteria and Measures by Mode and Strategy — I-75

Mode/ Strategy	Mobility	Safety	Economic Development	System Maintenance	Implementation	Cost Efficiency
Highway Capacity	2040 Trend V/C	Crash Rate (Relative to Statewide Avg)	2020 Employment	Project addresses bridge deficiency (Y/N)	# of related projects	Benefit-Cost Index
	2040 Build V/C	Project improves incident management (Y/N)	2040 Employment	Project addresses pavement deficiency (Y/N)	Cost Estimate	Dollar per Benefit
Safety	2040 Trend V/C	Crash Rate (Relative to Statewide Avg)	2020 Employment	Project addresses bridge deficiency (Y/N)	# of related projects	Benefit-Cost Index
	2040 Build V/C	Project improves incident management (Y/N)	2040 Employment	Project addresses pavement deficiency (Y/N)	Cost Estimate	Dollar per Benefit
		Crash Reduction Potential				
TSM&O	2040 Trend V/C	Crash Rate (Relative to Statewide Avg)	2020 Employment	Project addresses bridge deficiency (Y/N)	# of related projects	Benefit-Cost Index
	2040 Build V/C	Project improves incident management (Y/N)	2040 Employment	Project addresses pavement deficiency (Y/N)	Cost Estimate	Dollar per Benefit
Freight	2040 Trend V/C	Project improves incident management (Y/N)	2020 Employment	Project addresses bridge deficiency (Y/N)	# of related projects	Benefit-Cost Index
	2040 Build V/C		2040 Employment	Project addresses pavement deficiency (Y/N)	Cost Estimate	Dollar per Benefit
	% Trucks			Provides truck parking (Y/N)		
Multimodal	2020 Population	Project improves incident management (Y/N)	2020 Employment	Project addresses bridge deficiency (Y/N)	# of related projects	Benefit-Cost Index
	2040 Population		2040 Employment	Project addresses pavement deficiency (Y/N)	Cost Estimate	Dollar per Benefit
Economic Development	2020 Population	Project improves incident management (Y/N)	2020 Employment	Project addresses bridge deficiency (Y/N)	# of related projects	Benefit-Cost Index
	2040 Population		2040 Employment	Project addresses pavement deficiency (Y/N)	Cost Estimate	Dollar per Benefit

Prioritization Criteria and Measures

Mobility

Appropriate measures for mobility differ across modes/strategies. While the volume-to-capacity (V/C) ratio is appropriate for measuring highway capacity, it does not capture mobility for bicycles and pedestrians, for example. As shown in Table 5-2, comparison of the 2040 Trend V/C ratio versus the 2040 Build V/C ratio was used as a measure of mobility for highway capacity, safety, TSM&O, and Freight projects. Numeric scores 1, 2, and 3, were recorded based on the following thresholds, which consider the resulting change in V/C and, for freight projects, the percent trucks on the adjacent section of interstate:

Capacity, Safety, TSM&O

1 = No improvement to mobility

2 = Likely improvement to mobility

3 = Definite improvement to mobility

Freight

1 = No improvement to mobility

2 = Improvement to mobility, % trucks < 20%

3 = Improvement to mobility, % trucks > 20%

Comparison of 2020 population versus 2040 population within three miles of each project was used for multimodal and economic development projects. Population numbers were obtained via the Tennessee Statewide Travel Demand Model (TSM) and by traffic analysis zone. Resulting numeric scores were based on the following thresholds:

Multimodal, Economic Development

1 = 0-10% Increase

2 = 10-15% Increase

3 = 15% + Increase

Where criterion could not be measured and "N/A" was noted, engineering judgement was used to score the project's potential for mobility improvement within the applicable thresholds.

Safety

Criterion used to measure the potential safety improvement for each project also vary across mode/strategy. One measure common to all was a "yes" or "no" response to the question "Does the project improve incident management?" For freight, multimodal and economic development projects, this was the only measure used for safety. Thresholds were applied as follows:

Freight, Multimodal, Economic Development

1 = N/A

2 = No

3 = Yes

Building upon hot spot calculations from Technical Memorandum 2, capacity, safety, and TSM&O projects are measured by the relative crash rate as well. The impact of safety projects is further refined by the crash reduction potential, which was determined in Technical Memorandum 3. The following thresholds were applied:

Capacity, TSM&O

1 = Crash rate < statewide average crash rate[1]

2 = Crash rate > statewide average crash rate; Does not improve incident management

3 = Crash rate > statewide average crash rate; Improves incident management

Safety

1 = Crash rate < statewide average crash rate

2 = Crash rate > statewide average crash rate; Below average crash reduction potential

3 = Crash rate > statewide average crash rate; Above average crash reduction potential OR Improves incident management

Where criterion could not be measured and "N/A" was noted, engineering judgement was used to score the project's potential for safety improvement within the applicable thresholds.

Economic Development

The economic development potential of each project was measured by the projected change in employment from 2020 to 2040 within three miles of each project. Employment projections were obtained via the TSM and by traffic analysis zones. The following thresholds were used to score each project.

Capacity, Safety, TSM&O, Freight, Multimodal, Economic Development

1 = 10-20% increase

2 = 20-25% increase

3 = 25%+ increase

System Maintenance

System maintenance was added as a measure for the I-75 corridor prioritization to recognize opportunities where projects will also address existing bridge and/or pavement deficiencies. The following thresholds were used to score each project, given "yes" or "no" responses to the questions "Project addresses bridge deficiency?" and "Project addresses pavement

1- The statewide average crash rate for rural interstate facilities is 0.528 and 1.112 for urban interstates.

deficiency?'. For freight projects, an additional "yes" / "no" question was added: "Project provides truck parking?"

Capacity, Safety, TSM&O, Multimodal, Economic Development

1 = No to both

2 = Yes to one

3 = Yes to both

Freight

1 = No to all

2 = Yes to one

3 = Yes to all

Implementation

The implementation measure was included to give priority to projects that could be constructed or initiated in conjunction with other projects, thus conserving the time and money associated with multiple, individual contracts. Figures 5-4 and 5-5 illustrates the relative proximity of the multimodal solutions prioritized for the I-75 corridor. The following thresholds were utilized to score the implementation of each project:

Capacity, Safety, TSM&O, Freight, Multimodal, Economic Development

1 = 0 overlapping projects

2 = 1 or 2 overlapping projects

3 = 3+ overlapping projects

Cost Efficiency

For the I-75 corridor project prioritization, a benefit-cost index and a dollar-per-benefit was calculated for each solution. These measures capture the benefit of each prioritization criteria and compare the total relative benefit to the estimated project cost. Specifically, the score assigned to each of the five prioritization criteria were summed to represent the total relative benefit of each project. To calculate the benefit-cost index, this total relative benefit was divided by the cost (in millions) estimated for each project. The dollar-per-benefit is simply the cost estimate divided by the total benefit score. Note that cost estimates were prepared for solutions that were recommended for further study. However, because the total benefit represents the potential of the associated capital improvement, no direct benefit-cost index or dollar-per-benefit was calculated for these solutions.

Project Rankings

When evaluated side-by-side, the total benefit score, benefit-cost index, and dollar-per-benefit indicate projects with high benefit that can be implemented with smaller financial investment. The project rankings are discussed per mode/strategy below. Tables 5-1 through 5-6 of Technical Memorandum 4 detail the prioritization effort and rank the projects by the total benefit score, which ranges from 5 (lowest) to 15 (highest).

Project Rankings by Mode and Strategy

Highway Capacity

Each of the Capacity solutions score a high total benefit (11+). Due to the project lengths and cost associated with widenings, these projects have low benefit-cost indexes. Capacity solution C2 received the highest possible total benefit score, reflective of its benefit to mobility, safety, economic development, system maintenance, as well as its relation to other projects including S7, F3, and TS1. The total cost for widening this 12.7 mile section of I-75 is estimated at $108,000,000, which includes widening of 15 bridges - the structurally deficient Tennessee River Bridge accounting for the highest costs. It should also be noted that according to the Knoxville TPO, the Loudon County representative has recently introduced to the TPO Technical Committee the need for a truck-climbing lane on I-75 northbound north of US-321. Evaluation of a truck climbing lane at this location should be included in further analyses of Capacity solution C2.

Safety

Safety solution S5 (addition of right turn lane on the northbound off-ramp at SR-61) boasts a high total benefit score as well as a high benefit-cost index. This solution is relatively low cost, yet has the potential to significantly improve mobility and safety on I-75 and impacts a growing employment population. Safety solutions S10, S6, S7, and S9 also received high total benefit scores, with S6 also receiving a very high benefit-cost-index.

TSM&O

Four of the five TSM&O solutions scored high total benefit numbers. Signal coordination on adjacent spillover arterial streets (TS1) and integrated corridor management in the Chattanooga area (TS3) also showed positive benefit-cost indexes.

Figure 5-4. Relative Proximity of Multimodal Solutions — I-75 (north)

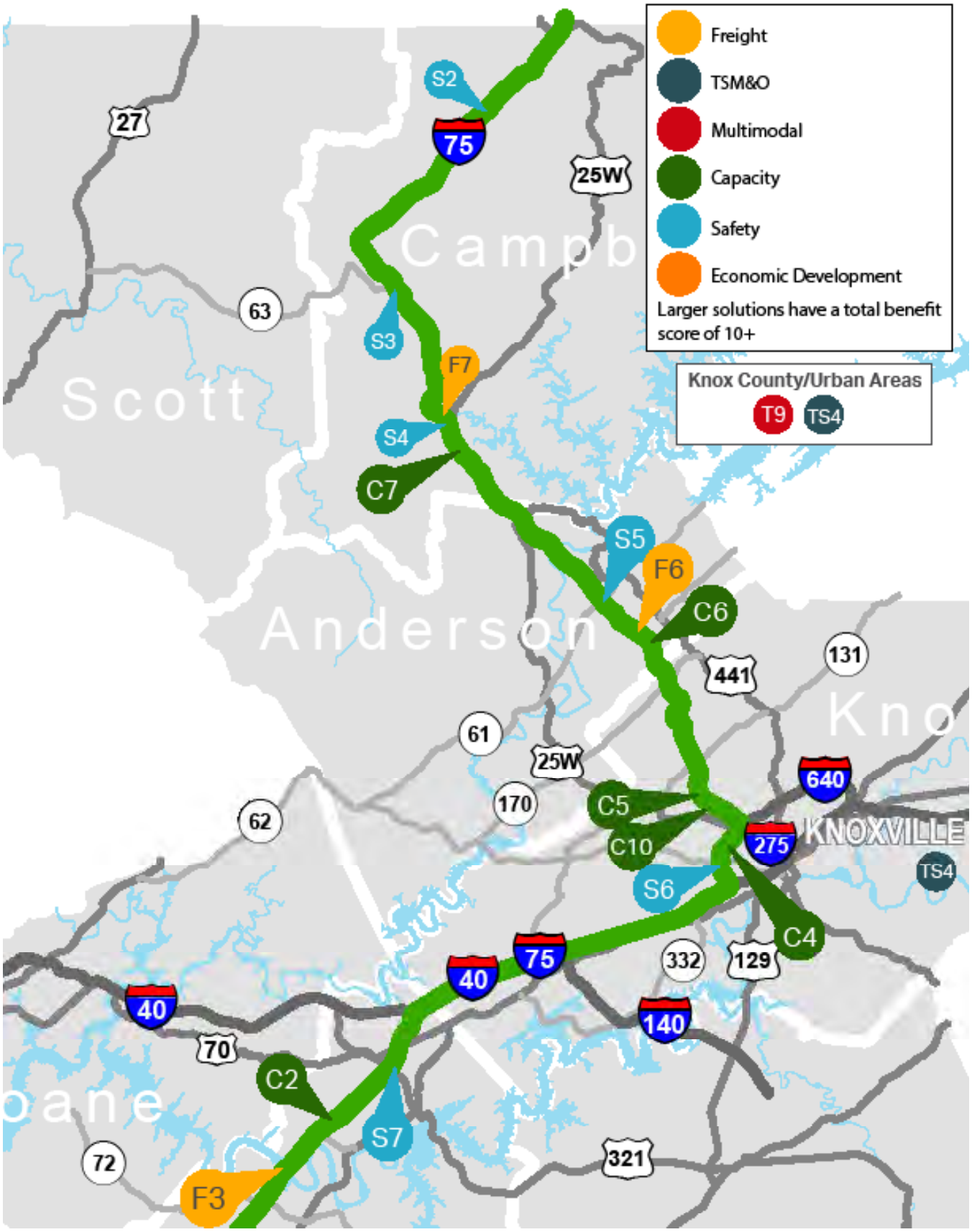
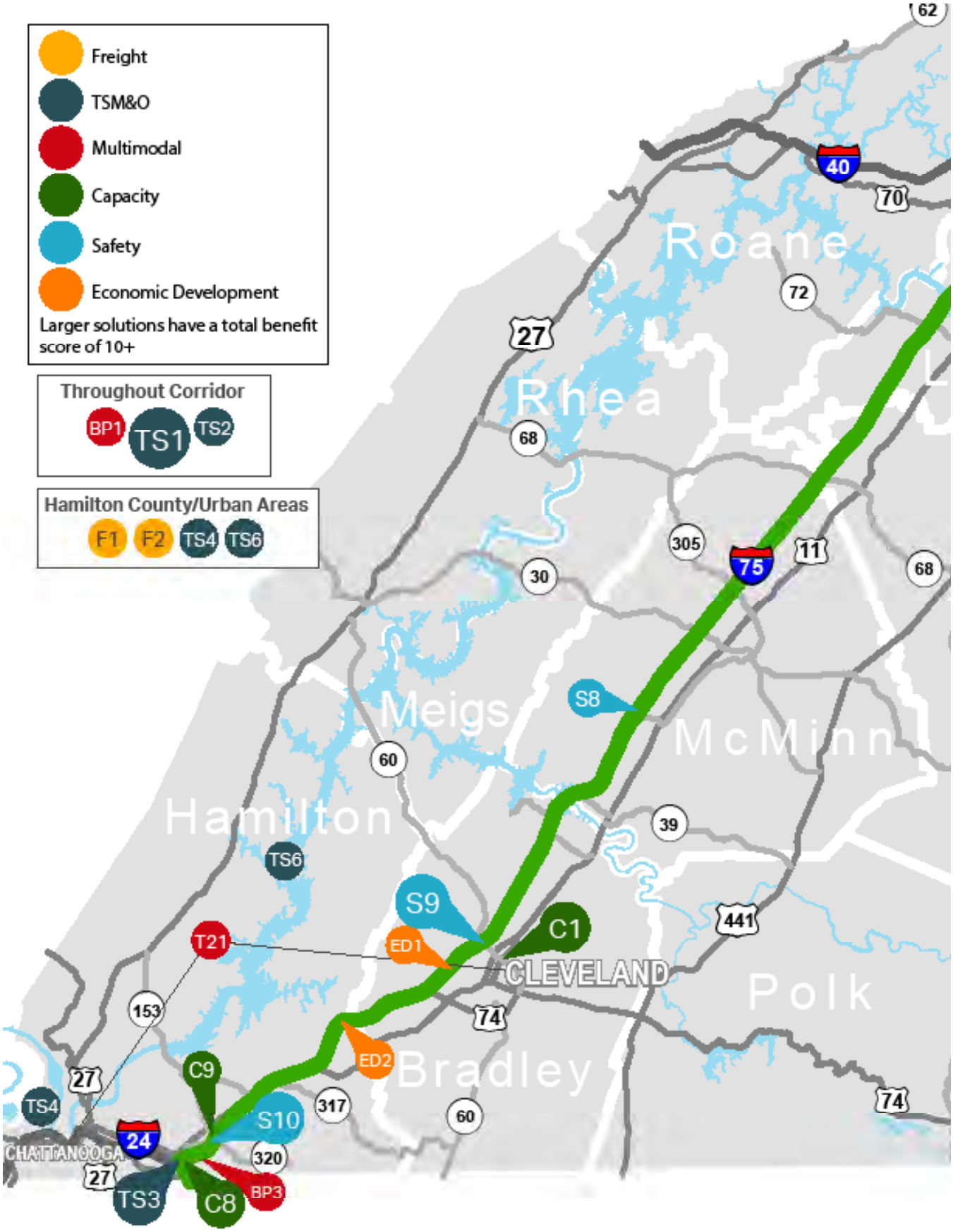


Figure 5-5. Relative Proximity of Multimodal Solutions — I-75 (south)



Freight

Addressing structural deficiencies on the Tennessee River Bridge in Loudon County (F3) and on the East Wolf Valley Road Bridge in Anderson County (F6) received high total benefit scores. Due to the size and environmental mitigation factors associated with improvements to the Tennessee River Bridge, the benefit-cost index for F3 was much lower than that of F6.

Multimodal

A study to evaluate existing pedestrian and bicycle connectivity/accommodations at U.S. and state route crossings (BP1) scored the highest total benefit among multimodal solutions. The resulting study should consider the factors listed in Section 4 of this report as well as local initiatives, such as Cleveland's recent multi-modal access grant for a mutli-use path on SR-60 near the interchange. In addition to BP1, multimodal solution T9 (study to establish a Regional Transit Authority in Knox County) also received a high total benefit score.

Economic Development

Both Economic Development solutions, ED1 and ED2, received high total benefit scores of 11. New access points in the Cleveland area and between Ooltewah and Cleveland would benefit these two distinct areas of growing population and employment.

6. Key Findings

The prioritized solutions address the key corridor transportation deficiencies identified by stakeholders and through data analysis.

As a result of the structure of the project prioritization system, all projects have a potential total benefit range of 5-15 and can therefore be compared across modes/strategies. Table 6-1 tabulates all solutions for the I-75 corridor, sorted by total benefit score. Solutions which recommend studies are shown in Table 6-2. Projects with total benefit scores of 10 or greater have generally demonstrated benefit to mobility, safety, economic development, system maintenance, and implementation.

Use of Table 6-1 in conjunction with Figure 5-4 and 5-5 can be used to inform decisions on fund allocation and construction packages. As mentioned previously, weights can easily be applied to the prioritization criteria in Tables 5-1 through 5-6 of Technical Memorandum 4 to adjust for policy, programming, and political decisions.

Finally, Table 6-3 summarizes the performance benefits of the of the collective solutions recommended for the I-75 corridor. As shown, proposed solutions improve network VHD during the peak period by 5% (compared to the 2040 Trend scenario). Specifically, peak period VHD on urban and rural interstates is reduced by 35% and 32%, respectively. Related benefits also include a 20% increase in average speeds on urban interstates and 12% increase in average speeds on rural interstates. These improvements in delay are largely attributed to capacity improvements on multi-mile sections of I-75 and at several interchanges.

Additionally, multimodal solution performance measures indicate improvement to bridge and pavement conditions as well as truck parking. Bike/ped solution BP3 accounts for the improvement to pedestrian and bicycle accommodations at U.S. and state route interchanges.

Further improvements to the I-75 corridor are expected to result from the "deep dive" studies shown in Table 6-2. The ramp metering and queue monitoring study, for example, may reveal the need for new systems and equipment at multiple interchanges in urban areas. Likewise, the bike/ped connectivity study has the potential to propose numerous small-scale safety and connectivity improvements for non-vehicle users across the corridor.

Table 6-1. Project Ranking Across all Modes/Strategies — I-75

ID	Project Description	Termini	Cost Efficiency			
			Total Benefit	Cost Estimate	Benefit Cost Index	Dollar per Benefit
C2	Widen existing four lane section	SR-72 to I-40	15	$108,000,000	0.1	$7,200,000
C4	Widen existing six lane section	Western Avenue to I-275	14	$16,600,000	0.8	$1,185,700
C5	Construct auxiliary lane NB between interchanges	Callahan Drive to SR-131	14	$15,700,000	0.9	$1,121,400
C7	Widen NB lanes; consider truck climbing lanes	US-441 to SR-63	14	$77,900,000	0.2	$5,564,300
C1	Widen existing four lane section	US-64 Bypass/US-75 to SR-60	13	$40,700,000	0.3	$3,130,800
C6	Widen existing four lane section; consider truck climbing lanes	SR-170 to US-441	13	$131,700,000	0.1	$10,130,800
C8	Widen/Apply TSM&O and/or Arterial Management Strategies to address forecasted congestion	I-75/I-24 Interchange to GA State Line	12	$8,110,000	1.5	$675,800
S5	Add right-turn only lane on NB off-ramp	SR-61 (Charles G Seivers Blvd) Interchange	11	$406,000	27.1	$37,000
S10	Install advanced signage and increase capacity of NB exit ramp; Modify interchange to remove weave caused by loop ramps	SR-320 (Brainerd Rd) Interchange	11	$15,000,000	0.7	$1,363,600
TS1	Signal coordination on adjacent spillover streets to manage on- and off-ramp congestion	Brainerd Rd, Shallowford Rd, Harrison Rd, Kingston Pk, Central Ave Pk	11	$1,410,000	7.8	$128,200
TS3	Integrated Corridor Management (with real-time technology platform)	Ringgold Rd to Shallowford Rd	11	$ 3,000,000	3.7	$272,700
C10	Widen northbound to create auxiliary lane	Merchants Drive to Callahan Drive	11	$9,850,000	1.1	$895,500
S6	Add pavement markings to indicate lanes for I-40 junction	Western Ave Interchange	10	$9,090	1,100.1	$900
S7	Extend length of NB deceleration lane	US-321 Interchange	10	$1,740,000	5.8	$174,000
S9	Increase length of NB and SB deceleration lane; Install advanced signage for NB off-ramp	SR-60 Interchange	10	$2,160,000	4.6	$216,000
F3	Address bridge deficiency to maintain appropriate load carrying capacity	Tennessee River Bridge	10	$11,600,000	0.9	$1,160,000
F6	Address bridge deficiency to maintain appropriate load carrying capacity	East Wolf Valley Rd Bridge	10	$ 1,230,000	8.1	$ 123,000
S3	Extend length of SB deceleration and NB acceleration lanes	SR-63 (Oneida) Interchange	9	$2,100,000	4.3	$233,300
S4	Extend length of NB and SB deceleration lanes	SR-63 (Caryville) Interchange	9	$2,100,000	4.3	$233,300

Table 6-1. Project Ranking Across all Modes/Strategies (cont.) — I-75

ID	Project Description	Termini	Cost Efficiency			
			Total Benefit	Cost Estimate	Benefit Cost Index	Dollar per Benefit
S2	Speed limit reduction / warning signage/ retroreflective markers	Jellico Mountain Area	8	$262,000	30.5	$32,800
F2	Resurface so that at least 90% of the corridor has good ride quality	GA State Line to Bradley Co Line	8	$10,400,000	0.8	$1,300,000
F7	Address bridge deficiency to maintain appropriate load carrying capacity	Bruce Gap Road Bridge	8	$903,000	8.9	$112,900
BP3	Trail connector	Facilities west of I-75 to Camp Jordan Park	8	$7,290,000	1.1	$911,300
S8	Install additional lighting on NB exit ramp	McMinn County Rest Area	7	$75,900	92.2	$10,800
F1	Add overnight truck parking in or near Chattanooga	GA State Line to Bradley Co Line	7	$1,270,000	5.5	$181,400

Table 6-2. Project Ranking Across all Modes/Strategies (Studies) — I-75

ID	Project Description	Termini	Cost Efficiency			
			Total Benefit	Cost Estimate	Benefit Cost Index	Dollar per Benefit
C9	Evaluate options for increasing capacity and improving merge/ diverge and weave areas between the SR-320 and SR-153 interchanges.	SR-320 to SR-153	13	$200,000	N/A	N/A
BP1	Study to propose bike/ped connectivity and safety at existing U.S. and S.R. interchanges, as well as the Shallowford Rd interchange	Throughout Corridor	12	$100,000	N/A	N/A
TS4	Evaluate locations that would benefit from ramp metering and queue detection systems	Urban Areas of Chattanooga and Knoxville	12	$250,000	N/A	N/A
TS6	Evaluate balanced alternative routing opportunities	Hamilton County	11	$100,000	N/A	N/A
ED1	Evaluate need for additional interstate access point to accommodate economic growth	SR-60 to SR-74	11	$100,000	N/A	N/A
ED2	Evaluate need for new interchange to accommodate growth (consider existing overpass for Ooltewah/ Georgetown Rd)	Ooltewah to Cleveland	11	$100,000	N/A	N/A
T9	Study to establish a Regional Transit Authority to provide inter-county transit service	Knox County	10	$250,000	N/A	N/A
T21	Study commuter route between Chattanooga and Cleveland. Regional transit access would likely require implementation of a Regional Transit Authority	Chattanooga to Cleveland	8	$100,000	N/A	N/A
TS2	Conduct study to evaluate correlation between travel speed and crash severity	I-75 and adjacent, parallel arterials	6	$25,000	N/A	N/A

Table 6-3. Performance Measure Summary — I-75

Goal	Performance Measure		Unit	Base (2010)	Trend (2040)	Build 2040	% Change (Base vs Trend)	% Change (Trend vs Build)
Traffic Operations	Traffic on interstate operates at LOS D or better		% of interstate operating at LOS D or better	94.5	65.1	88.5	31	36
	Total Daily Vehicle Miles Traveled (VMT)		Miles (1,000s)	38,071	51,409	50,271	35	-2
	Total Daily Vehicle Hours of Travel (VHT)		Hours (1,000s)	1,069	1,762	1,715	64	-3
	Total Peak Hour Vehicle Hours of Delay (VHD)		Hours	35.5	54.6	52.0	54	-5
	Total VMT / Trip		Miles	4.93	4.88	47.7	-1	-2
	Total Vehicle Minutes Traveled / Trip		Minutes	1.68	2.06	2.05	22	<1
	Average Peak Hour Travel Speed	Urban Interstate	MPH	49	40	48	-19	20
		Rural Interstate	MPH	67	54	60	-20	12
	Congested Travel Time between key O&D Pairs along Corridor (Total)		Minutes	328	412	380	26	-8
	Peak Hour Density at Improved Interchanges		Vehicles/Mile/Lane	See “Traffic Operations Memo”				
	Average and Max Queues at Improved Interchanges		Feet	See “Traffic Operations Memo”				
Safety	Crash reduction in safety “hot spots”		Above or Below Average Crash Reduction Potential	See “Safety Recommendations”				
Operations & Maintenance	Bridge Condition (Sufficiency Rating)		% of bridges < 50	0	0	0	N/A	N/A
			50 < % of bridges < 80	30	28[1]	20	N/A	N/A
	Pavement Condition (Resurfacing)		% of corridor resurfaced within the last 10 years	74[2]	76[3]	88	N/A	N/A
Multimodal	Pedestrian and Bicycle Accommodations at U.S. and State Route Interchanges		% interchanges with bike facilities	0	0	3	N/A	N/A
			% interchanges with ped. facilities	9	9	11	N/A	N/A
	Freight (Truck Parking)		# of Rest Area Spots	145	145	145	0	0
			# of Truck Stop Spots	1,161	1,161	1,211	0	4

1- Per TDOT Structures Division, one bridge on I-75 is scheduled for repair. Improve Act projects also include 3 bridge repair projects on I-75, two in Loudon County and 1 in Knox County.
2- Based on 2017 TRIMS data
3- Per TDOT Pavement Office’s 2020 and 2021 Resurfacing Program. Also review of 2018-Feb 2020 TDOT Bid Lettings. (included resurfacing L.M.3.60-8.70, Knox County)

I-26 Corridor

▶ Final Report

Table of Contents

Tables

Figures

Figures cont.

