



# I-40/81

## Multimodal Corridor Study



### Technical Memorandum **Existing and Future Conditions**

July 2020





## Table of Contents

- 1. Introduction..... 1**
- 2. Projects on I-40 and I-81 ..... 2**
  - Projects Completed from Previous I-40/81 Study .....2
  - Underway/Programmed .....3
- 3. Future Population and Employment ..... 6**
- 4. Traffic Volumes, Congestion, and Travel Patterns ..... 11**
  - Traffic Volumes..... 11
  - Congestion ..... 11
  - Travel Patterns ..... 17
  - Travel Times ..... 18
- 5. Transportation Systems Management and Operations ..... 20**
  - ITS ..... 20
  - Incident Management ..... 25
  - Managed Lanes ..... 27
- 6. System Condition..... 30**
  - Pavement ..... 30
  - Bridge..... 32
  - Alignment ..... 39
  - Other ..... 40
- 7. Safety and Security ..... 41**
  - Region 1 ..... 42
  - Region 2..... 44
  - Region 3..... 47
  - Region 4..... 50
- 8. Freight Movement and Diversion ..... 53**
  - Supply Chains ..... 54
  - Freight Bottlenecks..... 54
  - Region 1 ..... 56
  - Region 2..... 57
  - Region 3..... 58
  - Region 4..... 60
  - Ports of Charleston and Savannah ..... 61
  - Truck Parking and Other Facilities ..... 62
- 9. Economic Access and Land Use ..... 63**
- 10. Transit and Multimodal Connections ..... 66**
  - Fixed-Route Service ..... 66
  - Demand Response and Other Service..... 67
  - Intercity Transit..... 68
- 11. Transportation Technologies and Transportation Demand Management..... 70**
  - Connected Vehicles..... 70
  - Autonomous Vehicles ..... 70
  - Integrated Corridor Management..... 71
  - Transportation Demand Management ..... 71



# I-40/81 Multimodal Corridor Study

## Tables

Table 1. Projects Completed from Previous I-40/81 Study.....	2
Table 2. Projects Underway from Previous I-40 and I-81 Study.....	3
Table 3. Other I-40 and I-81 Projects Programmed in 2020-2023 STIP.....	3
Table 4. VDOT I-81 Corridor Improvement Plan Projects Near Tennessee.....	5
Table 5. Statewide Population Growth by TDOT Region, 2018 to 2040.....	6
Table 6. Study Area Population and Employment Change (2018-2040).....	10
Table 7. Region 1 Congested Locations.....	14
Table 8. Region 2 Congested Locations.....	15
Table 9. Region 3 Congested Locations.....	16
Table 10. Region 4 Congested Locations.....	17
Table 11. Top Inter-County Commuting Flows Among the 28 Counties in the I-40/81 Corridor.....	18
Table 12. Increase in Peak Travel Time between Key Cities, EB/NB (2018 to 2040 Trend Scenario).....	19
Table 13. Increase in Peak Travel Time between Key Cities, WB/SB (2018 to 2040 Trend Scenario).....	19
Table 14. ITS Resources in Corridor.....	21
Table 15. Pavement Condition Thresholds.....	30
Table 16. I-40/81 Corridor Pavement Condition by County.....	31
Table 17. Sufficiency Rating of Structurally Deficient Bridges.....	37
Table 18. Significant Grades Along the Corridor Without a Climbing Lane.....	39
Table 19. Maintenance Inventory.....	41
Table 20. Sign Condition.....	41
Table 21. Crash Data for High Crash Segments in Region 1.....	43
Table 22. Crash Data for High Crash Segments in Region 2.....	46
Table 23. Crash Data for High Crash Segments in Region 3.....	49
Table 24. Crash Data for High Crash Segments in Region 4.....	52
Table 25. Freight Bottlenecks Identified in Statewide Freight Plan.....	56
Table 26. Intercity Bus Stops on the Corridor.....	69
Table 27. Communities Served by Non-Interlining Carriers.....	69
Table 28. Existing TDM Programs.....	72
Table A-29. Region 1 Interchange Inventory for I-40.....	73
Table A-30. Region 1 Interchange Inventory for I-81.....	75
Table A-31. Region 2 Interchange Inventory for I-40.....	76
Table A-32. Region 3 Interchange Inventory for I-40.....	77
Table A-33. Region 4 Interchange Inventory for I-40.....	78



# I-40/81 Multimodal Corridor Study

## Figures

- Figure 1: Study Corridor ..... 1
- Figure 2. Projects Recommended by VDOT I-81 Corridor Plan ..... 5
- Figure 3. Corridor Population Growth (2018 – 2040) ..... 7
- Figure 4. Corridor Employment Growth (2018 – 2040) ..... 8
- Figure 5. Corridor Population Change, 2018 to 2040 ..... 9
- Figure 6. Corridor Employment Change, 2018 to 2040 ..... 9
- Figure 7. Average Annual Daily Traffic (AADT) 2018 ..... 11
- Figure 8. Projected Percent of Corridor Congested ..... 12
- Figure 9. Volume-to-Capacity Ratios, 2018 – East Tennessee ..... 13
- Figure 10. Volume-to-Capacity Ratios, 2040 Trend Scenario – East Tennessee ..... 13
- Figure 11. Volume-to-Capacity Ratios, 2018 – Middle and West Tennessee ..... 15
- Figure 12. Volume-to-Capacity Ratios, 2040 Trend Scenario– Middle and West Tennessee ..... 15
- Figure 13. County-to-County Commuting within the I-40/81 Corridor Area ..... 18
- Figure 14. Region 1 ITS Infrastructure ..... 21
- Figure 15. Region 2 ITS Infrastructure ..... 22
- Figure 16. Region 3 ITS Infrastructure ..... 23
- Figure 17. Region 4 ITS Infrastructure ..... 24
- Figure 18. Statewide Smartway ..... 25
- Figure 19. HELP Routes ..... 26
- Figure 20. Designated Detours for Incidents on I-40 in Putnam and Cumberland Counties ..... 27
- Figure 21. HOV Lanes ..... 29
- Figure 22. Truck Climbing Lanes ..... 29
- Figure 23. Region 1 Structurally Deficient Bridges ..... 33
- Figure 24. Region 2 Structurally Deficient Bridges ..... 34
- Figure 25. Region 3 Structurally Deficient Bridges ..... 35
- Figure 26. Region 4 Structurally Deficient Bridges ..... 36
- Figure 27. Sufficiency Rating Breakdown ..... 37
- Figure 28. Significant Grades ..... 40
- Figure 29. Crashes in the Region 1 Portion of the Corridor ..... 42
- Figure 30. High Crash Segments – Region 1 (2014-2018) ..... 43
- Figure 31. Crashes in the Region 2 Portion of the Corridor ..... 44
- Figure 32. High Crash Segments – Region 2 (2014-2018) ..... 45
- Figure 33. Crashes in the Region 3 Portion of the Corridor ..... 47
- Figure 34. High Crash Segments – Region 3 (2014-2018) ..... 48
- Figure 35. Crashes in the Region 4 Portion of the Corridor ..... 50
- Figure 36. High Crash Segments – Region 4 (2014-2018) ..... 51
- Figure 37. Crescent Corridor ..... 53
- Figure 38. Growth in Freight Tonnage, 2016 to 2045 ..... 54
- Figure 39. Percent Growth in Freight Tonnage, 2016 to 2045 ..... 55
- Figure 40. Freight Infrastructure – Region 1 ..... 57
- Figure 41. Freight Infrastructure – Region 2 ..... 58
- Figure 42. Freight Infrastructure – Region 3 ..... 59
- Figure 43. Freight Infrastructure – Region 4 ..... 61
- Figure 44. Truck-Related Interstate Infrastructure ..... 62
- Figure 45. State Certified Industrial Sites ..... 64
- Figure 46. Location of Fixed-Route Transit ..... 66



# I-40/81 Multimodal Corridor Study

## 1. Introduction

The safe and efficient movement of people and goods along I-40 and I-81 throughout the state of Tennessee is critical to the quality of life of residents, economic development of Tennessee's communities, and national and global freight movement and trade. The Tennessee Department of Transportation (TDOT) has undertaken the I-40/81 Corridor Feasibility Study to develop a 20-year, phased set of investments that the state and its partners can make to help address multimodal needs and opportunities along I-40 and I-81. Investments will focus on enhancing operational efficiency, improving safety and security, expanding transportation choices, and supporting economic growth along the corridor, in adjacent communities, and throughout the state.

The study area for the I-40/81 corridor extends for 531 miles across Tennessee from Memphis in the west, to Bristol in the northeast, includes 28 counties directly adjacent to the corridor, and crosses six Metropolitan Planning Organizations (MPO) and nine Rural Planning Organizations (RPO). Numerous cities including Memphis, Jackson, Nashville, Cookeville, Knoxville, Kingsport and Bristol rely heavily on the corridor for commerce, tourism, and accessibility to goods, services, and jobs.

This technical memorandum (TM) documents and provides an analysis of existing and future conditions of the I-40/81 corridor across the state. To project future conditions, the TM uses a trend scenario that incorporates conditions on the existing roadway network, recently completed projects that may affect the study area, socioeconomic and demographic data, and other factors that impact the corridor's current and future travel characteristics, congestion and traffic, and land development patterns. This analysis, coupled with public outreach and other complementary efforts, is critical to the development of a phased set of investment priorities for the corridor.





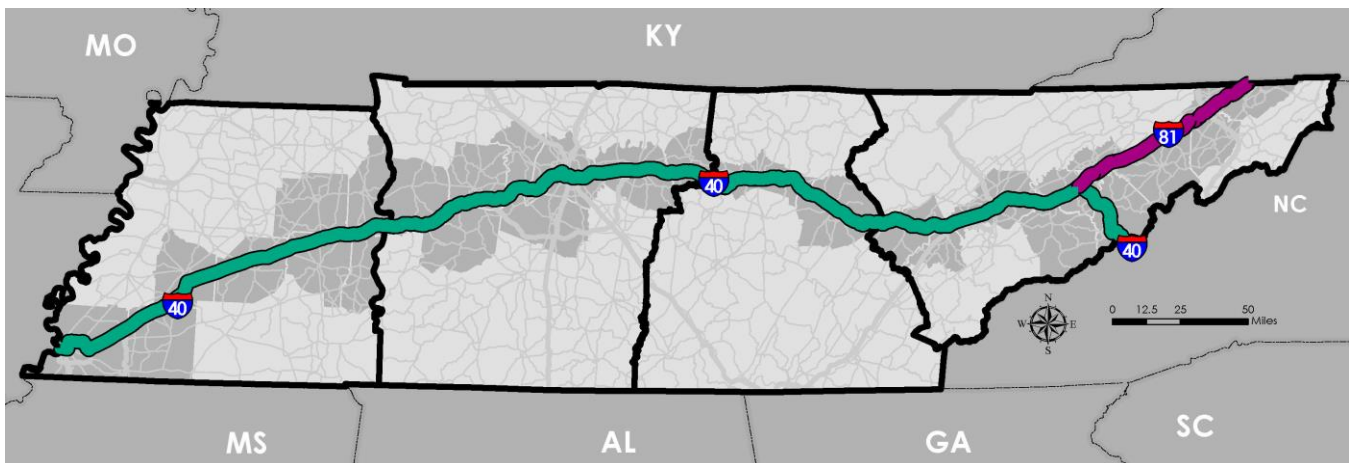
FAST FACTS FOR CORRIDOR	
 <b>Length</b>	<b>531</b> miles
 <b>Number of Counties</b>	<b>28</b>
 <b>Max Volume</b>	<b>212,693</b> (Knox County, 2018)
 <b>Major Cities</b>	<b>Memphis, Jackson, Nashville, Cookeville, Knoxville, Kingsport, Bristol</b>

Figure 1: Study Corridor





# I-40/81 Multimodal Corridor Study

## 2. Projects on I-40 and I-81

The I-40/81 Corridor Feasibility Study completed in 2008 included project recommendations ranging from roadway capacity enhancements to climbing lanes and ITS projects. Several of these projects have been completed and are listed in Table 1. This list of improvements, along with other recent I-40/81 projects that are now open to traffic, was used to update the Tennessee statewide travel demand model (TSM) to reflect current conditions. Tables 2 and 3 were used to develop a future year (2040) trend scenario that includes projects that are underway or legislatively committed.

### Projects Completed from Previous I-40/81 Study

Table 1. Projects Completed from Previous I-40/81 Study

Region 1	
Description/Type of Work	Category
I-81 near MP 60/Add NB truck climbing lane (Sullivan County)	Climbing Lane
I-81 Rest Area in Jefferson County/Lengthen ramps	Ramp/Interchange
I-40/I-81 Interchange/Lengthen ramps	Ramp/Interchange
I-40 from SR 131 (Exit 374) to I-140 (Exit 376)/Add WB auxiliary lane <sup>1</sup>	Ramp/Interchange
I-40 Weigh Station in Knox County/Lengthen ramps	Ramp/Interchange
Region 2	
Description/Type of Work	Category
I-40 near MP 326/Add WB truck climbing lane (Cumberland County)	Climbing Lane
Region 3	
Description/Type of Work	Category
I-40/I-440 Interchange/Lengthen ramp	Ramp/Interchange
I-40/SR 50 Interchange/Lengthen ramps	Ramp/Interchange
I-40 near MP 250/ Add EB truck climbing lane (Smith County)	Climbing Lane
I-40 near MP 180/Add EB truck climbing lane (Dickson County)	Climbing Lane
Region 4	
Description/Type of Work	Category
US-45 (Hollywood Dr.) from I-40 to Miller Dr./Widen to 5 lanes	Ramp/Interchange
I-40 Weigh Station in Haywood County/Lengthen ramps	Ramp/Interchange
I-40/SR 76 Interchange/Lengthen ramps	Ramp/Interchange
I-40 near MP 133/Add WB truck climbing lane (Benton County)	Climbing Lane

<sup>1</sup> 2008 study recommended a longer segment, from I-75 (Exit 369) to I-140 (Exit 376).



# I-40/81 Multimodal Corridor Study

## Underway/Programmed

In addition to projects that have already been constructed on the corridor, the projects in Table 2 and Table 3 are partially completed or under development, and have been included in the development of the 2040 trend scenario used for future conditions analysis and needs, as described later in this memo.

Table 2. Projects Underway from Previous I-40 and I-81 Study

Description	Type of Work
I-81 ITS Smartway Expansion from I-26 (Exit 57) interchange to Virginia state line	ITS
I-40 at Clinch River/Widen bridge to provide full shoulders	Ramp/Interchange
I-40 near MP 339/Add EB truck climbing lane (Cumberland County)	Climbing Lane
I-40 from Mt. Juliet Rd. (Exit 226) to I-840 (Exit 235)/ Widen to 6 lanes	Roadway Capacity
I-40 from near I-840 to near US 70S (Exit 196) and from near SR 255 (Donelson Pike, Exit 216) to near US 70 (Exit 239)/ ITS Freeway Management <sup>2</sup>	ITS
I-40/US-45 Bypass and I-40/US-45 Interchanges/Reconstruct and add auxiliary lanes	Ramp/Interchange
I-40 from Lower Brownsville Rd. (Exit 74) to SR-152 (Exit 93)/Widen to 6 lanes	Roadway Capacity
I-40 from Germantown Rd. (Exit 18) to SR 205 (Exit 59)/Widen to 8 lanes <sup>3</sup>	Roadway Capacity
I-40 from SR-300 (Exit 3) to Sycamore View Rd. (Exit 12)/ Widen to 8 lanes	Roadway Capacity
North 2 <sup>nd</sup> /3 <sup>rd</sup> St. Connector from Downtown Memphis to I-40/SR-300 (Exit 3)/ Construct new roadway	Corridor Capacity
I-40 from Spring St. (Exit 290) to SR-299 (Exit 338)/ ITS Freeway Management	ITS

Table 3. Other I-40 and I-81 Projects Programmed in 2020-2023 STIP

Region 1			
Route	Description/Type of Work	Termini	PIN
I-40	ITS Smartway Rural Deployment	ITS Rural Deployment on I-40 from Jefferson County line to NC state line	124292.00
I-40	Rest Area Improvements	Hartford Welcome Center Renovation	124301.00
I-81	Widen	I-40 to SR-341 Roy Messer Hwy.	124423.00

<sup>2</sup> 2008 study recommendations had slightly different termini.

<sup>3</sup> Part of a longer segment recommended for widening in the previous I-40/81 study



# I-40/81 Multimodal Corridor Study

I-40W	Interchange improvements from I-275 to near SR-115 (US-129)	Interchange at I-275 (I-40 Westbound Approach)	124440.00
I-40	ITS Smartway Expansion	From near Strawberry Plains Pike (Exit 398) Interchange to near SR-66 (Sevierville, Exit 407) Interchange	124474.00
<b>Region 2</b>			
Route	Description/Type of Work	Termini	PIN
I-40	ITS Smartway Expansion	Cumberland Plateau, from near MM 285 to near SR-299 (Exit 338)	124054.00
<b>Region 3</b>			
Route	Description/Type of Work	Termini	PIN
I-40	Widen from 4 lanes to 6 lanes on existing alignment	From McCrory Lane (Exit 192) to just west of SR-1/US-70S (Exit 196)	124211.00
I-40	Conceptual study to determine improvements to Fesslers Lane interchanges and 3 major system interchanges, along with possible environmental and ROW impacts and construction phasing	From I-24/I-40 Interchange near the Silliman Evans Bridge to near I-440 in southeast Nashville	124260.01
<b>Region 4</b>			
Route	Description/Type of Work	Termini	PIN
I-40	Widen from 4 lanes to 6 lanes on existing alignment	From east of SR-5(US-45) to SR-1 (US-70) in Jackson	114149.01
I-40	Widen from 4-lanes to 6-lanes on existing alignment	From west of SR-20 (US-412, Hollywood Drive) to west of SR-186 (US-45 Bypass)	114149.03
I-40	Widen	From Decatur County Line to SR-191 (Birdsong Road)	124119.00
I-40	Rest Area Improvements	Benton County Rest Area Renovation	124123.00
I-40	ITS Smartway Expansion	Along I-40 in the Jackson area	124708.00





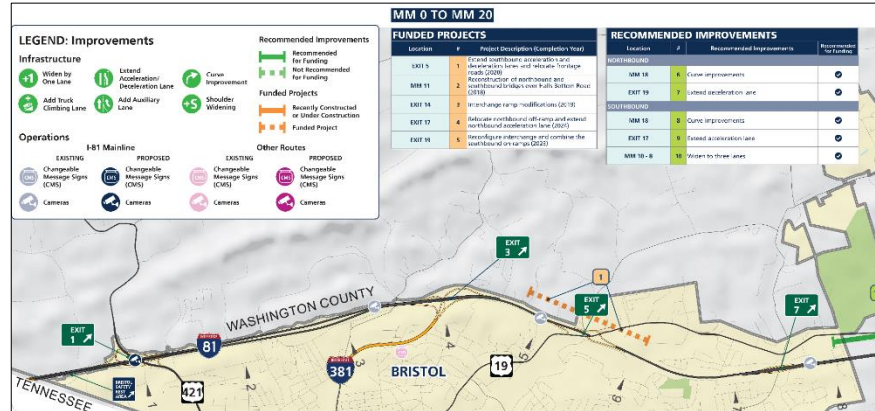
# I-40/81 Multimodal Corridor Study

## Virginia DOT I-81 Corridor Plan

The Commonwealth of Virginia recently completed a comprehensive planning effort for I-81 in Virginia that includes the section of the corridor that borders Tennessee. The Virginia Department of Transportation's (VDOT) I-81 Corridor Improvement Plan includes recommendations for I-81 throughout Virginia to alleviate worsening congestion and

degradation of the corridor's transportation performance. Based on public input, applied prioritization methodology, and available market capacity, the plan recommends implementing \$2.04 billion in capital improvements during a 7- to 10-year period. The plan also identifies \$43 million in immediate operations and incident management improvements and \$2 billion in capital improvements. Overall, the plan identifies more than \$4.3 billion in recommended improvements in the I-81 corridor.

Figure 2. Projects Recommended by VDOT I-81 Corridor Plan



Source: I-81 Corridor Improvement Plan, Virginia Department of Transportation (VDOT), December 2018

The Tri-Cities area of Tennessee, which includes Bristol, Johnson City, and Kingsport, will be impacted by improvements made to Virginia's portion of the I-81 corridor.

Table 4. VDOT I-81 Corridor Improvement Plan Projects Near Tennessee

Funded Improvements Near Tennessee	
Description/Type of Work	Termini
Extend southbound acceleration and deceleration lanes and relocate frontage roads	VA Exit 5 (US 11W/ Lee Highway)
Additional Recommended Improvements Near Tennessee	
Description/Type of Work	Termini
Widening of I-81 Southbound from two to three lanes	VA MM 10 - MM 8
CCTV Cameras	VA Exit 1 and Exit 10



## 3. Future Population and Employment

TDOT’s 25-Year Long-Range Transportation Policy Plan, Demographic and Employment Changes and Trends Policy Paper (2016) includes employment and population projections for the state through the year 2040.<sup>4</sup> According to the policy paper, growth is expected to be concentrated in the ten most populous urban counties of the state. Six of the top ten counties expected to have the greatest population growth as identified by the policy paper are in the I-40/81 corridor: Williamson (1), Knox (3), Davidson (4), Shelby (6), Wilson (7), and Sevier (9). Similarly, seven of the top ten counties in terms of employment growth as identified in TDOT’s policy paper are in the corridor: Williamson (1), Wilson (2), Washington (5), Knox (6), Davidson (7), Shelby (8), and Sullivan (9).

Population projections from the Tennessee State Data Center at University of Tennessee, Knoxville for the state of Tennessee were analyzed to gain an understanding of the pace of growth in the corridor relative to the rest of the state. According to the State Data Center, the population of Tennessee is expected to grow by more than 1 million people by 2040, from nearly 6.8 million to over 7.8 million. TDOT Region 3 contributes a disproportionate amount of this growth and is expected to add more than 700,000 people by 2040.<sup>5</sup>

Table 5. Statewide Population Growth by TDOT Region, 2018 to 2040

Region	2018	2040	Change 2018-2040	Percent Growth 2018-2040
1	1,746,039	1,917,222	171,183	9.8%
2	1,067,396	1,188,220	120,824	11.3%
3	2,395,953	3,130,057	734,104	30.6%
4	1,560,622	1,604,713	44,091	2.8%
<b>Tennessee</b>	<b>6,770,010</b>	<b>7,840,212</b>	<b>1,070,202</b>	<b>15.8%</b>

The I-40/81 corridor study area includes 28 counties adjacent to the interstate (Figure 1). When looking at the corridor specifically, both population and employment growth are concentrated in Regions 1 and 3. The 2018 population of the 28 counties in the corridor is approximately 3.7 million. These counties are expected to grow a total of 15 percent by 2040, to 4.3 million, on pace with the state as a whole. Region 3 is projected to experience the largest overall growth in the study area, accounting for nearly 60 percent of the anticipated population growth in the 28-county area.

<sup>4</sup> TDOT’s 25-Year Long-Range Transportation Policy Plan, Demographic and Employment Changes and Trends Policy Paper, 2016.

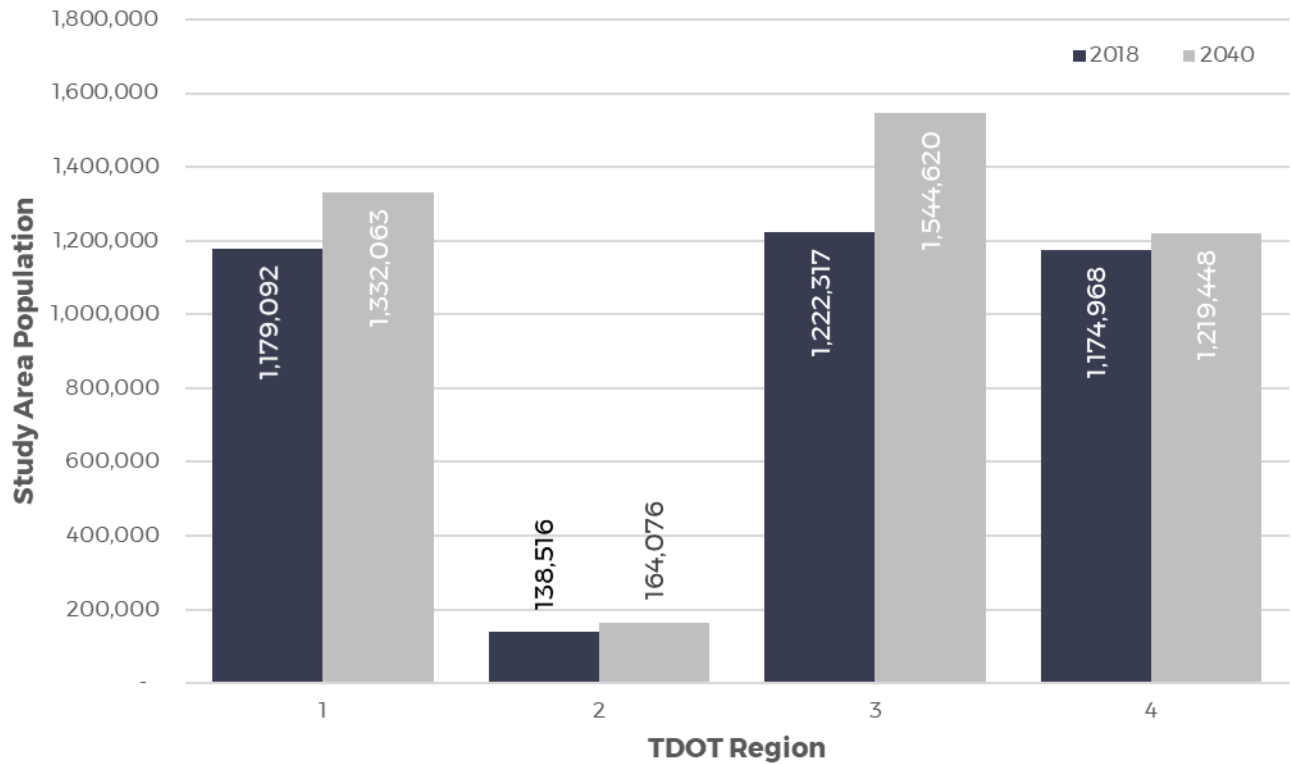
[https://www.tn.gov/content/dam/tn/tdot/documents/Demographic\\_022316.pdf](https://www.tn.gov/content/dam/tn/tdot/documents/Demographic_022316.pdf)

<sup>5</sup> Boyd Center for Business and Economic Research, UTK State Data Center, <https://tnsdc.utk.edu/estimates-and-projections/boyd-center-population-projections/>



# I-40/81 Multimodal Corridor Study

Figure 3. Corridor Population Growth (2018 – 2040)



Source: UTK State Data Center, October 2019

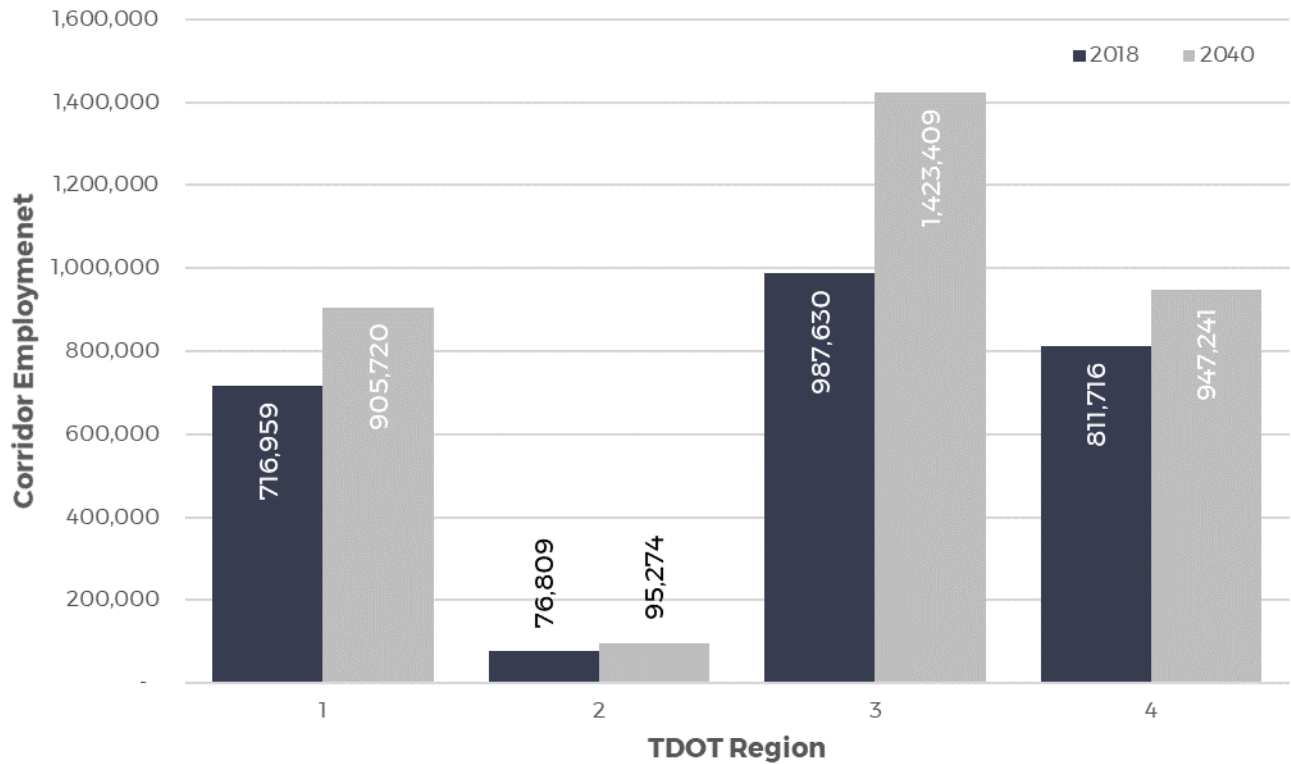
In Regions 1 and 4, the I-40/81 corridor makes up a large fraction of total growth in those portions of the state. For example, of the projected 171,183 growth in population across all of Region 1, 152,971 (or 89 percent) will occur in counties included in this study. In other words, growth in these regions is concentrated in and around the I-40 and I-81 interstate corridors. The pattern is even more pronounced in Region 4 where population growth in the study area counties is anticipated to outpace overall population growth in the region, likely a result of projected loss of population in counties outside the study area (44,480 growth in study area, and only 44,091 in the region as a whole).

Region 2 is projected to account for only four percent of population growth and two percent of employment growth in the corridor, related partly to the fact that Region 2 includes only two counties on the corridor, and the number of large urbanized areas along I-40 and I-81 in other regions.



# I-40/81 Multimodal Corridor Study

Figure 4. Corridor Employment Growth (2018 - 2040)

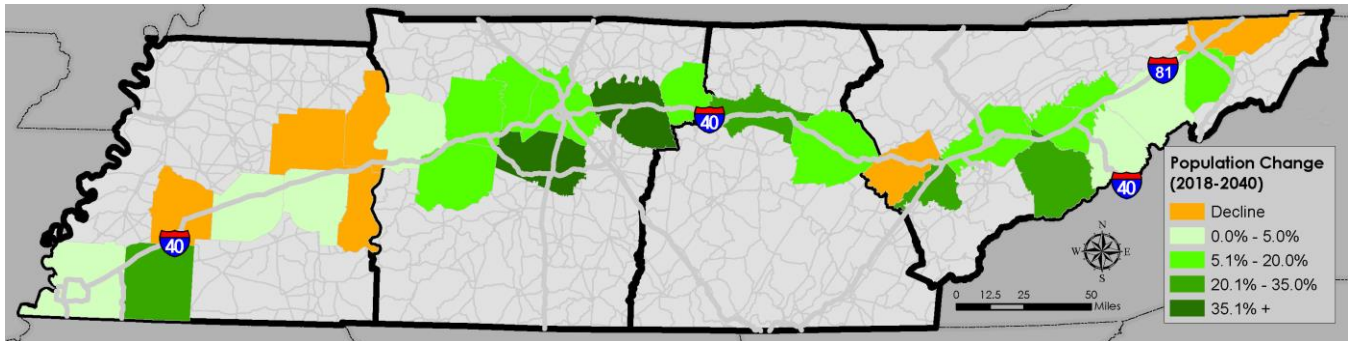


Source: Woods and Poole and Tennessee Statewide Travel Model (TSM)

Employment growth in the corridor is expected to dramatically outpace population growth, with corridor employment increasing from approximately 2.6 million in 2018 to 3.4 million in 2040, an increase of 30 percent. The TDOT policy paper projects that much of this employment growth will be focused in the greater Nashville metropolitan area. This is reflected in the employment projections developed as part of this effort. Employment is also expected to increase dramatically in suburban counties adjacent to the major metropolitan centers of Memphis and Knoxville, as shown in Figure 6.

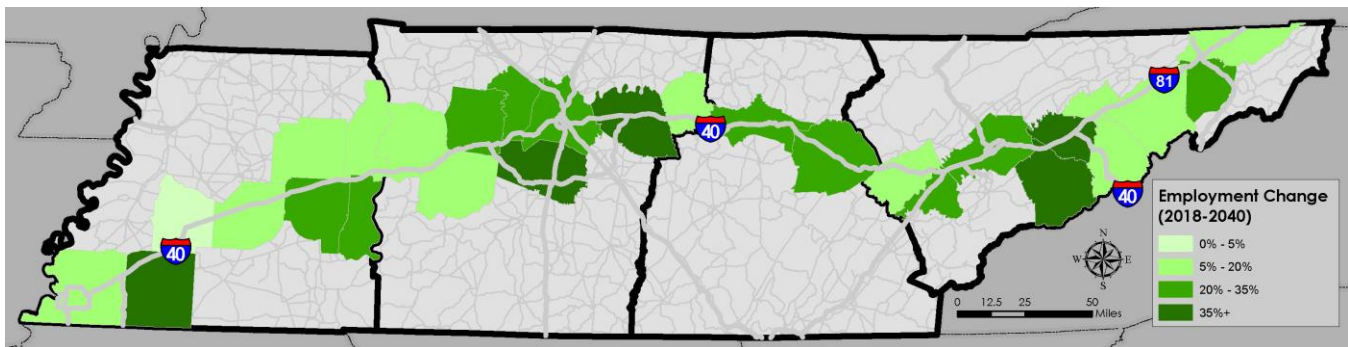
The policy paper also identifies that in 2040, the population will be comprised of a greater portion of people over 65, with mobility needs that may be different than other groups. This trend will likely change transportation needs, particularly in rural areas of the state where many of Tennessee’s rural citizens are projected to continue aging in place, likely increasing the need for rural transit services.

Figure 5. Corridor Population Change, 2018 to 2040



Source: UTK State Data Center, October 2019

Figure 6. Corridor Employment Change, 2018 to 2040



Source: Woods and Poole and TSM

The portion of the study area in **Region 1** is comprised of ten counties that are expected to increase by 178,366 residents by 2040, bringing their population to over 1.3 million people. Employment is expected to grow by slightly over 1 percent a year in these counties and outpaces population growth, growing by 188,761. By 2040, Region 1 is anticipated to exceed Region 4 in terms of total population in both the corridor study area and regionwide.

Of the 24 counties in **Region 2**, only Cumberland and Putnam counties lie within the corridor study area. These two counties represent approximately 4 percent of the corridor population and 3 percent of corridor employment in 2018 and in 2040. Population is expected to grow by 25,437 in these two counties, with employment projected to grow by 18,465.

In line with trends identified in the TDOT 25-Year Long Range Transportation Policy Plan, **Region 3** is forecast to grow at a much higher rate than the other regions and by 2040 will be more populous than Regions 2 and 4 combined. Statewide, Region 3 will see more than half of the state’s growth, with Williamson County expected to lead the state in terms of total population growth. Wilson County, to the east of Nashville, is also expected to grow rapidly, roughly two percent annually in both population and employment.

The eight counties that comprise the study area in **Region 4** have roughly the same population as Region 1 counties in 2018 but are anticipated to experience more moderate rates of growth, with an increase of four percent through 2040. Three counties are expected to decrease in population by 2040: Benton, Carroll, and Haywood. Fayette County, a suburb of Memphis, is the fastest growing county in the Region 4 portion of the corridor, with a projected population growth of 22 percent, and employment growth of 67 percent.



# I-40/81 Multimodal Corridor Study

Table 6. Study Area Population and Employment Change (2018-2040)

Region	Counties	2018 Pop	2018 Emp	2040 Pop	2040 Emp	Pop Change	Annual Pop Change	Emp Change	Annual Emp Change
1	Cocke, Greene, Hamblen, Jefferson, Knox, Loudon, Roane, Sevier, Sullivan, Washington	1,179,092	716,959	1,332,063	905,720	13.0%	0.6%	26%	1.1%
2	Cumberland, Putnam	138,516	76,809	164,076	95,274	18.5%	0.8%	24%	1.0%
3	Cheatham, Davidson, Dickson, Hickman, Humphreys, Smith, Williamson, Wilson	1,222,317	987,630	1,544,620	1,423,409	26.4%	1.1%	44%	1.7%
4	Benton, Carroll, Decatur, Fayette, Haywood, Henderson, Madison, Shelby	1,174,968	811,716	1,219,448	947,241	3.8%	0.2%	17%	0.7%

Source: UTK State Data Center and TSM

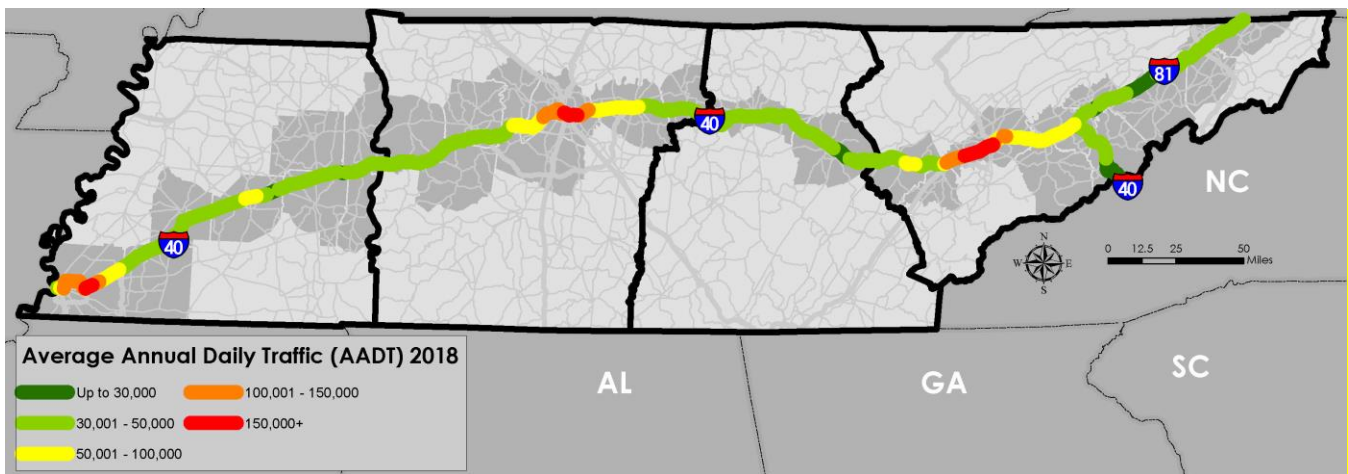
## 4. Traffic Volumes, Congestion, and Travel Patterns

In addition to population and employment projections, information on existing traffic volumes, travel patterns, and congestion help to understand the impact that commute patterns and growth and development patterns have on transportation infrastructure. Data from TDOT’s Enhanced Tennessee Roadway Information Management System (E-TRIMS), the Tennessee Statewide Travel Demand Model (TSM), and the National Performance Management Research Data Set (NPMRDS) were used to identify congested segments throughout the corridor.

### Traffic Volumes

Traffic count data for I-40 and I-81, measured in terms of Average Annual Daily Traffic (AADT), was retrieved from E-TRIMS. All of the top locations for AADT are in the I-40 section of the corridor, with the highest volumes exceeding 200,000 in Knox County where I-40 runs concurrently with I-75. Predictably, AADT is highest in urban areas, with six of the top ten locations in Knox County, three in Davidson County, and one in Shelby County. As population and employment continue to grow throughout the corridor, largely concentrated in and around urban areas, traffic volumes and demand on I-40/81’s infrastructure will increase.

Figure 7. Average Annual Daily Traffic (AADT) 2018



Source: E-TRIMS

### Congestion

The TSM and NPMRDS were used to identify congested segments in both the base year (2018) and future year (2040) as defined by both recurring and non-recurring congestion, and were supplemented using stakeholder feedback collected to date. The TSM provided maximum daily volume-to-capacity (V/C) ratios for roadway segments, indicating the number of vehicles using the road in comparison to the number of vehicles that the roadway is designed to move.

NPMRDS is a national data set of average travel times on the National Highway System (NHS) provided by the USDOT for use in transportation performance management. Travel times are provided for every hour for roadway segments throughout the corridor. NPMRDS data was used to calculate two related measures of congestion related to travel time: vehicle excess hours traveled (VEHT) and vehicle hours of unreliability (VHU). Both measures compare average travel times on the corridor to both the free flow travel time and the 95th percentile travel times. Comparing average travel time to free flow travel time helps to identify the recurring congestion that occurs on the roadway, reported as vehicle excess hours traveled, or VEHT. Comparing the 95th percentile travel time to the average travel time provides insight on the locations of non-recurring congestion, expressed as vehicle hours of



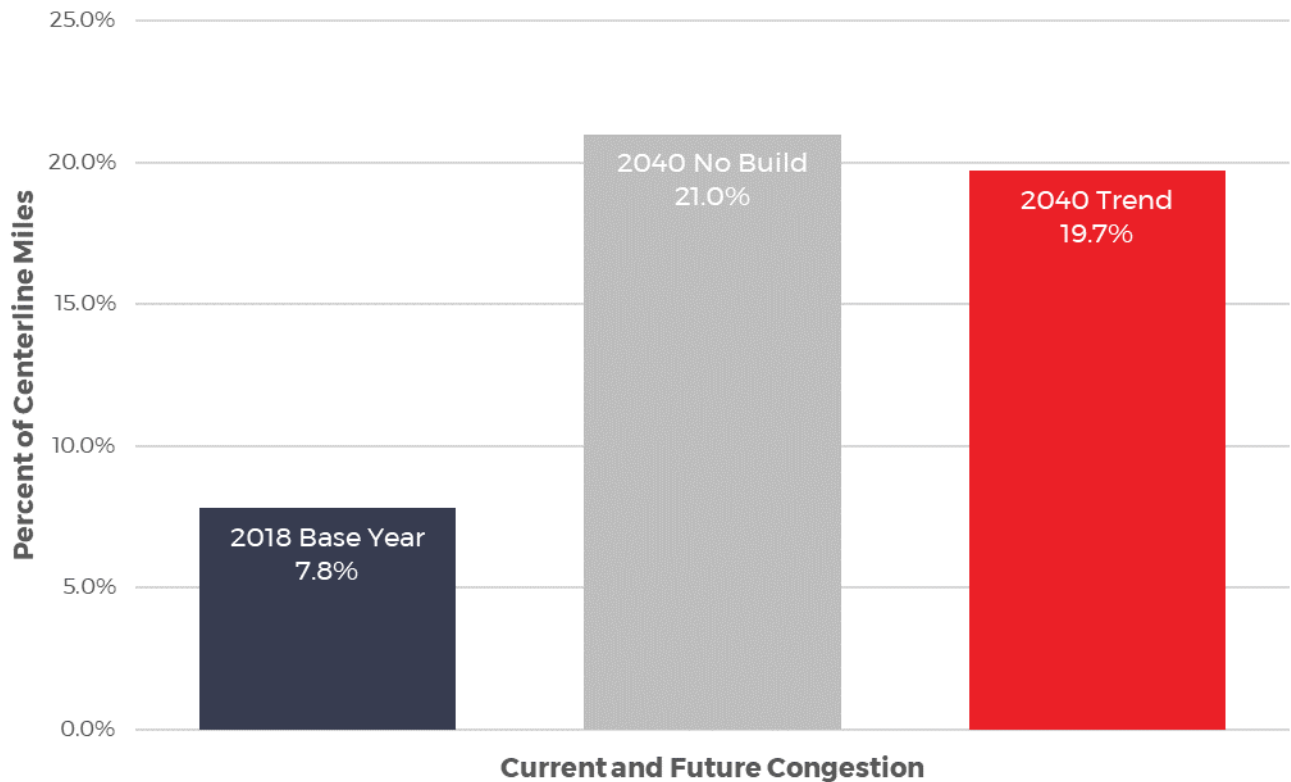
# I-40/81 Multimodal Corridor Study

unreliability (VHU). Non-recurring congestion is typically caused by crashes, work zones, weather, and special events.

Generally speaking, congested locations along I-40 and I-81 are concentrated in urban areas throughout the corridor, specifically Knoxville, Memphis and Nashville. Figures 9 through 12 and Tables 7 through 10 identify congested segments by TDOT region, and represent both directions of travel unless otherwise noted.

Presently, approximately 8 percent roadway centerline miles in the corridor are congested (defined as having a volume-to-capacity ratio of 0.8 or more, or LOS of D or worse at any point during the day). This is expected to nearly triple to 21 percent of roadway miles by 2040, if no additional investments are made in the corridor. Even with the completion of projects in the corridor that are currently underway or under development, congestion is still expected to increase by over 150 percent by 2040. Underway or under development projects are those that have construction funding currently programmed.