I-26 Corridor

1. Introduction

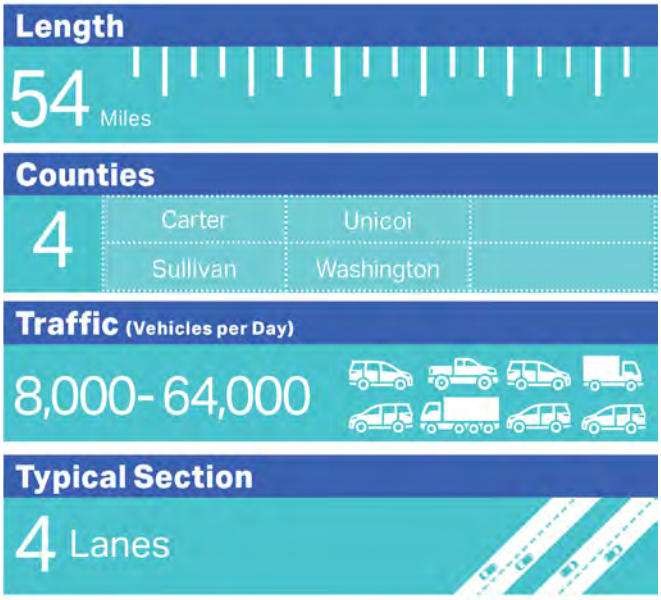
The I-26 corridor serves as a backbone for economic development and growth in northeast Tennessee. As population and employment grow and redevelopment changes the face of the region, new travel demands place pressure on the Interstate as well as parallel and intersecting highways. This results in increased traffic congestion, travel times, and conflicts, which impact the corridor's ability to sustain future growth.

Interstate 26 is a nominally east-west (but physically northwest-southeast) route in the southeastern United States, connecting Charleston, South Carolina, at US-17, to Kingsport, Tennessee at US-11W. Originally constructed as US-23, this 54 mile stretch of I-26 within Tennessee begins at the North Carolina border and terminates at the junction of US-11W and US-23 in Kingsport.

The study area is shown in Figure 1-1; it includes Carter, Sullivan, Unicoi and Washington counties. The main purpose of this study is to identify existing and emerging deficiencies along the I-26 corridor and to evaluate and prioritize improvements to address those deficiencies. The study explores multimodal

Figure 1-1. I-26 Study Area

Figure 1-2. I-26 Fast Facts



issues and opportunities and considers innovative approaches available to the Tennessee Department of Transportation (TDOT) to address capacity and congestion, enhance operational efficiency, improve safety and security, expand transportation choices, and support economic growth and competitiveness.

Previous technical memoranda:

- Provided a data and information inventory for the corridor
- Assessed existing and future deficiencies and needs along the I-26 corridor
- Established goals and performance measures to assess the effectiveness of various solutions to the problems
- Filtered the I-26 universe of alternatives through a screening and prioritization process

The prioritization process evaluated solutions based on their impact on mobility and safety, potential environmental impacts, cost, and potential economic impacts. Ultimately, the prioritized solutions both resolve the identified deficiencies and have a high benefit-cost index.

2. Sources of Data

Roadway, demographic, economic and performance data were collected from numerous sources. These were supplemented by a robust program to gather input from key stakeholders -- such as metropolitan planning organizations, business groups, and large institutions -- and the traveling public. These data were used to identify trends in travel, employment, development, and land use that impact the future of the region. The data ultimately were evaluated to identify the key transportation deficiencies impacting travel in the I-26 corridor.

Previous Plans and Studies

Many agencies have conducted studies and developed a variety of plans for the I-26 study area; however, this study is the first comprehensive study to be conducted for the entire I-26 corridor. Previous studies have focused on all modes of transportation and various levels of infrastructure, from statewide and regional to community-specific. Key studies, plans, and programs (listed in Figure 2-1) were reviewed to develop an understanding of the corridor and the needs and opportunities that have been previously identified. TDOT's State Transportation Improvement Program (STIP), Kingsport and Johnson City Metropolitan Transportation Planning Organizations' (MTPO) Long Range Transportation Plans (LRTP) and Transportation Improvement Programs (TIP) were specifically reviewed to develop an understanding of the needs and opportunities that have previously been identified and to identify projects within the study area for which money has already been allocated. These programmed projects are shown in Table 2-1 and Figure 2-2.

Figure 2-1. Previous Plans and Studies — I-26

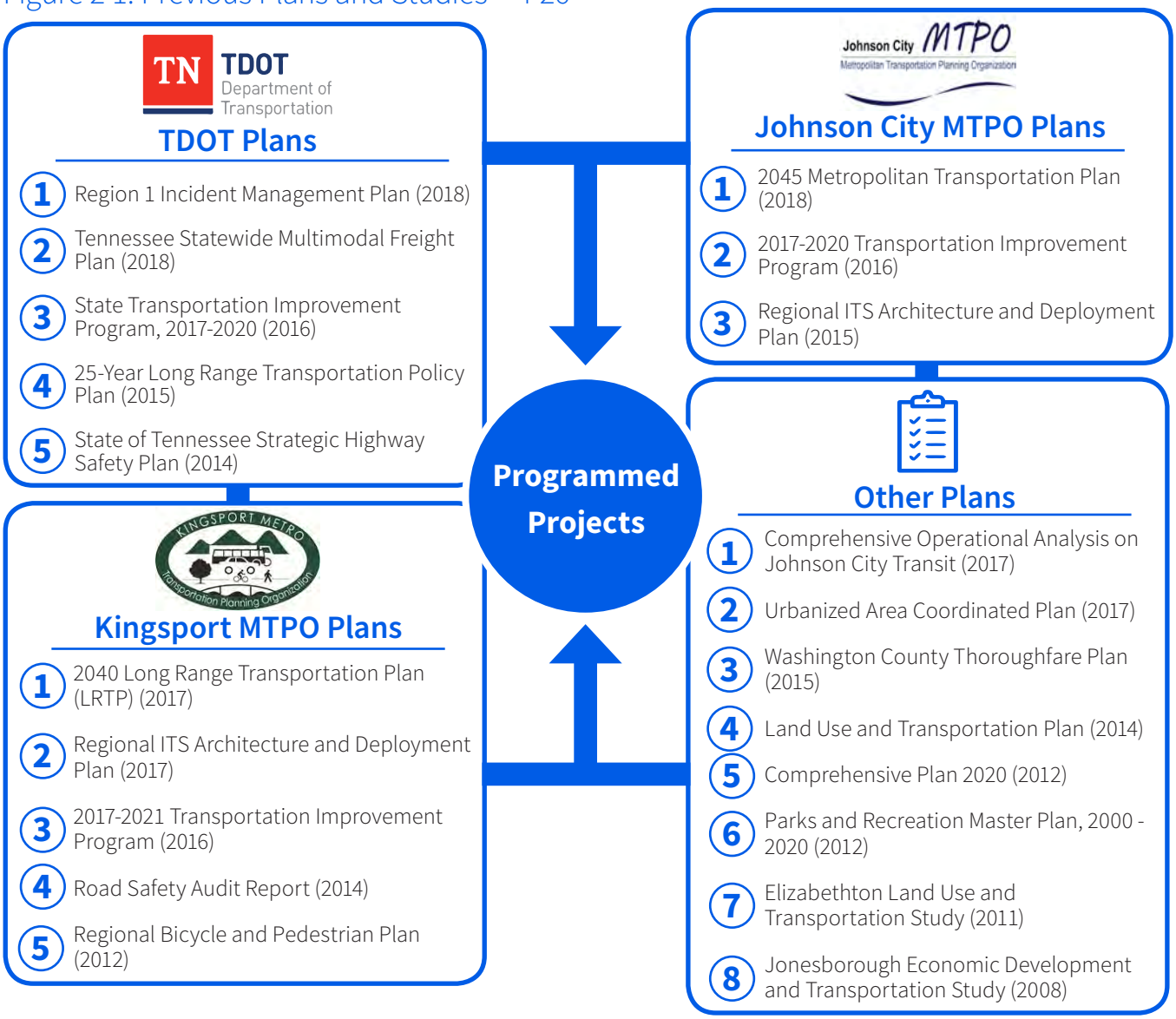


Table 2-1. Corridor Programmed Projects — I-26

	Figure 2-2 ID	Route and Project Limits	Improvement	Cost	Year	Lead Agency/ Funding Type	TIP #
Kingsport MTPO FY2017 - 2020 TIP	1	Kingsport Area Transit Service (KATS)	Operations	$9,000,000	2017-2021	Kingsport/FTA 5307	TIP # PT-1
			Capital	$2,867,000		Kingsport/FTA 5307	TIP # PT-2a
			Capital	$2,867,000		Kingsport/FTA 5339	TIP # PT-2b
			Planning	$175,000		Kingsport/FTA 5307	TIP # PT-3
Johnson City MTPO FY2017 - 2020 TIP	2	I-26: Interchange at SR-354 (Exit 17)	Diverging Diamond Interchange (DDI)	$14,900,000	2019	TDOT/NHPP/ IMPROVE Act	TIP # 90115
	3	SR-381 from Knob Creek Rd to Browns Mill Rd	Adaptive signal control	$290,000	2019	Johnson City/ STBG-Local	TIP # 2013-02
	4	Systemwide deployment throughout Johnson City	Adaptive signal control	$550,000	2020	STBG-Local	TIP # 2014-11
	5	Johnson City Transit (JCT)	Operations	$12,300,000	2017-2020	JCT/ FTA 5307	TIP # 2017-08
			Captial	$1,060,000	2017-2020	JCT/ FTA 5307	TIP # 2017-09
			Capital	$4,849,400	2017-2020	JCT/ FTA 5307/FTA 5339	TIP # 2017-10
			Operations	$2,677,470	2017-2020	JCT/ FTA 5310	TIP # 2017-11
			Capital	$731,780	2018-2019	JCT/ FTA 5317	TIP # 2017-15
			Operations	$220,000	2019-2020	JCT/ FTA 5316	TIP # 2017-17

Sources: Johnson City MTPO FY2017-2020 TIP and Kingsport MTPO FY2017-2020 TIP
FTA = Federal Transit Administration
L-STBG = Local Surface Transportation Block Grant Program
NHPP = National Highway Performance Program

Data Analysis

A large body of technical data were analyzed to develop a picture of corridor conditions. These included sources detailing roadway conditions, traffic and freight operations, safety, population and employment growth, environmental conditions, and other factors to create a "trend scenario." These data sources are shown in Figure 2-3.

Figure 2-3. Data Sources

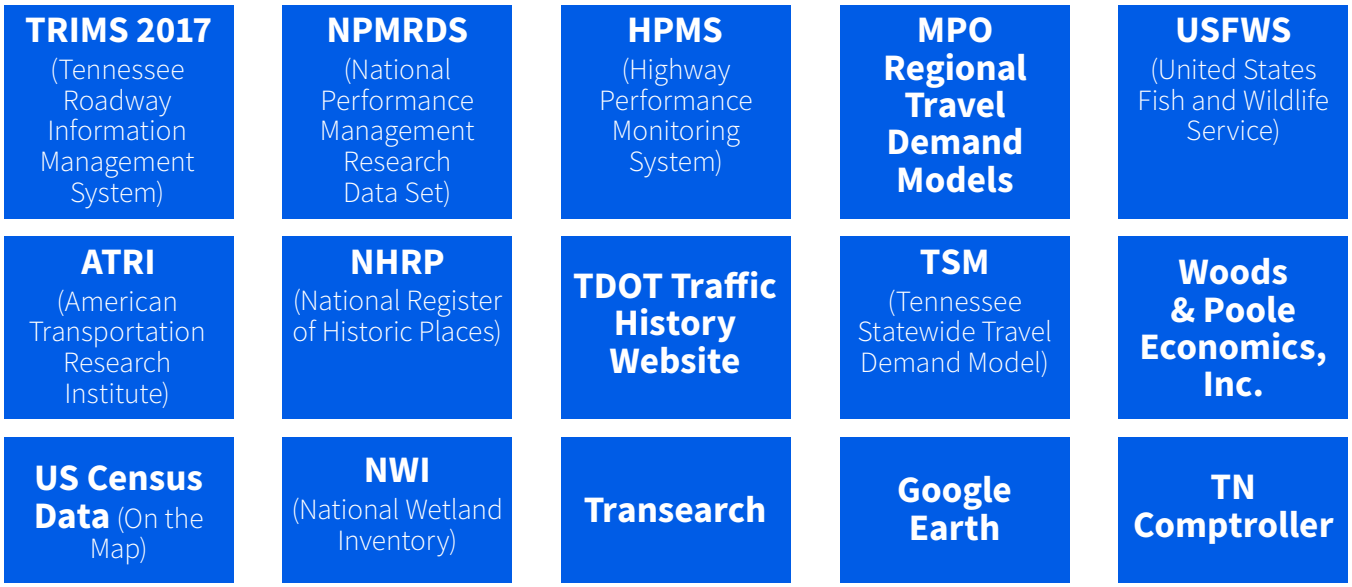
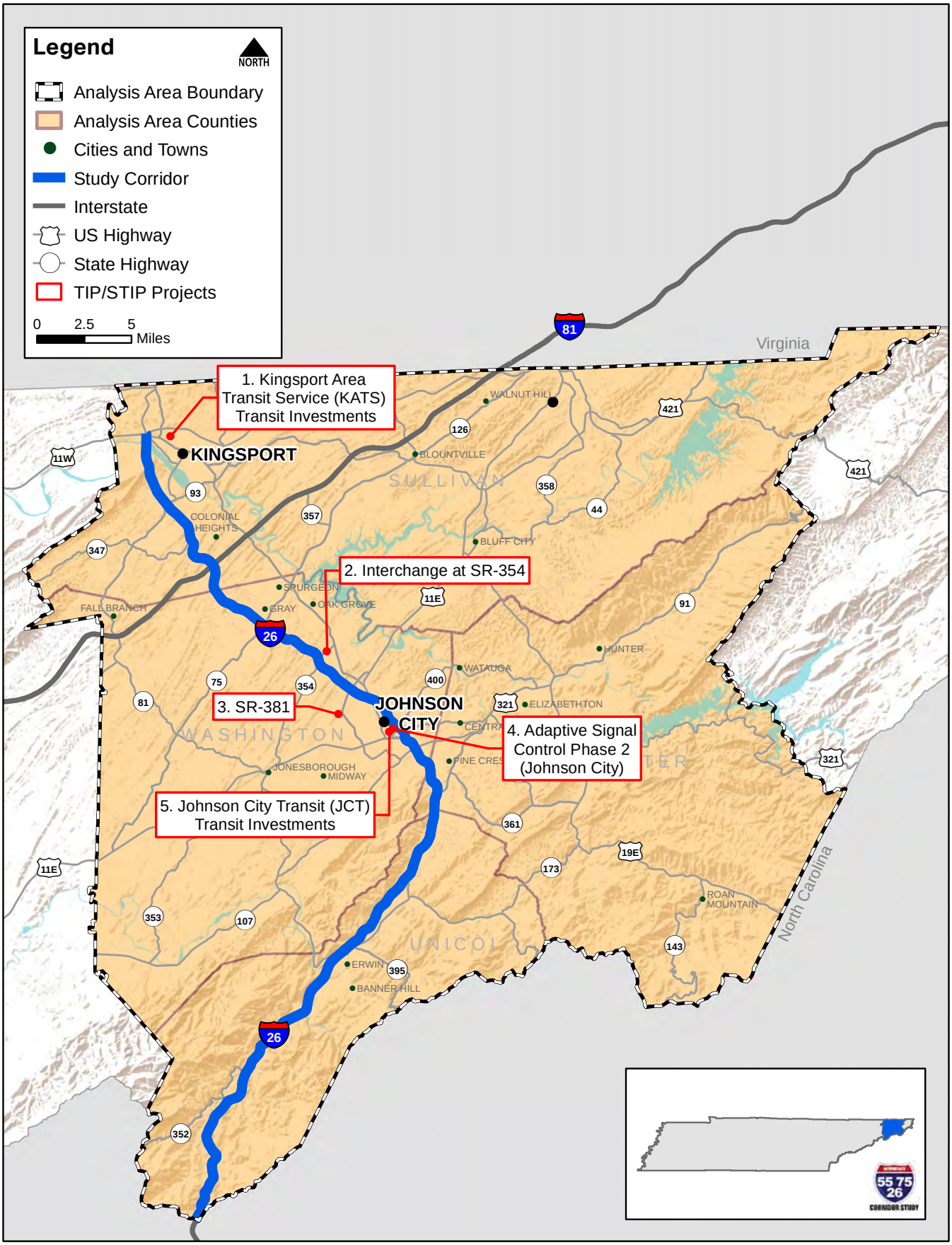


Figure 2-2. Corridor Programmed Projects* — I-26



* Only projects listed in the TIP or STIP are included in this figure.

Sources: Johnson City MTPO FY2017-2020 TIP and Kingsport MTPO FY2017-2020 TIP

The trend scenario predicts existing and future conditions if current practices, plans, and policies remain unchanged. The trend scenario establishes the existing and projected transportation conditions along the I-26 corridor and serves as the baseline for identifying needs and, ultimately, proposed improvements. The 2010 and 2040 Tennessee Statewide Travel Demand Model (TSM) trend scenarios were originally developed by TDOT in 2017 (Phase 3/ Version 3). As part of this study, the trend scenarios were updated and validated based on the following:

- Population and employment data and projections from Woods and Poole Economics, Inc.
- Projects currently programmed for construction in TDOT's STIP
- Projects currently programmed for construction in the Kingsport MTPO TIP and the Johnson City MTPO's TIP (both FY2017-2020)
- Recent MPO travel demand model projections of socioeconomic data, traffic volumes, and travel times
- Recent Transearch freight data and projections

The study team (including TDOT and MPO/MTPO staff) determined the updated Phase 3/Version 3 TSM (with 2010 base year) was producing results comparable to regional models with more recent base years- creating better model efficiency.

Public / Stakeholder Input

The study's technical analyses were complemented by a robust stakeholder and public involvement effort. The data generated by outreach activities – which included public meetings, key stakeholder interviews and a public survey – was used to focus technical analysis on items that stakeholders perceive as critical, and to prioritize transportation issues to be addressed. This was complemented and enhanced by an effort to provide information to and gather input from traditionally under-represented and underserved populations.

60% of survey comments related to the I-26 corridor

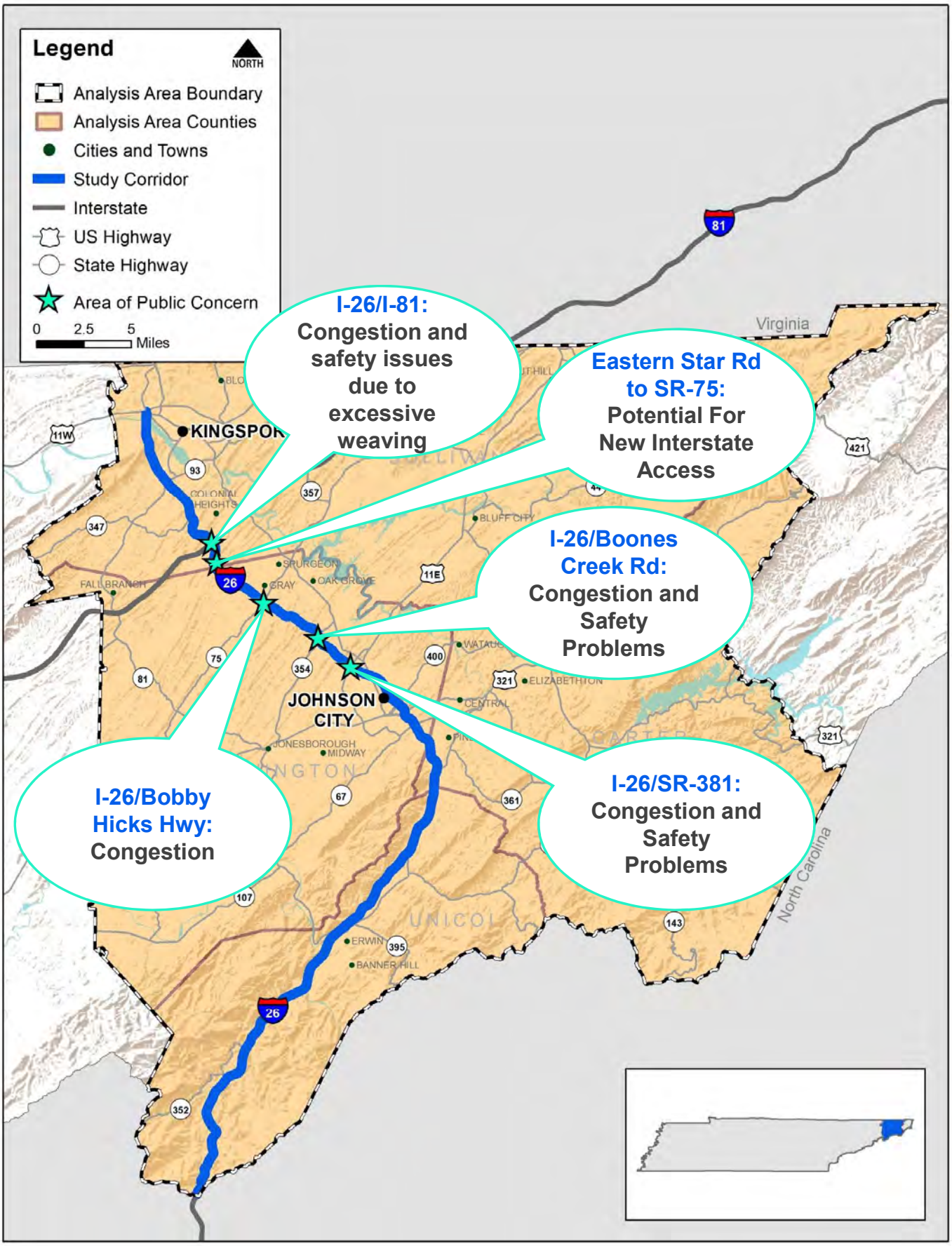
Members of the public and stakeholders identified many areas along the interstate corridor as exhibiting transportation problems. As shown in Figure 2-4, these areas are primarily distributed between Johnson City and Kingsport. The most frequently mentioned locations include:

- I-26/I-81 interchange
  - Congestion at this interchange is perceived to create delays and safety issues due to excessive weaving movements and lack of capacity. This interchange received more comments than any other location.
- I-26/SR-354 (Boones Creek Road) interchange
  - This location is perceived to have a lack of capacity. As indicated in Table 2-1, this interchange is programmed for reconstruction as a Diverging Diamond Interchange.
- I-26/SR-75 (Bobby Hicks Highway/Suncrest Drive Interchange)
  - This interchange, which serves a commercial and industrial area, is also reported to experience congestion.
- I-26/SR-381 interchange
  - This Single Point Urban Interchange is perceived to experience congestion problems.

3. Existing Conditions & Deficiencies

Existing and future deficiencies and needs along the I-26 corridor were identified by examining transportation issues including land use and economic development trends, highway capacity and congestion, travel demand, safety, presence of Intelligent Transportation Systems (ITS), freight, transit, and non-motorized travel.