Figure 8. Projected Percent of Corridor Congested



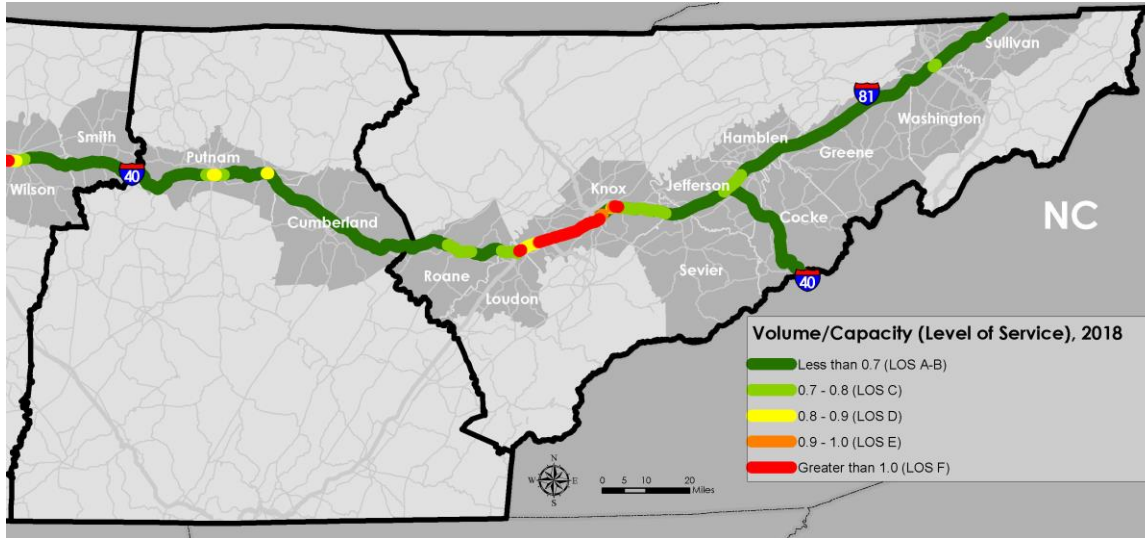




# I-40/81 Multimodal Corridor Study

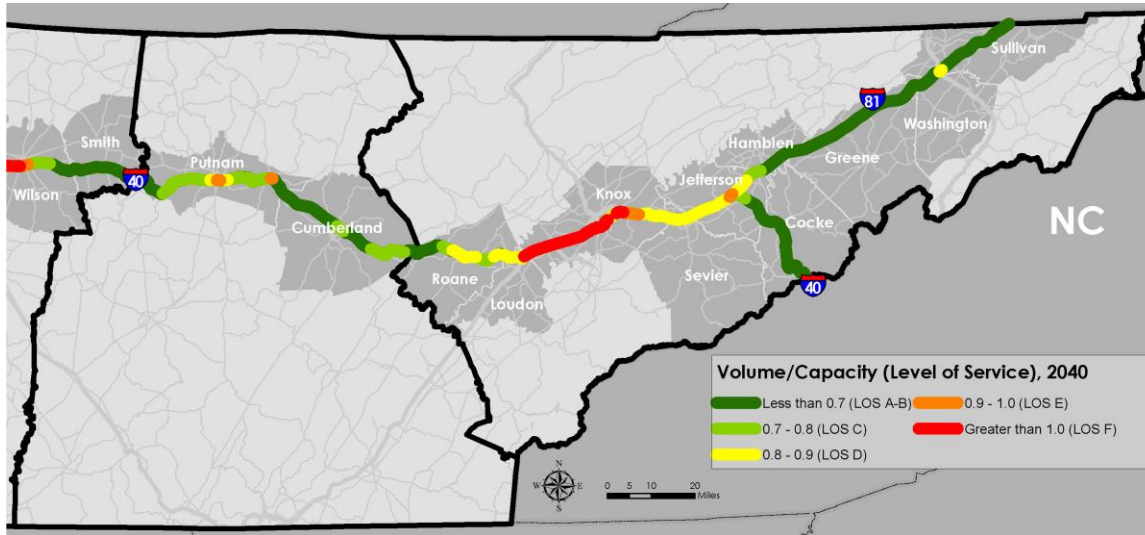
## East Tennessee

Figure 9. Volume-to-Capacity Ratios, 2018 – East Tennessee



Source: TSM

Figure 10. Volume-to-Capacity Ratios, 2040 Trend Scenario – East Tennessee



Source: TSM

**Region 1** – Congestion in Region 1 is concentrated on I-40 in Knoxville between Farragut and Strawberry Plains. These areas are associated with urban development and rolling terrain. They are also areas where there are several drops in the number of thru-lanes, including in the westbound direction at I-640, in the eastbound direction at I-75, and at the Alcoa Highway (US 129, SR 115) merge. The congested segment between I-75 and Campbell Station Road, near the border of Loudon and Knoxville counties, also includes a truck weigh station which affects traffic operations. This weigh station is located in an area with steep grades, further complicating operations, especially for freight traffic in the corridor.



# I-40/81 Multimodal Corridor Study

Congestion along I-40 in Knox County is also influenced significantly by major interchanges including: I-640 which serves as a bypass around downtown Knoxville, Alcoa Highway (US 129, SR 115), and Pellissippi Parkway (designated as SR 162 north of I-40, and as I-140 south of the interstate).

Congestion is projected to worsen in Region 1 by 2040, with rising volume-to-capacity ratios, the growing length of congested segments, and worsening delays. Congestion in rural portions of the corridor, specifically in Roane and Jefferson Counties, is also expected to reach LOS D by 2040.

Table 7. Region 1 Congested Locations

Route	Description	County	Max V/C Ratio	
			2018	2040
I-40	Walker Springs Rd. to Alcoa Hwy (includes I-640 west)	Knox	1.33	1.52
I-40	N. Campbell Station Rd. to Walker Springs Rd.	Knox	1.24	1.38
I-40	Rutledge Pike (US 11W) to Asheville Highway (US 11E, SR 168) (segment includes east side of I-640)	Knox	1.14	1.38
I-40	Alcoa Hwy (US 129, SR 115) to James White Parkway (SR 158)	Knox	1.07	1.23
I-40	I-75 to Campbell Station Rd.	Loudon, Knox	1.03	1.25
I-40	Eastbound - from SR 92 to I-81	Jefferson	0.78	0.98
I-40	Roane State Hwy (US 70) to Gallaher Rd.	Roane	0.77	0.87
I-81	I-81 and I-26 interchange	Sullivan	0.75	0.83
I-40	Strawberry Plains Pike to SR 92	Knox, Jefferson	0.71	0.88

One congested segment was identified on I-81 in the vicinity of the I-26 interchange. Analysis and recommended improvements for this interchange were part of the recently completed I-55/75/26 study. That study identified reconfiguring of the I-81 and I-26 interchange as a safety improvement that should also consider capacity improvements to accommodate economic growth and truck movements. The study also recommends enhancements to lighting and advanced signage at interchanges.

**Region 2** - The top congested segments in Region 2 are concentrated in Putnam County in the Cookeville area and to the east in Monterey. Much of the congestion in Region 2 can be attributed to the rapid urbanization of Cookeville, which is nearing a population of 50,000, as well as steep grades in the Monterey area in the eastern portion of Putnam County. I-40 has a four percent grade between SR-24 (East Spring Street) and SR-24 (Monterey Highway) in Putnam County, creating delays related to the significant speed differentials between heavy trucks and other traffic, and limited passing opportunities.

Similar to Region 1, congestion is expected to worsen on the corridor by 2040, with the volume on certain segments of I-40 nearing the capacity for which the interstate is currently designed and constructed.



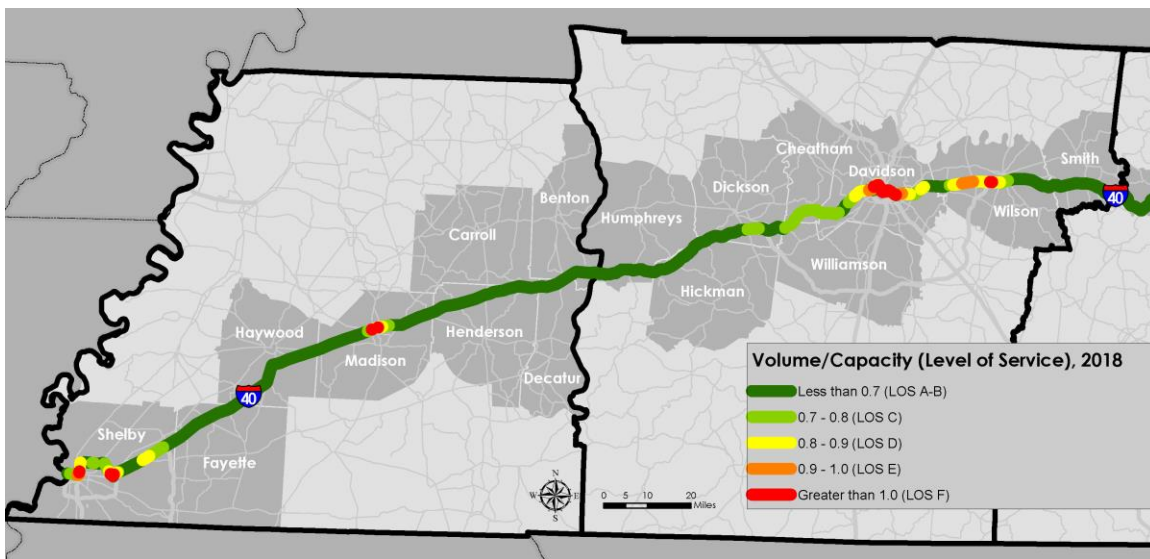
# I-40/81 Multimodal Corridor Study

Table 8. Region 2 Congested Locations

Route	Description	County	Max VOC	
			2018	2040
I-40	Eastbound - SR 84 to SR 24	Putnam	0.84	0.98
I-40	Westbound - SR-111 to SR 136 (South Jefferson Ave.)	Putnam	0.83	0.96

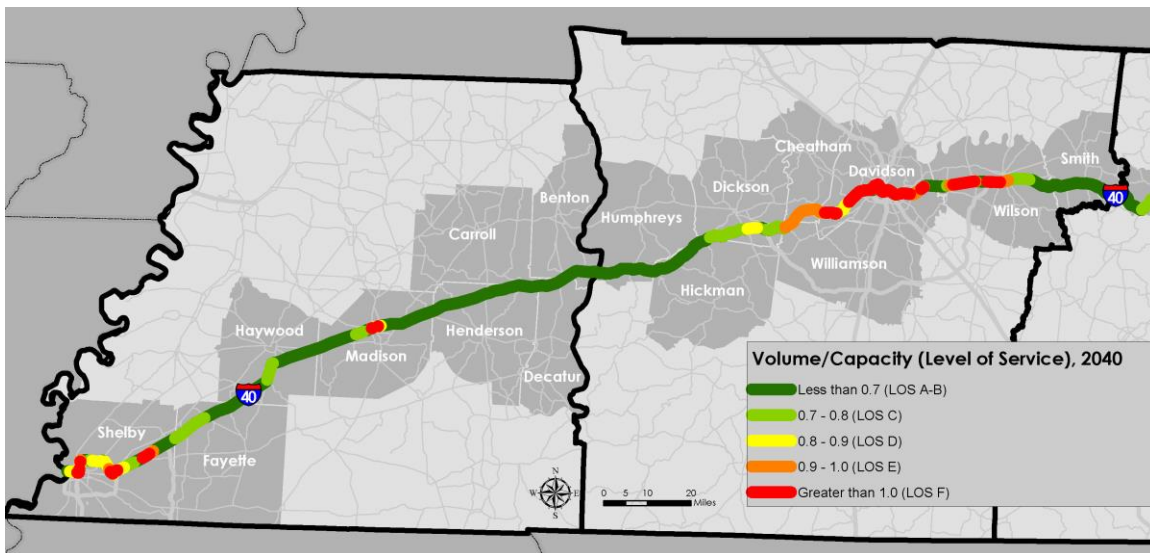
## Middle and West Tennessee

Figure 11. Volume-to-Capacity Ratios, 2018 - Middle and West Tennessee



Source: TSM

Figure 12. Volume-to-Capacity Ratios, 2040 Trend Scenario- Middle and West Tennessee



Source: TSM



# I-40/81 Multimodal Corridor Study

**Region 3** – The top bottlenecks in Region 3 are concentrated in the downtown core of Nashville, near the interchange with I-24 and in the “Inner Loop.” Interchanges are complex and spaced between 0.25 miles and 1.5 miles apart. Several lane drops are experienced in both directions, including at the system interchanges of I-440 and I-65.

I-40 in Region 3 interchanges with two other interstates, and travels through many of the state’s larger urban north and suburban centers. The downtown core of Nashville has system interchanges with I-65, which runs north-south to Kentucky and Alabama; I-24 which connects the state to Kentucky and Georgia; and I-440 which provides a bypass around downtown. In addition, I-840 is a recently designated interstate route that allows long-haul trucks and thru-travelers to bypass Nashville congestion altogether, connecting to I-40 in Dickson County west of Nashville, and in Wilson County east of Nashville. As development in metropolitan Nashville continues to spread outward to surrounding counties, I-840 is itself spurring new growth centers that generate additional traffic circulating throughout the Middle Tennessee interstate system.

Table 9. Region 3 Congested Locations

Route	Description	County	Max VOC	
			2018	2040
I-40	I-65 to I-24 - Southern portion of inner loop in Downtown Nashville	Davidson	1.39	1.64
I-40	I-440 west to I-40 (inner loop)- West of Downtown Nashville to western portion of inner loop	Davidson	1.29	1.48
I-40	I-24 to I-440 (east) - From Southern portion of inner loop to I-440 southeast of downtown	Davidson	1.24	1.43
I-40	I-40 to I-65 - Western portion of inner loop in Downtown Nashville	Davidson	1.23	1.52
I-40	Beckwith Rd. S. Hartmann Dr. (includes SR-109 and I-840)	Wilson	1.03	1.33
I-40	46th Ave. (51 <sup>st</sup> Ave. in 2040) to I-440 west	Davidson	0.95	1.27
I-40	Spence Lane to SR 155 (Briley Pkwy.)	Davidson	0.95	1.17
I-40	Charlotte Pike to SR 155 (Briley Pkwy.)	Davidson	0.86	1.17
I-40	Westbound - Stewarts Ferry Pike/Bell Rd. to SR 265 (Old Hickory Blvd.)	Davidson	0.8	1.08
I-40	Westbound - McCrory Lane to US 70S (SR 1, Memphis-Bristol Hwy.)	Davidson	0.78	1.06
I-40	SR-46 and I-840	Dickson	0.73	0.82



# I-40/81 Multimodal Corridor Study

**Region 4** – The top bottlenecks in Region 4 are in Memphis. Like downtown Nashville, downtown Memphis has several system interchanges which create congestion and weaving issues for drivers, including the I-240 interchange in east Memphis that allows travelers to bypass downtown and access freight intensive activities in the southern portion of the city, and the I-69 interchange north of downtown Memphis. Continued growth in east Shelby County also contributes to traffic congestion around the interchanges at Canada Road, SR 177 (Germantown Parkway), and Sycamore View Road.

While the overall congestion in Region 4 is projected to worsen by 2040, the length and severity of congestion in the Jackson area is actually expected to improve. As noted earlier, widening projects are underway on I-40 through central Jackson which will provide additional capacity and improve merging at interchanges. Once these projects are completed, the statewide travel demand model projects continued congestion along the section of I-40 between the very busy interchanges of the US 45 Bypass and US 45 (SR 5, North Highland Ave.).

Table 10. Region 4 Congested Locations

Route	Description	County	Max VOC	
			2018	2040
I-40	SR 204 (Covington Pk.) to Sycamore View Rd.	Shelby	1.26	1.53
I-40	US 45 Bypass to US 45 (SR 5, N. Highland Ave.)	Madison	1.18	1.36
I-40	Exit 1B (US-51/SR-4/Danny Thomas Blvd.) to Exit 2 (Chelsea Ave. and Smith Ave.)	Shelby	1.15	1.31
I-40	I-40 at Canada Rd.	Shelby	0.89	1.03
I-40	Exit 2 (Chelsea Ave and Smith Ave.) to Exit 5 (North Hollywood St.)	Shelby	0.85	1.01

## Travel Patterns

County-to-county commuting patterns were also analyzed using Census Transportation Planning Products (CTPP) 2012-2016 five-year data. CTPP data is based on the American Community Survey (ACS) and is designed to help understand where people are commuting to and from, and how they get there. Data was analyzed for each of the 28 counties in the study area. While the largest flows are within counties with large populations, identifying intercounty commuting patterns in the study area can help identify portions of the corridor where I-40 or I-81 is likely to be used for daily travel.

Table 11 presents the top inter-county commuting flows within the counties in the I-40/81 corridor. With the exception of flows between Davidson, Williamson and Cheatham counties, which are more likely to use I-65 or I-24, the thousands of work trips being made among these counties are likely using I-40 and I-81 for at least a portion of the journey.

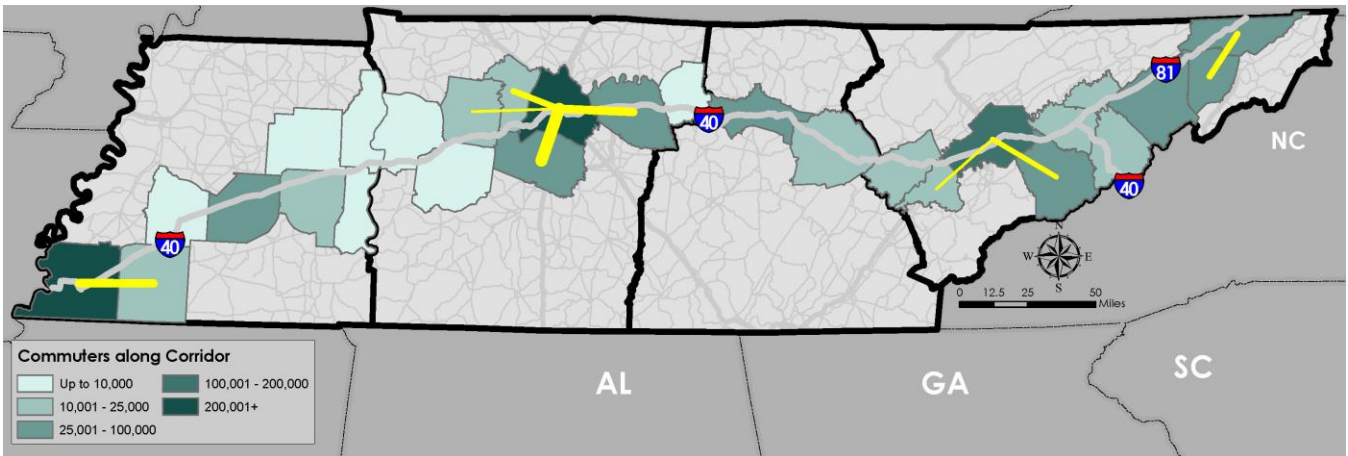


# I-40/81 Multimodal Corridor Study

Table 11. Top Inter-County Commuting Flows Among the 28 Counties in the I-40/81 Corridor

Residence	Workplace	# of Workers
Davidson	Williamson	30,785
Williamson	Davidson	29,510
Wilson	Davidson	23,485
Fayette	Shelby	10,940
Cheatham	Davidson	9,745
Washington	Sullivan	8,650
Sullivan	Washington	7,710
Sevier	Knox	7,345
Loudon	Knox	5,860
Davidson	Wilson	5,515
Dickson	Davidson	5,075

Figure 13. County-to-County Commuting within the I-40/81 Corridor Area



Source: U.S. Census Bureau, American Community Survey 2012-2016 Five-year estimates. Special Tabulation: Census Transportation Planning

## Travel Times

Peak travel times between key cities along the corridor are anticipated to increase throughout the corridor by 2040, as shown in Table 12 and Table 13. The most significant changes are between Cookeville, Nashville, and Dickson, with trips taking roughly 15 to 25 percent longer by 2040. Other notable increases in typical travel times are between Crossville and Knoxville, and between Knoxville and Morristown.



## I-40/81 Multimodal Corridor Study

Table 12. Increase in Peak Travel Time between Key Cities, EB/NB (2018 to 2040 Trend Scenario)

Cities	2018 Minutes	2040 Minutes	Growth Minutes	Growth Percent
Memphis and Jackson	74.1	79.3	5.1	6.9%
Jackson and Dickson	76.6	79.2	2.7	3.5%
Dickson and Nashville	38.8	45.3	6.6	16.9%
Nashville and Cookeville	77.2	90.1	12.9	16.8%
Cookeville and Crossville	26.1	28.9	2.8	10.9%
Crossville and Knoxville	80.3	91.4	11.1	13.9%
Knoxville and Morristown	44.4	51.4	7.0	15.7%
Morristown and Kingsport	40.6	42.2	1.6	3.9%
Kingsport and Bristol	15.3	15.7	0.4	2.3%

Table 13. Increase in Peak Travel Time between Key Cities, WB/SB (2018 to 2040 Trend Scenario)

Cities	2018 Minutes	2040 Minutes	Growth Minutes	Growth Percent
Bristol and Kingsport	15.0	15.2	0.2	1.2%
Kingsport and Morristown	39.8	40.8	0.9	2.4%
Morristown and Knoxville	40.7	46.0	5.3	13.1%
Knoxville and Crossville	80.4	92.4	12.0	14.9%
Crossville and Cookeville	25.5	27.6	2.2	8.5%
Cookeville and Nashville	74.5	86.6	12.1	16.2%
Nashville and Dickson	41.7	52.7	11.0	26.4%
Dickson and Jackson	76.5	81.7	5.2	6.7%
Jackson and Memphis	72.1	73.9	1.8	2.5%



### 5. Transportation Systems Management and Operations

I-40 and I-81 are an integral part of the statewide and national transportation network, providing a primary backbone across the entire length of Tennessee for both intrastate and interstate travel. As the population and economy of the state continue to grow, and limitations on federal, state, and local funding sources remain, transportation systems management and operations strategies (TSMO) have become increasingly important solutions for the transportation network and mobility of individuals.

TSMO strategies on interstates can provide a cost-effective alternative to costly construction projects. TDOT currently employs several such strategies to maintain and enhance safety and mobility along the I-40/81 corridor. These include the ITS SmartWay program, HELP Patrol, high-occupancy vehicle lanes, weather monitoring, and dynamic message signs. TDOT also partners with the Tennessee Highway Patrol (THP) and local law enforcement to manage traffic during special events that affect the corridor, such as University of Tennessee football games (Knoxville) and racing events at Bristol Motor Speedway (Bristol). There are numerous opportunities for the application of operational solutions along both I-40 and I-81 that utilize ITS, managed lanes, and other low-cost strategies.

#### ITS

Intelligent Transportation Systems (ITS) is defined as the system of electronics, communications, or information processing in transportation and its infrastructure, including vehicles used singly or integrated, with the goal to improve safety and mobility. Examples of ITS include speed cameras, dynamic message signs (DMS), CCTV systems, traffic signalization and optimization, in-vehicle navigation systems, and other wired and wireless communications-based and electronics technologies. TDOT's ITS program, **SmartWay**, uses cameras, DMS, roadway detection systems, and video to monitor interstates across the state. Traffic and other travel information is communicated to travelers through DMS, highway advisory radio, 511 phone system, and TDOT's online Smartway maps available on the web and through a mobile app. Across the entire state, SmartWay includes a total of 551 cameras, 183 message signs, 1107 roadway detection systems, and 49 video detection systems.<sup>6</sup>

TDOT operates the SmartWay program and associated infrastructure through four regionally located **Traffic Management Centers (TMC)** in Knoxville (Region 1), Chattanooga (Region 2), Nashville (Region 3), and Memphis (Region 4). These TMCs are responsible for operating and managing the program in both metropolitan areas and rural areas, and operate 24 hours a day, seven days a week.<sup>7</sup> Each TMC serves as a focal point for traffic management operations and communications. The equipment and resources used to support the SmartWay program help improve safety and mobility on Tennessee roadways.

Based on an inventory of ITS resources maintained in E-TRIMS, equipment in the I-40/81 corridor is split relatively evenly among Regions 1, 3, and 4, with fewer resources in Region 2, which has about 14 percent of the corridor mileage within its boundaries. At this time, the majority of resources in Region 1 are on I-40, though an ITS expansion project is currently planned in Region 1 along I-81 from I-26 to the Virginia state line.

<sup>6</sup> TDOT Integrated ITS SmartWay Systems, <https://www.tn.gov/tdot/intelligent-transportation-systems/integrated-its-smartway-systems.html>, accessed 19 March 2020.

<sup>7</sup> Region 2 moves to 24 hours a day, <https://www.tn.gov/tdot/news/2017/9/29/tdot-traffic-management-center-in-chattanooga-to-begin-around-the-clock-ope.html>, accessed 19 March 2020, Region 4 moves to 24 hours a day per interview with Region 4.



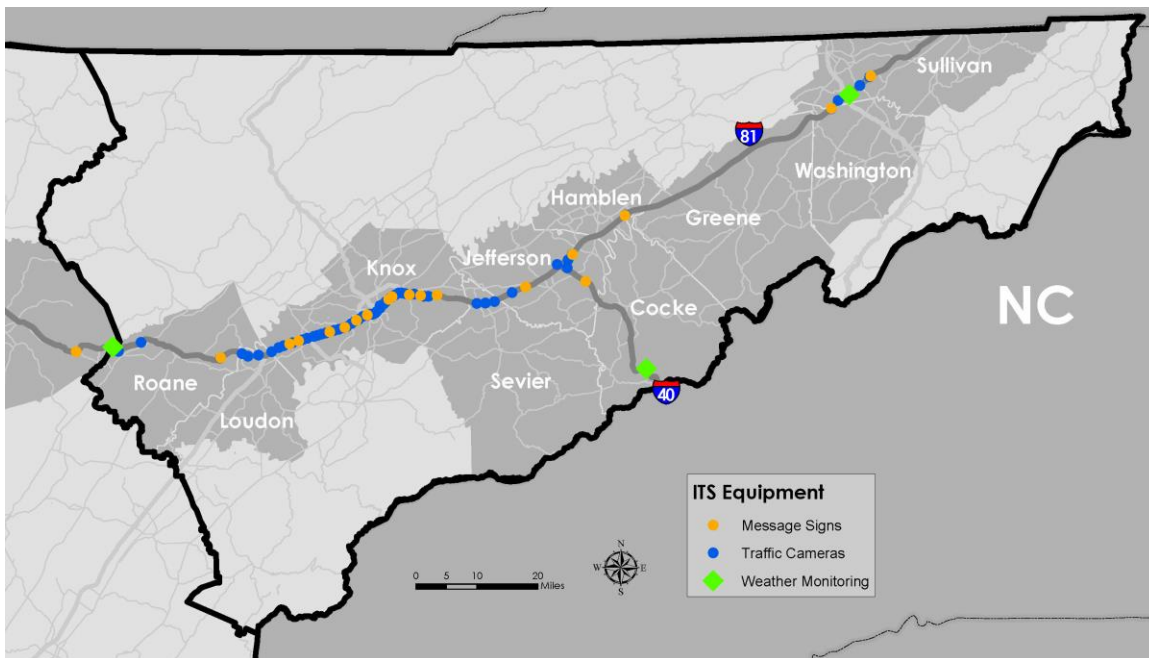


# I-40/81 Multimodal Corridor Study

Table 14. ITS Resources in Corridor

ITS Resource	Region					TOTAL
	1		2	3	4	
	I-40	I-81	I-40	I-40	I-40	
ATR (Automatic Traffic Recorder)	3	-	1	3	1	8
RWIS (Weather Monitoring Station)	3	1	1	1	-	6
ITS Signs	14	4	1	17	16	52
ITS Cameras	53	8	-	33	39	133
Proposed Embedded Detection Loops	-	-	-	1	-	1
Embedded Detection Loops	2	-	6	3	2	13

Figure 14. Region 1 ITS Infrastructure

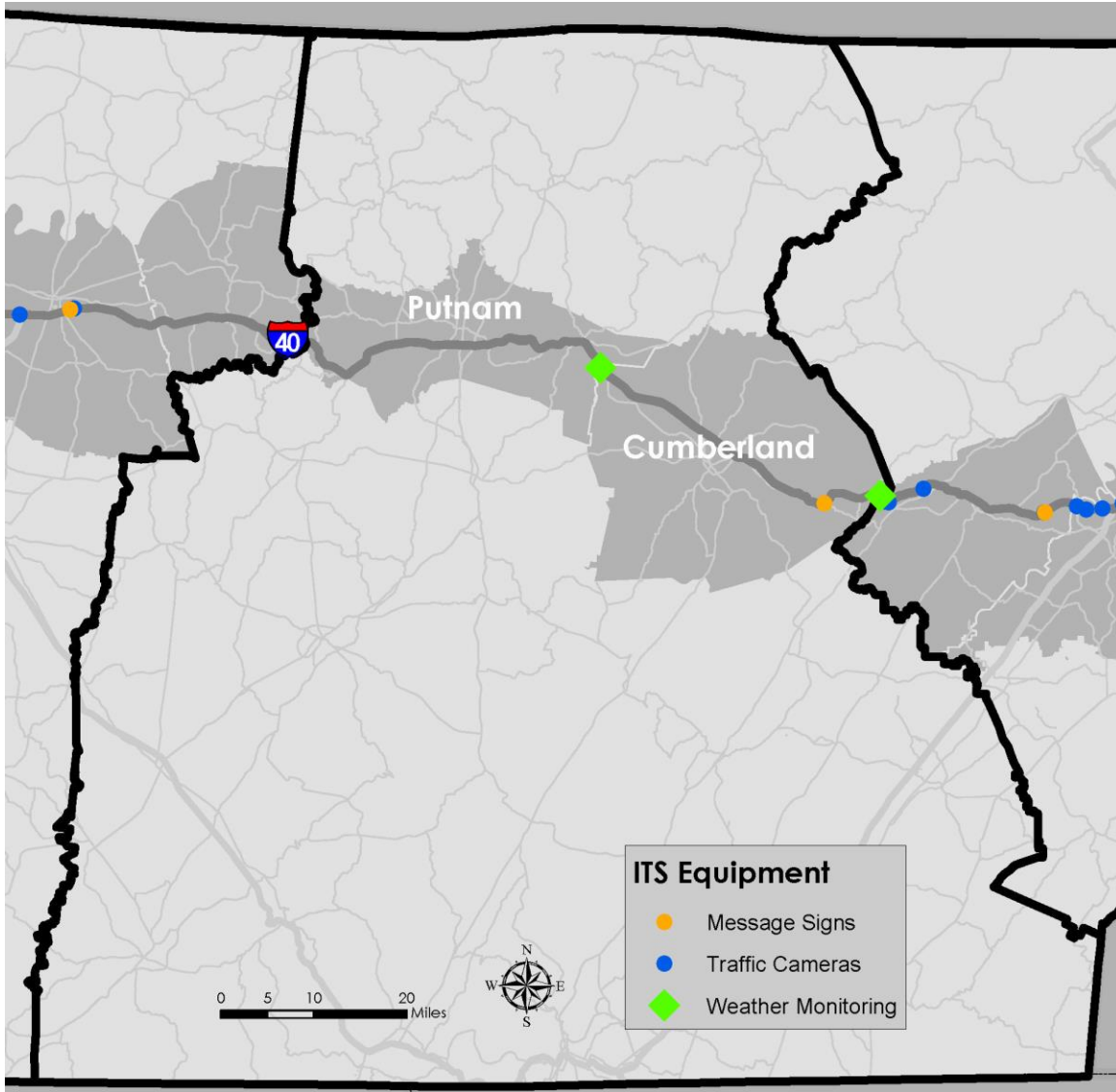


Source: E-TRIMS



# I-40/81 Multimodal Corridor Study

Figure 15. Region 2 ITS Infrastructure

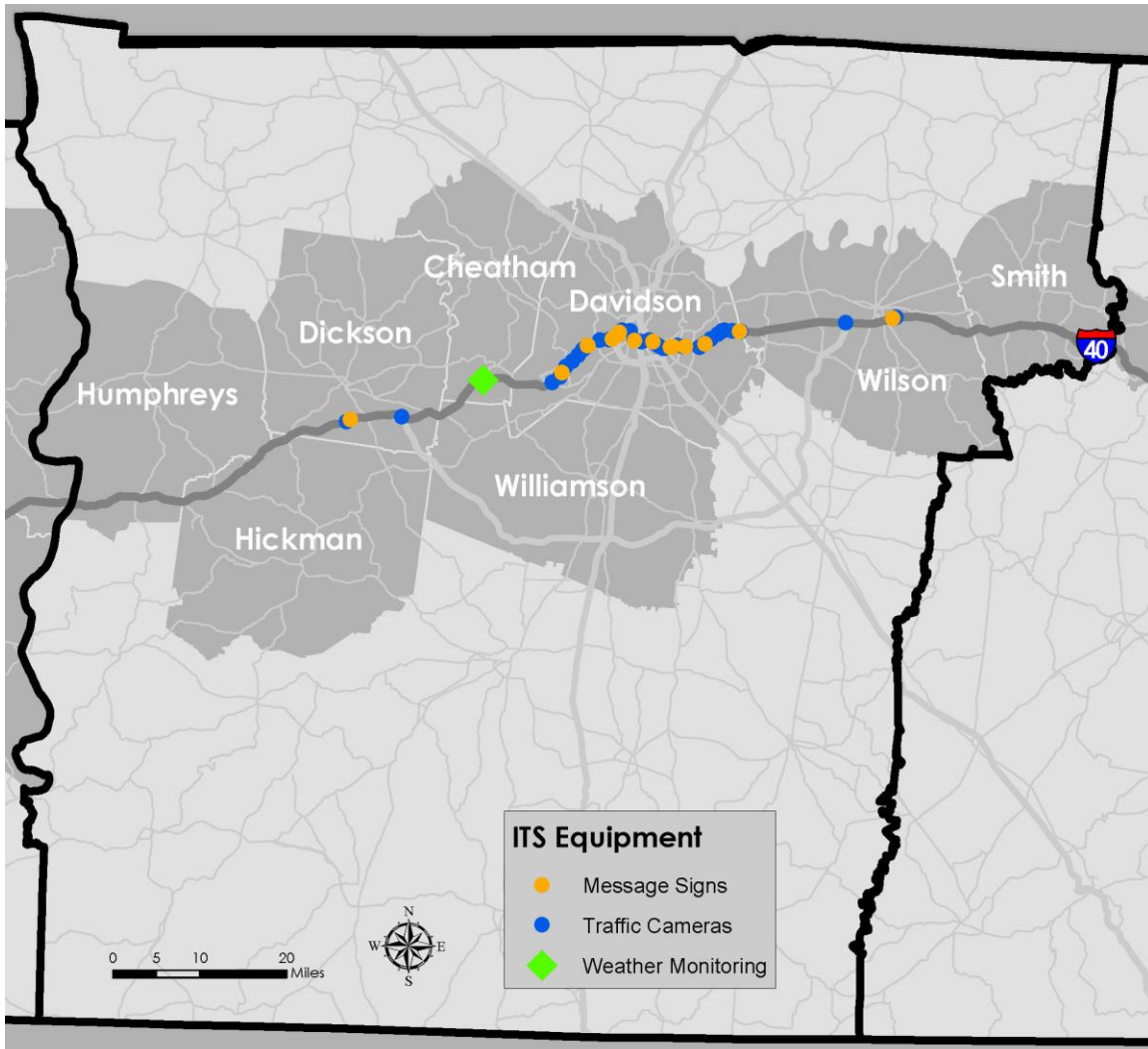


Source: E-TRIMS



# I-40/81 Multimodal Corridor Study

Figure 16. Region 3 ITS Infrastructure

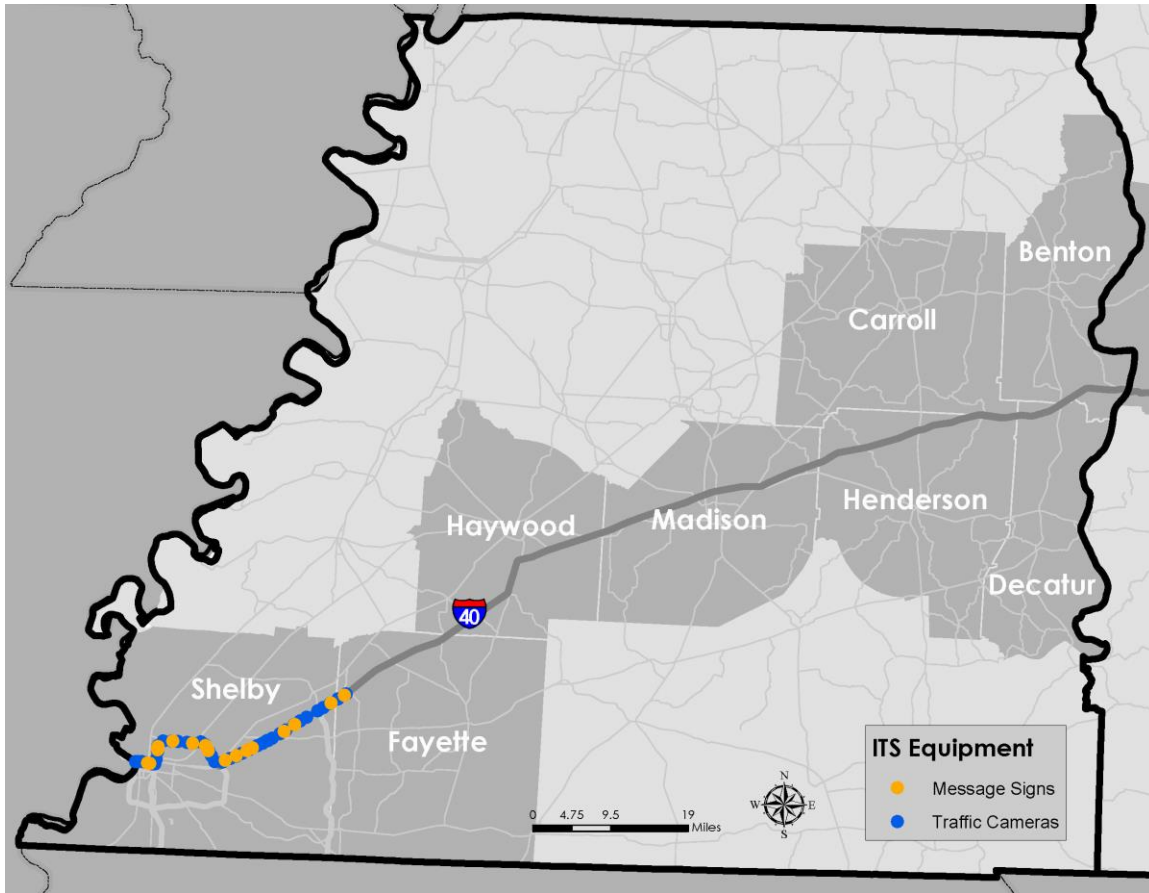


Source: E-TRIMS



## I-40/81 Multimodal Corridor Study

Figure 17. Region 4 ITS Infrastructure



Source: E-TRIMS

Other ITS infrastructure operated within the corridor includes:

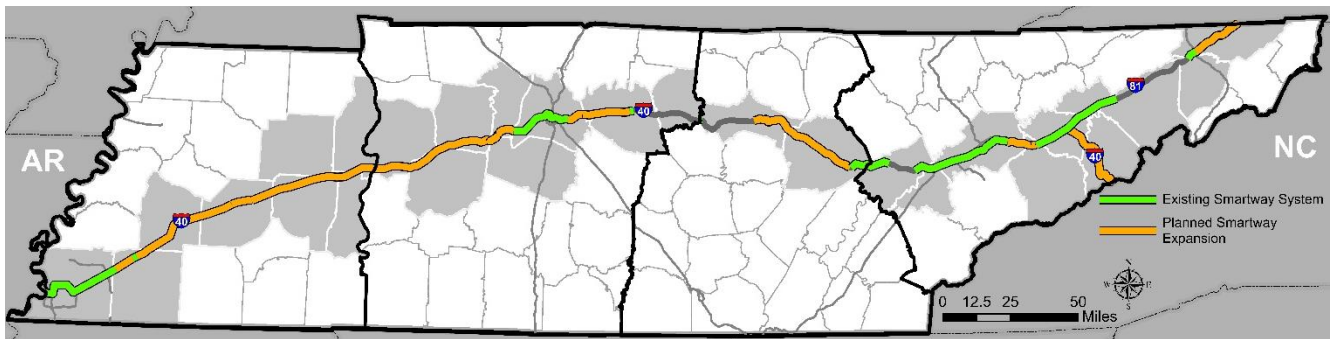
- **Automatic Traffic Recorders (ATR)** – These are traffic counters placed at specific locations to record the distribution and variation of traffic flow. These may be used to collect data continuously or at any location for shorter periods.
- **RWIS (Weather Monitoring Stations)** – The Roadway Weather Information System (RWIS) measures atmospheric, pavement, and/or water level conditions.
- **Embedded Detection Loops** – These systems that use a moving magnet or an alternating current, located beneath the pavement, to detect vehicles passing or arriving at a certain point. On the interstate, these are used to collect traffic volumes and vehicle classification.



## I-40/81 Multimodal Corridor Study

In the initial implementation of Smartway, ITS resources were concentrated in larger urban areas that experience recurring congestion, and for monitoring selected other locations such as Rockwood Mountain (Regions 1 and 2) and the I-81/I-26 interchange (Region 1). TDOT is now working to further expand urban coverage in Nashville, westward to I-840 in Dickson County and eastward to US 70 in Wilson County, and in Knoxville from the Strawberry Plains Pike interchange to SR 66 in Sevier County. In addition, TDOT has a number of ITS projects under development which will expand Smartway system coverage to other parts of the I-40/81 corridor. As shown in Figure 18, these projects will add coverage through the Jackson urban area; for the Cookeville and Crossville urban areas; in Region 1 for the entirety of I-40 between I-81 and the North Carolina state line; and along I-81 from I-26 to the Virginia state line. These expansion projects include the installation of CCTVs, dynamic messaging signs (DMS), laying of conduit, and addition of mainline fiber.<sup>8</sup> In June 2020, Tennessee also received \$11 million in federal grant funds to support expansion of ITS to all portions of the I-40/81 corridor between Memphis and Nashville that do not already have existing or planned infrastructure.<sup>9</sup>

Figure 18. Statewide Smartway



Source: E-TRIMS

Once completed, few gaps in ITS infrastructure will remain along the corridor. These gaps may be prioritized for ITS investments to help create a fully implemented ITS program that spans the entire length of the I-40/81 corridor. Gaps that will remain for consideration of enhanced ITS infrastructure are located along:

- I-81 in Greene and Washington counties
- I-40 in Roane County between existing SmartWay deployments
- I-40 in Regions 2 and 3 (east of existing SmartWay deployment in Wilson County) through Smith and western Putnam counties

## Incident Management

FHWA's Office of Operations describes incident management as a planned and coordinated multi-disciplinary process to detect, respond to, and clear traffic incidents so that traffic flow may be restored as safely and quickly as possible. Effective incident management reduces the duration and impacts of traffic incidents and improves the safety of motorists and emergency responders.

In past analyses of congestion, TDOT identified that 60 percent of all freeway congestion is non-recurring and that 20 percent of all freeway crashes are secondary. As part of TDOT's efforts to mitigate the effects of non-recurring congestion, the department operates the HELP program, consisting of trucks that patrol the most heavily traveled sections of highways to provide motorist

<sup>8</sup> TDOT ITS SmartWay Expansion, <https://www.tn.gov/tdot/intelligent-transportation-systems/integrated-its-smartway-systems/its-smartway-expansion.html>, accessed 19 March 2020.

<sup>9</sup> INFRA 2020 grant announcements, <https://www.transportation.gov/buildamerica/financing/infra-grants/infra-2020-fact-sheets>, accessed 10 July, 2020.



# I-40/81 Multimodal Corridor Study

assistance and improve incident response and clearance times. The HELP program is one of the most visible results of TDOT’s commitment to highway incident management and quick clearance time of incidents. TDOT has the following HELP routes on the I-40/81 Corridor:

### Region 1 - Knoxville

- I-40, west of Knoxville, Exit 369 to Exit 373 (2017 Expansion)
- I-40, west of Knoxville, Exit 373 to Exit 383
- I-40, east of Knoxville, Exit 383 to Exit 394
- I-40, east of Knoxville, Exit 394 to Exit 398 (2017 Expansion)

### Region 2 - None

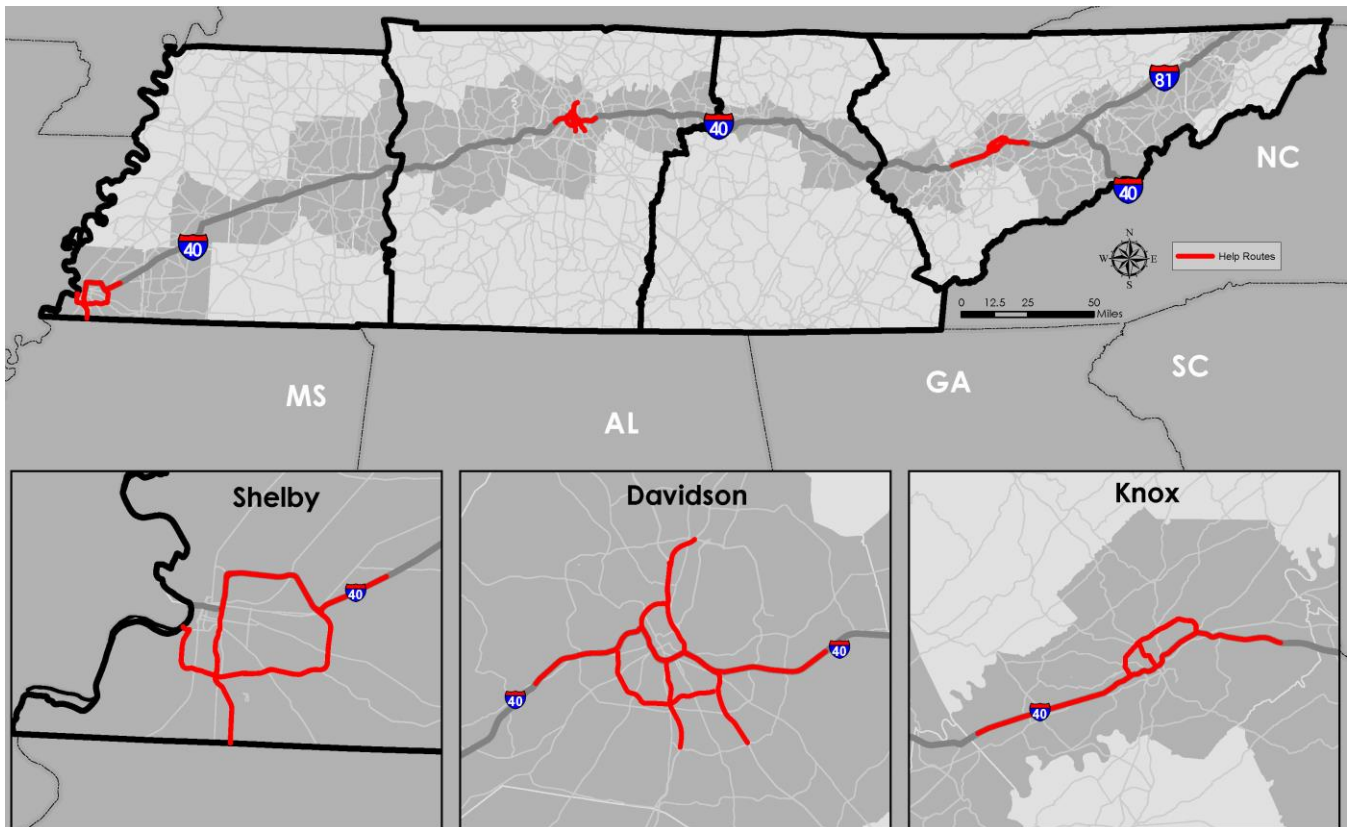
### Region 3 - Nashville

- I-40, west of Nashville, Exit 201 to Downtown
- I-40, east of Nashville, Downtown to Exit 219