Figure 2-4. I-26 Corridor Stakeholder Priority Locations

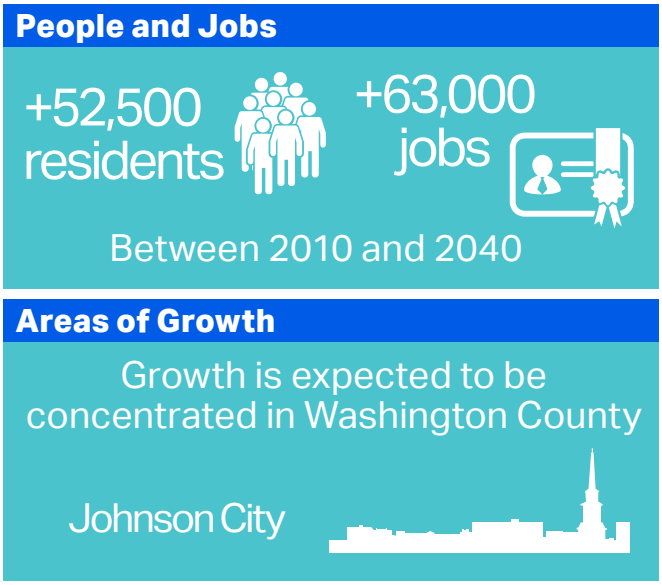


Source: TDOT Online Public Survey and I-26 Public Involvement Meeting (PIM)

Land Use & Economic Development

Land use, development patterns, and geographical and cultural features of the study area impact the demand for, design, and operations of transportation facilities. The locations of economic activity generators and the flows of goods and people between them are a key elements in identifying existing and future transportation needs.

Figure 3-1. Land Use and Economic Development



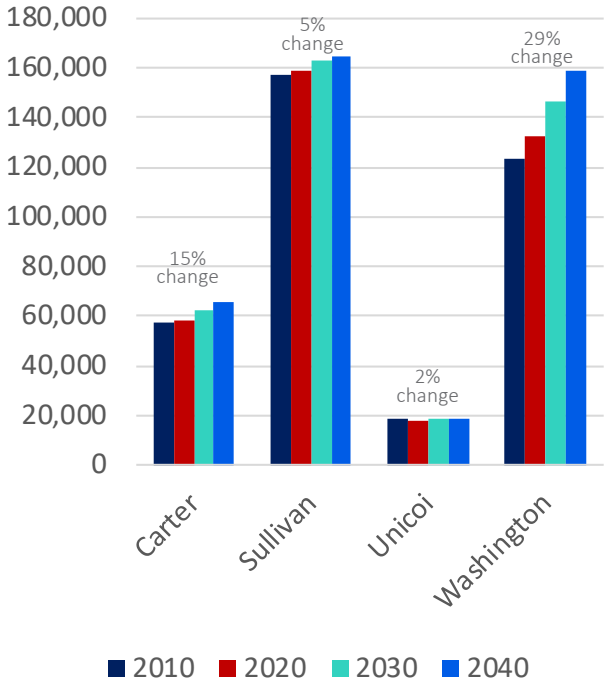
Population & Employment

Study area population and employment drives travel demand in the I-26 corridor. A high-level review of population and employment projections from Woods & Poole Economics, Inc. was undertaken for the four county study area. According to Woods & Poole Economics data, these counties are expected to see an additional 52,500 residents and 63,000 jobs by 2040. This represents a 15% increase in people and 33% increase in employment since 2010. Washington County is expected to see the most significant growth in employment and population accounting for approximately 68% of the region's population growth and 59% of the region's employment growth. Figures 3-2 and 3-3 show the population and employment growth trends per county. Figures 3-4 and 3-5 illustrate where the growth is expected to occur.

To focus on the needs of underserved populations, minority (persons identifying as other than "white alone") and low income populations – in this case persons living in poverty -- in the study area were mapped using data from the US Census Bureau's 2012-2016 American Community Survey (ACS). It should be noted that persons living in poverty represent the most extreme range of the region's low-income population.

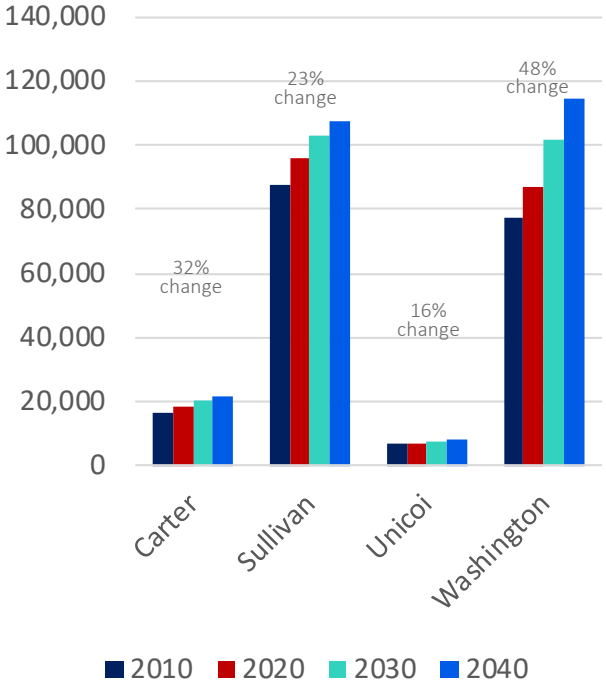
The ACS data showed the highest concentrations of minorities are found around Kingsport and Johnson City. The highest concentrations of people in poverty are found around Kingsport, Johnson City, and in Carter County.

Figure 3-2. County Growth Trends, Population — I-26



Source: Woods & Poole Economics, Inc., 2018

Figure 3-3. County Growth Trends, Employment – I-26



Source: Woods & Poole Economics, Inc., 2018

Figure 3-4. I-26 Change in Population (2010 to 2040)

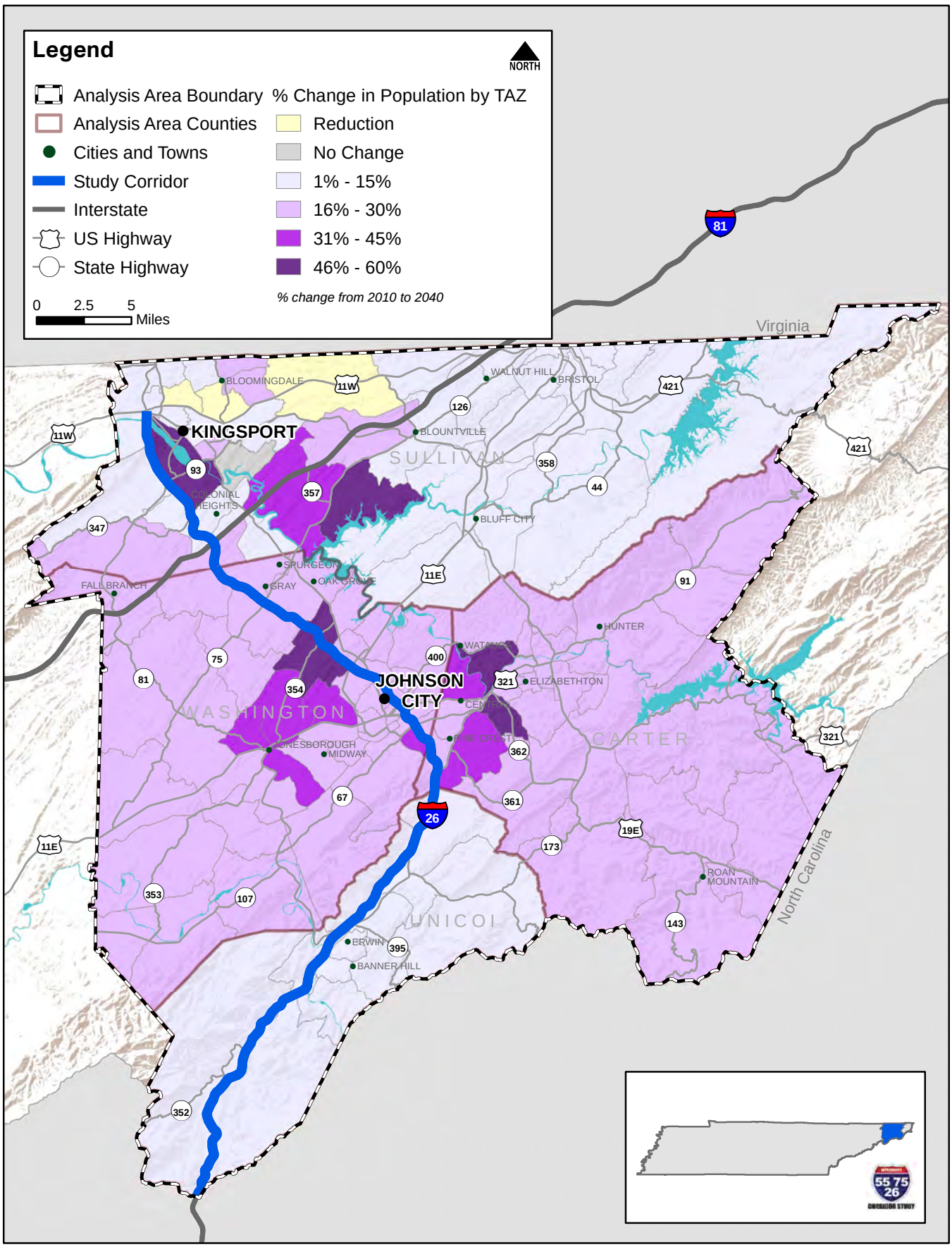
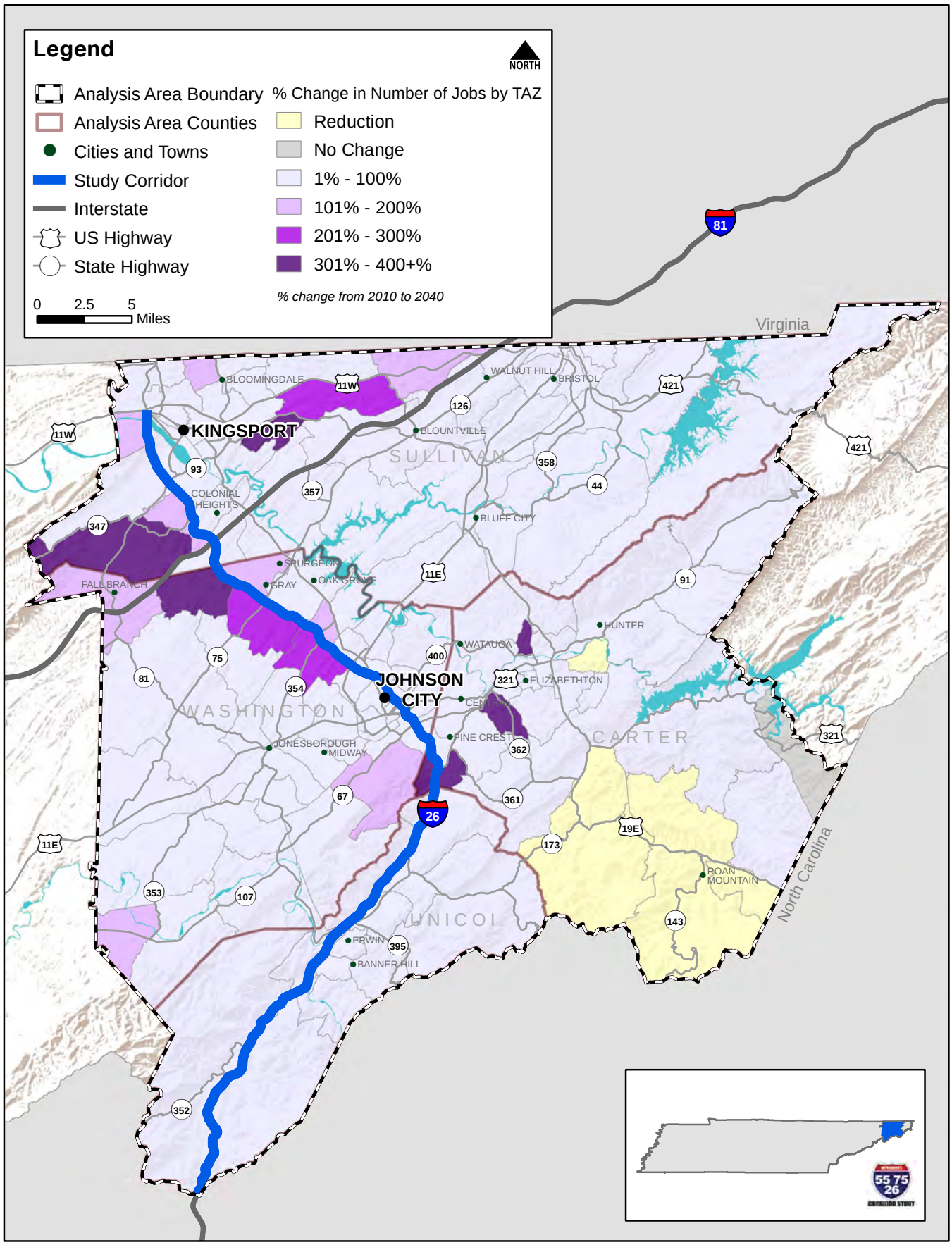


Figure 3-5. I-26 Change in Number of Jobs (2010 to 2040)



Land Use

Existing development patterns and in-progress plans will direct much of the forecasted population and employment growth over the next 20 years. As shown in Figures 3-4 and 3-5, much of the future growth anticipated along the I-26 corridor is expected to occur in and around the major urban areas of Kingsport and Johnson City in Sullivan and Washington Counties, respectively. Key development initiatives were identified and are shown on the existing land use map in Figure 3-6.

- Aerospace Park
  - This direct-airfield development at Tri- Cities Airport offers 40 acres certified for immediate development and has an additional 120 acres under construction. Aerospace Park has access to I-26 via SR-75 and I-81 via SR-357.
- The I-26/I-81 interchange area
  - Often referred to as the Tri-Cities Crossing, this area holds significant development potential, specifically for commercial and/or industrial developments, given its access to the Carolinas, Virginia, and the western portion of Tennessee.
- Exit 17 for SR-354 (Boones Creek Road)
  - Located in northern Washington County, Exit 17 is expected to see significant commercial growth around the interchange and additional residential growth is expected farther from the interchange around the new Boones Creek Elementary School, which opened in August 2019.
- Exit 19 for SR-381 (State of Franklin Road)
  - This area is home to a large number of commercial businesses and is expected to see increased development, including additional multifamily residential.
- Downtown Johnson City
  - Further south on I-26, the exits for downtown Johnson City are expected to see additional growth in the future as urban infill and redevelopment of historic buildings continue to occur for use as commercial and office space.
- Impact of out-of-state I-26 improvements
  - Future growth in industrial land uses could result along the corridor when improvements to I-26 are completed through Asheville, North Carolina.

Traffic Operations

TDOT collects and maintains Annual Average Daily Traffic (AADT) volume data on roadways across the state. Figure 3-7 shows the 2017 AADT volumes recorded in the Tennessee Roadway Information Management System (TRIMS) at 15 count stations along I-26. As shown, daily volumes range from 8,360 vehicles per day (VPD) (24% trucks) near the North Carolina border in Unicoi County, to 64,230 VPD (6% trucks) near Johnson City. Near the Virginia border in Sullivan County, volumes decrease to approximately 26,560 VPD (7% trucks). Throughout the corridor, eight to nine percent of the total daily volume occurs during the peak hours. The capacity of four-lane rural freeway facilities ranges from 52,000 VPD to 67,000 VPD. The capacity of four-lane urban freeway facilities ranges from 71,000 VPD to 92,000 VPD (Highway Capacity Manual 2010 Exhibit 10-8 and 10-9). I-26 is classified as an urban freeway facility between US-11W and the Carter/Unicoi County Line and within the Town of Erwin.

The highest traffic volume occurs just north of Johnson City

Table 3-1 is populated with data obtained from the TSM, which provides base year (2010) daily trip information and forecasts the daily trips that will be made in 2040 based on projected growth and land use changes.

As shown, total daily trips in the four-county area are expected to reach 2.3 million by 2040, representing a 23% increase over total trips in 2010.

Table 3-1. Area Daily Trip Breakdown 2010 and 2040 — I-26

	Daily Trips		
Trip Types	**2010**	**2040**	**% Change**
Personal Trips	1,784,300	2,196,300	23%
Truck Trips	51,200	68,500	34%
Total Trips	**1,835,500**	**2,264,800**	**23%**
Percent truck trips	2.8%	3.0%	

Source: Tennessee Statewide Travel Demand Model (TSM)

Figure 3-6. I-26 Existing Land Use & Key Development Initiatives

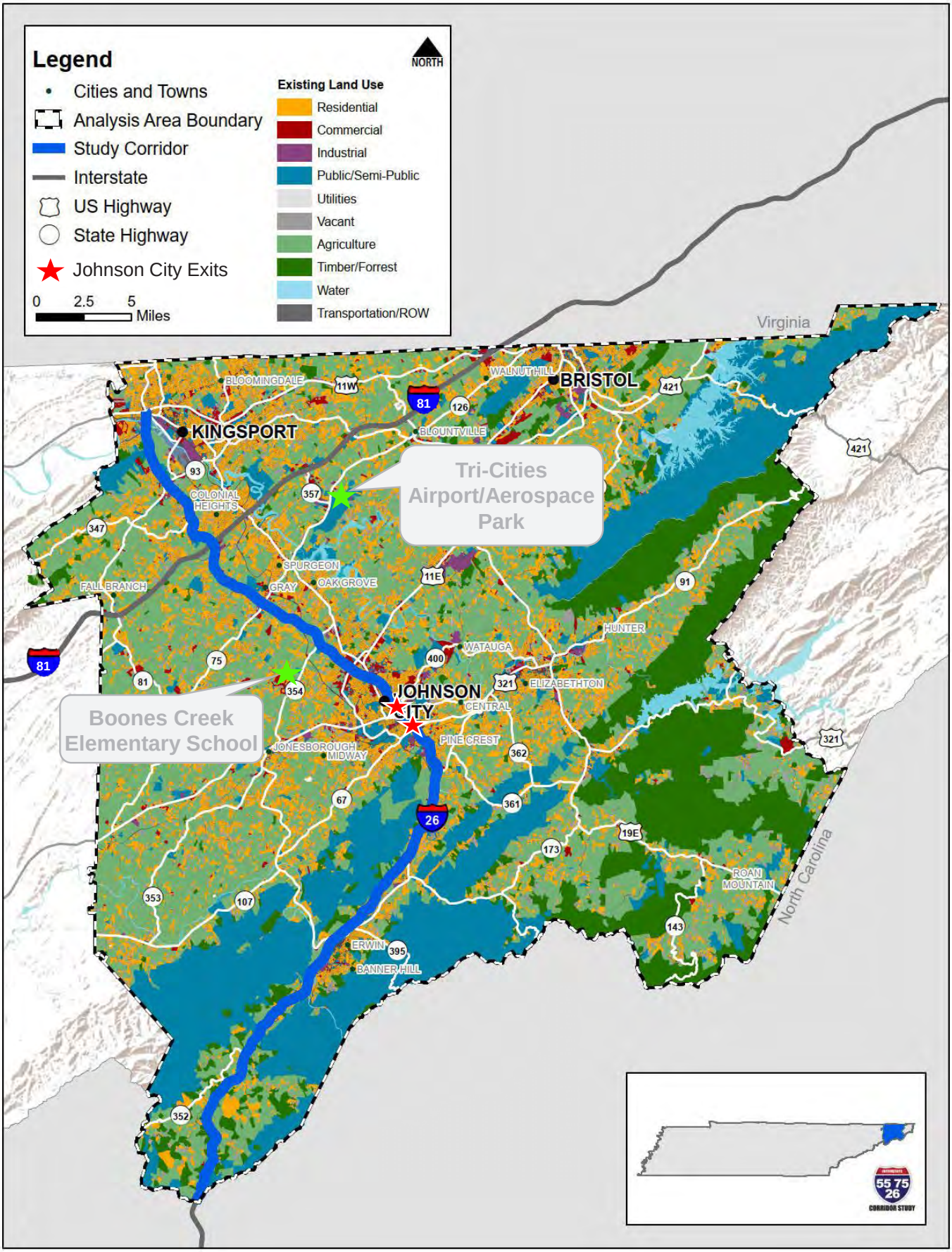
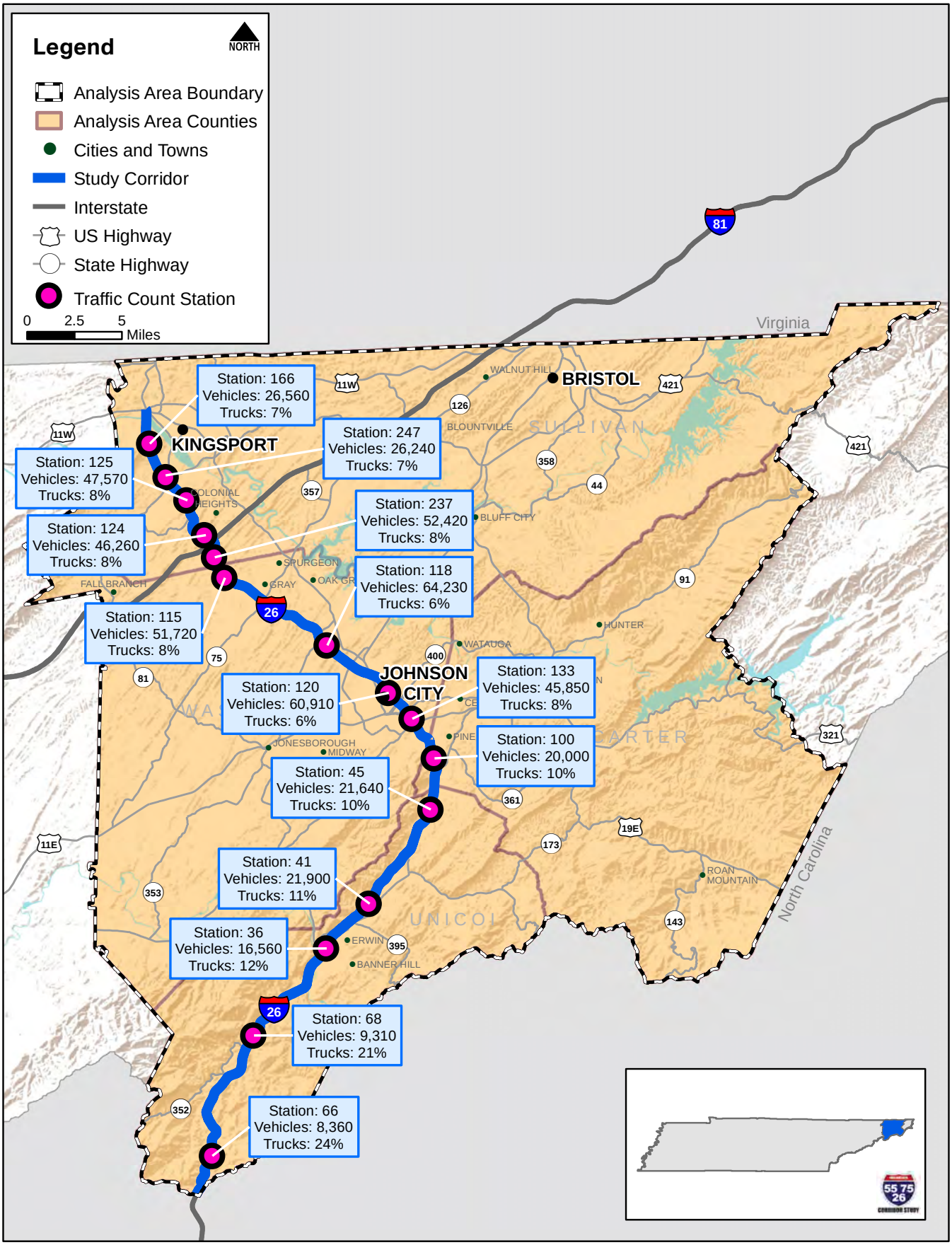


Figure 3-7. 2017 Average Annual Daily Traffic Volumes Along I-26



Source: Tennessee Roadway Information Management System (TRIMS) - 2017

Highway Capacity

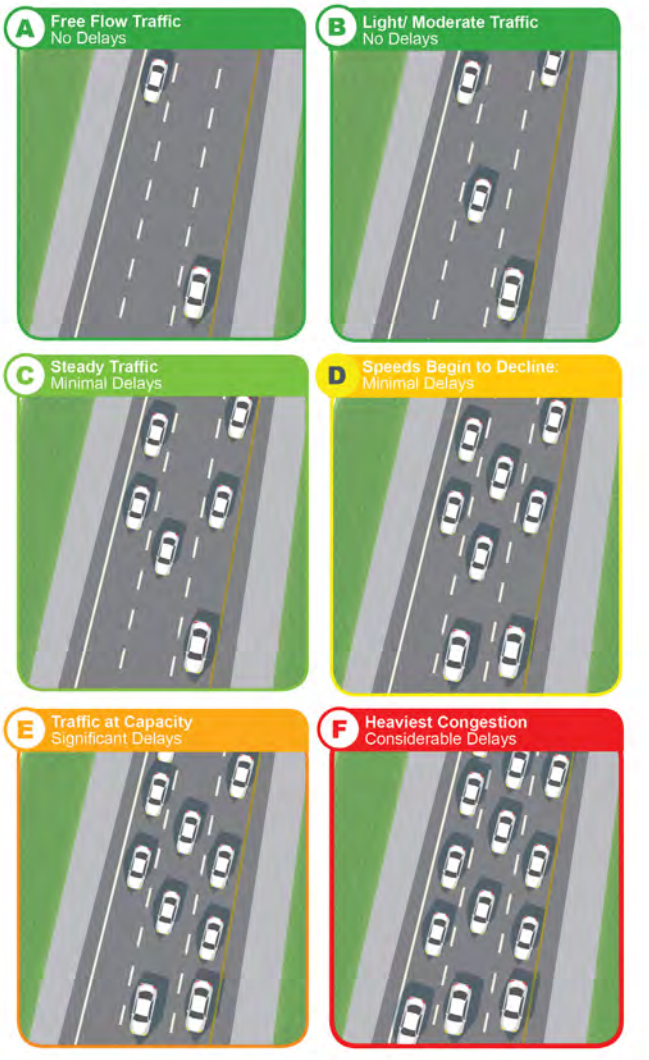
Vehicle capacity, as defined in the Highway Capacity Manual (HCM), is the maximum number of vehicles that can pass a given point during a specific period of time under prevailing roadway, traffic, and control conditions. Figure 3-8 illustrates the 2040 peak period volume-to-capacity (VC) ratios (obtained from the TSM) for each Interstate segment. Where the volume-to-capacity ratio is greater than 1.0, drivers experience poor operating conditions and high delay, represented as level-of-service (LOS) F (see Figure 3-9). According to the TSM output, I-26 currently operates very well – with all but one segment in Johnson City at LOS A and B. By 2040, segments of I-26, primarily between Johnson City and Kingsport, will begin to experience increased congestion, noted by LOS D. As indicated in red on Figure 3-8, one short segment of I-26 in the downtown Johnson City area is expected to reach capacity by 2040 and operate at LOS F.

Further investigation of this location revealed a short 1,400-foot distance between the eastbound on-ramp at SR-400 and eastbound off-ramp at SR-91. Close ramp spacing creates complicated weave areas, which tend to slow travel speeds during the AM and PM peak hours. It should be noted that the corresponding westbound lanes of I-26 have similar characteristics, and while they are not expected to reach capacity by 2040, traffic operations here should be monitored for similar operational issues.

It should be noted that the Kingsport MTPO 2040 and Johnson City MTPO 2045 LRTPs indicate that the following sections of I-26 will operate at LOS E or F in 2040/2045:

- I-26 at US-11W
- I-26 at SR-93
- I-26 between I-81 and Ford Creek Road, near the Sullivan/Washington county line
- I-26 between the Sullivan/Washington county line to near SR-381

Figure 3-9. LOS Characteristics



Transportation Systems Management & Operations (TSM&O)

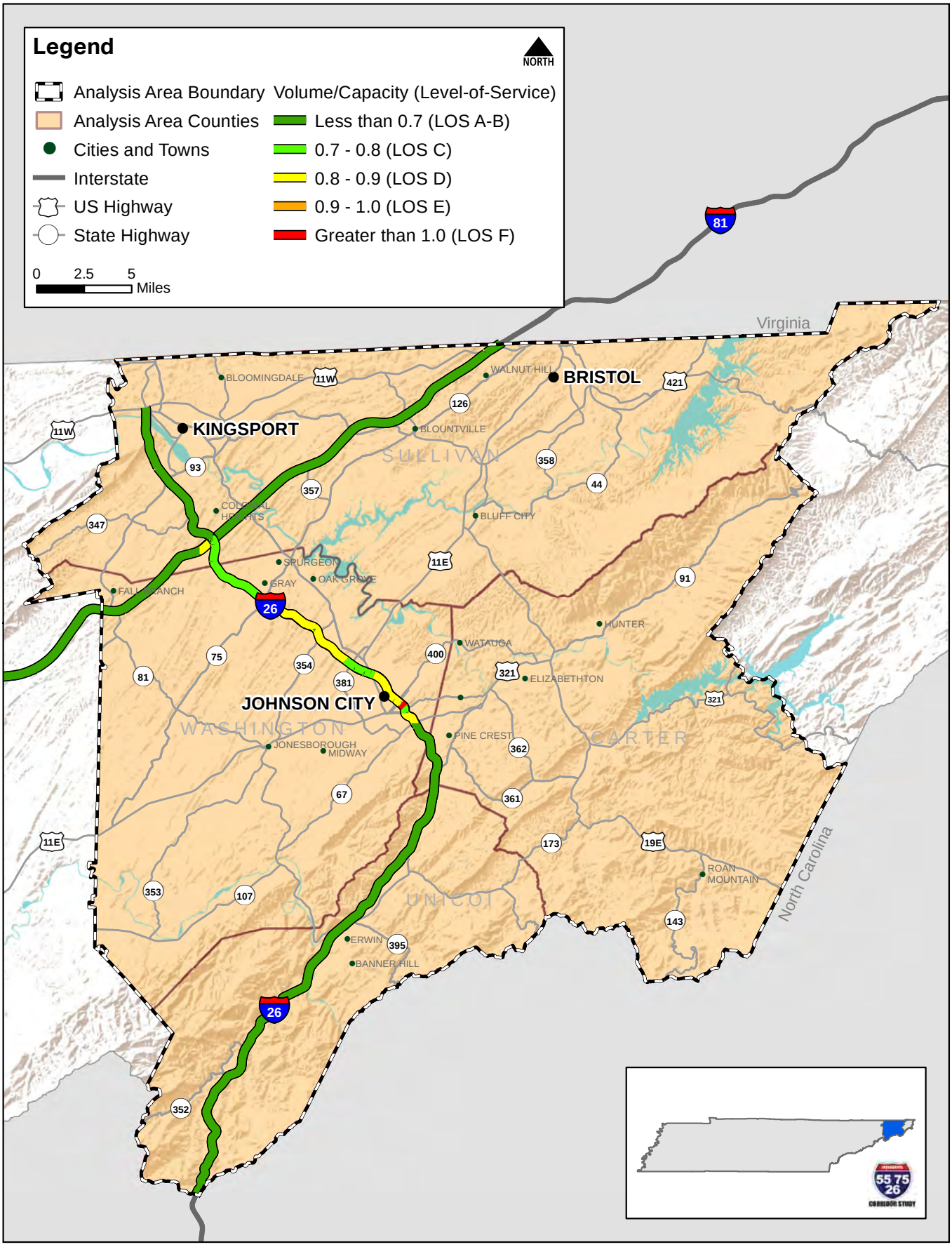
ITS

Intelligent Transportation Systems provide information which improves transportation safety, operations, and mobility. TDOT's ITS program, SmartWay, utilizes cameras and sensors to monitor interstate corridors throughout Tennessee. Approximately half of the I-26 corridor is rural in nature, and SmartWay technology is primarily concentrated in the urbanized areas.

Currently, SmartWay system elements are limited on the I-26 corridor. As shown in Figure 3-10, five Closed Circuit Television (CCTV) cameras monitor congestion on I-81 near the I-26 interchange, and two Digital Message Signs (DMS) visually communicate information to drivers. Highway Advisory Radio (HAR) transmitters broadcast messages to drivers on I-26 near the I-81 interchange. The Johnson City Traffic Division also operates and manages cameras along I-26. TN 511 provides traffic information and weather condition updates by phone throughout the corridor, and the SmartWay App provides real-time traffic information.

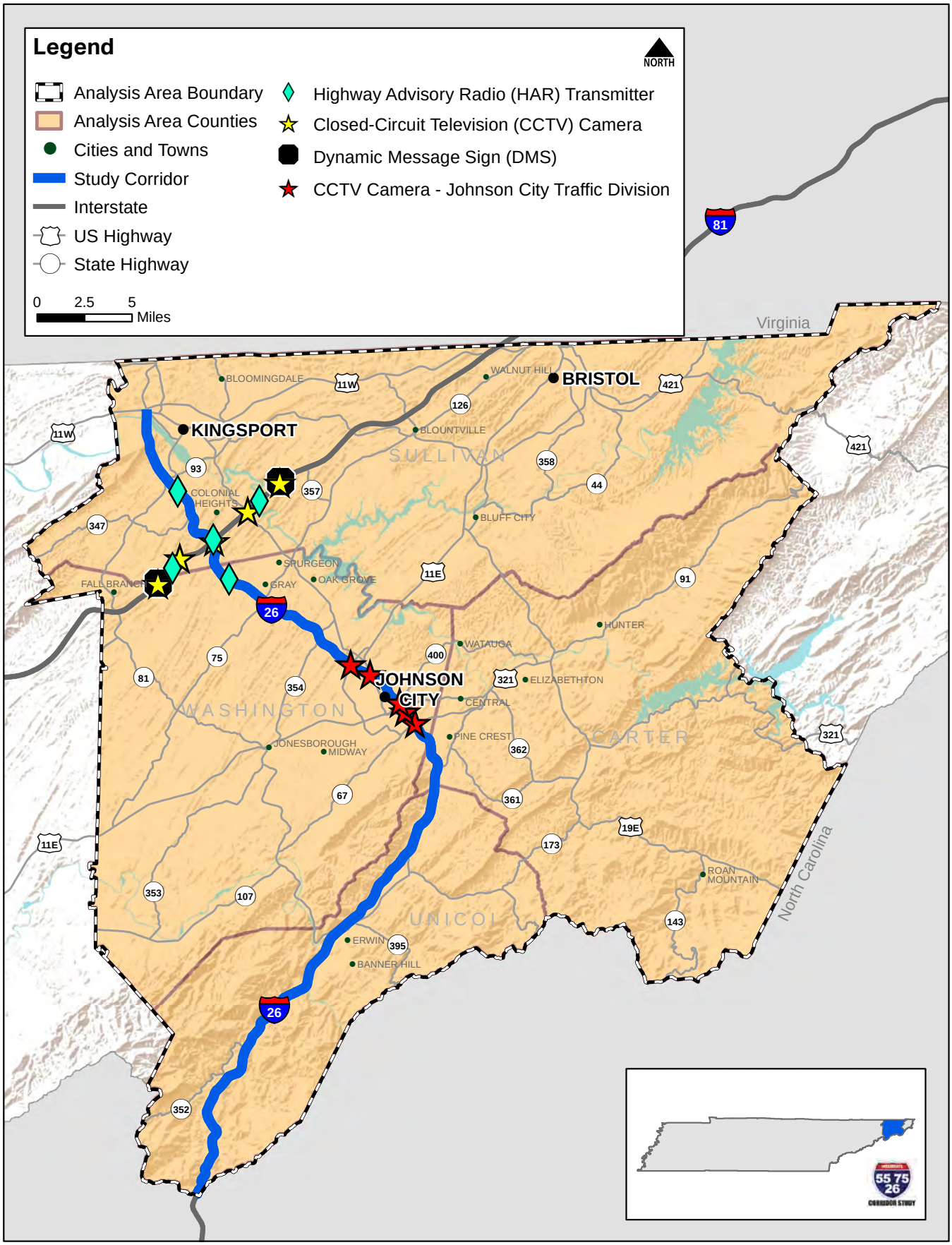
Johnson City and Kingsport have developed plans for and implemented intelligent transportation system (ITS) elements on the roadway network adjacent to I-26. The Johnson City ITS Architecture and Deployment Plan (updated in 2015), recommends projects ranging from speed monitoring deployment and flood detection/warning systems, to Traffic Operation Center (TOC) implementation, adaptive signal control, and SmartWay expansion. The Johnson City MTPO FY2017-2020 TIP includes Phase 1 of a project to add adaptive signal control on SR-381 in the vicinity of I-26.

Figure 3-8. Volume-to-Capacity Ratios/Level-of-Service (2040) — I-26



Source: Tennessee Statewide Travel Demand Model (TSM)

Figure 3-10. Intelligent Transportation System Components — I-26



Source: Tennessee Department of Transportation

The Kingsport ITS Architecture and Deployment Plan, which involved the Virginia Department of Transportation, was adopted in 2008 and additionally recommended speed monitoring systems, freeway off-ramp queue detection, and TDOT SmartWay deployment at the I-26/I-81 interchange. As mentioned above, the latter has been installed.

Traffic Incident Management

Responding to traffic incidents in an effective and timely manner reduces congestion, wasted fuel, and the likelihood of secondary crashes. The time it takes to respond to an incident and clear the roads is directly related to the likelihood of a secondary crash. This response time can be greatly reduced using ITS technologies, including monitored CCTV cameras, radar detectors to determine travel speeds, and DMS to direct/notify drivers. The highly coordinated incident management process requires accurate and efficient communication among numerous agencies.

TDOT's HELP program has been incorporating the latest ITS technologies and strategies since its inception in 1999. However, with exceptions for assistance during special events, HELP trucks are currently not deployed on I-26. As a result, scene management and crash clearance rest solely on law enforcement and first responders.

According to the Johnson City MTPO, at the request of the Kingsport and Johnson City MTPOs, TDOT installed 0.2 mile marker signs on I-26 in both the Kingsport and Johnson City urbanized areas. While these signs support the local first responders, maintenance of the 0.2 mile marker signs has become an issue. Stakeholders report that routine maintenance is not always timely.

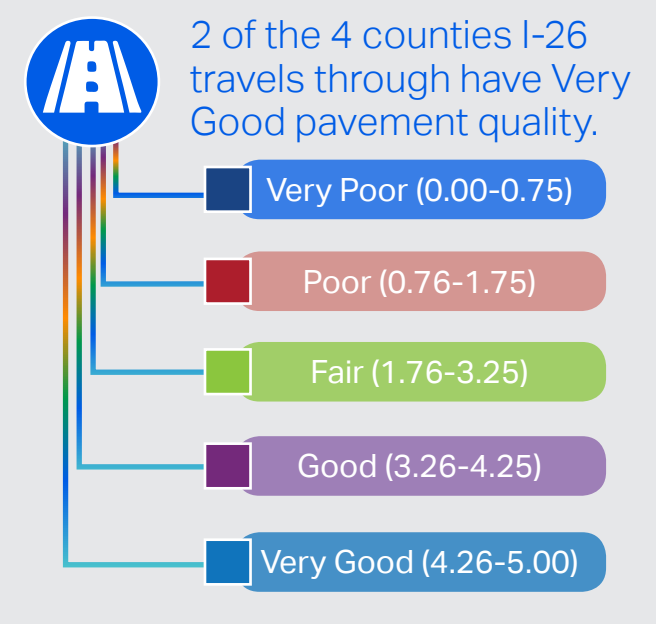
System Maintenance

Pavement

TDOT collects and maintains pavement management data for all roads included in the state's network. The Pavement Quality Index (PQI), expressed on a scale from 0-5, is the overall measure of a pavement's roughness and distress. The PQI is calculated based on both the Pavement Distress Index and the Pavement Smoothness Index, the latter of which is a function of the International Roughness Index (IRI). The IRI measures the number of vertical deviations over a section of road, and has been used as a performance measure toward goals set by the Federal Highway Administration (FHWA) since 1998. As of 2006, FHWA designated an IRI equal to 95 inches/ mile or less to be representative of a road with good ride quality.

Only 75% of I-26 roadway miles in Washington County meet FHWA's "Good" ride quality criteria. TRIMS maintenance history (as of 2017) illustrated in Figure 3-12, indicates that most of I-26 in Washington County was last resurfaced in 2002. Likewise, I-26 in Sullivan County and 11 miles in Unicoi County were last resurfaced in 2007. During a field review, pavement near Johnson City and Kingsport appeared to be recently resurfaced. The pavement along US-23, north of I-26, was observed to be in poor condition.

Figure 3-11. Pavement Quality Index

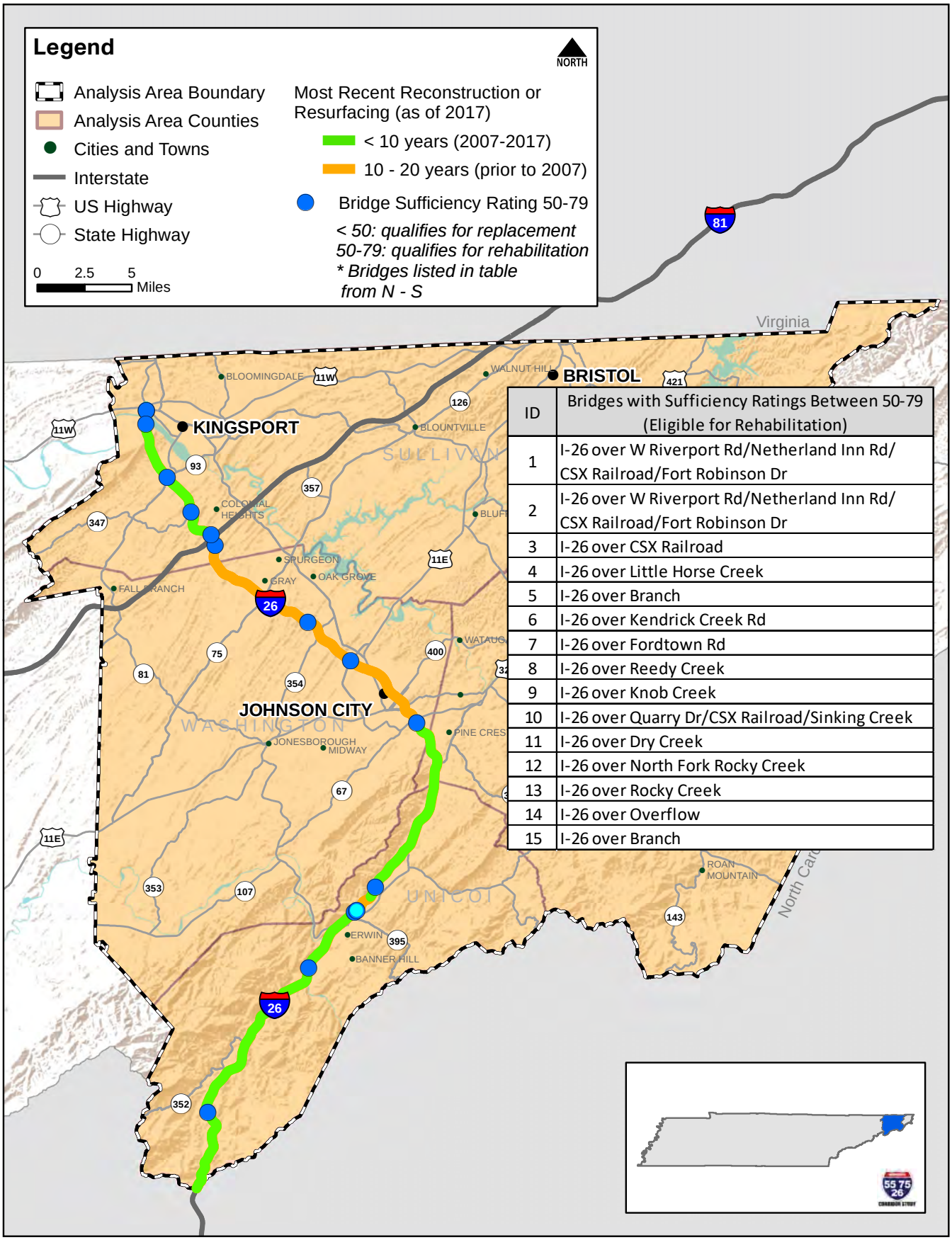


Bridge Conditions

TDOT routinely inspects and evaluates the 19,822 structures designated as public highway bridges in the state. These include bridges owned and maintained by TDOT, as well as those owned and maintained by local governments. TDOT designates a bridge as "structurally deficient" if one or more major structural components are rated in poor condition, or if its load carrying capacity is well below current design standards. Via the Better Bridge Program, the state addressed deficiencies on 193 of the 200 structurally deficient state-owned bridges in 2013. There are no structurally deficient bridges on the I-26 corridor.

The Federal Highway Administration's Highway Bridge Replacement and Rehabilitation Program provides funds to assist states in replacing or rehabilitating deficient highway bridges located on any public road. To be eligible, a bridge must carry highway traffic, be deficient, and have a sufficiency rating of 80 or less. The sufficiency rating of an individual bridge, on a scale of 0 to 100, is based on structural adequacy and safety, serviceability and functional obsolescence, and essentiality for public use. A rating of 0 is the worst possible bridge. A sufficiency rating that is less than 50 is eligible for replacement and a sufficiency rating of less than 80 but greater than 50 is eligible for rehabilitation.

Figure 3-12. Recent Reconstruction/Resurfacing, Bridge Sufficiency Ratings — I-26



ID	Bridges with Sufficiency Ratings Between 50-79 (Eligible for Rehabilitation)
1	I-26 over W Riverport Rd/Netherland Inn Rd/ CSX Railroad/Fort Robinson Dr
2	I-26 over W Riverport Rd/Netherland Inn Rd/ CSX Railroad/Fort Robinson Dr
3	I-26 over CSX Railroad
4	I-26 over Little Horse Creek
5	I-26 over Branch
6	I-26 over Kendrick Creek Rd
7	I-26 over Fordtown Rd
8	I-26 over Reedy Creek
9	I-26 over Knob Creek
10	I-26 over Quarry Dr/CSX Railroad/Sinking Creek
11	I-26 over Dry Creek
12	I-26 over North Fork Rocky Creek
13	I-26 over Rocky Creek
14	I-26 over Overflow
15	I-26 over Branch

Source: Tennessee Roadway Information Management System (TRIMS) - 2017

Of the 141 bridges on I-26 in the study area, only 15 have sufficiency ratings low enough to be eligible for rehabilitation under the Federal Highway Administration's program. The locations of these are shown on Figure 3-12. No bridges have sufficiency ratings low enough to be eligible for replacement.

Multimodal Facilities

Public Transportation

In the I-26 corridor, public transportation systems can be found in the form of on-demand paratransit services and fixed route bus services. Public transportation options are limited to the more densely populated areas of the study area including the cities of Kingsport and Johnson City (see Figure 3-13). Each of these cities offer a similar level of fixed route bus service and on-demand services to residents and visitors.

The Kingsport Area Transit Service (KATS) offers six fixed bus routes within the Kingsport area. While one of the four routes, Route 1, intersects I-26, none of the KATS routes run on the interstate itself. In addition to fixed route bus service, KATS also offers a dial-a-ride paratransit service, providing door-to-door next day service.

Johnson City Transit (JCT) offers seven fixed bus routes within the Johnson City area. While several of these JCT fixed bus routes intersect I-26, two routes run on the interstate itself:

- Orange North
- Silver

Each route has one bus running at a time and offers hourly service, with the exception of the Orange route which runs every 90 minutes. Most routes operate Monday through Friday from 6:15 a.m. to 6:15 p.m. and Saturdays from 8:15 a.m. to 5:15 p.m. Bus trips are $1.00 per ride, one way. In addition to the fixed route bus service, JCT offers an on-demand paratransit service called XTRA. This curb-to-curb service operates within the corporate limits of Johnson City, or within 3/4 mile of a JCT fixed route, whichever provides the farthest service to JCT patrons. Door-to-door service is provided on a case-by-case basis as needed. Fares for XTRA are $2.00 per one-way trip and $4.00 round trip.

Currently, there is one park and ride lot along the I-26 corridor located at the corner of North State of Franklin Road and West Oakland Avenue in Johnson City (see Figure 3-13). The Kingsport MTPO has recently undertaken a study to evaluate the feasibility of creating park and ride lots in the Kingsport metro area. The study will have recommendations including locations, destinations, shared costs and more.