### Region 4 - Memphis

- I-40, east of Memphis, Mississippi River to Exit 25
- I-40 / I-55 Mississippi River Crossings (2016 Expansion)

Figure 19. HELP Routes



Source: E-TRIMS

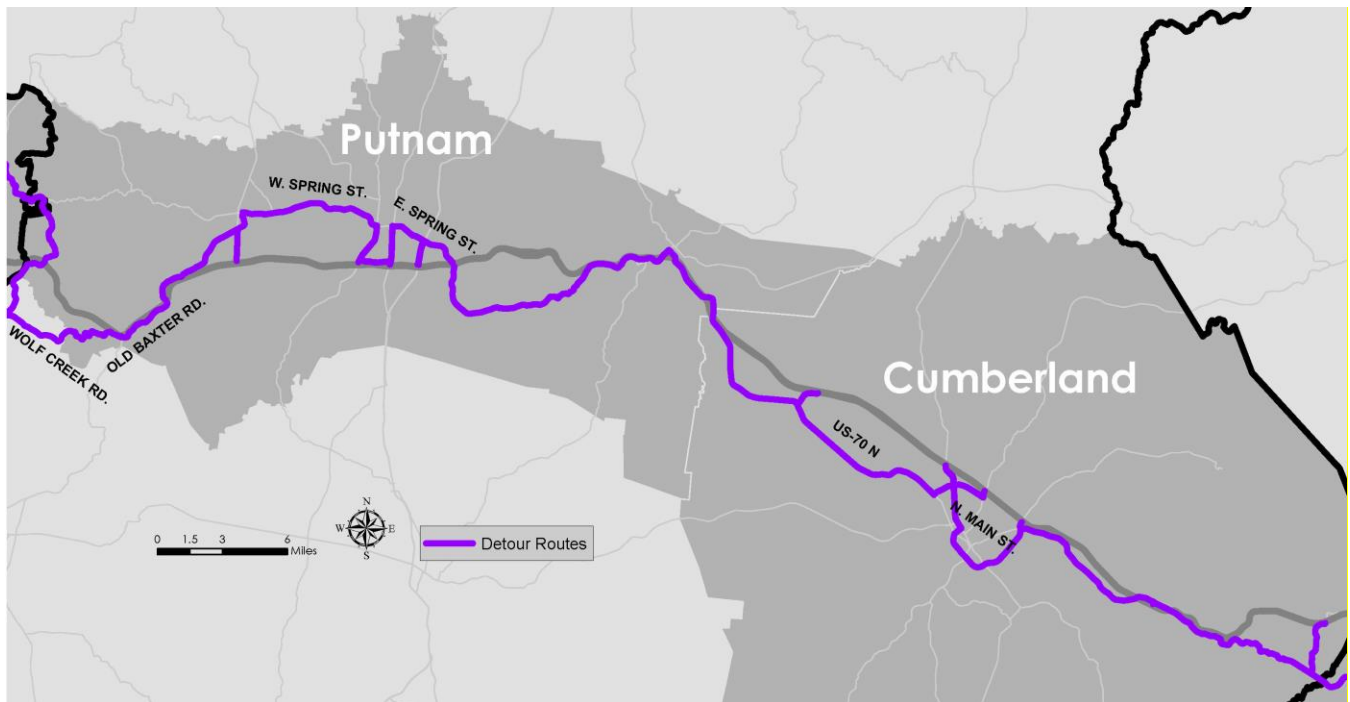


## I-40/81 Multimodal Corridor Study

TDOT has also developed Interstate Incident Management Plans for each of its four regions. These plans provide staff with action plans and pre-established detours based on the location of an incident on the Region's interstate system. These plans identify facilities that can be used to reroute traffic from the mainline between every exit on the interstate in both directions and help improve incident management, reduce secondary crashes, and keep responders safe. These plans support the state's goal of maintaining safety and mobility for interstate travelers, helping to minimize the time needed for department staff to respond to interstate closures, and detailing work zone traffic control and signing so that maintenance staff know what measures to put in place.

An example of designated I-40 detour routes is shown in Figure 20. Specific detours are put into action depending on which exits are located on either side of an identified incident.

Figure 20. Designated Detours for Incidents on I-40 in Putnam and Cumberland Counties



Source: E-TRIMS

### Managed Lanes

Managed lanes are highway facilities where operational strategies are proactively implemented and managed in response to changing conditions. Demand and available capacity for these facilities is actively managed by applying strategies or modifying existing strategies.

There are various types of managed lanes that operate across the United States and worldwide. The only type currently in operation along the I-40/81 corridor is high occupancy vehicle (HOV) lanes, which designate one lane for exclusive use by high occupancy vehicles – i.e., those in which there is at least one occupant other than the driver. HOV lanes move more people in fewer vehicles, reducing demand for new highways. They can also benefit drivers of single-occupant vehicles by taking carpoolers and buses out of general purpose lanes.

The I-40/81 corridor includes approximately 47 miles of HOV lanes, which are located within the Memphis and Nashville urban areas as shown in Figure 21. Under current policy, the HOV requirements are only in effect during the peak travel hours: 7:00 AM to 9:00 AM for inbound traffic



## I-40/81 Multimodal Corridor Study

(toward downtown Memphis and Nashville) and 4:00 PM to 6:00 PM for outbound traffic. At all other times, the lane may be used equally by both HOV and single-occupancy vehicles. Current policy also allows certain single-occupancy vehicles to use the HOV lane during the peak hours, including motorcycles and eligible low emission and/or energy efficient vehicles. Drivers of such vehicles can obtain a Smart Pass decal from the Tennessee Department of Revenue at no cost.

Research performed for TDOT in 2018 found that fewer than 25 percent of the vehicles in the HOV lanes during peak traffic periods were actually legal users.<sup>10</sup> In the HOV lane between SR 109 in Wilson County and SR 155 (Briley Parkway), violation rates were at 85 percent in the morning peak period, and 79 percent in the afternoon peak period. In Memphis, the violation rate was 87 percent in the morning and 86 percent in the afternoon for the I-40 HOV lane that operates from just east of the US 64 (Bartlett) interchange to Sycamore View Road.

Enforcement of HOV lanes in Tennessee has been an ongoing challenge. The Tennessee Highway Patrol, which has responsibility for enforcement, has previously identified two concerns. First, THP has reported that the agency does not have sufficient resources to perform this function and still meet other needs, including traffic safety. Second, THP has expressed the concern that interstate shoulders do not offer sufficient space to safely pull over a vehicle violating the HOV lane, and that the act of stopping a vehicle has a more detrimental effect to overall traffic flow than simply allowing the violation.

TDOT completed an HOV Certification Report in 2018 to determine whether HOV lanes are in compliance with Title 23 of U.S. Code Section 166(d). HOV lanes are considered degraded if they fail to maintain a minimum average operating speed – in this case, 45 mph – for 90 percent of the time over a consecutive 180-day period during morning and/or evening weekday peak hours. TDOT monitored both the morning (inbound) and evening (outbound) traffic during the effective hours of operation between March 2018 and December 2018. The Certification Report found that I-40 westbound in Memphis was degraded 1.6 percent of days, while the eastbound portion was degraded for 6.5 percent of days. Similar results were observed on I-40 in Nashville, with one percent of days degraded for the westbound (inbound) portion of the HOV facility, and seven percent for the eastbound (outbound) portion of the facility.<sup>11</sup>

---

<sup>10</sup> High Occupancy Vehicle (HOV) Detection System Testing, Project #: RES2016-06, Submitted to Tennessee Department of Transportation, July 2018.

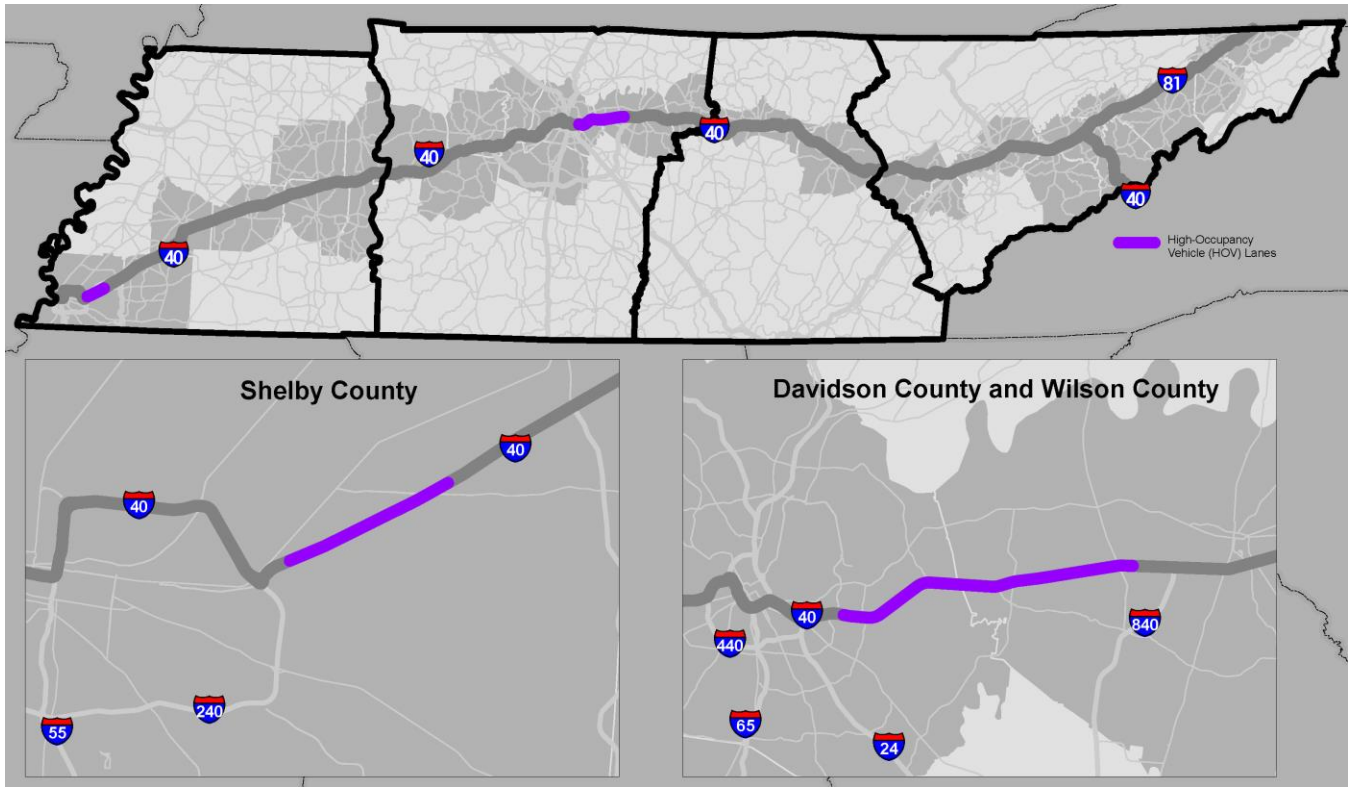
<sup>11</sup> HOV Certification 2018, Traffic Operations Division, Tennessee Department of Transportation, February 2019, [https://www.tn.gov/content/dam/tn/tdot/traffic-engineering/01-HOV%20Certification%202018\\_Final.pdf](https://www.tn.gov/content/dam/tn/tdot/traffic-engineering/01-HOV%20Certification%202018_Final.pdf), accessed 19 March 2020.





# I-40/81 Multimodal Corridor Study

Figure 21. HOV Lanes

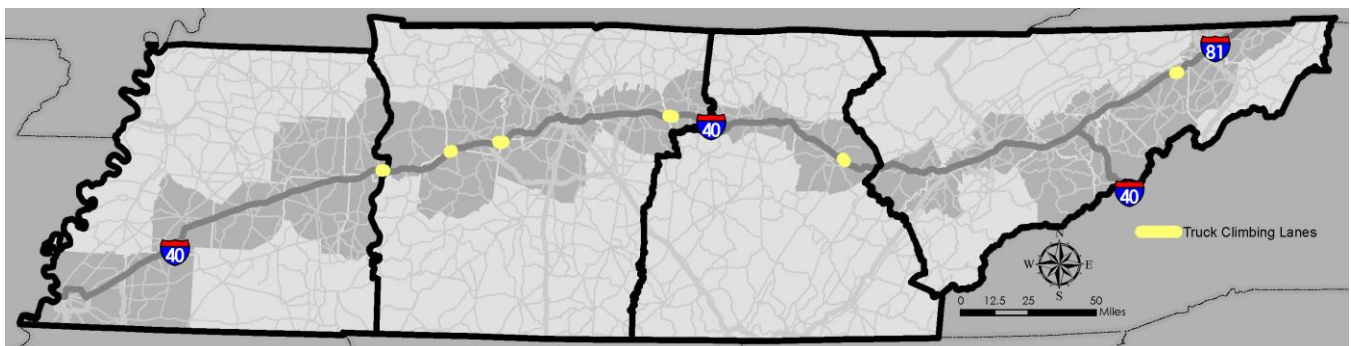


Source: E-TRIMS

## Other Elements of Operational Management

Truck climbing lanes are constructed in areas where steep grades may cause heavier vehicles to travel more slowly. They provide a space for slower-moving vehicles to continue traveling while freeing the remaining travel lanes for other motorists to use at normal speeds. Existing truck climbing lanes along I-40 are located in Humphreys, Hickman, Dickson, Smith, and Cumberland counties and on I-81 in Sullivan County (Figure 22).

Figure 22. Truck Climbing Lanes



Source: E-TRIMS



## 6. System Condition

Current pavement condition, obtained from TDOT’s Pavement Management System, is reported by county and TDOT region in Table 16. Table 16 shows pavement condition using several measures, including age, pavement quality index (PQI), and international roughness index (IRI). As shown, Region 4 has the overall best pavement conditions in the corridor, as defined by PQI, and Region 2 has the smoothest roadways per IRI. Overall, the corridor has good pavement quality. Three counties in Region 4 have an overall PQI of “Fair” as rated based on PQI, and may soon need resurfacing: Carroll, Decatur, and Fayette. As of this report’s date, a resurfacing project in Fayette County is underway, and one is in development in Decatur County. Bridges along the corridor are also generally in a good condition. Of the 920 bridges located along the corridor, only 28 (three percent of the total) are classified as structurally deficient. These will be discussed in greater detail later in this section.

Keeping traffic flowing safely and efficiently along the corridor requires transportation infrastructure to be kept in a state of good repair, one of the national goals established by Congress and periodically evaluated using measurements set by the USDOT. To report on the condition of the corridor and ongoing maintenance needs, data on pavement and bridge condition was collected from E-TRIMS as well as the National Bridge Inventory (NBI).

TDOT has developed a **Transportation Asset Management Plan (TAMP)** that includes a risk-based plan for pavement and bridges on the NHS – including I-40/81 – and all state routes. The TAMP uses historical asset conditions to identify trends and project future needs of the system and to budget for the current year through the next ten years. While infrastructure condition, maintenance needs, and programmed funding are not broken down by individual interstates, analysis and needs from the TAMP can be used to understand required investments for Tennessee’s interstate system as a whole over the next decade. TDOT has also established bridge and pavement condition performance measures in compliance with federal target setting requirements.

### Pavement

To help identify roadways needing rehabilitation or maintenance, TDOT has historically collected pavement condition data and calculated a Pavement Quality Index (PQI) to monitor the health of all pavement in the TDOT network. The data is categorized into two measurements: roughness and distress. The PQI scale ranges from 0 (needs resurfacing) to 5 (not a priority) and is calculated based on aspects of the pavement that affect ride quality and pavement distress. The Pavement Quality Index is derived from the International Roughness Index (IRI), rutting, fatigue cracking and faulting, to determine the overall performance rating of good, fair, or poor. Based on TDOT’s TAMP, an IRI of under 95 is “Good”, between 95-170 “Fair”, and over 170 is “Poor”.

Table 15. Pavement Condition Thresholds

Metric	Good	Fair	Poor
IRI	<95	95-170	>170
PQI	>3.25	1.76-3.25	<1.75

TDOT considers a number of factors when prioritizing annual pavement improvements on state-maintained roads: its Standard Operating Guidelines (SOG), Remaining Service life (RSL) and Lane-Mile Year Analysis, and PQI. Each TDOT region performs an analysis to recommend pavement projects for roadway sections that are nearing the end of their remaining service life.



# I-40/81 Multimodal Corridor Study

Table 16. I-40/81 Corridor Pavement Condition by County

Region 1			
County	Average IRI	Average PQI	Average Age Years
Cocke	58	3.5	11
Greene	39	4.3	7
Hamblen	38	4.4	6
Jefferson	52	4.1	16
Knox	60	3.8	15
Loudon	51	4.0	23
Roane	56	3.8	12
Sevier	45	4.1	12
Sullivan	46	4.0	8
Washington	36	4.4	7
<b>Region 1</b>	<b>51</b>	<b>4.0</b>	<b>12</b>
Region 2			
County	Average IRI	Average PQI	Average Age Years
Cumberland	42	3.7	9
Putnam	42	3.8	7
<b>Region 2</b>	<b>42</b>	<b>3.8</b>	<b>8</b>
Region 3			
County	Average IRI	Average PQI	Average Age Years
Cheatham	46	4.4	7
Davidson	66	3.7	12
Dickson	42	4.2	7
Hickman	46	4.3	8
Humphreys	53	4.4	5
Smith	45	4.1	7
Williamson	52	4.1	8
Wilson	50	4.2	8
<b>Region 3</b>	<b>53</b>	<b>4.1</b>	<b>8</b>



# I-40/81 Multimodal Corridor Study

Region 4			
County	Average IRI	Average PQI	Average Age Years
Benton	49	4.5	4
Carroll	53	2.7	6
Decatur	47	2.8	8
Fayette	60	3.1	1
Haywood	56	3.8	11
Henderson	48	4.1	6
Madison	67	3.4	10
Shelby	77	3.8	8
<b>Region 4</b>	<b>49</b>	<b>4.5</b>	<b>4</b>

Source: TDOT Pavement Management System, March 2020

TDOT has established State of Good Repair targets for pavement condition on the interstate system per federal requirements. These targets are set as 4-year averages. TDOT's current 4-year targets are 60 percent of interstate lane miles in good condition and one percent of interstate lane miles in poor condition. While the corridor is currently performing well relative to the national performance measures targets required under 23 CFR 490, analysis done as part of the TAMP shows that interstate pavement conditions are anticipated to dip below a PQI of between 4.0-4.5 if current funding levels are maintained. While still expected to remain in good condition with available funding levels, it is important to note that the amount of funding dedicated to asset preservation will directly impact future conditions on the I-40/81 corridor. TDOT may have opportunities to address emerging maintenance needs when it schedules and designs the implementation of various capital projects along the corridor. Given the traffic impacts and safety issues related to construction work zones, it is beneficial to address multiple needs while lane closures are already in place.

## Bridge

Data on bridge condition was obtained from E-TRIMS, Inventory and Appraisal Reports, and TDOT's Structurally Deficient Bridges list to identify bridges in need of rehabilitation or replacement and those eligible for federal funding based on their sufficiency rating. Bridges are described according to whether they are structurally deficient and/or functionally obsolete, and are also assigned a sufficiency rating.

TDOT conducts bridge inspections on all publicly owned bridges in the state every two years, except for federally owned bridges. Bridge scores are developed based on these inspections. The department follows the National Bridge Inspection (NBI) reporting process and uses NBI ratings for deck, superstructure, and substructure, while culverts are assessed using a culvert score.

The Bridge Management Program has four (4) strategies to determine where to allocate funding. The four (4) programs TDOT is currently using for funding allocation strategies are explained in more detail below and include Review of NBIS Inspection Reports, Smart Project Scoping and Selection, Hold the Line, and Not a Worst-First Program.



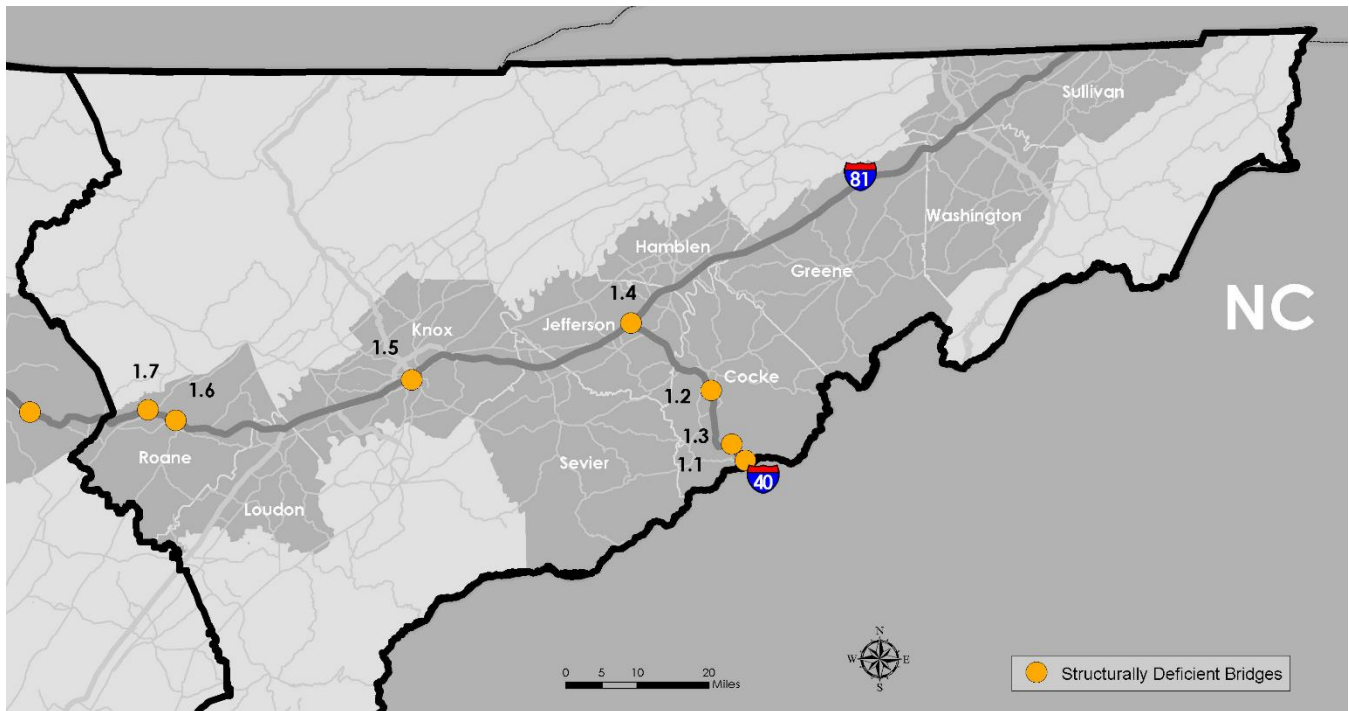
# I-40/81 Multimodal Corridor Study

## Structurally Deficient and Functionally Obsolete Status

A highway bridge is classified as **structurally deficient** if one or more major structural components of the bridge are rated in "poor" condition (0 to 4 on the NBI rating scale). A bridge can also be classified as structurally deficient if its load carrying capacity is significantly below current design standards or if it crosses a waterway that frequently overtops the bridge during floods. A highway bridge is classified as **functionally obsolete** if the design of the bridge does not meet current standards. Typically, this applies if the roadway width or the provided clearances of the bridge fall short of those desired for current traffic demand. Being functionally obsolete is generally considered to be less serious than being structurally deficient since the bridge may be in fair to good condition (structurally) and is judged safe to carry traffic.