Pedestrian/Bicycle

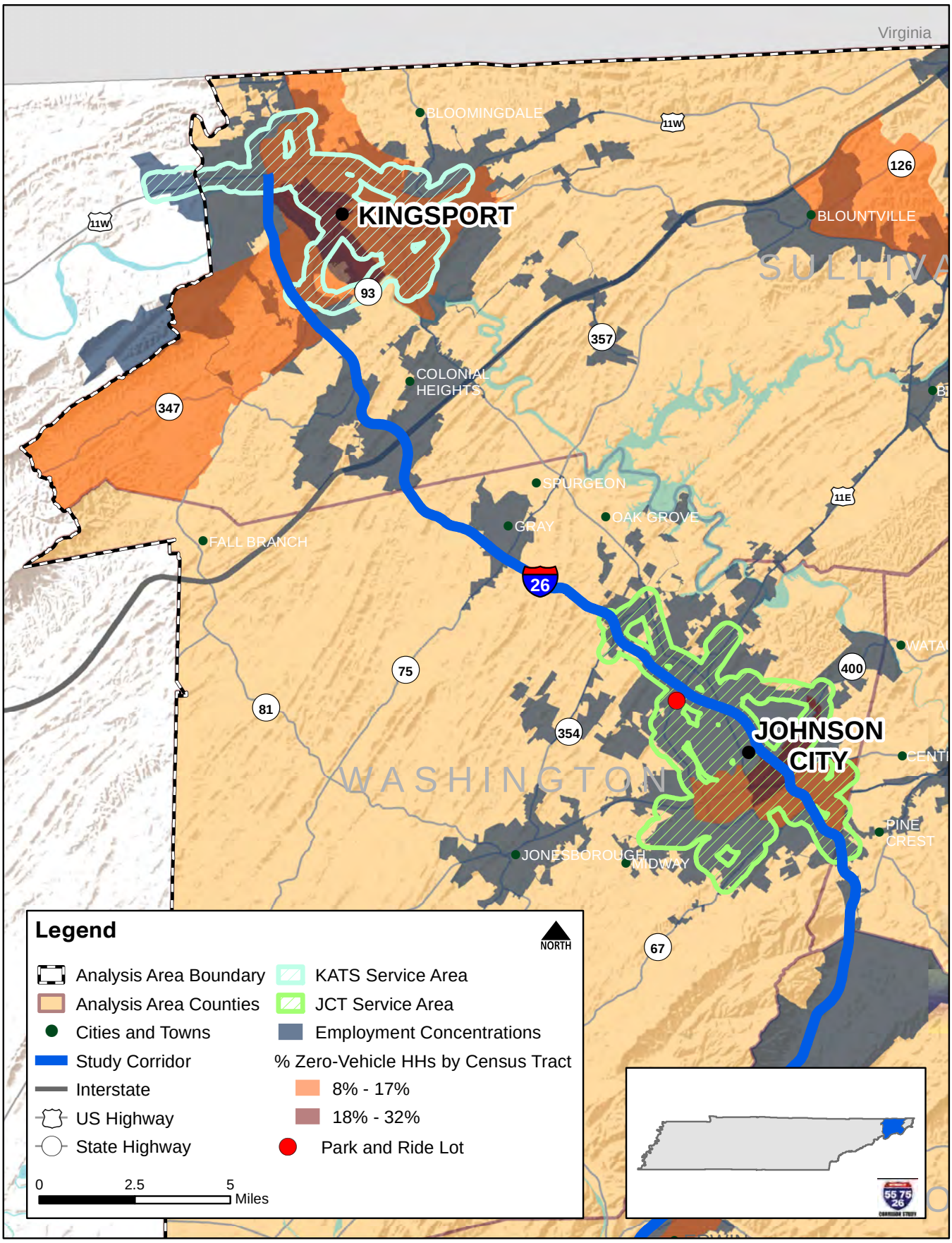
Unless planned for ahead of time, geometric limitations created by Interstate structures often result in discontinuous pedestrian and bicycle accommodations on cross-streets through an interchange. Where bicycle lanes and sidewalk may be present on either side of the Interstate, the cross-section through the interchange may be limited to only vehicular traffic, which discourages multi-modal connectivity. Furthermore, ramp intersections often create bicycle lanes and sidewalk paths that are difficult to navigate, and in some cases unsafe. As shown in Figure 3-14 and Table 3-2, I-26 interchanges with U.S. and state routes were evaluated to assess connectivity for pedestrians and bicyclists across the Interstate. Where pedestrian and bicycle accommodations existed on the cross-street, free-flow right turns at ramp interchanges were also noted. While free-flow right turns have operational benefits, the movement allows vehicles to maintain higher rates of speed off the ramp and through the intersection, putting pedestrians and bicyclists at a disadvantage. Motorists traveling at higher speeds are less likely to yield to pedestrians and higher intersecting speeds are more difficult for bicyclists to judge and manoeuvre. AADT on the cross-roads was also noted as higher traffic volumes limit mobility for pedestrians and bicyclists.

Noteworthy are the interchanges of I-26 with the two proposed state bicycle routes: SR-400 and US-11W/SR-1. SR-400 crosses I-26 as one-way pairs, through two interchange structures. No bicycle lane is designated; however, sidewalk and a wide outside lane are present. US-11W/SR-1 carries sidewalk through the interchange; however, no paved shoulder or bicycle lane is present. AADT volumes near this interchange approached 30,000 vpd in 2018.

Transportation Demand Management

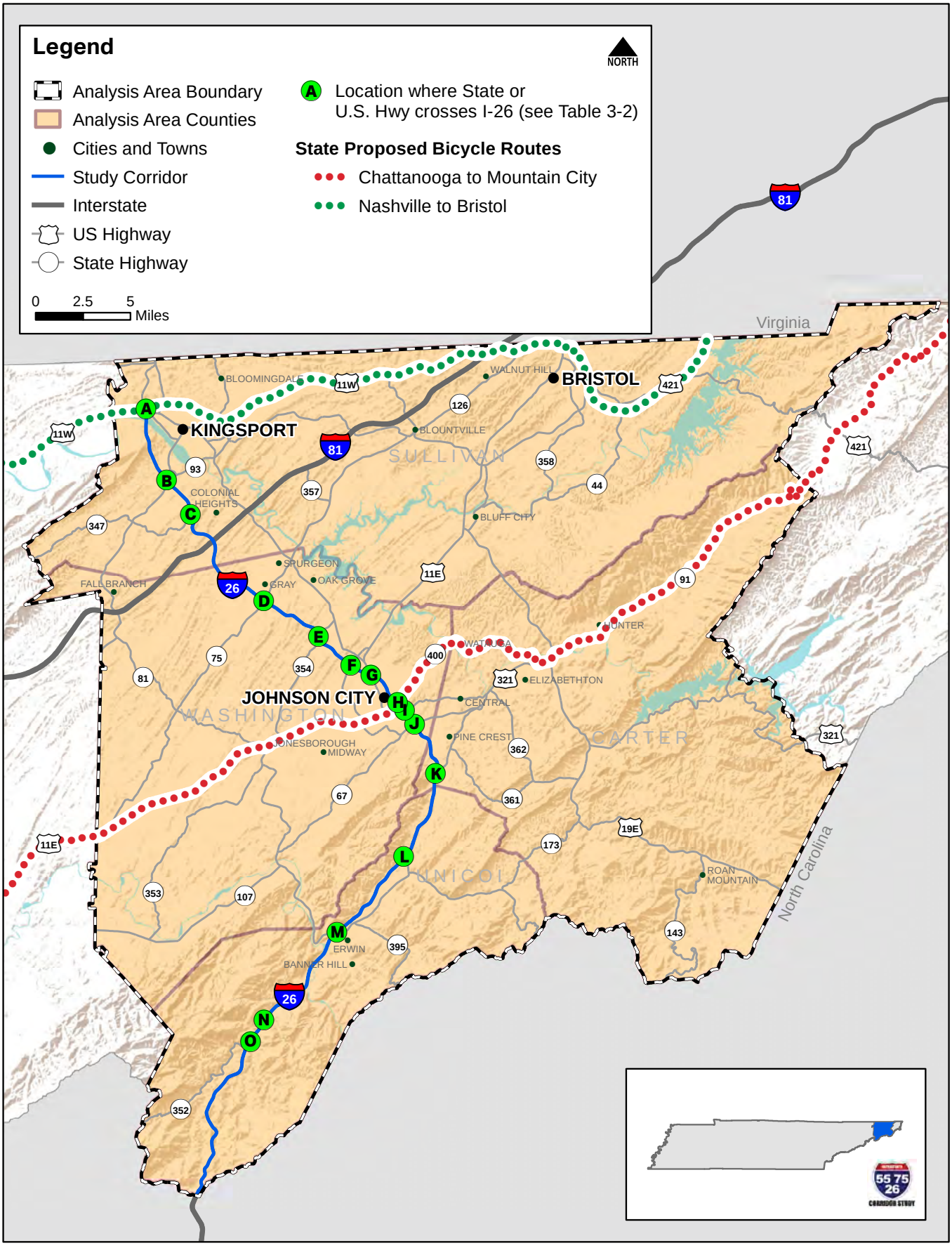
Transportation Demand Management (TDM) is a set of strategies that influence travel behavior to reduce single-occupancy vehicle travel. Ranging from ridesharing, bicycling, teleworking, taking transit, car sharing and on-demand or real-time applications, TDM strategies redistribute commuter travel across a variety of alternatives and away from daily peak periods. TDM programs represent a flexible, low-cost way to engage residents, travelers, businesses and local governments in the effort to reduce commuter travel and associated costs and impacts on the community including traffic congestion and emissions. The Statewide TDM Plan identified a number of ways regional TDM programs can support TDOT with managing mobility. They can also provide needed assistance on selected corridors when capacity is at a premium – especially during large construction projects. The I-26 corridor does

Figure 3-13. Transit Operations and Park-and-Ride Lots — I-26



Source: U.S. Census Bureau, Kingsport Area Transit Service, Johnson City Transit

Figure 3-14. Planned State Bicycle Routes and U.S./State Route Crossings — I-26



Source: Tennessee Department of Transportation

Table 3-2. Locations Where a U.S. or State Route Crosses I-26

Map Letter	State Route/U.S. Hwy Crossings	Crossroad AADT (2018)	Bicycle Lane/ Multi-Use Path?	Paved Shoulder >2'?	Sidewalk?	Free-Flow Right with Bicycle/Ped Facilities?
A	SR-1/US-11W (W. Stone Dr.)	29,500 (E)*	No	No	Yes	Yes
B	SR-93 (Wilcox Dr.)	25,500 (E) 13,400 (W)**	No	Yes	No	N/A
C	SR-347 (Rock Springs Rd.)	4,600 (E) 8,300 (W)	No	No	No	N/A
D	SR-75 (Bobby Hicks Hwy)	19,300 (E) 14,500 (W)	No	Yes	No	N/A
E	SR-354 (Boones Creek Rd.)	16,800 (E) 20,500 (W)	Yes	Yes	No	Yes
F	SR-381 (State of Franklin Rd.)	17,100 (E) 27,100 (W)	Yes	Yes	No	Yes
G	SR-34/US-11E (North Roan St.)	23,800 (E)	No	Yes	No	N/A
H	SR-400/ E. Watauga Ave./ E. Unaka Ave. (one-way pairs)	6,100 (W) 6,100 (W)	No	Wide Outside Lane	Yes	No
I	SR-91/ E. Market St./ E. Main St. (one-way pairs)	6,900 (E) 7,100 (W)	No	Wide Outside Lane	Yes	No
J	SR-67/US-321 (University Pkwy)	25,300 (W)	No	Yes	No	N/A
K	SR-359 (Okolona Rd.)	6,600 (E)	No	Yes	No	N/A
L	SR-173	5,700 (E)	No	Yes	No	N/A
M	SR-81/SR-107 (2nd Street - Erwin)	8,600 (E)	Yes (Ends at SB Ramps)	Yes	Under Structure Only	No
N	SR-36/US-19W (Dewey Frye Rd.)	No Counts	No	Yes	No	N/A
O	SR-352 (Old Asheville Hwy)	1,800 (E) 1,100 (W)	No	No	No	N/A

* East approach; ** West approach

Source: TDOT Traffic History website, Google Earth

not currently contain an urban area TDM program. Additionally, the region could benefit from additional park-and-ride lots and vanpool programs, potentially between Johnson City and Kingsport.

Safety

Increased traffic volumes and vehicle miles traveled increase the likelihood of traffic incidents. To identify trends in potential safety issues along the I-26 corridor, five-year (2014-2018) crash data was collected from TRIMS and evaluated.

Tennessee is working to reduce traffic fatalities as part of the nation's vision Toward Zero Deaths®. This vision is a highway system free of fatalities.

Figure 3-15. I-26 Safety Snapshot

Using TDOT's traffic volumes collected in 2018, crash rates were also calculated. These rates are reported in terms of crashes per million vehicle miles traveled. Figure 3-16 shows the comparison of these rates to the statewide averages for facilities of a similar type. More specifically, the statewide average crash rate is 0.528 crashes per million vehicle miles traveled for rural freeways and 1.112 crashes per million vehicle miles for urban freeways. I-26 crash rates were compared to the Tennessee statewide averages based on the following metrics:

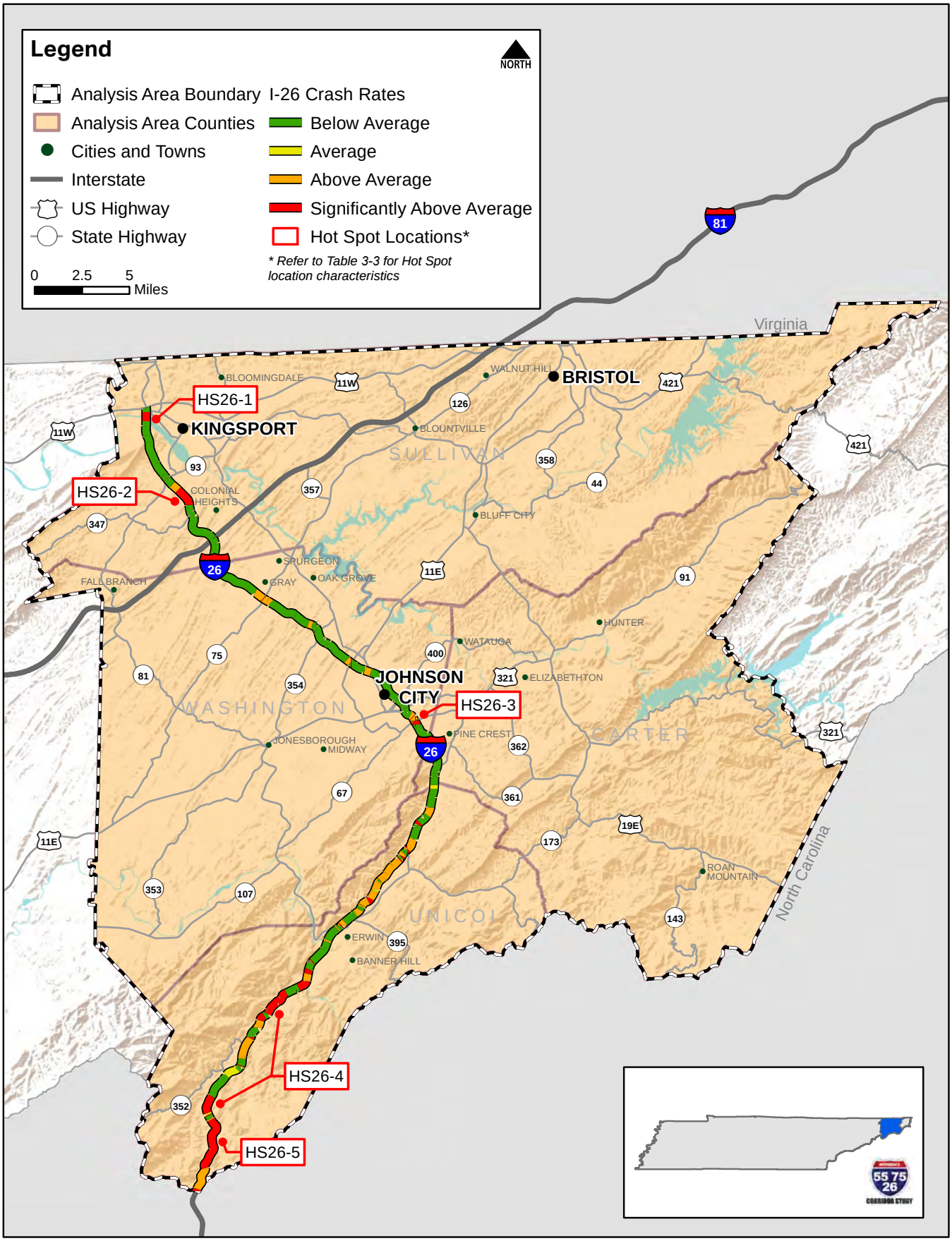
- **Below Average**: Locations with crash rates below the statewide average
- **Average**: Locations with crash rates at or within 15 percent above the statewide average
- **Above Average**: Locations with crash rates between 15 and 100 percent above the statewide average
- **Significantly Above Average**: Locations with crash rates greater than or equal to 100 percent higher than the statewide average

Areas where the crash rates were significantly above statewide averages were identified as hot spots and are shown in Figure 3-16 in red. Hot spots crash records were examined to discern if patterns indicated deficiencies that could be addressed. Table 3-3 shows the results of this analysis. In general, each of the hot spots were examined for trends in severity, prevalent collision types, non-vehicular accident events, lighting/weather conditions, relation to ramps and interchanges, as well as horizontal and vertical curvature. From these trends, potential crash factors were identified for each location, which ultimately informed the development of safety project solutions.

It should be noted that improvements to I-26 at the SR-67 interchange in Johnson City were completed in 2018 (PIN#112457.00). The project included an auxiliary lane on I-26 eastbound, an auxiliary lane on SR-67 northbound, improvements to the I-26 westbound off-ramp, signal modification at the ramp intersections, and lighting on I-26 eastbound. It is assumed that these improvements address deficiencies identified as safety hot spot H26-3.

Pedestrians and bicycle crashes within 500 feet of an interchange ramp were also analyzed for the 5-year period. In total, there were nine crashes involving a pedestrian or bicyclist, all of which occurred near downtown Johnson City. Of these three involved bicyclists and six involved pedestrians.

Figure 3-16. Crash Rates (2014-2018) — I-26



Source: Tennessee Statewide Travel Demand Model

Table 3-3. Hot-Spot Crash Location Characteristics – I-26

	Hot Spot ID				
	HS26-1	**HS26-2**	**HS26-3**	**HS26-4**	**HS26-5**
Termini	US-11W/ W. Stone Drive to Meadowview Parkway	SR-93/Wilcox Drive to SR-347/Rock Springs Road	SR-91/ E. Market Street to US-321/University Parkway	Various spot locations in Unicoi County (north of Flag Pond)	Various spot locations in Unicoi County (north of Flag Pond)
Number of Crashes	185	211	48	117	94
Severity (Fatal or Injuries)	22% (41)	25% (52)	10% (5)	21% (25)	32% (30)
Prevelant Collision Types	14% (25) Angle 67% (124) Non-Vehicle 12% (23) Rear-End	10% (22) Angle 68% (143) Non-Vehicle 13% (28) Rear-End	35% (17) Non-Vehicle 50% (24) Rear-End 13% (6) Sideswipe	85% (99) Non-Vehicle	96% (90) Non-Vehicle
Non-Vehicle Trends	56% (70) Roadway Barrier 22% (27) Animal	59% (84) Roadway Barrier 10% (21) Animal	35% (6) Roadway Barrier	61% (60) Roadway Barrier 21% (21) Animal	69% (62) Roadway Barrier
Lighting/ Weather	30% (55) in Dark-Unlit Conditions 25% (46) in Rain/Snow	28% (59) in Dark-Unlit Conditions 27% (56) in Rain/Snow	4% (2) in Dark-Unlit Conditions 25% (12) in Rain/Snow	34% (40) in Dark-Unlit Conditions 26% (30) in Rain/Snow	39% (37) in Dark-Unlit Conditions 46% (43) in Rain/Snow
Interchange Related	15% (28)	13% (28)	38% (18)	7% (8)	3% (3)
Curvature Issues	N/A	Horiz.: 2% (5) Grade: 4% average	Grade: 3% average	Horiz.: 69% (81)	Horiz.: 74% (70) Grade: 5% average
Potential Crash Factors	• Animal crossings from nearby nature preserve • Inadequate lighting at interchange • Small inside shoulder width near roadway barriers • Inadequate signage at interchange	• Inadequate lighting at welcome center ramps/exits • Small inside shoulder width near roadway barriers	• Uphill acceleration required on EB I-26 from SR-91/E. Market Street • Weaving on EB I-26 due to minimal sight distance between the end of acceleration lanes and US-321 (University Parkway)	• Curvature/speeding at night and/or in bad weather conditions	• Curvature/speeding at night and/or in bad weather conditions

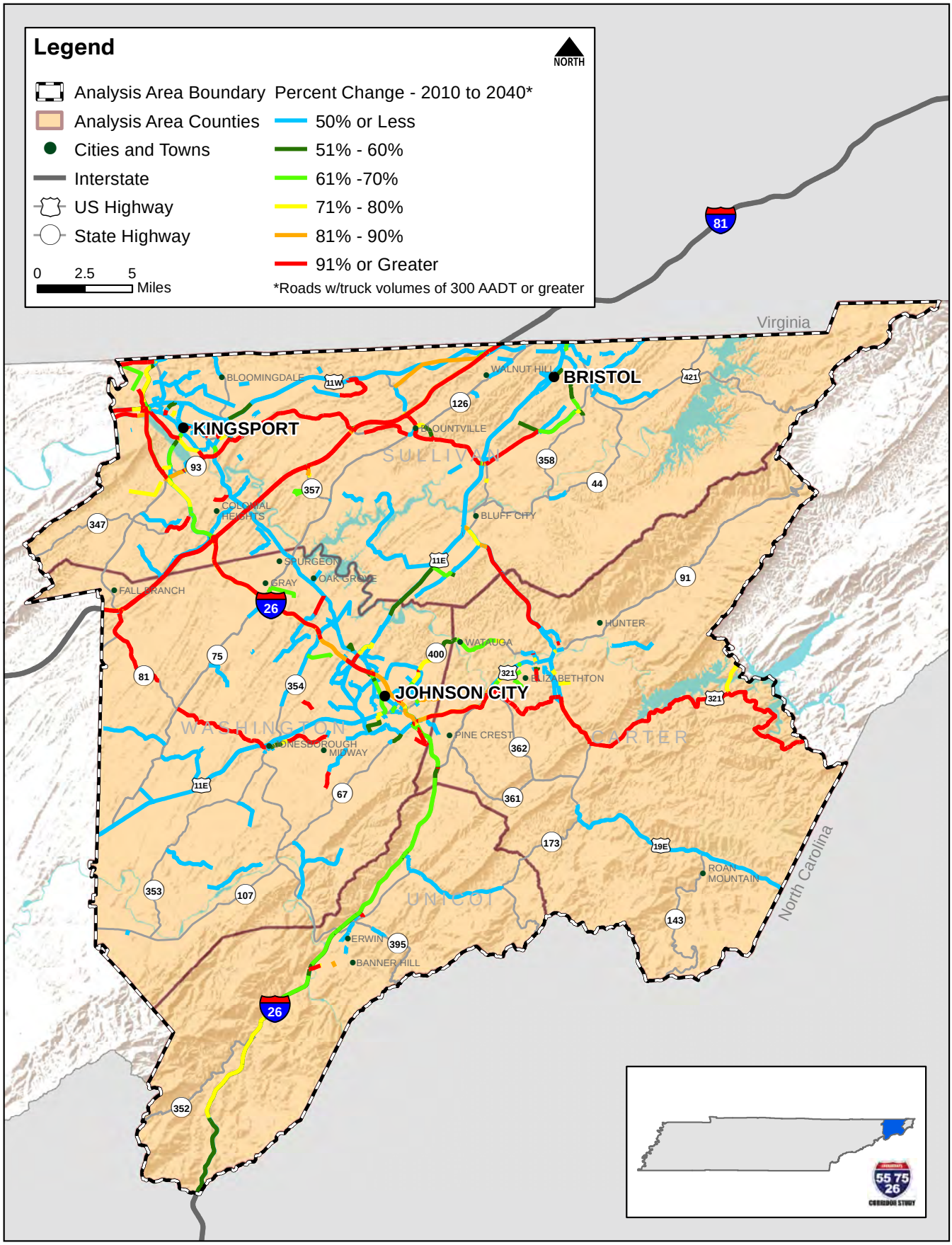
Source: Tennessee Roadway Information Management System (TRIMS) - 2017

Freight

Freight movement is an important element of a regional and national economy, as more efficient modes and routes enable improved logistics and result in reduced transportation costs. These cost savings can then be reallocated to growth, providing better jobs and higher wages in the area. Truck is the primary mode of transporting freight in the I-26 corridor, accounting for nearly 100 percent of inbound and outbound freight in the study area in 2016. Truck volumes are expected to grow by at least 61 percent from 2010 to 2040, with the portion north of Johnson City to south of the Virginia state border growing at a faster rate of 91 percent as shown in Figure 3-17. Parallel corridors are also showing high growth, indicating that traffic is and will continue diverting to other routes as a result of the lower level-of-service on I-26 between Johnson City and Kingsport (shown in Figure 3-18). The corridor sees high volumes of through traffic with between one and five million tons annually, with heavier volumes near Johnson City. The corridor has limited public and private truck parking with just two welcome centers and one private parking location.