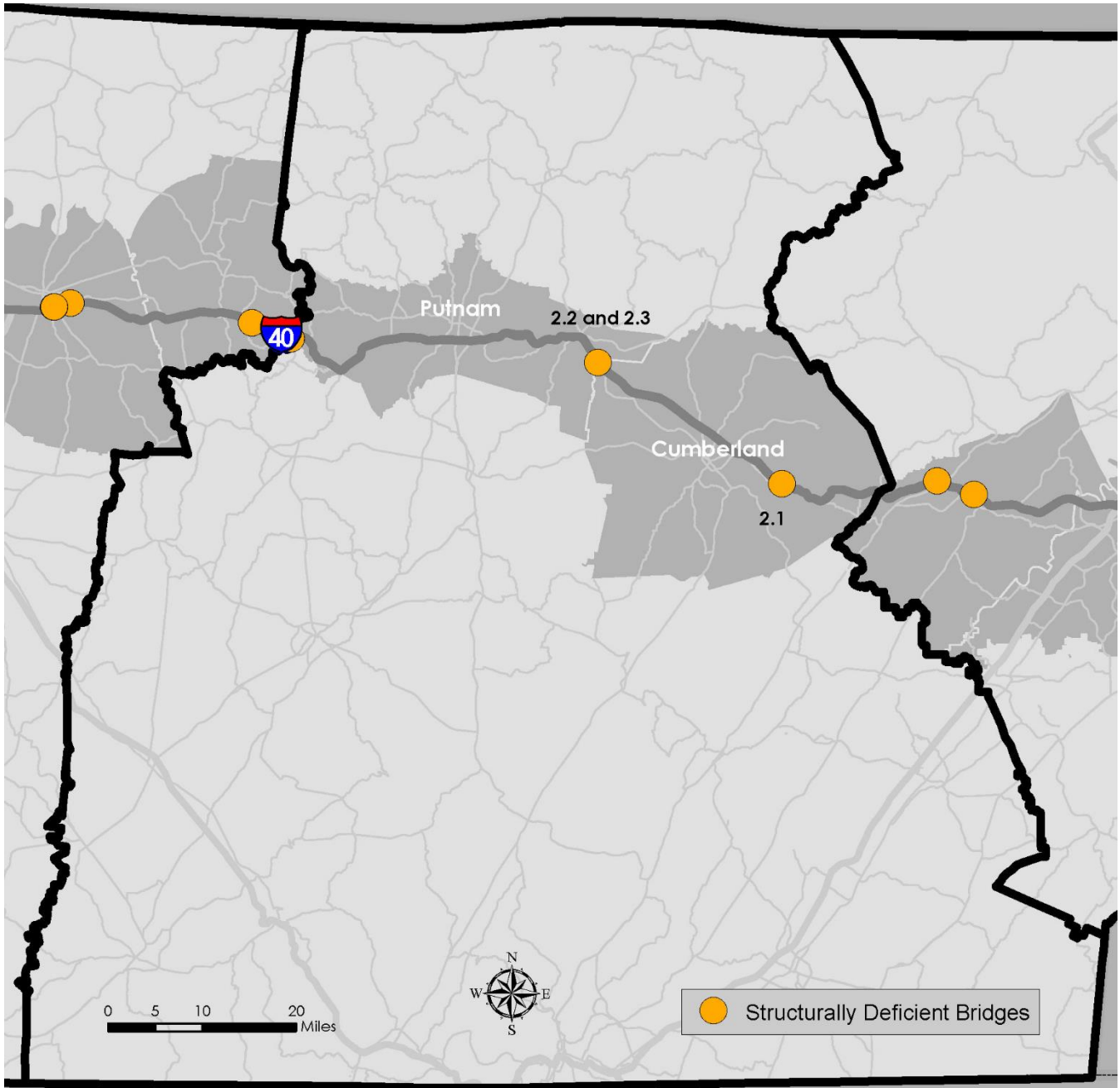
Of the 920 bridges located along the corridor, 28 bridges (three percent of the total) are classified as structurally deficient. These bridges are shown in the series of maps below. Three structurally deficient bridges are located at or near system interchanges along the corridor; one in Region 1 near the I-40/81 interchange and two bridges in downtown Nashville near the I-40/I-24 split.

Figure 23. Region 1 Structurally Deficient Bridges



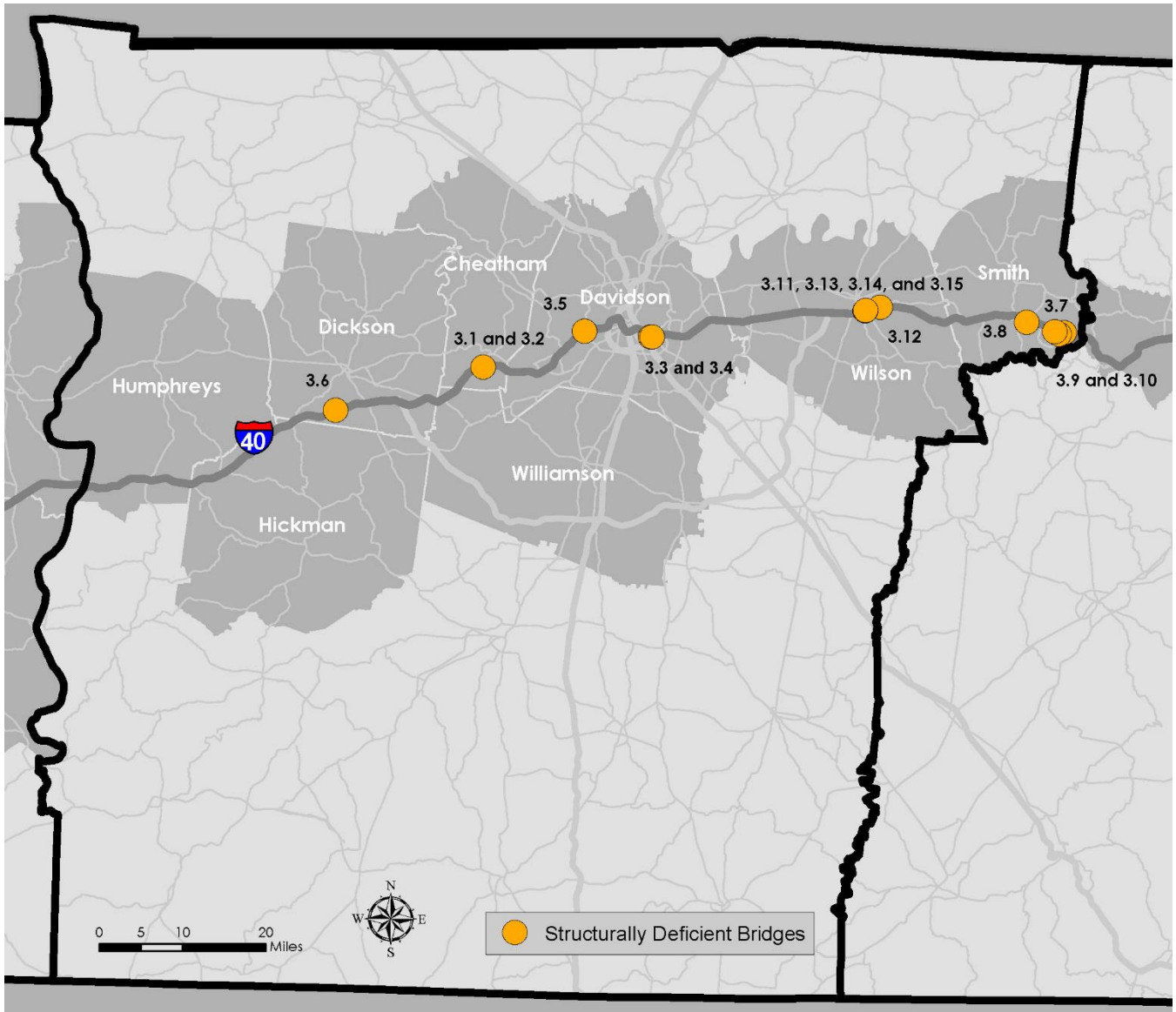
Source: E-TRIMS and TDOT 2018 Structurally Deficient Bridges List

Figure 24. Region 2 Structurally Deficient Bridges



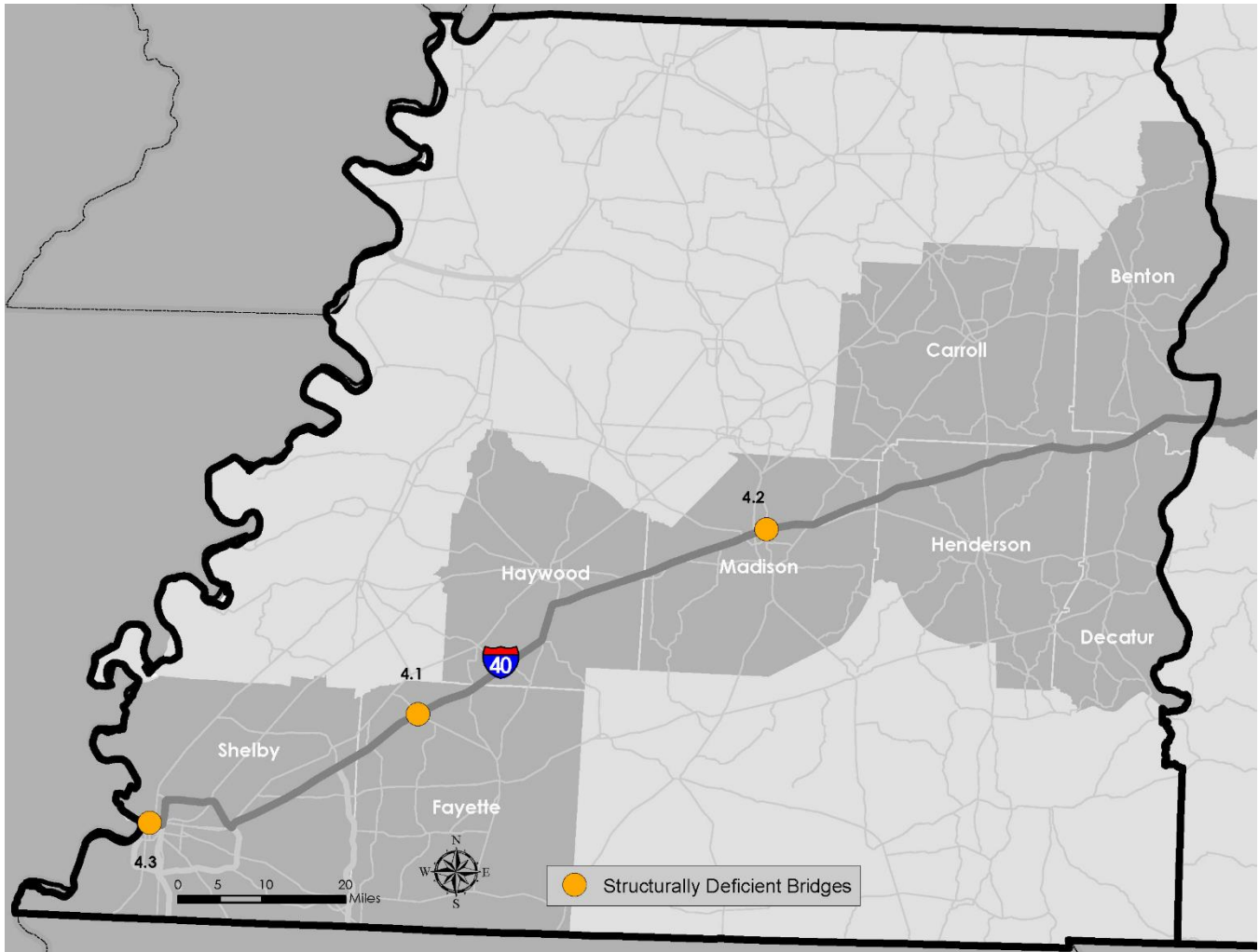
Source: E-TRIMS and TDOT 2018 Structurally Deficient Bridges List

Figure 25. Region 3 Structurally Deficient Bridges



Source: E-TRIMS and TDOT 2018 Structurally Deficient Bridges List

Figure 26. Region 4 Structurally Deficient Bridges



Source: E-TRIMS and *TDOT 2018 Structurally Deficient Bridges List*

### Sufficiency Rating

Bridges classified as structurally deficient may be eligible for federal rehabilitation or replacement funding based on their corresponding sufficiency rating. The **sufficiency rating** of a highway bridge is a weighted, calculated rating indicating the sufficiency or capability of a highway bridge. Factors included in the sufficiency rating include the structural evaluation of the highway bridge (55 percent of the total score), the highway bridge’s serviceability and functional obsolescence (30 percent of the total score), and the highway bridge’s importance to the public (15 percent of the total score). A sufficiency rating of 100 indicates that the highway bridge is entirely sufficient, while a sufficiency rating of 0 indicates that a highway bridge is entirely insufficient or entirely deficient. Highway bridges with sufficiency ratings of 80 or less are eligible for federal rehabilitation funding, while highway bridges with sufficiency ratings of 50 or less are eligible for federal replacement funding.

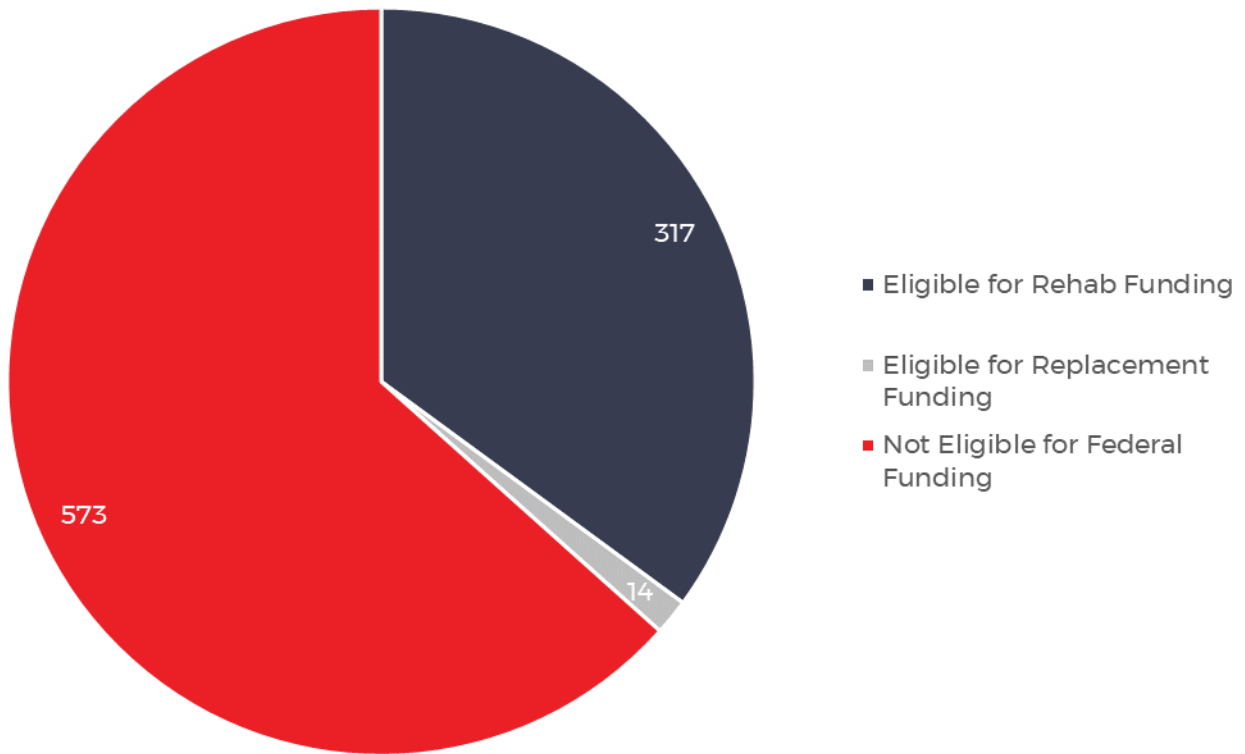
Of the 920 highway bridges within the study area, 14 have a sufficiency rating of under 50 and are thus eligible for federal replacement funding. Approximately one-third (317) of the bridges along the corridor have a sufficiency rating of between 50 and 80 and thus are eligible for rehabilitation funding.





# I-40/81 Multimodal Corridor Study

Figure 27. Sufficiency Rating Breakdown<sup>12</sup>



Of the 28 bridges previously identified as structurally deficient in Figure 23 through Figure 26, there are 22 eligible for federal rehabilitation or replacement funding. The sufficiency rating of each of these structurally deficient bridges is included in Table 17, providing an indication regarding whether they are eligible for federal funds for improvements.

Table 17. Sufficiency Rating of Structurally Deficient Bridges

Map ID	County	Description	Route	Structure Number	Sufficiency Rating	Eligible for Federal Funding for	
						Replace	Rehab
<b>Region 1</b>							
1.1	Cocke	Green Corner Rd. (1321)	I-40	151004000371	62		■
1.2	Cocke	Golf Course Rd. (A526)	I-40	151004000151	76.8		■
1.3	Cocke	NFA 1242	I-40	151004000351	92		
1.4	Jefferson	I-40 WBL	I-81	451004000392	75.2		■

<sup>12</sup> Figure does not display 16 bridges for which information was unavailable.



# I-40/81 Multimodal Corridor Study

Map ID	County	Description	Route	Structure Number	Sufficiency Rating	Eligible for Federal Funding for	
						Replace	Rehab
1.5	Knox	I-40-RL/17th St.	I-40	471004000531	54		■
1.6	Roane	Clinch River & NFA A774	I-40	731004000131	49	■	
1.7	Roane	NFA A448 Warrior Dr./I-40	I-40	731004000032	89.6		
<b>Region 2</b>							
2.1	Cumberland	SR 1	I-40	181004000351	49.3	■	
2.2	Cumberland	SR 24	I-40	181004000011	50.3		■
2.3	Cumberland	SR 24	I-40	181004000021	83		
<b>Region 3</b>							
3.1	Cheatham	Harpeth River	I-40	111004000071	49.1	■	
3.2	Cheatham	Harpeth River	I-40	111004000081	51.3		■
3.3	Davidson	Arlington Ave./I-40 L	I-40	191004001122	61.3		■
3.4	Davidson	I-40 STR 5B/I-24	I-40	191002400671	67		■
3.5	Davidson	I-40/Westboro Rd.	I-40	191004000271	81		
3.6	Dickson	I-40-RL/East Piney Rd.	I-40	221004000051	53.8		■
3.7	Smith	Caney Fork River	I-40	801004000321	58.9		■
3.8	Smith	Bolling Branch & Priv. R.	I-40	801004000231	64.4		■
3.9	Smith	Caney Fork River	I-40	801004000331	64.7		■
3.10	Smith	Caney Fork River	I-40	801004000341	86.6		
3.11	Wilson	I-40/SR 26	I-40	951004000351	51.2		■
3.12	Wilson	Spring Creek	I-40	951004000381	57.4		■
3.13	Wilson	CSX Railroad	I-40	951004000341	61.2		■
3.14	Wilson	CSX Railroad	I-40	951004000331	62.6		■
3.15	Wilson	I-40/SR 26	I-40	951004000361	69		■
<b>Region 4</b>							
4.1	Fayette	SR 59/I-40	I-40	241004000192	81.6		
4.2	Madison	SR 5	I-40	571004000271	64.8		■



# I-40/81 Multimodal Corridor Study

Map ID	County	Description	Route	Structure Number	Sufficiency Rating	Eligible for Federal Funding for	
						Replace	Rehab
4.3	Shelby	I-40-MS River/I-40L ramp to SR 3	I-40	79100400001A	60.1		■

## Alignment

The horizontal and vertical alignment of a roadway can affect the safety and operations of the route based on speed differentials caused when traversing a grade. Where multiple types of vehicles share the same roadway, a vertical grade can have varying effects on travel speed, presenting safety and operational issues where vehicles are traveling at increasing speed differentials. Horizontal curves provide transitions between tangent sections of roadway and are designed and constructed based on several factors including speed, rural or urban setting, type of terrain, and AADT. For purposes of identifying potential operational improvements along the I-40 and I-81 corridor, vertical alignment is the controlling metric, and only vertical alignment was used in analysis.

Table 18 below identifies sections of the I-40/81 corridor (by TDOT region) with grades that differ significantly from the character of nearby sections and do not currently include a climbing lane. Not all sections are of sufficient length and/or grade to induce significant changes in travel speed; however, especially where high truck volumes are present, speed differentials may be enough to present operational or safety issues not present in nearby sections without grades. These segments may be well-suited to solutions that aim to enhance safety by providing for the separation of trucks from passenger vehicles.

Table 18. Significant Grades Along the Corridor Without a Climbing Lane

Region	Location	County	Direction	Length Miles	Grade Percent
<b>On I-81</b>					
1	From near Exit 15 (SR 340, Fish Hatchery Road) to Exit 23 (SR 34, US 11E, West Andrew Johnson Highway)	Greene, Hamblen	Northbound	1	4
1	From near Exit 44 (Jearoldstown Road) to Exit 50 (SR 93)	Greene, Washington	Northbound	2.75	3.75
<b>On I-40</b>					
1	From near Exit 340 (Airport Road) to Exit 347 (SR 61, US 27, South Roane Street)	Roane	Westbound	7.25	4
1	From near Exit 394 (SR 9/168, US 11E/25W/70, Asheville Highway) to Exit 402 (Midway Road)	Knox	Eastbound	4.5	1.75
1	From near Exit 407 (SR 66, Winfield Dunn Parkway) to Exit 421 (I-81)	Jefferson, Sevier	Eastbound Westbound	4 4.5	2.75 2.5

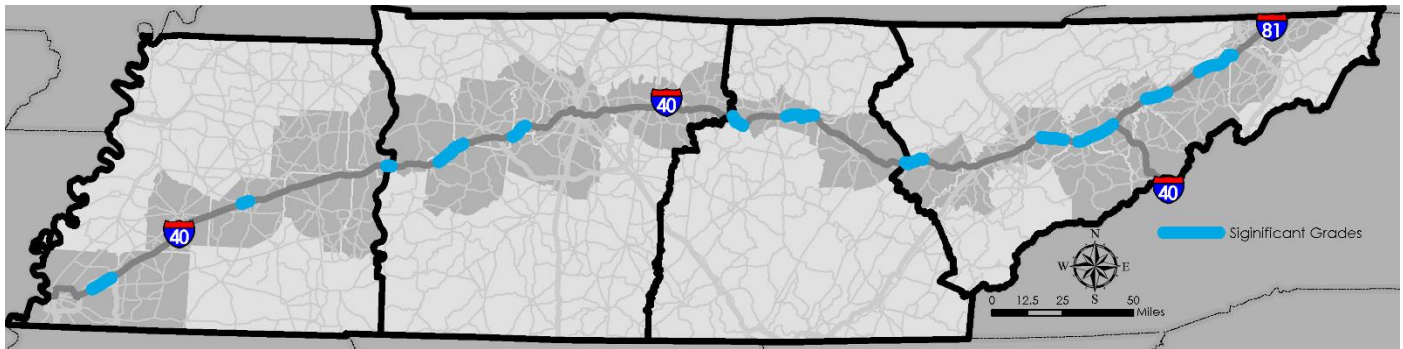


# I-40/81 Multimodal Corridor Study

Region	Location	County	Direction	Length Miles	Grade Percent
2	From near Exit 268 (SR 96, Buffalo Valley Road) to Exit 273 SR 56	Putnam	Eastbound	5.5	2.75
2	From near Exit 290 (SR 24, US 70N, East Spring Street) to Exit 300 (SR 24, US 70N)	Putnam	Eastbound	4.5	4
3	From near Exit 152 (SR 230) to Exit 163 (SR 48)	Dickson, Hickman	Eastbound	4	2.5
3	From near Exit 182 (SR 96) to Exit 188 (SR 249)	Cheatham, Williamson	Eastbound Westbound	2.75 1.75	1.75 2.5
4	From near Exit 16 SR 177 (Germantown Parkway) to Exit 24 (I-269)	Shelby	Eastbound Westbound	2.75 1.75	1 1.25
4	From near Exit 79 (SR 20, US 412, Hollywood Drive) to Exit 82 (SR 5, US 45, Highland Avenue)	Jackson, Madison	Eastbound	2.25	1.25

Source: E-TRIMS

Figure 28. Significant Grades



## Other

In addition to pavement and bridges, the I-40/81 corridor has other infrastructure that helps support safe and efficient travel throughout the state. The maintenance of infrastructure such as signs, rest areas, parking areas, and weigh stations all contribute to the safe and efficient movement of people and goods throughout the corridor.



# I-40/81 Multimodal Corridor Study

Table 19. Maintenance Inventory

Region	Feature			
	Signs	Rest Areas	Parking Areas	Weigh Stations
1	3,657	5	2	2
2	1,113	1	2	0
3	3,274	1	2	0
4	3,208	2	1	1

Source: E-TRIMS

Table 20. Sign Condition

Region	Total	Condition					
		Good		Fair		Poor	
1	3,657	3,300	90%	266	7%	91	2%
2	1,113	988	89%	101	9%	24	2%
3	3,274	2,895	88%	245	7%	134	4%
4	3,208	2,888	90%	271	8%	49	2%

Source: E-TRIMS

## 7. Safety and Security

Historical crash data for the I-40/81 corridor was obtained from E-TRIMS and the *Tennessee Integrated Traffic Analysis Network* (TITAN). It includes information such as location, date, time of day, severity (including the total number of involved vehicles, injuries, and fatalities), crash events, and weather conditions.

The safety analysis presented here is based on available data for a five-year study period between January 1, 2014 and December 31, 2018. Reviewing 5 years of data helps to control for the effect that changes in traffic patterns, roadway construction, and trip origins and destinations may have on statistical trends in crashes in the study area.

In addition, this analysis used a comparison of *actual* crash rate to *critical* crash rate to help isolate roadway segments with significantly high crash rates not attributable to random variation. The *actual crash rate* is defined as the number of crashes per million vehicle-miles (MVM) of travel. The *critical crash rate* is a threshold value calculated for a given roadway segment (also calculated in MVM) that determines whether the actual crash rate of that segment significantly deviates from the average crash rate for facilities with similar characteristics. Segments of the corridor where the *actual-to-critical crash rate ratio* was greater than 1.0 have been identified as high crash areas where safety improvements may be particularly beneficial.

During the study period, 21 roadway segments in the study area featured an actual-to-critical crash rate ratio greater than 1.0. These segments are highlighted in the next several sections.



# I-40/81 Multimodal Corridor Study

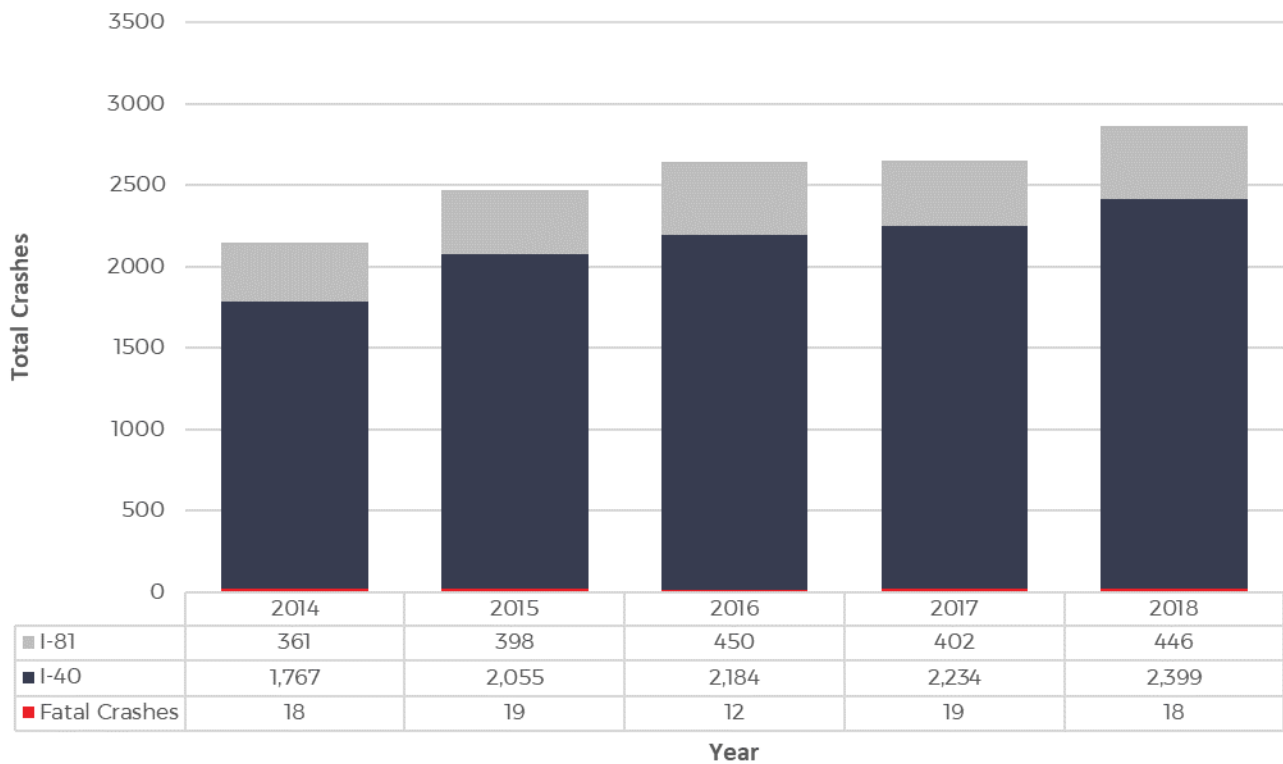
## Region 1

Figure 29 shows the total and fatal crashes occurring in the portion of the study area within TDOT Region 1. A total of 12,698 crashes occurred during the study period, of which 86 were fatal crashes.

During the study period, five roadway segments in the Region 1 portion of the corridor had an actual-to-critical crash rate ratio greater than 1.0. All of these segments are located on the I-40 portion of the corridor and shown in orange in Figure 30.

- From Exit 340 (SR 299, Airport Road) to Exit 347 (SR 61, US 27, South Roane Street) in Roane County;
- From Exit 378 (Cedar Bluff Road) to Exit 379 (Bridgewater Road / Walker Springs Road) in Knox County;
- From Exit 385 (I-75 / I-640) to Exit 388 (SR 158, James White Parkway) in Knox County;
- From Exit 421 (I- 81) to Exit 424 (SR 113, Oak Grove Road) in Jefferson County; and
- From Exit 443 (SR 339, Foothills Parkway) to Exit 447 (Hartford Road) in Cocke County.

Figure 29. Crashes in the Region 1 Portion of the Corridor

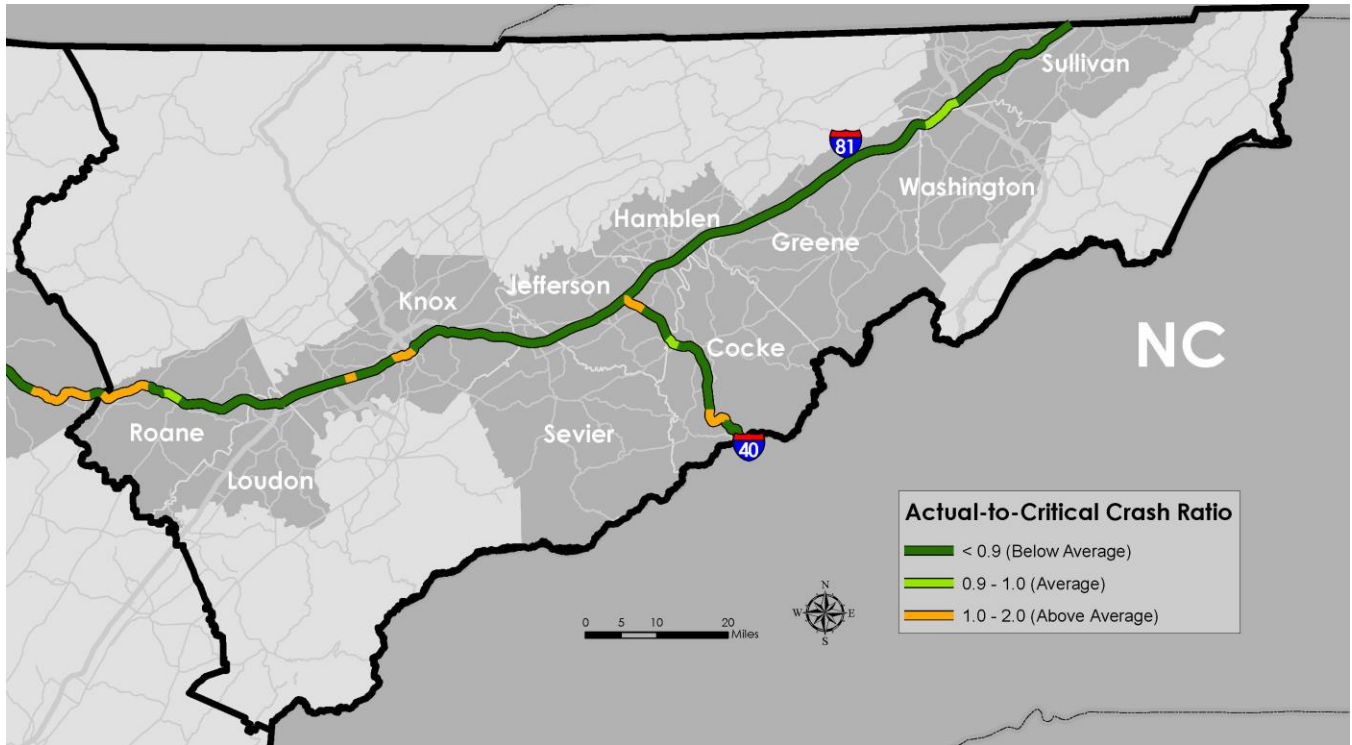


Source: E-TRIMS



# I-40/81 Multimodal Corridor Study

Figure 30. Segments with Higher Crash Rates – Region 1 (2014-2018)



Source: E-TRIMS

Table 21. Crash Data for Segments with Higher Crash Rates in Region 1

Crash Types		I-40									
		Exit 340 to Exit 347		Exit 378 to Exit 379		Exit 385 to Exit 388		Exit 421 to Exit 424		Exit 443 to Exit 447	
<b>Total</b>	<b>Crashes</b>	<b>520</b>		<b>631</b>		<b>1,124</b>		<b>144</b>		<b>130</b>	
<b>Severity</b>	<b>Fatal Crashes</b>	1	0.2%	3	0.5%	3	0.3%	0	0.0%	1	0.8%
	<b>Injury Crashes</b>	126	24%	94	15%	218	19%	29	20%	24	18%
<b>Collision Types</b>	<b>Single Vehicle</b>	343	66%	82	13%	165	15%	51	35%	85	65%
	<b>Rear End</b>	64	12%	369	58%	611	54%	48	33%	19	15%
	<b>Sideswipe-Same Direction</b>	91	18%	105	17%	235	21%	35	24%	22	17%
<b>Weather Conditions</b>	<b>Snow, Rain, Sleet</b>	305	59%	123	19%	209	19%	26	18%	40	31%
	<b>Clear</b>	131	25%	427	68%	796	71%	103	72%	79	61%

Source: E-TRIMS



# I-40/81 Multimodal Corridor Study

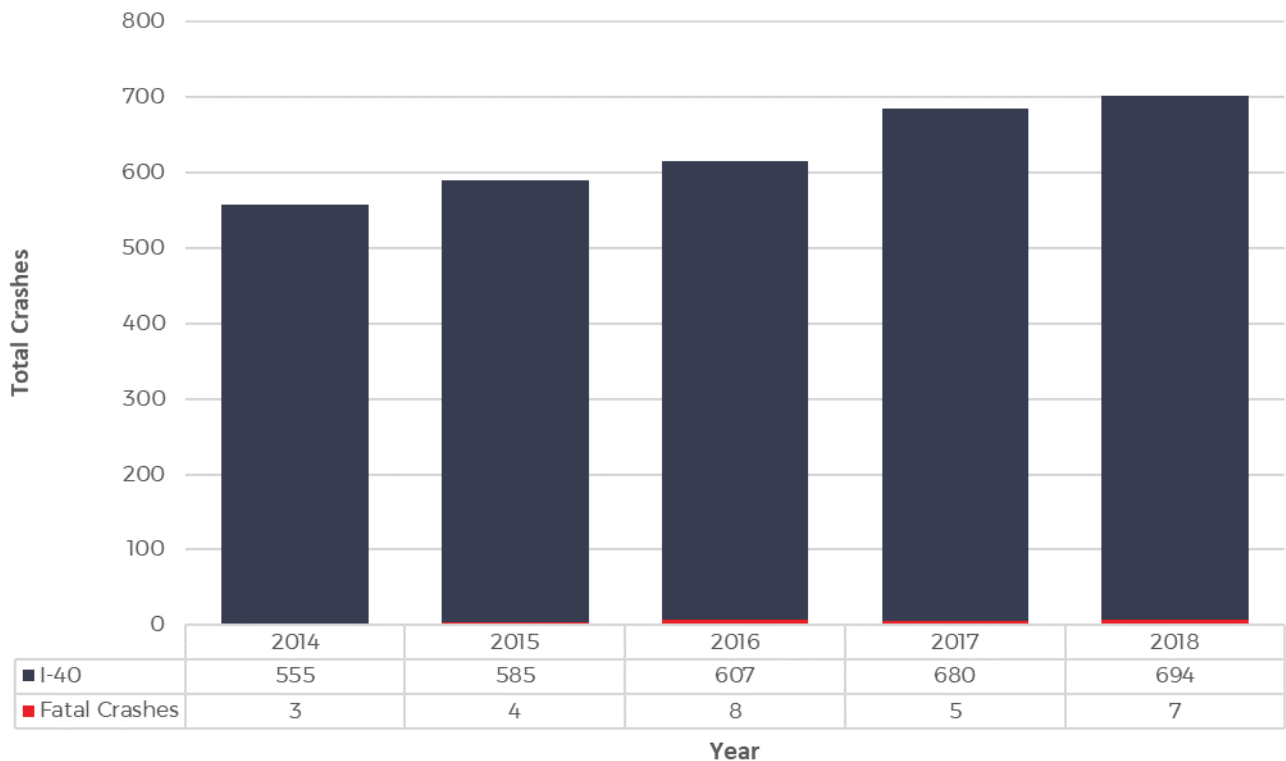
Rear-end collisions, commonly associated with heavy traffic congestion, represented a larger share of crashes on the two segments located in Knox County. These sections of the corridor are characterized by urban development, with six to ten total travel lanes separated by median barrier, rolling terrain, and few horizontal or vertical alignment changes.

Outside the urban areas, crashes were much more likely to be single-vehicle roadway departures. The three segments located in Roane, Jefferson, and Cocke counties are characterized by rural development, with four to six total travel lanes on independent roadways or separated by a depressed median, rolling terrain, and frequent horizontal and vertical alignment changes. The section in Roane County occurs as drivers are traversing Rockwood Mountain, while the section in Cocke County is a winding portion of I-40 in the mountainous border area near the Tennessee/North Carolina state line. Crashes in these sections were also more likely to occur during periods of rain, snow or sleet.

## Region 2

Figure 31 shows the total and fatal crashes occurring in the Region 2 portion of the corridor for each year of the study period. As shown, a total of 3,121 crashes occurred during the study period, of which 27 were fatal crashes.

Figure 31. Crashes in the Region 2 Portion of the Corridor



Source: E-TRIMS



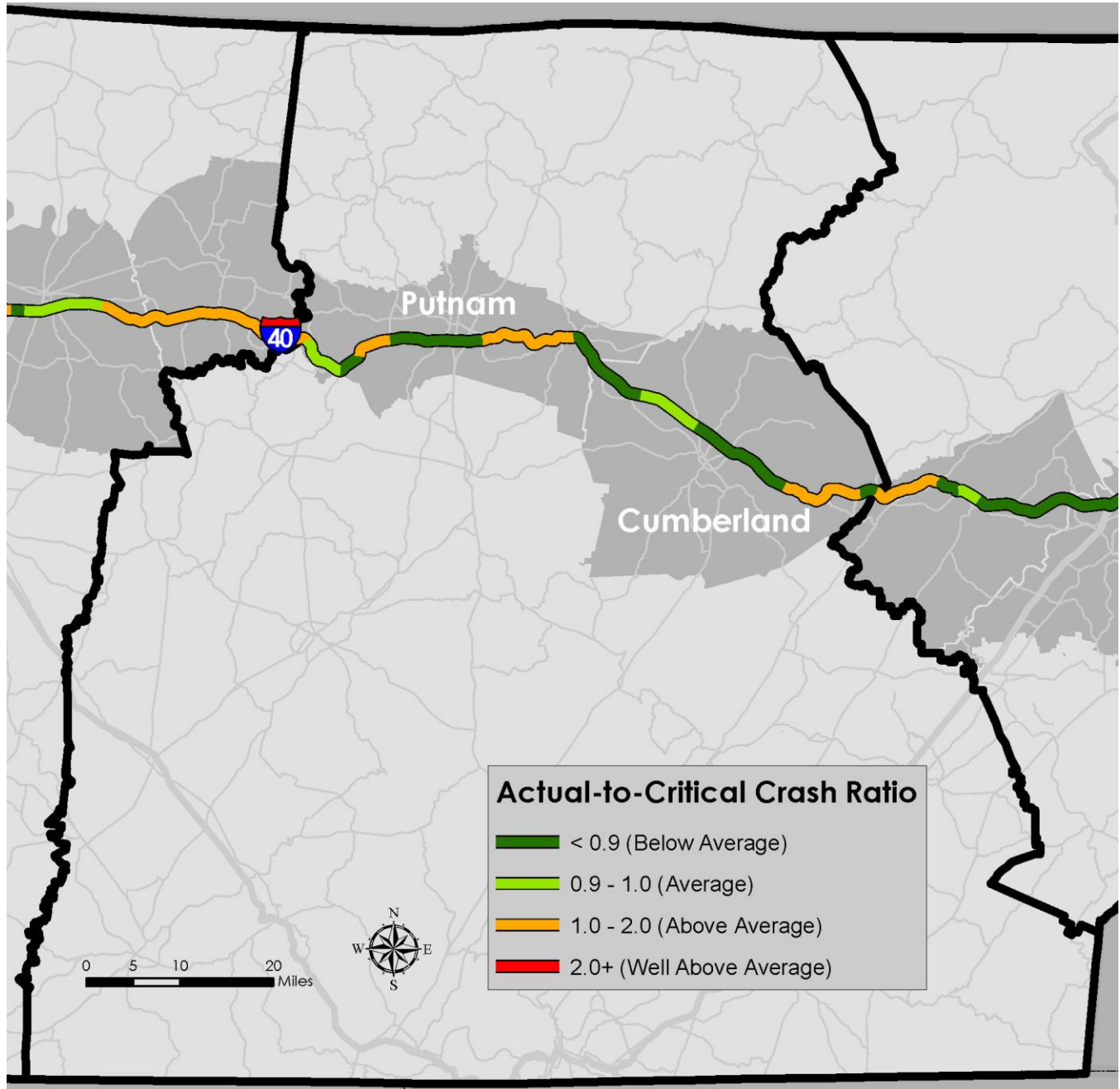


## I-40/81 Multimodal Corridor Study

During the study period, three roadway segments in the portion of the study area located within TDOT Region 2 featured an actual-to-critical crash rate ratio greater than 1.0. These segments are shown in orange in Figure 32 and include:

- From Exit 276 (Old Baxter Road) to Exit 280 (SR 56) in Putnam County;
- From Exit 290 (SR 24, US 70N) to Exit 300 (SR 24/84, US 70N) in Putnam County; and
- From Exit 329 (Market Street) to Exit 338 (SR 299, Westel Road) in Cumberland County.

Figure 32. Segments with Higher Crash Rates - Region 2 (2014-2018)



Source: E-TRIMS



# I-40/81 Multimodal Corridor Study

Table 22. Crash Data for Segments with Higher Crash Rates in Region 2

Crash Types		I-40					
		Exit 276 to Exit 280		Exit 290 to Exit 300		Exit 329 to Exit 338	
Total	Crashes	203		643		365	
Severity	Fatal Crashes	2	1.0%	5	0.8%	3	0.8%
	Injury Crashes	36	18%	105	16%	78	21%
Collision Types	Single Vehicle	121	60%	281	44%	262	72%
	Rear End	43	21%	225	35%	42	12%
	Sideswipe-Same Direction	27	13%	98	15%	42	12%
Weather Conditions	Snow, Rain, Sleet	36	18%	154	24%	125	34%
	Clear	133	66%	405	63%	211	58%

Source: E-TRIMS

An approximately 0.84-mile segment of Interstate 40 from the Smith-Putnam County line to Exit 268 (SR 96) that features an actual-to-critical crash rate ratio greater than 1.0 during the study period is located within TDOT Region 2, but is included as part of a larger contiguous segment located in Region 3 for the purposes of this analysis.

The three segments in Region 2 are characterized by rural terrain, with four total travel lanes on independent roadways or separated by a depressed median, rolling terrain, and frequent horizontal and vertical alignment changes. Crashes in these segments were primarily single-vehicle roadway departures (55 percent of the total crashes in these segments); however, they also featured a higher proportion of rear-end crashes (26 percent of the total crashes in these segments) relative to other rural segments in the study area. Crashes in the Cumberland County section, at the edge of the Plateau, were more commonly associated with poor weather conditions.