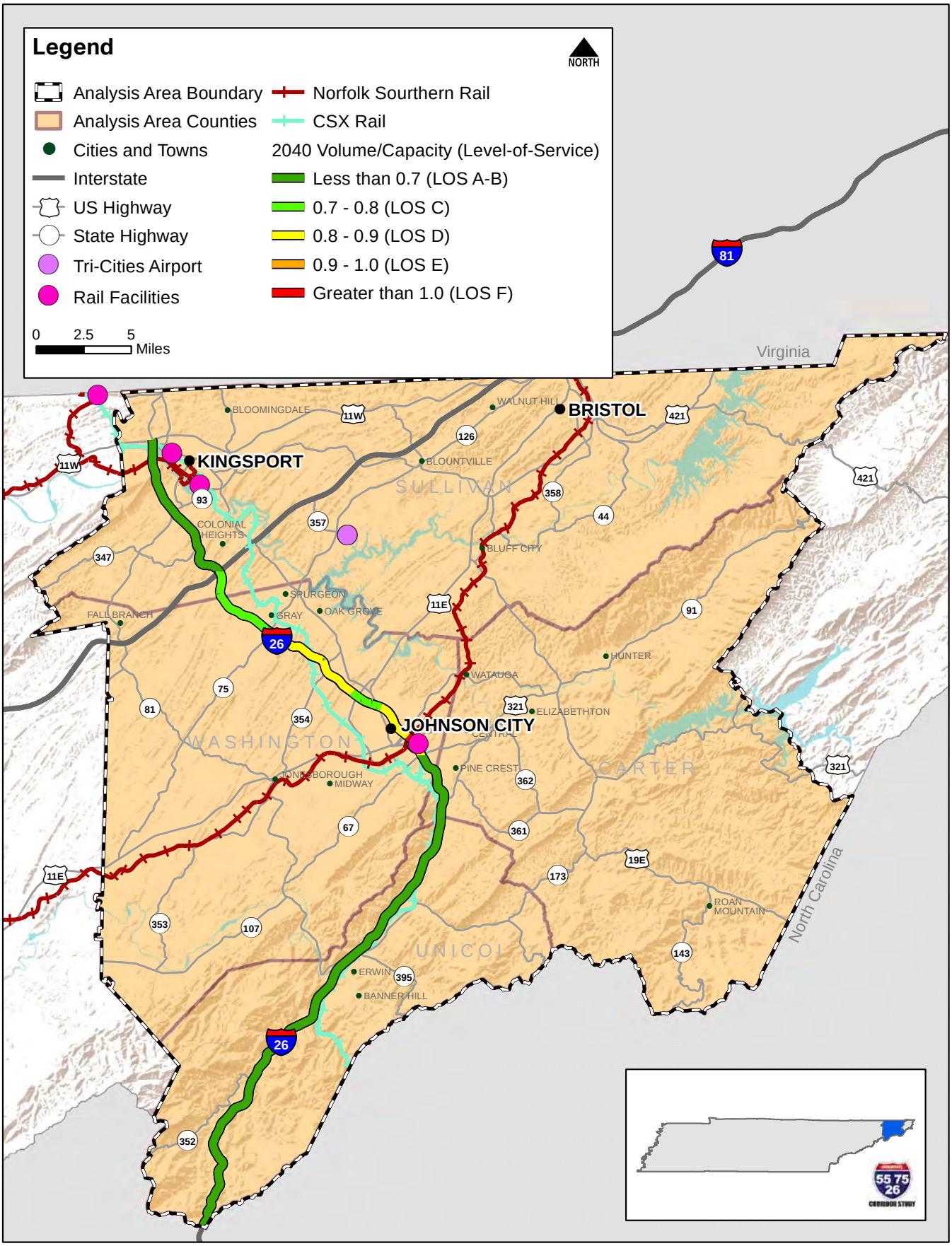
As noted in the Tennessee Statewide Multimodal Freight Plan (2018), changes to the I-26 corridor study area are recommended in the form of elimination of bottleneck locations, interchange improvements, and implementation of intelligent transportation systems (ITS). Additionally, truck parking is a critical need for the I-26 corridor.

Figure 3-17. Growth in Truck Volume from 2010 to 2040 — I-26



Source: Tennessee Statewide Travel Demand Model

Figure 3-18. Freight Facilities — I-26



Source: InfoUSA and Tennessee Statewide Travel Demand Model

A. Bottleneck Locations: The Tennessee Freight Plan lists three potential bottleneck locations on the I-26 corridor. All involve steep grades through mountainous terrain:

- Between US-11W and Meadowview Parkway in Sullivan County
- Between Flag Pond Road and the North Carolina State Line in Unicoi County
- At Clear Branch Access in Unicoi County

B. Interchange Upgrades: Four interchange upgrades are listed in the Tennessee Freight Plan. These projects are in various stages of planning, construction and completion:

- An interchange modification is needed in Washington County at I-26 and SR-354. The project location is on a Critical Freight Corridor (CFC) of the National Highway Freight Network (NHFN). The CFCs are delineated into rural and urban corridors that provide important connections to Interstates, ports, public transportation facilities, and intermodal freight facilities. The project has begun and has an estimated completion date of fall 2020.
- Completed in 2018, the interchange upgrade at I-26 and SR-67 in Washington County added an auxiliary lane and widened eastbound I-26. The interchange is also on the CFC.
- Reconstruction of the I-81/I-26 interchange is needed to improve safety. TDOT is also assessing short-term solutions, but reconstruction may be necessary. This project scored as a low priority state project in the 2018 Freight Plan.
- Reconstruction of intersections and interchanges between I-26 and West Stone Drive on John B. Dennis Highway (SR-93). The project would improve traffic flow, upgrade signals, and improve geometry thereby increasing economic efficiency, productivity and competitiveness, reducing congestion, and improving safety, security, and resilience. The project is estimated to cost $1.7 million and scored as a low priority state project.

C. ITS Projects: Proposed ITS projects as found in the Tennessee Freight Plan are listed below.

- Expansion of ITS options along I-81 between I-26 and the Virginia State Line. The project would improve economic efficiency, productivity, and competitiveness, reduce congestion, improve safety, security, and resiliency, improve state of good repair, use advanced technology, and reduce adverse and burdensome impacts. It is estimated to cost $1.8 million and is scored as a medium priority state project.

D. Truck Parking: Truck parking is a critical component of supply chain operations. Hours of service rules state that drivers must stop after 14 hours; therefore, it is important that drivers are offered a selection of locations throughout their journey where they can rest and possibly eat, shower, or sleep overnight. Without proper rest, drivers risk fines and crashes, jeopardizing the safety of all road users, especially in mountainous corridors like I-26. Drivers often spend the last hour of their driving time looking for a place to park. In the absence of available truck parking, trucks often stop on highway on- and off-ramps, which is both unsafe and illegal. As of 2015, Tennessee had one of the lowest rates of commercial vehicle truck parking spaces per 100,000 miles of combination truck vehicles miles of travel (VMT) in the nation, at less than 60.[1]

The website www.truckstopguide.com does not list any truck stops along I-26 in TN. The closest truck stop along the I-26 corridor is in Hendersonville, North Carolina, which is approximately 90 minutes from Johnson City. Some public truck parking exists at the Welcome Centers in Unicoi (27 spots) and Kingsport (13 spots) and at Sam's Gap Hill (13 spots), but these are not sufficient and may not provide adequate amenities. Parking at the welcome centers, for example, is limited to 2 hours maximum. According to the FHWA Model Development for National Assessment of Commercial Vehicle Parking[2], this segment of I-26 should have 25 rest area parking spots and 81 truck stop parking spots. In addition, with the exception of the Kingsport Welcome Center, existing truck parking is not located near the population centers that are the origins and destinations of most truck traffic. While more parking overall is necessary, parking within the urban core has the additional benefit of reducing the number of inbound trucks during the morning peak hours.

Deficiencies Summary

As detailed in the previous subsections, this study identified and evaluated existing and forecast transportation deficiencies in the I-26 corridor based on extensive plans review, data analysis, and stakeholder outreach. The identified deficiencies are summarized, by mode or strategy, in Table 3-4. In addition to the location and description of each deficiency, Table 3-4 shows the source by which each deficiency was identified.

1- https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/jasons_law/truckparkingsurvey/ch2.htm
2- https://www.fhwa.dot.gov/publications/research/safety/01159/3.cfm

Table 3-4. Deficiencies Summary — I-26

Mode/ Strategy	Location	Issues/Deficiency	Source
Highway Capacity	I-81 Interchange	Congestion & safety issues due to ramp geometry / weaving	Public/Stakeholder
	SR-75 Interchange	Congestion	Public/Stakeholder
	SR-354 Interchange*	Congestion & safety problems	Public/Stakeholder
	SR-381 Interchange	Congestion & safety problems	Public/Stakeholder
	Eastbound I-26, from SR-400 to SR-91	TSM predicts segment to be overcapacity by 2040. Short weave distance between ramps.	Data Analysis
Safety	US-11W to Meadowview Pkwy	Animal crossings from adjacent nature preserve; inadequate lighting and signage at interchange; small inside shoulders	Data Analysis; Public/ Stakeholder
	SR-93 to SR-347	Inadequate lighting at welcome center ramps; small inside shoulder width near roadway barriers	Data Analysis; Public/ Stakeholder
	Various spot locations in Unicoi County	Curvature; speeding at night and/or in bad weather conditions	Data Analysis; Public/ Stakeholder
	SR-91 Interchange	Pedestrian/bicycle crashes near the ramp intersections	Data Analysis
TSM&O	Kingsport & Johnson City Urbanized Areas	Need for additional CCTV & DMS	Public/Stakeholder
	Throughout Corridor	Need for systems to improve incident management response time	Public/Stakeholder
	Throughout Corridor	HELP Truck Deployment	Public/Stakeholder
	Throughout Corridor	Maintenance of signs & median cable barrier	Public/Stakeholder
Freight	US-11W to Meadowview Pkwy	Grade-related potential bottleneck	Tennessee Freight Plan
	Between Flag Pond Rd and the NC State Line	Grade-related potential bottleneck	Tennessee Freight Plan
	Near Clear Branch Access	Grade-related potential bottleneck	Tennessee Freight Plan
	SR-93 to SR-347	Grade-related potential bottleneck	Kingsport MTPO 2040 LRTP
	Between SR-354 and SR-381	Potential bottleneck	Tennessee Freight Plan
	I-81 Interchange	Reconstruction needed to improve freight safety	Tennessee Freight Plan
	Throughout Corridor	Need for additional truck stop parking spaces	Data Analysis
Multimodal	Kingsport to Johnson City	Need for commuter service between these locations.	Data Analysis / JCT Comprehensive Operations Analysis
	Throughout Corridor	Only one park-and-ride lot available	Data Analysis
	SR-400 Interchange	Proposed State Bicycle Route; No designated bicycle lane.	Data Analysis
	US-11W Interchange	Proposed State Bicycle Route; No paved shoulder or bicycle lane	Data Analysis
	US-11W Interchange, SR-381 Interchange	Free-flow right turns from exit ramps with sidewalk on cross-street	Data Analysis
Economic Development	Eastern Star Rd to SR-75	Potential for new interstate access	Public/Stakeholder
	I-81 Interchange	Improvements to accommodate nearby future development	Public/Stakeholder
	Downtown Johnson City Interchanges	Improvements to accommodate urban infill and redevelopment	Public/Stakeholder

*Programmed interchange modification to a Diverging Diamond Interchange is under construction.

4. Multimodal Solutions/ Universe of Alternatives

Introduction

Following the identification and analysis of corridor transportation deficiencies, the study developed goals for the corridor and performance measures used to assess the effectiveness of various solutions to those problems. A universe of alternatives, or potential solutions, was developed. The universe of alternatives was organized based on the issues each potential solution addresses, including safety, traffic congestion, freight movement, and multimodal travel. Many of the solutions may benefit more than one aspect of travel in the corridor. Ultimately, selected solutions were assembled into a Build (2040) scenario that accounted for their impacts on regional travel.

30 potential solutions for the I-26 corridor are discussed in this report

Performance Measures

Goals for potential improvements along the I-26 corridor were selected to reinforce the three strategic emphasis areas in TDOT's 25-Year Long-Range Transportation Plan: efficiency, effectiveness, and economic competitiveness. As shown in Table 4-1, the five identified goals were further developed into 12 specific objectives, intended to guide development and evaluation of possible solutions. In order to evaluate how well a potential solution satisfies an objective - and ultimately a goal - measures must be established that are data driven and comparable across the Base (2010), Trend (2040) and Build (2040) scenarios. Table 4-2 outlines the performance measures established for the I-26 corridor. As indicated, the measures fall into four categories (Traffic Operations, Safety, Operations & Maintenance, and Multimodal), which directly support the objectives identified in Table 4-1.

Traffic Operations Alternatives

As indicated in Section 3 of this report, TSM analysis of the 2040 Trend scenario identified one location for more detailed traffic operations analyses and evaluation of possible solutions: eastbound I-26 between SR-400 and SR-91.

Table 4-1. Performance Goals and Objectives — I-26

Goals	Objectives		
Provide efficient and reliable travel	Improve travel times and reduce delay	Provide transportation options for people and freight	Optimize freight movement
Improve safety conditions	Reduce crash rates along the corridor – especially at identified crash "hot spots"	Implement or upgrade technologies that promote safety and effective incident management	Improve bicycle and pedestrian accommodations
Coordinate transportation investments with economic development plans	Improve interchange on/ off ramps	Coordinate with MPOs/ RPOs to determine areas where new/improved Interstate access is needed	
Invest equitably throughout the corridor	Expand transportation options for traditionally underserved populations within the corridor	Consider regional transit options	Identify areas with the greatest data-driven needs
Protect the natural environment and sensitive resources within the corridor	Identify transportation improvements that are not likely to result in major impacts to environmental, social, and cultural resources		

Table 4-2. Performance Measures — I-26

Goal	Performance Measure		Unit
Traffic Operations	Traffic on interstate operates at LOS D or better		% of interstate operating at LOS D or better
	Total Daily Vehicle Miles Traveled (VMT)		Miles (1,000s)
	Total Daily Vehicle Hours of Travel (VHT)		Hours (1,000s)
	Total Peak Hour Vehicle Hours of Delay (VHD)		Hours
	Total VMT / Trip		Miles
	Total Vehicle Minutes Traveled / Trip		Minutes
	Average Peak Hour Travel Speed	Urban Interstate	MPH
		Rural Interstate	MPH
	Congested Travel Time between key O&D Pairs along Corridor (Total)		Minutes
	Peak Hour Density at Improved Interchanges		Vehicles/Mile/Lane
	Average and Max Queues at Improved Interchanges		Feet
Safety	Crash reduction in safety "hot spots"		Above or Below Average Crash Reduction Potential
Operations & Maintenance	Bridge Condition (Sufficiency Rating)		% of bridges < 50
			50 < % of bridges < 80
	Pavement Condition (Resurfacing)		% of corridor resurfaced within the last 10 years
Multimodal	Pedestrian and Bicycle Accommodations at U.S. and State Route Interchanges		% interchanges with bike facilities
			% interchanges with ped. facilities
	Freight (Truck Parking)		# of Rest Area Spots
			# of Truck Stop Spots

The projected 2040 PM peak period volumes for this segment exceed the capacity of the existing facility. Additionally, the short 1,400-foot distance between the eastbound on-ramp at SR-400 and eastbound off-ramp at SR-91 creates a complicated weave area, which is expected to slow travel speeds during the AM and PM peak hours. It should be noted that the corresponding westbound lanes of I-26 have similar characteristics, and while they are not expected to reach capacity by 2040, traffic operations here should be monitored for similar operational issues. Possible solutions address the weave area by implementing one of the following four options:

1. Providing more distance between the on- and off-ramps
2. Constructing a collector-distributor road
3. Separating movements via braided ramps
4. Providing an option lane at the SR-91 off-ramp

In a February 2020 letter to TDOT, the Kingsport MTPO noted concerns about growth-related future capacity issues near the I-26/I-81 interchange and the Meadowview Basin area (SR-126 & SR-93 interchanges). The MTPO suggested that long-range plans should include six lanes on I-26 from Exit 3 in the Meadowview (Kingsport) area to Exit 27 near Unicoi. As shown in Figure 3-8, the 2040 TSM Trend Scenario results indicate that with exception to the segment between SR-400 and SR-91 that was just discussed, the entire length of I-26 will operate at LOS D or better in 2040. While other solutions identified as part of this study will help to mitigate future congestion, widening is not specifically recommended. To address the MTPO's concerns about the Meadowview Basin area, which

include weaving movements between the closely spaced Meadowview Parkway and SR-93/SR-126 interchanges, possible solutions also include a study to evaluate the need for collector-distributor lanes or other improvements between these interchanges.

Note that the conceptual planning and preliminary design phases of all interchange and surface road improvements recommended in this report should incorporate pedestrian and bicycle planning.

Eastbound weave area between SR-400 and SR-91

Safety Alternatives

As a first step in identifying safety solutions to address these factors along the I-26 corridor, TDOT's April 2017 IMPROVE Act was reviewed to determine if any safety-related solutions were recommended in these areas. There were no explicit safety solutions proposed as part of the IMPROVE Act on I-26, though there is one recommendation for a Diverging Diamond Interchange (DDI) improvement at SR-354/Boones Creek Road near Johnson City, which is currently under construction.

The potential crash factors at each hot spot were then reviewed, in tandem with public comments as well as aerial and street-level photography to identify potential solutions. It is important to note that some recommendations are unrelated to a crash hot spot, but instead may have originated from public or stakeholder input obtained throughout the planning process, or were noted during a field review.

In addition to identifying potential safety improvements for locations along the corridor, the crash reduction potential for each recommendation was explored through the research of Crash Modification Factors (CMFs). A CMF estimates a safety countermeasure's ability to reduce crashes and crash severity. Based on data provided by the CMF Clearinghouse, each recommendation is categorized as having above or below average crash reduction potential, specific to the I-26 corridor, where data was available. It is important to note that the reduction potential for each recommendation is only applicable to crash types that would be prevented by implementing the improvements.

Figures 4-1a and 4-1b depict each safety solution and its crash reduction potential. Priority should also be given to maintenance of new and existing signage, guardrail, and median cabling. If damaged, these treatments are not effective for safety.

TSM&O Alternatives

According to FHWA, TSM&O is "a set of strategies that focus on operational improvements that can maintain and even restore the performance of the existing transportation system before extra capacity is needed." Based on the definition of TSM&O, the I-26 corridor is a prime candidate for such strategies, as levels of service are currently such that motorists experience congestion, but not yet significant delays.

Several of the possible solutions outlined in other sections of this report would also be considered TSM&O solutions:

- Freight Solution, F4: Install CCTV to monitor for congestion and accidents and advise trucks via HAR in Washington County between SR-381 and SR-321
- Safety Solution, S4: Install Road Weather Information System in Unicoi County
- Multimodal Solution, BP1: Add bicycle lane/multi use path on SR-400 through the I-26 interchange
- Multimodal Solution, BP2: Add bicycle lane/ multi-use path on SR-1 / US-11W through the I-26 interchange
- Multimodal Solution, BP3: Conduct a study to propose bicycle and pedestrian connectivity and safety improvements at existing U.S. and State Route interchanges.

Additional solutions were developed via review of existing plans, public / stakeholder feedback, and field observations. These solutions are shown in Figure 4-2. It should be noted that stakeholders in the Kingsport area acknowledge the importance of providing multiple resources to "refill" a vehicle-including electric charging stations and propane or natural gas refueling stations. In a February 6th letter to TDOT, Kingsport MTPO staff noted the desire to partner with NCDOT to identify I-26 as an official "Alternative Fuels Corridor".

Figure 4-1a. Potential Safety Improvements — I-26

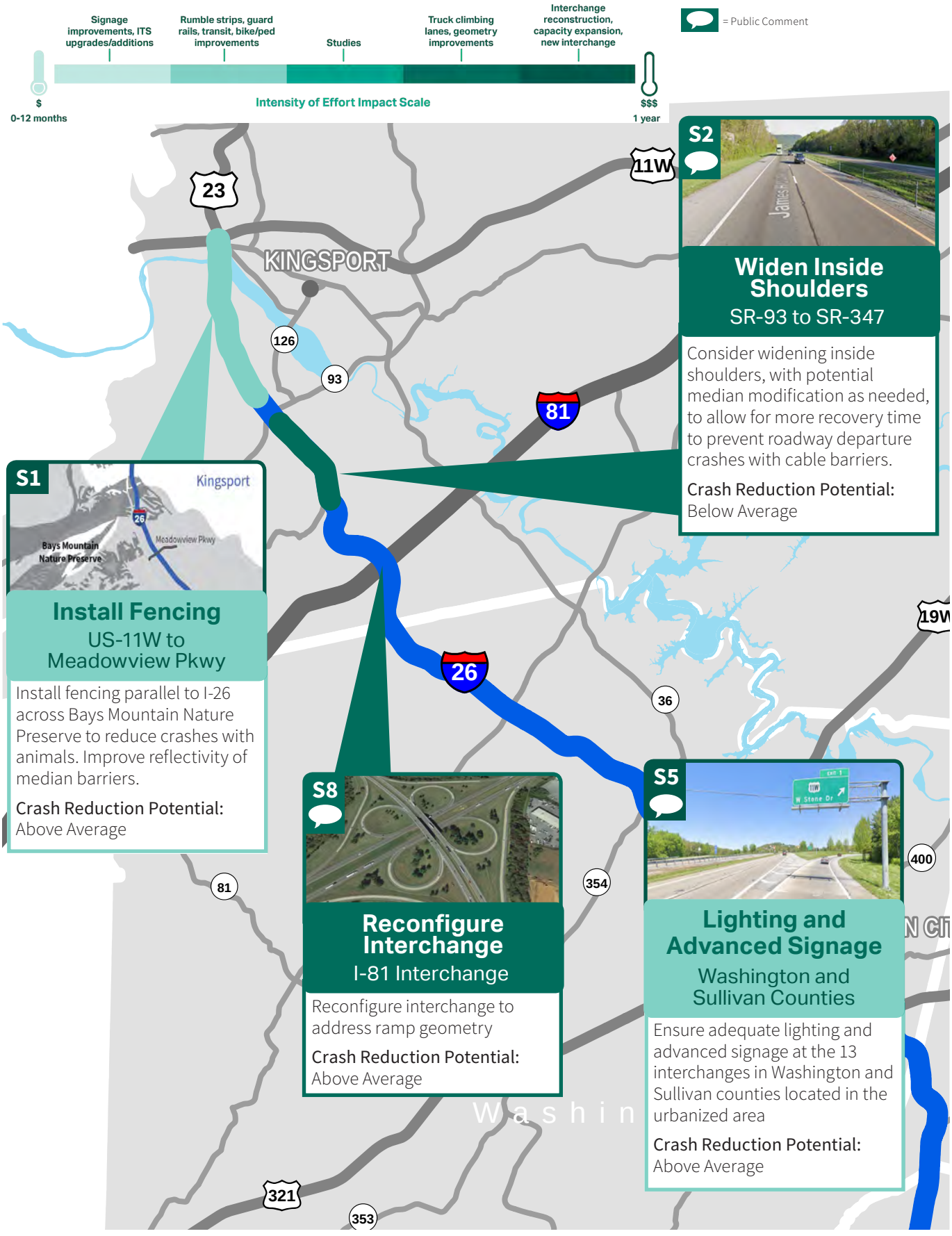
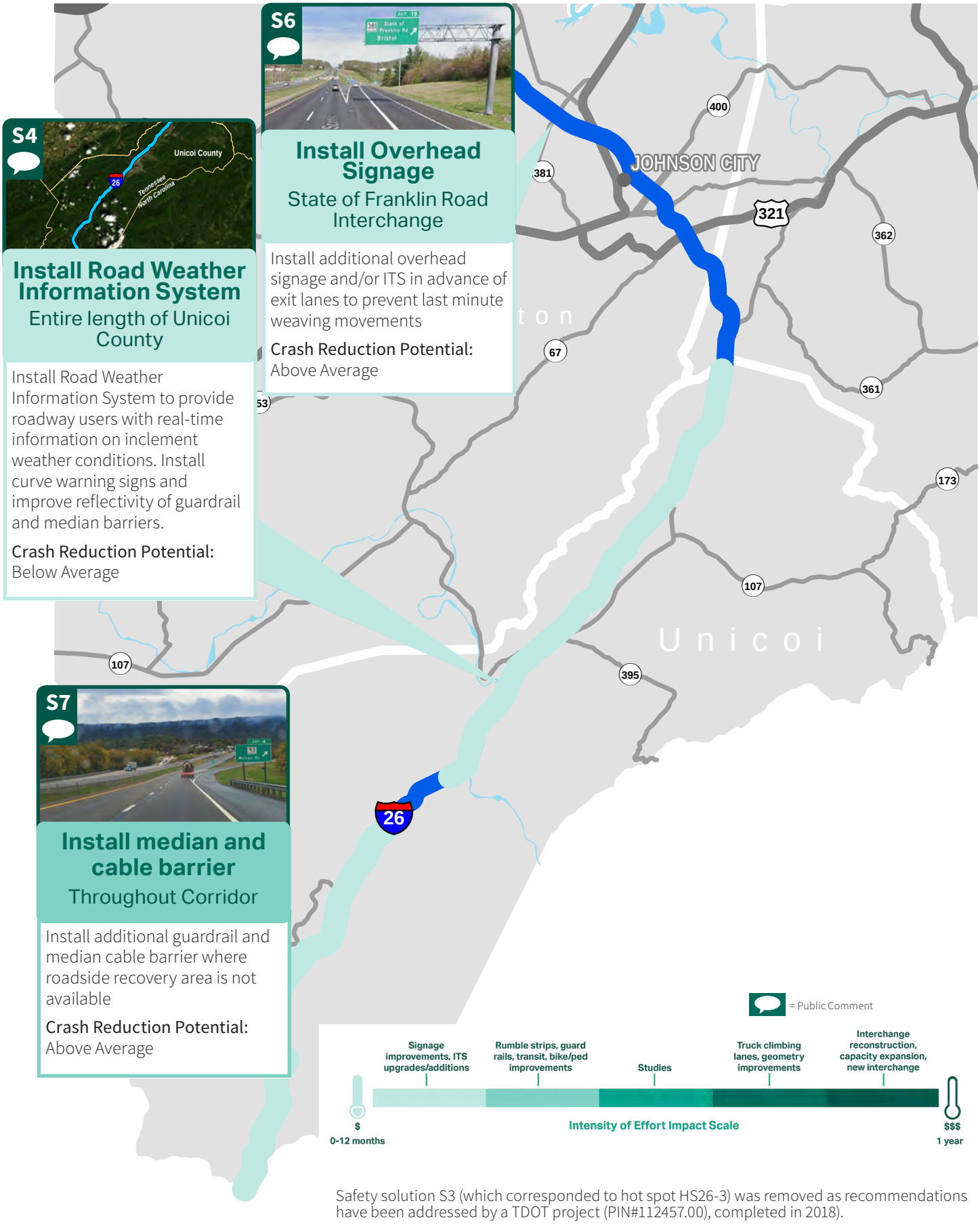


Figure 4-1b. Potential Safety Improvements — I-26



Safety solution S3 (which corresponded to hot spot HS26-3) was removed as recommendations have been addressed by a TDOT project (PIN#112457.00), completed in 2018).

Freight Alternatives

Potential options for improving freight mobility include infrastructure improvements, such as truck climbing lanes and interchange redesigns, as well as management and operation strategies, such as truck parking and communication strategies. Suggested freight improvements for the I-26 corridor are shown in Figure 4-3 and discussed as needed below.

Truck Parking

To address truck stop parking needs supportive of the hours of service rules, an additional 50 truck parking spots with overnight availability should be constructed along the corridor.

Interchange Redesigns

The TN Freight Plan indicated a potential truck bottleneck near US-11W in Kingsport. Likewise the Kingsport MTPO 2040 LRTP indicated need for study of the I-81 interchange for capacity and freight vehicle accommodations.

Truck Climbing Lanes

Large commercial vehicles are extremely sensitive to changes in grade. Research has shown that the frequency of collisions increases dramatically when vehicles traveling more than 10 mph below the average traffic speed are present in the traffic stream. When the length of the ascending grade is not long enough for trucks to maintain speeds within 10 mph of the average traffic speed, climbing lanes can relieve some conflict by allowing slower vehicles to move out of the primary traffic lanes thereby increasing the level of service for the highway. Longer acceleration and deceleration lanes at interstate on- and off-ramps can provide analogous benefits.

To address potential bottlenecks due to grade, identified in Section 3 of the report, truck climbing lanes are recommended as potential solutions at the following locations:

- EB SR-93 to SR-347
- EB near Clear Branch Access
- EB from Flag Pond Road to North Carolina state line

ITS

To monitor congestion and accidents in the Johnson City area, the study recommends installation of CCTV and HAR to advise trucks.

Parallel Corridors

The identification and use of alternative, parallel routes can be an approach to accommodate increasing traffic. One alternative route exists along the corridor that allows travelers to bypass Johnson City via SR-354 and SR-81; however, this route adds 1.2 miles to the trip distance and 10-15 minutes to the travel time on roads that are not well-suited for large truck travel.

The most recent Kingsport MTPO TIP (2020-2023) includes the 5-lane widening of SR-36 from SR-75 to I-81, which is the last 2-lane segment of this parallel route between Johnson City and Kingsport. In general, diverting truck traffic from interstate highways to lower order roads will increase potential safety problems, pavement wear, and traffic disruption. Therefore, these alternative routes would not be recommended in the absence of a traffic incident on I-26.

Driver Education and Stakeholder Engagement

In addition to the infrastructure and management strategies previously discussed, a key freight stakeholder noted several other items that can improve truck freight traffic in the State. These include driver education and stakeholder engagement regarding roadway construction. Driver education can include both truck and non-truck driving populations. Driver training programs can change truck driver behaviors to improve delivery efficiency, energy consumption, environmental impacts, and the safety of all road users.

The Tennessee Trucking Association has partnered with the Tennessee Highway Safety Office to educate students and senior citizens about sharing the road with trucks and has expressed interest in connecting with other agencies to teach the public about freight safety.

Economic Development

The Tennessee transportation system supports the economy of the state by providing access to employment for workers and facilitating the movement of goods into, out of, and within the state. Among the goals for transportation system planning in this study is the following: Coordinate transportation system investments with economic development plans. This goal is informed by two objectives:

- Improve interchange on/off ramps.
- Coordinate with MPOs/RPOs to determine areas where new or improved Interstate access is needed.

Based on this analysis and stakeholder input, development and employment growth in the I-26 corridor is expected to be centered on the segment of interstate between Kingsport and Johnson City. The area southwest of the interchange of I-26 and I-81 was identified in both analyses to be particularly attractive to new development. This area is already relatively job-dense, and future development may drive traffic growth beyond the capacity of current interchange design.

Figure 4-2. Potential TSM&O Solutions — I-26

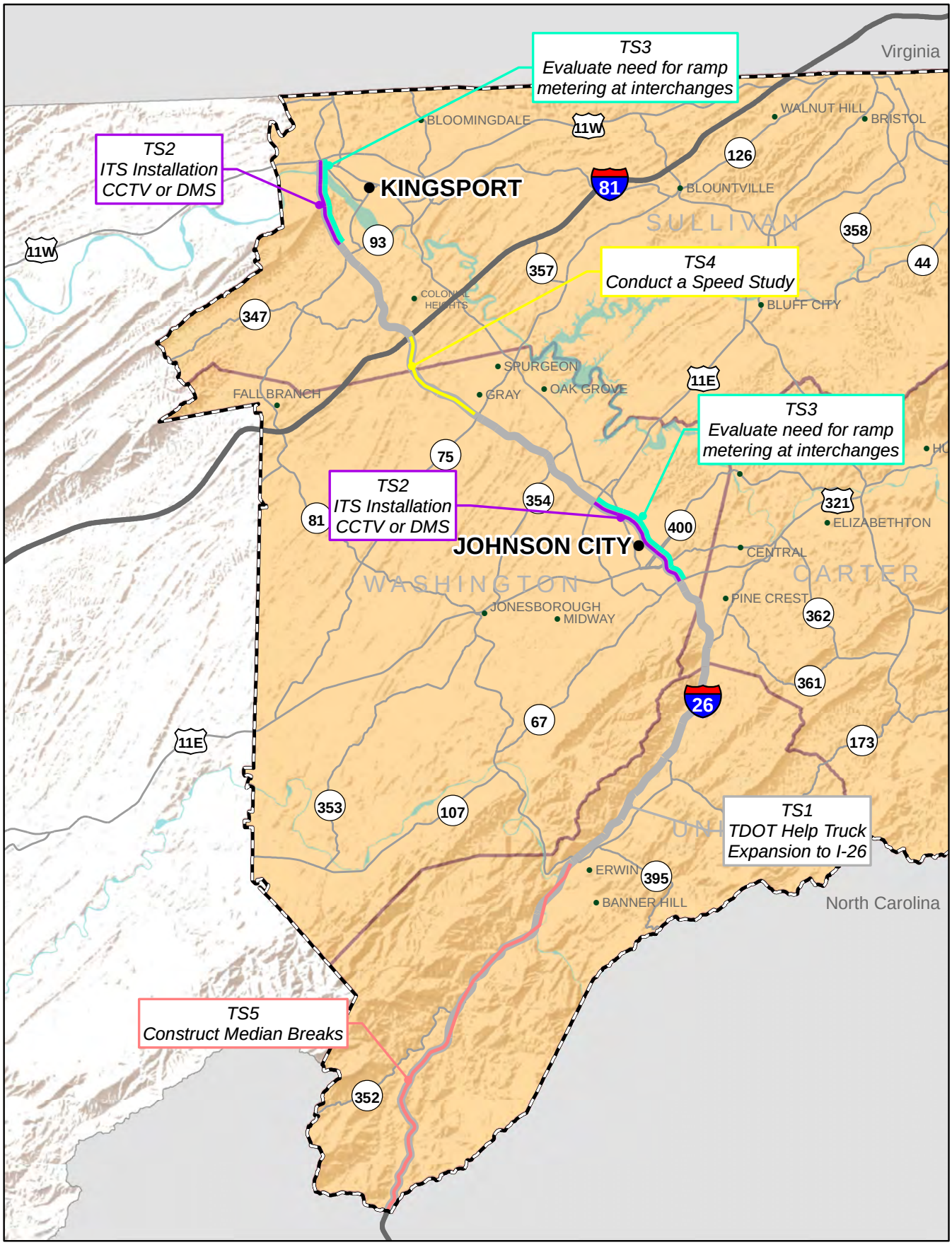
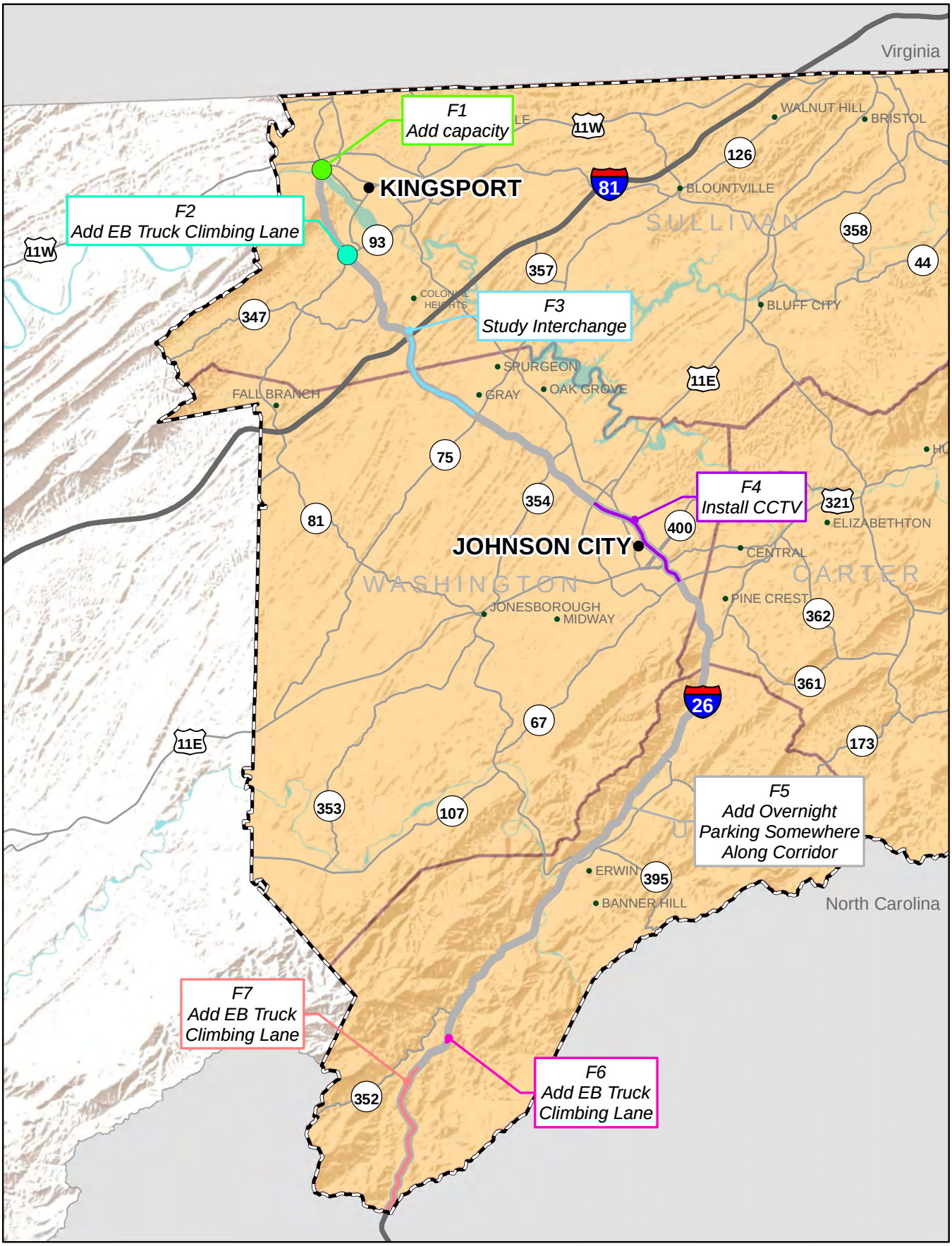


Figure 4-3. Potential Freight Improvements — I-26



The other area expected to see additional employment is located south of Johnson City, near Pine Crest. Currently, development in this area is relatively sparse, but its proximity to the urbanized area and Interstate access may make it attractive to developers.

One segment of the freeway corridor was called out by stakeholders for potential consideration of an additional access point. The segment of I-26 between Eastern Star Road and SR-75 was considered for an interchange approximately 20 years ago according to regional transportation planners. As this area is expected to see economic development activity in the future, it may be reasonable to reconsider adding an interchange to facilitate orderly development.

Figure 4-4. Potential Economic Development Improvements — I-26

Multimodal

While driving is the mode most supported in the I-26 corridor, it is important to ensure that multimodal transportation options exist. Several multimodal deficiencies were identified in Section 3, including a lack of regional connection between Johnson City and Kingsport and the need for more park-and-ride facilities. Meaningful transportation choices provide mobility opportunities for all users and can help alleviate congestion along I-26. A complete multimodal network includes transit, bicycle and pedestrian infrastructure, and additional resources including park-and-ride facilities that promote carpooling and transit use.

Potential transit and bicycle/pedestrian solutions recommended for the I-26 corridor include:

- T3: Commuter-Focused Rideshare – Several large employers located in Gray, outside of Johnson City, are currently not served by transit. By creating a rideshare program, more commuter traffic could be directed off of I-26, alleviating perceived congestion issues around Johnson City.
- T9: Regional Transit Access: Consider conducting a study as to whether a commuter route between Johnson City and Kingsport would be feasible. If created, a commuter route could reduce vehicles on I-26 during peak hours.
- T10: A January 2020 letter from the Kingsport MTPO and to TDOT Long Range Planning noted that an MTPO study of potential ridesharing/ van-pool service between Johnson City and Kingsport revealed the need for park-and-ride lots at the SR-93, SR-347, and SR-75 interchanges.
- BP1: Add bicycle lane/multi-use path on SR-400 through the I-26 interchange to accommodate bicycles on the proposed Chattanooga to Mountain City state bicycle route
- BP2: Add bicycle lane/multi-use path on SR-1/US-11W through the I-26 interchange to accommodate bicycles on the proposed Nashville to Bristol state bicycle route
- BP3: Consider conducting a study to identify bicycle and pedestrian connectivity and safety improvements at existing U.S. and state route interchanges.

Further bicycle and pedestrian study should consider the following measures:

- In-field, geometric analysis:
  - Average pedestrian crossing distance
  - Whether motor vehicles cross through crosswalks using free flow or slip lanes
  - Average buffer distance from traffic flow
  - Sidewalk width
  - Bicycle facility width
  - Existence of vertical buffers for pedestrians or cyclists
- Land Use Analysis (rural, rural town, suburban, urban core)
- Evaluation of Adjacent Infrastructure
- Detailed review of pedestrian and bicycle-related crashes within 0.5 miles of an interchange

Bicycle and pedestrian studies could further be expanded to include all interchanges and identify locations where new pedestrian/bicycle crossings may be appropriate.

Universe of Alternatives

Table 4-3 gathers these potential solutions into the total universe of alternatives for the I-26 corridor. The universe of alternatives presents a wide range of potential solutions to identified deficiencies. No solution is excluded from the universe of alternatives – it is essentially a brainstorming effort comprised of public and stakeholder ideas as well as best practices identified by planners and engineers. The list is supplemented by projects proposed in existing plans and studies.

Figure 4-5. Potential Solutions By Category — I-26

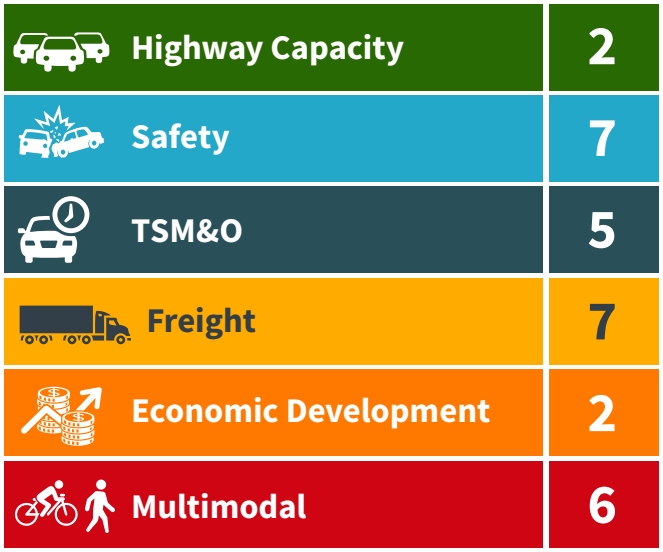


Table 4-3. Universe of Alternatives — I-26

	ID	County	Termini (From)	Termini (To)	Description	Source of Recommended Solution
Highway Capacity	C1	Washington	SR-91	SR-400	Increase spacing between ramps OR create C-D system OR construct braided ramps OR widen off-ramps to provide option lanes	Data Analysis
	C2	Sullivan	Meadowview Parkway	SR-93/SR-126	Conduct a study to evaluate the need for collector-distributor lanes and/or other improvements between these interchanges	Public/Stakeholder
Safety	S1	Sullivan	US-11W/W. Stone Drive	Meadowview Parkway	Install Fencing by Bays Mountain Nature Preserve	Data Analysis
	S2	Sullivan	SR-93/Wilcox Drive	SR-347/Rock Springs Road	Widen Inside Shoulders	Public/Stakeholder
	S4	Unicoi	TN/NC State Line	Unicoi/Carter County Line	Install Road Weather Information System	Public/Stakeholder
	S5	Washington, Sullivan	Kingsport and Johnson City Urbanized Areas		Install Additional Lighting and Signage	Public/Stakeholder
	S6	Washington	State of Franklin Road		Install Additional Overhead Signage	Public/Stakeholder
	S7	All	Throughout Corridor		Install additional guardrail and median cable barrier where roadside recovery area is not available	Public/Stakeholder
	S8	Sullivan	I-81 Interchange		Reconfigure interchange to address ramp geometry	Public/ Stakeholder and Tennessee Freight Plan (2018)

Table 4-3. Universe of Alternatives cont. — I-26

	ID	County	Termini (From)	Termini (To)	Description	Source of Recommended Solution
TSM&O	TS1	All	Throughout Corridor		HELP Truck Expansion to I-26	Public/Stakeholder
	TS2	Washington/ Sullivan	Kingsport and Johnson City Urbanized Areas		ITS Installation (CCTV & DMS)	Public/Stakeholder
	TS3	Washington/ Sullivan	Kingsport and Johnson City Urbanized Areas		Evaluate Need for Ramp Metering	Public/Stakeholder
	TS4	Washington	Eastern Star Road	Boones Creek Road	Conduct a speed study on I-26	Public/Stakeholder
	TS5	Unicoi	Erwin	NC State Line	Construct median breaks to allow for EMS vehicle turnaround	Public/Stakeholder
Freight	F1	Sullivan	US-11W	Meadowview Parkway	Add capacity to relieve bottleneck south of US-11W	Tennessee Freight Plan (2018)
	F2	Sullivan	SR-93	SR-347	Add eastbound truck climbing lane	Kingsport MPTO 2040 LRTP
	F3	Sullivan	I-81 Interchange		Study I-81/I-26 interchange for capacity, design for ease of truck use	Kingsport MPTO 2040 LRTP
	F4	Washington	SR-381	US-321	Install CCTV to monitor for congestion and accidents, advise trucks via HAR	Data Analysis
	F5	All	Kingsport	NC State Line	Add at least one overnight parking location along the corridor (~50 truck parking spots)	Data Analysis
	F6	Unicoi	West of Clear Branch Access	East of Clear Branch Access	Add eastbound truck climbing lane	Tennessee Freight Plan (2018)
	F7	Unicoi	Flag Pond Road	NC State Line	Add eastbound truck climbing lane	Tennessee Freight Plan (2018)
Economic Development	ED1	Washington	Eastern Star Road	SR-75	Evaluate need for additional interstate access point to accommodate economic growth	Public/Stakeholder
	ED2	Sullivan	I-81 Interchange		Improve interchange capacity and geometry to accommodate expected economic growth	Public/Stakeholder
Multimodal	T3	Washington	JCT Transit Center	Citi Commerce Solutions/ Frontier Health (Gray)	Study a commuter route between Johnson City and Gray	JCT Comprehensive Operations Analysis
	T9	Washington, Sullivan	Johnson City	Kingsport	Study a commuter route between Johnson City and Kingsport	Data Analysis
	BP1	Washington	E. Watauga / E. Unaka from Oak Street	E. Watauga / E. Unaka to Elm Street	Add bicycle lane/multi-use path on SR-400 through I-26 interchange	Data Analysis
	BP2	Sullivan	W. Stone Drive from Stonegate Road	W. Stone Drive to Union Street	Add bicycle lane/multi-use path on SR-1/ US-11W (W. Stone Drive) through I-26 interchange	Data Analysis
	BP3	All	Throughout Corridor		Conduct a study to propose bicycle and pedestrian connectivity and safety improvements at existing U.S. and SR interchanges	Data Analysis
	T10	Washington/ Sullivan	Various Locations		Designate park-and-ride lots near SR-93, SR-347, and SR-75	Public/Stakeholder

5. Solutions Screening & Project Priorities

The I-26 universe of alternatives were filtered through a solutions screening and prioritization process (see Figure 5-1). This process evaluates solutions based on their impact on mobility and safety, potential environmental impacts, cost, and potential economic impacts. Ultimately, the prioritized solutions both resolve the identified deficiencies and have a high benefit/cost ratio.

Solutions Screening, Phase 1

The Phase 1 solutions screening process was intended to eliminate solutions with evident fatal flaws. To do so, each possible solution was evaluated against the following questions:

1. Does the proposed solution make sense given the identified deficiency?
2. Does the proposed solution align with other planned or programmed projects in the area?
3. Is the proposed solution supported by stakeholders and the public?
4. Does the proposed solution negatively impact environmental features such as wetlands, rare or protected species, or superfund sites?
5. Does the proposed solution negatively impact cultural features such as sensitive community populations, historic sites, public lands, or community institutions?

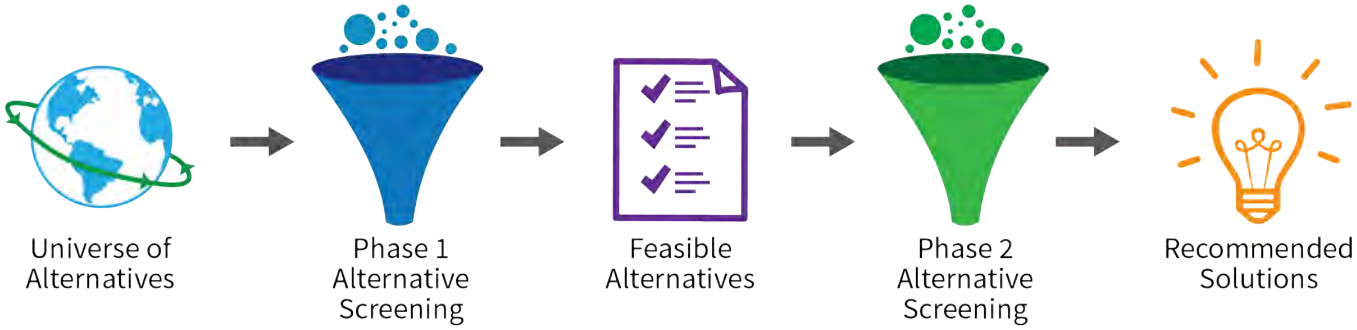
Projects which received a "NO" response for questions 1, 2, or 3, or a "YES" response for questions 4 or 5 were eliminated and did not move forward to the Phase 2 solutions screening. Exceptions include projects where the potential is high for environmental/cultural impact mitigation. Two I-26 solutions were eliminated in the Phase I solutions screening process – both because the recommended infrastructure is already in place:

- F1: Add capacity to relieve bottleneck south of US-11W. (Stakeholders agreed that traffic volumes here are very low and truck climbing lanes are already provided in both directions over Bays Mountain).
- BP1: Add bicycle lane/multiuse path on SR-400 through the interchange. Upon closer evaluation, SR-400 provides a wide outside lane, shoulder and carries only one-way traffic through the I-26 interchange.

Figure 5-2. Solutions Passing Phase 1 Screening — I-26

Highway Capacity	2
Safety	7
TSM&O	5
Freight	6
Economic Development	2
Multimodal	5

Figure 5-1. Solutions Screening and Prioritization Process



Solutions Screening, Phase 2

The Phase 2 alternatives screening process utilized performance measures to further refine the list of feasible alternatives. Potential solutions that passed the Phase 1 Screening were evaluated against the following questions:

1. Does the proposed solution improve level of service on the interstate corridor?
2. Does the proposed solution improve peak hour travel speeds on the interstate corridor?
3. Does the proposed solution improve travel times between key origin and destination (O&D) pairs along the corridor?
4. Does the proposed solution improve peak hour densities at the improved interchange?
5. Does the proposed solution reduce average and max queues at the improved interchange?
6. Does the proposed solution have the potential to reduce crashes in safety hot spots?
7. Does the proposed solution address deficiencies in bridges with a low sufficiency rating?
8. Does the proposed solution increase pavement quality?
9. Does the proposed solution provide for pedestrian / bicycle connectivity and safety at interchanges?
10. Does the proposed solution provide additional truck parking opportunities, particularly in urban areas?
11. Does the proposed solution have the potential to reduce vehicle miles traveled (VMT)?
12. Does the proposed solution improve incident management?
13. Does the proposed solution provide potential economic development opportunities?

Projects which received only “NO” responses were eliminated and did not move forward as feasible multimodal solutions. As indicated by Figure 5-3, all projects passed the Phase 2 screening and were moved forward to project prioritization.

Prioritization Methodology

Aligning with previous TDOT multimodal corridor studies, the prioritization methodology for this study addresses coordinated construction efforts (priority given to projects that could be accomplished simultaneously at a given location) and culminates in a benefit-cost index for each project, which recognizes the relative multimodal benefit of each project compared to the estimated financial investment. Consistency with TDOT and MPO programmed projects has been maintained throughout the alternative development process, having identified such projects as part of the Trend Scenario.

The most recent TDOT multimodal corridor study introduced flexible decision-making support tool wherein weights can be applied to priority settings based on policy, programming, and political decisions. The prioritization criteria and measures for the I-26 corridor are structured in a similar fashion, such that weights can be applied by decision-makers. As indicated in Table 5-1, solutions developed for the I-26 corridor were evaluated over six categories: mobility, safety, economic development, system maintenance, implementation and cost efficiency, as detailed here.

Figure 5-3. Solutions Passing Phase 2 Screening — I-26

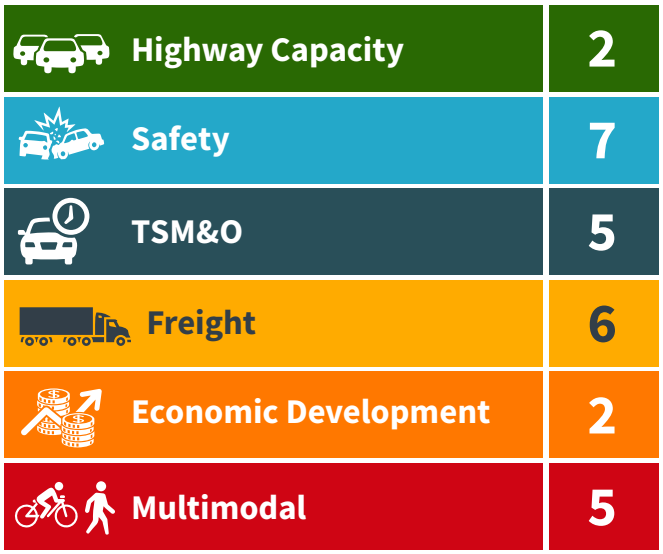


Table 5-1. Prioritization Criteria and Measures by Mode and Strategy — I-26

Mode/ Strategy	Mobility	Safety	Economic Development	System Maintenance	Implementation	Cost Efficiency
Highway Capacity	2040 Trend VC	Crash Rate (Relative to Statewide Avg)	2020 Employment	Project addresses bridge deficiency (Y/N)	# of related projects	Benefit-Cost Index
	2040 Build VC	Project improves incident management (Y/N)	2040 Employment	Project addresses pavement deficiency (Y/N)		Dollar per Benefit
Safety	2040 Trend	Crash Rate (Relative to Statewide Avg)	2020 Employment	Project addresses bridge deficiency (Y/N)	Cost Estimate	Benefit-Cost Index
	2040 Build VC	Project improves incident management (Y/N)	2040 Employment	Project addresses pavement deficiency (Y/N)	# of related projects	Dollar per Benefit
		Crash Reduction Potential				
TSM&O	2040 Trend	Crash Rate (Relative to Statewide Avg)	2020 Employment	Project addresses bridge deficiency (Y/N)	# of related projects	Benefit-Cost Index
	2040 Build VC	Project improves incident management (Y/N)	2040 Employment	Project addresses pavement deficiency (Y/N)	Cost Estimate	Dollar per Benefit
Freight	2040 Trend VC	Project improves incident management (Y/N)	2020 Employment	Project addresses bridge deficiency (Y/N)	# of related projects	Benefit-Cost Index
	2040 Build VC		2040 Employment	Project addresses pavement deficiency (Y/N)	Cost Estimate	Dollar per Benefit
	% Trucks			Provides truck parking (Y/N)		
Multimodal	2020 Population	Project improves incident management (Y/N)	2020 Employment	Project addresses bridge deficiency (Y/N)	# of related projects	Benefit-Cost Index
	2040 Population		2040 Employment	Project addresses pavement deficiency (Y/N)	Cost Estimate	Dollar per Benefit
Economic Development	2020 Population	Project improves incident management (Y/N)	2020 Employment	Project addresses bridge deficiency (Y/N)	# of related projects	Benefit-Cost Index
	2040 Population		2040 Employment	Project addresses pavement deficiency (Y/N)	Cost Estimate	Dollar per Benefit

Prioritization Criteria and Measures

Mobility

Appropriate measures for mobility differ across modes/strategies. While the volume-to-capacity (VC) ratio is appropriate for measuring highway capacity, it does not capture mobility for bicycles and pedestrians, for example. As shown in Table 5-1, comparison of the 2040 Trend VC ratio versus the 2040 Build VC ratio was used as a measure of mobility for highway capacity, safety, TSM&O, and Freight projects. Numeric scores 1, 2, and 3, were recorded based on the following thresholds, which consider the resulting change in VC and, for freight projects, the percent trucks on the adjacent section of interstate:

Capacity, Safety, TSM&O

1 = No improvement to mobility

2 = Likely improvement to mobility

3 = Definite improvement to mobility

Freight

1 = No improvement to mobility

2 = Improvement to mobility, % trucks < 20%

3 = Improvement to mobility, % trucks > 20%

Comparison of 2020 population versus 2040 population within three miles of each project was used for multimodal and economic development projects. Population numbers were obtained via the Tennessee Statewide Travel Demand Model (TSM) and by traffic analysis zone. Resulting numeric scores were based on the following thresholds:

Multimodal, Economic Development

1 = 0-10% Increase

2 = 10-15% Increase

3 = 15% + Increase

Where criterion could not be measured and "N/A" was noted, engineering judgement was used to score the project's potential for mobility improvement within the applicable thresholds.

Safety

Criterion used to measure the potential safety improvement for each project also vary across mode/strategy. One measure common to all was a "yes" or "no" response to the question "Does the project improve incident management?" For freight, multimodal and economic development projects, this was the only measure used for safety. Thresholds were applied as follows:

Freight, Multimodal, Economic Development

1 = N/A

2 = No

3 = Yes

Building upon hot spot calculations from Technical Memorandum 2, capacity, safety, and TSM&O projects are measured by the relative crash rate as well. The impact of safety projects is further refined by the crash reduction potential, which was determined in Technical Memorandum 3. The following thresholds were applied:

Capacity, TSM&O

1 = Crash rate < statewide average crash rate[1]

2 = Crash rate > statewide average crash rate; Does not improve incident management

3 = Crash rate > statewide average crash rate; Improves incident management

Safety

1 = Crash rate < statewide average crash rate

2 = Crash rate > statewide average crash rate; Below average crash reduction potential

3 = Crash rate > statewide average crash rate; Above average crash reduction potential OR Improves incident management

Where criterion could not be measured and "N/A" was noted, engineering judgement was used to score the project's potential for safety improvement within the applicable thresholds.

Economic Development

The economic development potential of each project was measured by the projected change in employment from 2020 to 2040 within three miles of each project. Employment projections were obtained via the TSM and by traffic analysis zones. The following thresholds were used to score each project.

Capacity, Safety, TSM&O, Freight, Multimodal, Economic Development

1 = 10-20% increase

2 = 20-25% increase

3 = 25%+ increase

System Maintenance

System maintenance was added as a measure for the I-26 corridor prioritization to recognize opportunities where projects will also address existing bridge and/or pavement deficiencies. The following thresholds were used to score each project, given "yes" or "no" responses to the questions "Project addresses bridge deficiency?" and "Project addresses pavement

1- The statewide average crash rate for rural interstate facilities is 0.528 and 1.112 for urban interstates.

deficiency?'. For freight projects, an additional "yes" / "no" question was added: "Project provides truck parking?"

Capacity, Safety, TSM&O, Multimodal, Economic Development

1 = No to both

2 = Yes to one

3 = Yes to both

Freight

1 = No to all

2 = Yes to one

3 = Yes to all

Implementation

The implementation measure was included to give priority to projects that could be constructed or initiated in conjunction with other projects, thus conserving the time and money associated with multiple, individual contracts. Figure 5-4 illustrates the relative proximity of the multimodal solutions prioritized for the I-26 corridor. The following thresholds were utilized to score the implementation of each project:

Capacity, Safety, TSM&O, Freight, Multimodal, Economic Development

1 = 0 overlapping projects

2 = 1 or 2 overlapping projects

3 = 3+ overlapping projects

Cost Efficiency

For the I-26 corridor project prioritization, a benefit-cost index and a dollar-per-benefit was calculated for each solution. These measures capture the benefit of each prioritization criteria and compare the total relative benefit to the estimated project cost. Specifically, the score assigned to each of the five prioritization criteria were summed to represent the total relative benefit of each project. To calculate the benefit-cost index, this total relative benefit was divided by the cost (in millions) estimated for each project. The dollar-per-benefit is simply the cost estimate divided by the total benefit score. Note that cost estimates were prepared for solutions that were recommended for further study. However, because the total benefit represents the potential of the associated capital improvement, no direct benefit-cost index or dollar-per-benefit was calculated for these solutions.

Project Rankings

When evaluated side-by-side, the total benefit score, benefit-cost index, and dollar-per-benefit indicate projects with high benefit that can be implemented with smaller financial investment. The project rankings are discussed per mode/strategy below. Tables 5-1 through 5-6 of Technical Memorandum 4 detail the prioritization effort and rank the projects by the total benefit score, which ranges from 5 (lowest) to 15 (highest).

Project Rankings by Mode and Strategy

Highway Capacity

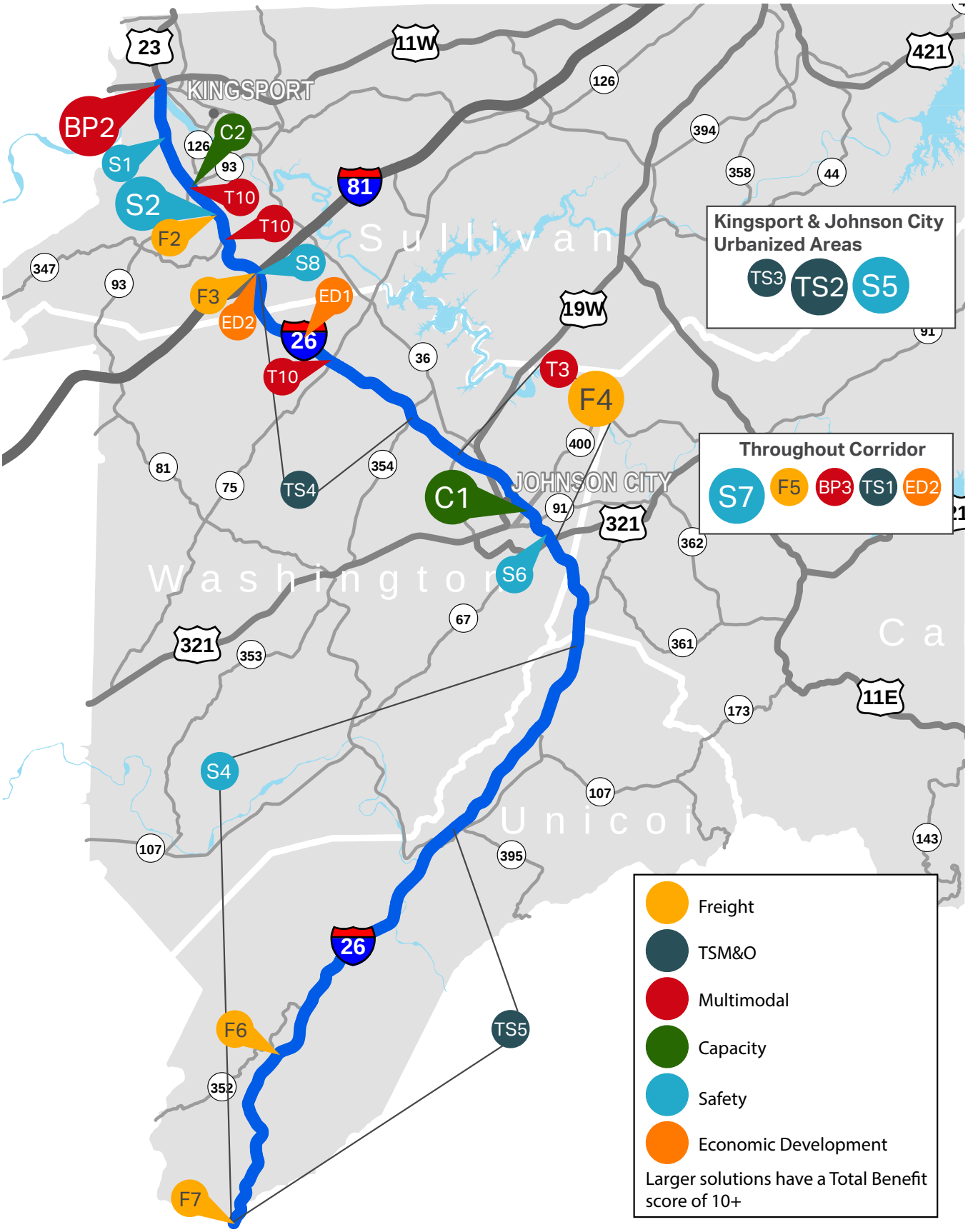
Capacity solution C1 received a high total benefit score reflective primarily of its improvement to mobility through the Johnson City urban area. Detailed traffic analyses of the braided ramps versus option lane indicated that an option lane at the eastbound off-ramp to SR-91 would best accommodate future volumes with the least impact to adjacent structures and land uses. Details of the traffic analysis can be found in the Traffic Operations Technical Memorandum.

Capacity solution C2 received a lower total benefit score. This section of I-26 is expected to operate at acceptable levels of service into 2040, and it does not have a crash rate indicative of a safety hot spot. The location should continue to be monitored by the Kingsport MTPO over time as the ramp proximity could create issues if unexpected new development were to occur in the area.

Safety

Safety solutions S2 and S5 received both high total benefit scores and high benefit-cost indexes. Widening inside shoulders through the Bays Mountain area (S2) and installing additional interchange lighting in the urban areas (S5) address safety hot spots and improve incident management. Safety solution S5 additionally offers an above average crash reduction potential and could be designed in cooperation with ITS and communication components of TSM&O solutions TS2 and TS3. At a higher dollar per benefit, but with the potential to impact the whole corridor, safety solution S7 also scored a high total benefit.

Figure 5-4. Relative Proximity of Multimodal Solutions — I-26



TSM&O

TSM&O solution TS2 scored a high total benefit and a benefit-cost index of 3.1. This reflects potential for improving incident management in a safety hot spot location, potential for implementation in conjunction with other projects, and a relatively low cost.

Freight

Of the six freight solutions that passed the Phase 2 screening, F4 (CCTV to monitor congestion and accidents/ advise trucks via HAR) scored the highest total benefit. This solution, initiated by stakeholders, corresponds closely to TSM&O solution TS2 and is attributed the same benefits. Study of the I-81/I-26 interchange (F3) scored the second highest total benefit. Study of this interchange is also identified in Safety and Economic Development strategies, as S8 and ED2, respectively.

Multimodal

Study of a commuter route between the Johnson City Transit Center and Gray (T3) scored the highest total benefit among multimodal solutions. The route would benefit an expected nearby 10-15% increase in population and 25-30% increase in employment. Addition of a bicycle lane/multi-use path on US-11W through the I-26 interchange (BP2) would also benefit a growing population and would provide connectivity on TDOT's proposed Nashville to Bristol State Bicycle Route.

Economic Development

Neither of the Economic Development solutions received high total benefit scores. However, it should be noted that study of improvements to the I-26/I-81 interchange was also recommended in Freight and Safety strategies.

6. Key Findings

The prioritized solutions address the key corridor transportation deficiencies identified by stakeholders and through data analysis.

As a result of the structure of the project prioritization system, all projects have a potential total benefit range of 5-15 and can therefore be compared across modes/ strategies. Table 6-1 tabulates all solutions for the I-26 corridor, sorted by total benefit score. Solutions which recommend studies are shown in Table 6-2. Projects scoring a total benefit of 10 or higher have generally demonstrated benefit to mobility, safety, economic development, system maintenance, and implementation.

Use of Table 6-1 in conjunction with Figure 5-4 can be used to inform decisions on fund allocation and construction packages. As mentioned previously, weights can easily be applied to the prioritization criteria in Tables 5-1 through 5-6 of Technical Memorandum 4 to adjust for policy, programming, and political decisions.

Finally, Table 6-3 summarizes the performance benefits of the collective solutions recommended for the I-26 corridor. As shown, proposed solutions improve network VHD during the peak period by only one percent (compared to the 2040 Trend scenario). As reflected by the 4% improvement in urban interstate peak travel speeds however, the corresponding peak VHD for urban interstates is improved by 11%, and the peak VHD for rural interstates is improved by 4%. These improvements in delay are largely attributed to capacity improvements at the SR-91 interchange and the addition of truck climbing lanes at various locations.

Additionally, multimodal solution performance measures indicate improvement to bridge and pavement conditions as well as truck parking. Bike/ ped solution BP2 accounts for the improvement to pedestrian and bicycle accommodations at U.S. and state route interchanges.

Further improvements to the I-26 corridor are expected to result from the "deep dive" studies shown in Table 6-2. The speed study, for example may reveal the need for additional enforcement in northern Washington County. Likewise, the bike/ped connectivity study has the potential to propose numerous small-scale safety and connectivity improvements for non-vehicle users across the corridor.

Table 6-1. Project Ranking Across all Modes/Strategies — I-26

ID	Project Description	Termini	Source of Solution	Cost Efficiency			
				Total Benefit	Cost Estimate	Benefit Cost Index	Dollar per Benefit
C1	Widen EB Off-Ramp to Provide Option Lane	SR-400 to SR-91	Data Analysis	12	$1,290,000	9.3	$107,500
F4	Install CCTV to Monitor Congestion & Accidents, Advise Trucks Via HAR	SR-381 to US-321	Data Analysis	11	$1,950,000	5.6	$177,300
S2	Widen Inside Shoulders	SR-93 to SR-347	Public/ Stakeholder	10	$3,180,000	3.1	$318,000
S5	Install Additional Lighting & Signage	Kingsport and Johnson City Urbanized Areas	Public/ Stakeholder	10	$6,490,000	1.5	$649,000
S7	Install Additional Guardrail & Median Cable Barrier	Throughout Corridor	Public/ Stakeholder	10	$14,400,000	0.7	$1,440,000
TS2	ITS Installation (CCTV & DMS)	Kingsport and Johnson City Urbanized Areas	Public/ Stakeholder	10	$3,270,000	3.1	$327,000
BP2	Add Bicycle Lane/ Multi-Use Path on US-11W Through I-26 Interchange	I-26 / US-11W Interchange	Data Analysis	10	$2,050,000	4.9	$205,000
S8	Reconfigure Interchange to Address Ramp Geometry	I-26/I-81 Interchange	Public/ Stakeholder, TN Freight Plan	9	$18,000,000	0.5	$2,000,000
ED2	Improve Interchange Capacity & Geometry to Accommodate Expected Economic Growth	I-26/I-81 Interchange	Public/ Stakeholder	9	$18,000,000	0.5	$2,000,000
S4	Install Road Weather Information System	TN/NC State Line to Unicoi/Carter Co Line	Public/ Stakeholder	8	$12,200,000	0.7	$1,525,000
S6	Install Additional Overhead Signage	State of Franklin Rd Interchange (SR-381)	Public/ Stakeholder	8	$248,000	32.3	$31,000
F5	Add Overnight Parking Location (~50 spaces)	Along Corridor	Data Analysis	8	$1,270,000	6.3	$158,800
F2	Add Eastbound Truck Climbing Lane	SR-93 to SR-347	Kingsport MTPO 2040 LRTP	8	$6,720,000	1.2	$840,000
F7	Add Eastbound Truck Climbing Lane	Flag Pond Rd to NC State Line	TN Freight Plan	8	$40,800,000	0.2	$5,100,000
S1	Install Fencing by Bays Mountain Nature Preserve	US-11W to Meadowview Pkwy	Data Analysis	7	$441,000	15.9	$63,000

Table 6-1. Project Ranking Across all Modes/Strategies (cont.) — I-26

ID	Project Description	Termini	Source of Solution	Cost Efficiency			
				Total Benefit	Cost Estimate	Benefit Cost Index	Dollar per Benefit
F6	Add Eastbound Truck Climbing Lane	Near Clear Branch Access	TN Freight Plan	7	$32,700,000	0.2	$4,671,400
TS5	Construct Median Breaks to allow for EMS Vehicle Turnaround	Erwin to NC State Line	Public/ Stakeholder	7	$77,000	90.9	$11,000
T10	Designate Park-and-Ride Lots Near SR-93, SR-347, SR-75	Various Locations	Public/ Stakeholder	7	$906,000	7.7	$129,400
TS1	HELP Truck Expansion to I-26	Throughout Corridor	Public/ Stakeholder	6	$675,000	8.9	$112,500

Table 6-2. Project Ranking Across all Modes/Strategies (Studies) — I-26

ID	Project Description	Termini	Source of Solution	Cost Efficiency			
				Total Benefit	Cost Estimate	Benefit Cost Index	Dollar per Benefit
TS3	Evaluate Need for Ramp Metering	Kingsport and Johnson City Urbanized Areas	Public/ Stakeholder	10	$75,000	N/A	N/A
T3	Study Commuter Route Between JCT Transit Center & Citi Commerce Solutions/Frontier Health (Gray)	Johnson City to Gray	JCT Comprehensive Operations Analysis	10	$50,000	N/A	N/A
F3	Study I-81/I-26 Interchange for Capacity, Truck Use	I-26/I-81 Interchange	Kingsport MTPO 2040 LRTP	9	$220,000	N/A	N/A
TS4	Conduct Speed Study	Eastern Star Rd to Boones Creek Rd (SR-354)	Public/ Stakeholder	9	$25,000	N/A	N/A
ED1	Evaluate Need for Additional Interstate Access Point	Eastern Star Rd to SR-75	Public/ Stakeholder	9	$100,000	N/A	N/A
T9	Study Commuter Route Between Johnson City & Kingsport	Johnson City to Kingsport	Data Analysis	9	$75,000	N/A	N/A
BP3	Study to propose Bike/ Ped Connectivity & Safety Improvements at U.S. & State Route Interchanges	Throughout Corridor	Data Analysis	9	$50,000	N/A	N/A
C2	Evaluate Need for C-D Lanes and/or Other Improvements Between Interchanges	Meadowview Pkwy to SR-93/ SR-126	Public/ Stakeholder	8	$160,000	N/A	N/A

Table 6-3. Performance Measure Summary — I-26

Goal	Performance Measure		Unit	Base (2010)	Trend (2040)	Build 2040	% Change (Base vs Trend)	% Change (Trend vs Build)
Traffic Operations	Traffic on interstate operates at LOS D or better		% of interstate operating at LOS D or better	100	99.6	99.6	<1	0
	Total Daily Vehicle Miles Traveled (VMT)		Miles (1,000s)	7,815	9,784	9,688	25	-1
	Total Daily Vehicle Hours of Travel (VHT)		Hours (1,000s)	211	259	258	23	-1
	Total Peak Hour Vehicle Hours of Delay (VHD)		Hours	7.3	9.4	9.35	28	-1
	Total VMT / Trip		Miles	4.26	4.32	4.28	1	-1
	Total Vehicle Minutes Traveled / Trip		Minutes	6.89	6.87	6.83	0	-1
	Average Peak Hour Travel Speed	Urban Interstate	MPH	68	63	66	-7	4
		Rural Interstate	MPH	72	70	70	-3	0
	Congested Travel Time between key O&D Pairs along Corridor (Total)		Minutes	172	185	185	8	0
	Peak Hour Density at Improved Interchanges		Vehicles/Mile/Lane	See “Traffic Operations Memo”				
	Average and Max Queues at Improved Interchanges		Feet	See “Traffic Operations Memo”				
Safety	Crash reduction in safety “hot spots”		Above or Below Average Crash Reduction Potential	See “Safety Recommendations”				
Operations & Maintenance	Bridge Condition (Sufficiency Rating)		% of bridges < 50	0	0	0	N/A	N/A
			50 < % of bridges < 80	11	9[1]	8	N/A	N/A
	Pavement Condition (Resurfacing)		% of corridor resurfaced within the last 10 years	71[2]	87[3]	87	N/A	N/A
Multimodal	Pedestrian and Bicycle Accommodations at U.S. and State Route Interchanges		% interchanges with bike facilities	33	33	40	N/A	N/A
			% interchanges with ped. facilities	27	27	27	N/A	N/A
	Freight (Truck Parking)		# of Rest Area Spots	53	53	53	0	0
			# of Truck Stop Spots	0	0	50	0	100

1- Per TDOT Structures Division, two bridges on I-26 are scheduled for repair.
2- Based on 2017 TRIMS data
3- Per TDOT Pavement Office’s 2020 and 2021 Resurfacing Program. Also includes 2019 resurface from Boones Creek Road to University Parkway in Washington County.