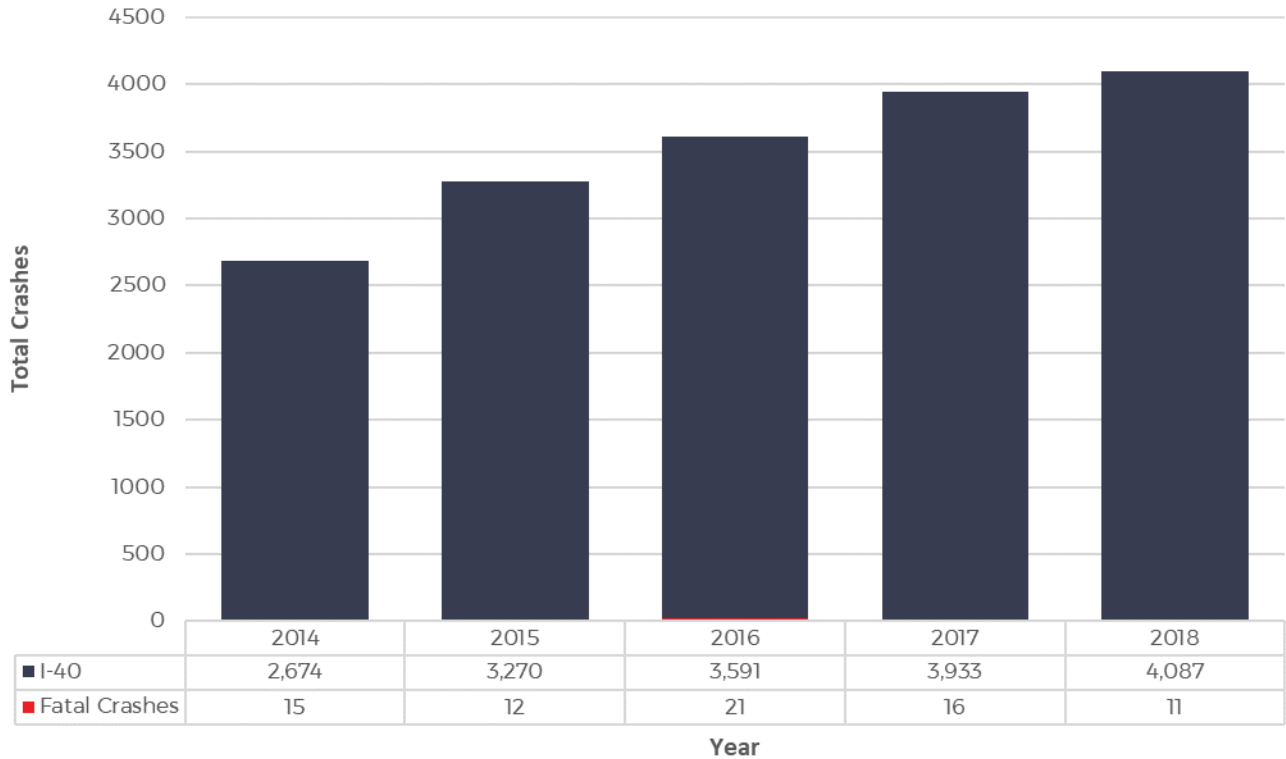


# I-40/81 Multimodal Corridor Study

## Region 3

Figure 33 shows the total and fatal crashes occurring in the portion of the study area located within TDOT Region 3 for each year of the study period. As shown, a total of 17,555 crashes occurred during the study period, of which 75 were fatal crashes.

Figure 33. Crashes in the Region 3 Portion of the Corridor



Source: E-TRIMS

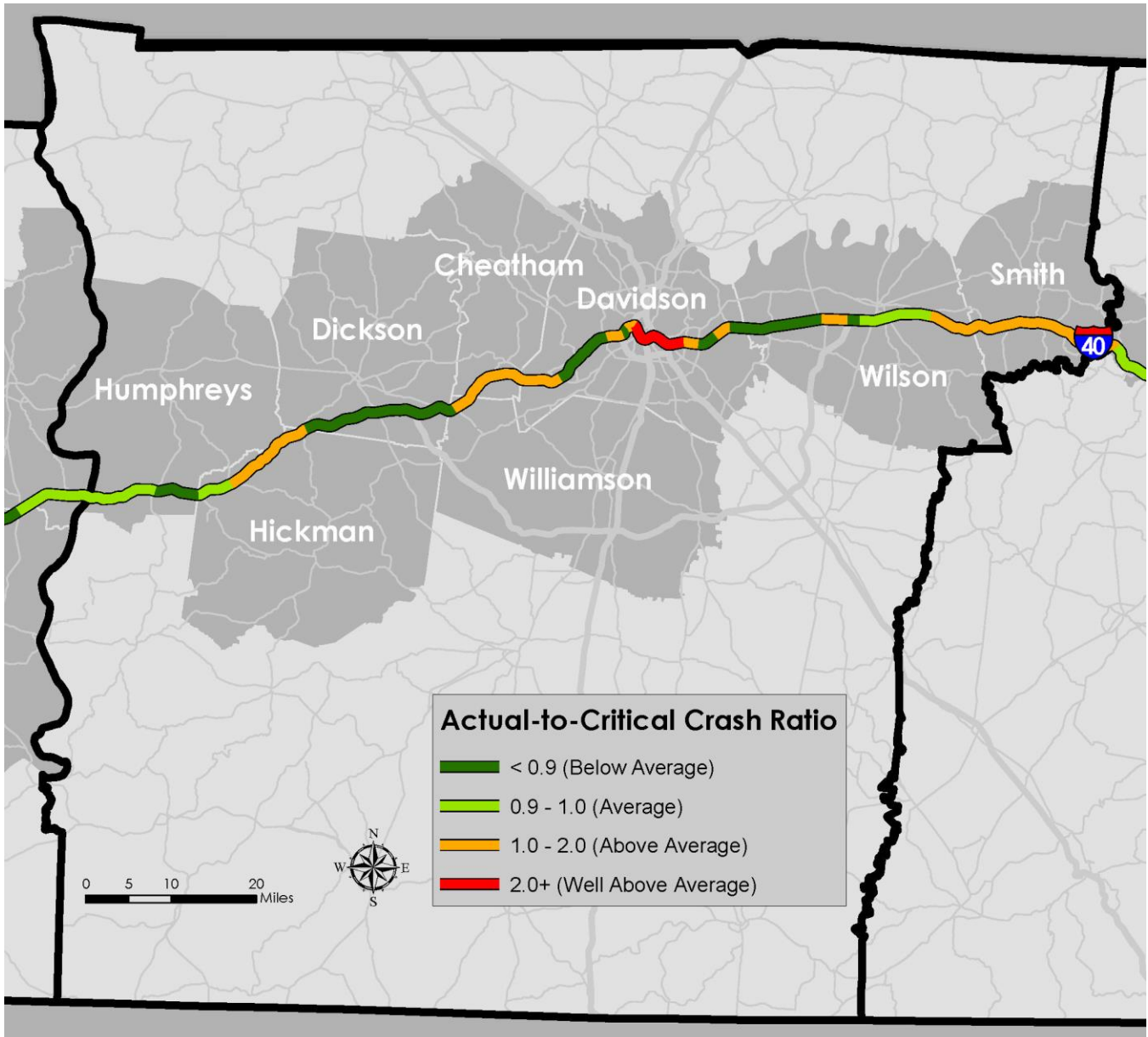
During the study period, seven roadway segments in the portion of the study area located within TDOT Region 3 featured an actual-to-critical crash rate ratio greater than 1.0. These segments are shown in orange and red in Figure 34 and include:

- From Exit 152 (SR 230) to Exit 163 (SR 48) in Dickson, Hickman, and Humphreys counties;
- From Exit 182 (SR 96) to Exit 196 (SR 1, US70S) in Cheatham, Davidson, and Williamson counties;
- I-40 from Exit 204 (SR 155 [Briley Parkway / White Bridge Road]) to Exit 206 (I- 440) in Davidson County;
- From Exit 207 (28<sup>th</sup> Avenue / Jefferson Street) to Exit 216 (SR255, Donelson Pike) in Davidson County;
- From Exit 219 (Stewarts Ferry Pike) to Exit 221 (SR 45, Old Hickory Boulevard) in Davidson County;
- From Exit 232 (SR 109) to Exit 235 (I-840) in Wilson County; and
- From Exit 245 (Linwood Road) to Exit 268 (SR 96) in Putnam, Smith, and Wilson counties.



# I-40/81 Multimodal Corridor Study

Figure 34. Segments with Higher Crash Rates – Region 3 (2014-2018)



Source: E-TRIMS



# I-40/81 Multimodal Corridor Study

Table 23. Crash Data for Segments with Higher Crash Rates in Region 3

Crash Types		I-40													
		Exit 152 to Exit 163		Exit 182 to Exist 196		Exit 204 to Exit 206		Exit 207 to Exit 216		Exit 219 to Exit 221		Exit 232 to Exit 235		Exit 245 to Exit 268	
Total	Crashes	422		1,121		729		7,655		703		424		1,287	
Severity	Fatal Crashes	5	1.2%	3	0.3%	0	0.0%	13	0.2%	2	0.3%	1	0.2%	13	1.0%
	Injury Crashes	117	28%	263	23%	179	25%	1735	23%	180	26%	119	28%	259	20%
Collision Types	Single Vehicle	230	55%	488	44%	156	21%	889	12%	300	43%	132	31%	736	57%
	Rear End	67	16%	342	31%	322	44%	3,718	49%	226	32%	175	41%	309	24%
	Sideswipe-Same Direction	97	23%	187	17%	125	17%	1,928	25%	98	14%	63	15%	152	12%
Weather Conditions	Snow, Rain, Sleet	145	34%	270	24%	149	20%	951	12%	208	30%	98	23%	328	25%
	Clear	223	53%	645	58%	422	58%	5,180	68%	348	50%	246	58%	794	62%

Source: E-TRIMS

The four segments located entirely in Davidson and Wilson Counties are characterized by urban development, with four to ten total travel lanes separated by median barrier, rolling terrain, and few horizontal or vertical alignment changes. Crashes in these segments included a higher percentage of rear-end collisions (47 percent of the total crashes in these segments) and sideswipe crashes (23 percent of the total crashes in these segments) relative to all crashes occurring in TDOT Region 3.

The remaining three segments are characterized by rural development, with four to six travel lanes on independent roadways or separated by a depressed median, rolling terrain, and frequent horizontal and vertical alignment changes. Crashes in these segments were primarily single-vehicle roadway departures (51 percent of the total crashes in these segments).

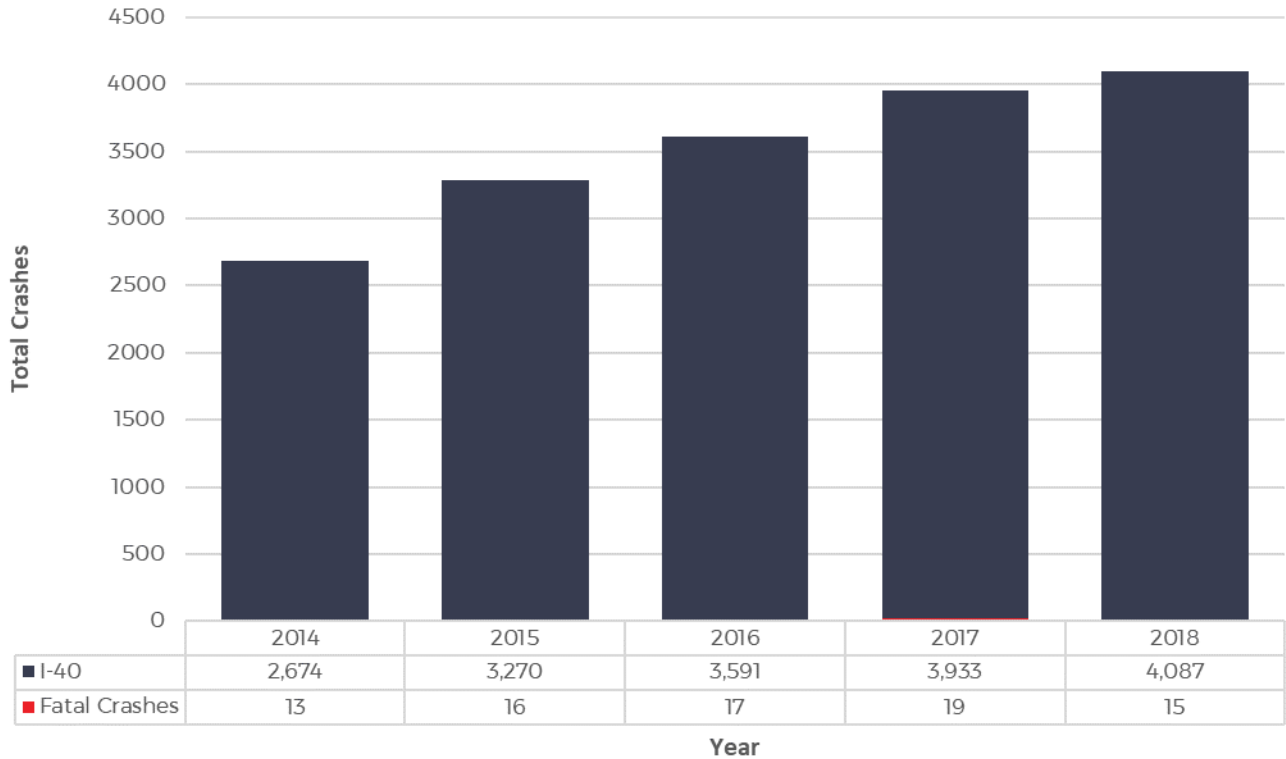


# I-40/81 Multimodal Corridor Study

## Region 4

Figure 35 shows the total and fatal crashes occurring in the portion of the study area located within TDOT Region 4 for each year of the study period. As shown, a total of 8,584 crashes occurred during the study period, of which 80 were fatal crashes.

Figure 35. Crashes in the Region 4 Portion of the Corridor



Source: E-TRIMS

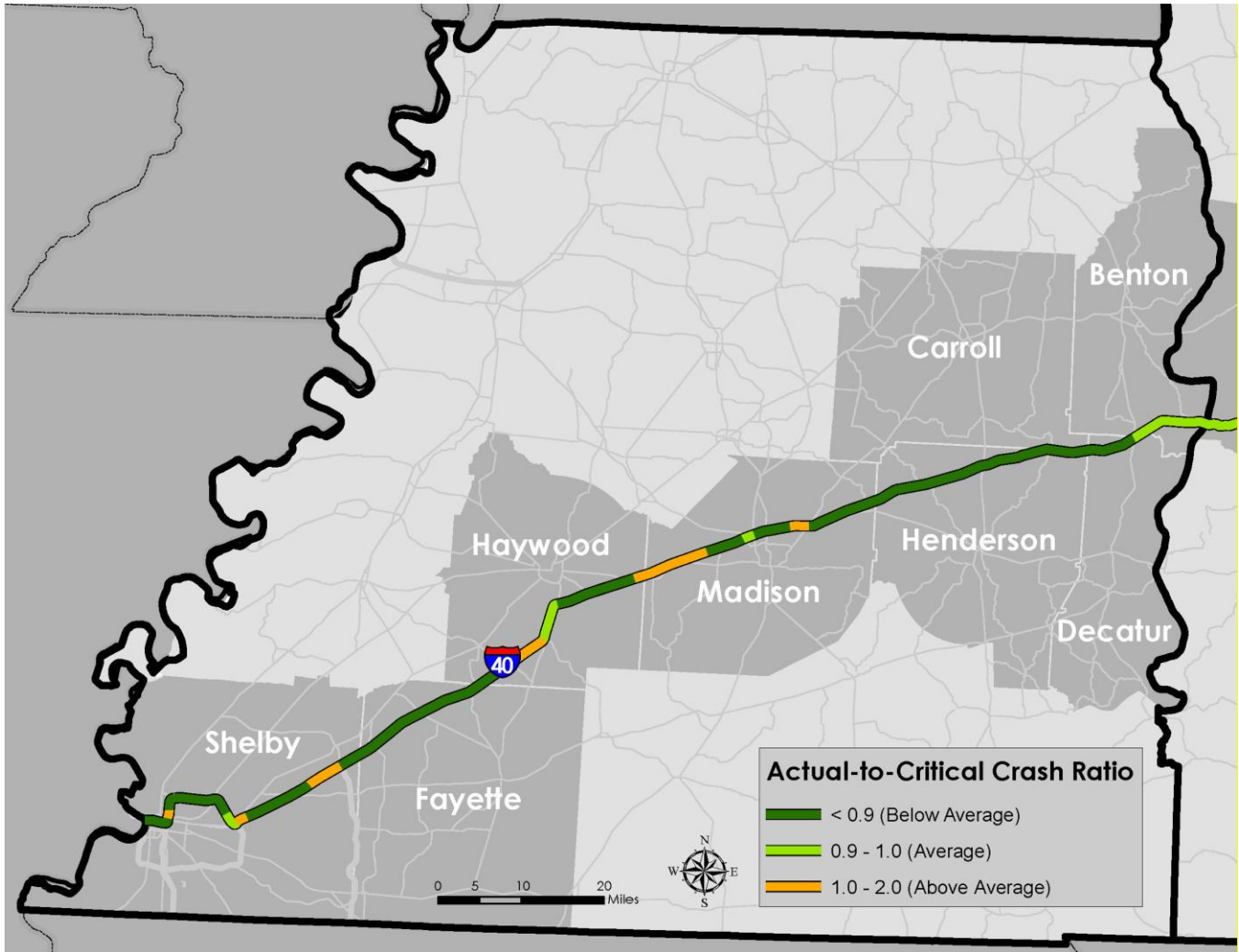
During the study period, six roadway segments in the portion of the study area located within TDOT Region 4 featured an actual-to-critical crash rate ratio greater than 1.0. These segments are shown in orange in Figure 36 and include:

- From Exit 1F (SR 14, Jackson Avenue) to Exit 2 (Chelsea Avenue / Smith Avenue) in Shelby County;
- From Exit 10 (I-240 / Sam Cooper Boulevard) to Exit 12 (Sycamore View Road) in Shelby County;
- From Exit 20 (Canada Road) to Exit 24 (SR 385, I-269) in Shelby County;
- From Exit 47 (Stanton-Dancyville Road) to Exit 52 (SR 179, Stanton-Koko Road) in Haywood County;
- From Exit 66 (SR 1, US 70) to Exit 74 (Lower Brownsville Road) in Haywood and Madison Counties; and
- From Exit 85 (Christmasville Road / Dr. F.E. Wright Drive) to Exit 87 (SR 1, US 70/412) in Madison County.



# I-40/81 Multimodal Corridor Study

Figure 36. Segments with Higher Crash Rates – Region 4 (2014-2018)



Source: E-TRIMS



# I-40/81 Multimodal Corridor Study

Table 24. Crash Data for Segments with Higher Crash Rates in Region 4

Crash Types		I-40											
		Exit 1F to Exit 2		Exit 10 to Exit 12		Exit 20 to Exit 24		Exit 47 to Exit 52		Exit 66 to Exit 74		Exit 85 to Exit 87	
<b>Total</b>	<b>Crashes</b>	<b>335</b>		<b>797</b>		<b>338</b>		<b>169</b>		<b>377</b>		<b>136</b>	
<b>Severity</b>	<b>Fatal Crashes</b>	0	0.0%	4	0.5%	5	1.5%	0	0.0%	3	0.8%	0	0.0%
	<b>Injury Crashes</b>	56	17%	135	17%	84	25%	42	25%	98	26%	29	21%
<b>Collision Types</b>	<b>Single Vehicle</b>	44	13%	75	9%	123	36%	91	54%	194	51%	56	41%
	<b>Rear End</b>	123	37%	386	48%	139	41%	35	21%	94	25%	40	29%
	<b>Sideswipe-Same Direction</b>	81	24%	119	15%	54	16%	34	20%	65	17%	27	20%
<b>Weather Conditions</b>	<b>Snow, Rain, Sleet</b>	55	16%	100	13%	63	19%	18	11%	103	27%	28	21%
	<b>Clear</b>	265	79%	674	85%	241	71%	126	75%	224	59%	89	65%

Source: E-TRIMS

The four segments located entirely in Madison and Shelby Counties are characterized by urban development, with four to ten total travel lanes separated by median barrier, rolling terrain, and few horizontal or vertical alignment changes. Crashes in these segments included a higher percentage of rear-end collisions (43 percent of the total crashes in these segments) relative to all crashes occurring in TDOT Region 4. As noted earlier, rear-end crashes, particularly in urban areas, are commonly associated with heavy traffic congestion.

The remaining two segments in Region 4 are characterized by rural development, with four travel lanes separated by a depressed median, and rolling terrain. Crashes in these segments were primarily single-vehicle roadway departures (52 percent of the total crashes in these segments).



## 8. Freight Movement and Diversion

The I-40/81 corridor travels through several freight intensive areas important for economic growth, commerce, and job creation. Freight movement is an important element of the statewide and regional economy. A large portion of Tennessee's economy includes goods-dependent industry relying heavily on freight, with a full 36 percent of jobs considered goods-dependent. The largest sectors in the state are manufacturing, retail trade, and wholesale trade. Due to the heavy reliance of the state's economy on freight transportation, TDOT established a set of guiding principles related to freight that are included as part of the Statewide Multimodal Freight Plan (2018). The I-40/81 corridor serves several supply chains and includes a number of identified freight bottlenecks that impede efficient freight movement.

The FAST Act created a National Multimodal Freight Network (NMFN) with the intent of strengthening the contribution of the network to the economic competitiveness of the country. The NMFN includes the National Highway Freight Network (NHFN), which consists of the Primary Highway Freight System (PHFS), Critical Rural Freight Corridors (CRFCs), Critical Urban Freight Corridors (CUFCs), and the remainder of the Interstate highway system not already designated as part of the PHFS. The I-40/81 corridor is part of the Primary Highway Freight System (PHFS), which includes the most critical portions of highways for the US freight transportation system determined by measurable and objective data. Several other routes connecting to the corridor have been identified as Critical Urban Freight Corridors and Critical Rural Freight Corridors through consultation with regional transportation planning organizations across the state.

Non-highway components of the National Multimodal Freight Network adjacent to the corridor include the International Port of Memphis, one of the busiest intermodal facilities in the country due to the FedEx hub; Memphis International Airport; Class I railroads; the Mississippi, Tennessee, and Cumberland Rivers; and various intermodal connectors. Truck parking facilities and weigh stations also serve as important elements of freight infrastructure that can be found throughout the corridor. Sufficient truck parking and efficient management of weigh stations can help improve safety and support the on-time delivery of products traveling by truck across the corridor.

According to the recently adopted statewide freight plan, of the 770 million tons of freight moving on Tennessee infrastructure annually, only 5 percent of movements are trips made solely within the state. This means that 95 percent of freight tonnage is either moving completely through the state or is originating or destined for a different state. Further, freight tonnage is expected to double throughout the state by 2040, with international trade increasing. Connections to the global economy through access to airports and major ports have been viewed as increasingly important for economic growth and development at both the state and national level.<sup>13</sup>

Figure 37. Crescent Corridor



Source: Norfolk Southern

<sup>13</sup> The impacts of the current COVID-19 pandemic on global supply chains are not yet fully clear. Some US companies are indicating they will shift to domestic sources for certain processes. In the absence of an established trend, this study has taken a conservative approach and relies primarily on existing projections.



## I-40/81 Multimodal Corridor Study

Investments are also being made outside the immediate interstate corridor that impact freight movement on I-40 and I-81. One of the most significant is Norfolk Southern's Crescent Corridor. The Crescent Corridor is a \$2.5 billion-plus rail infrastructure project that is nearly complete. The corridor spans 11 states and provides more direct routes from the southeastern to the northeastern US. Although the Crescent Corridor does not pass through every portion of the state, TDOT's previous I-40/81 Corridor Study found a higher benefit/cost ratio associated with the Tennessee portion of the NS project compared to a Trans-Tennessee Rail Corridor that would create a statewide connection entirely within Tennessee. The cited benefits include greater potential for diversion of truck traffic to rail, reduction of air pollution, and improved safety on I-40 as a result of the anticipated truck diversions. Based in part on the results of the I-40/81 Corridor Study, Tennessee later partnered with NS on a major federal grant to advance the Crescent Corridor improvements.

### Supply Chains

Key supply chains served by I-40 and I-81 identified in the Statewide Multimodal Freight Plan include:

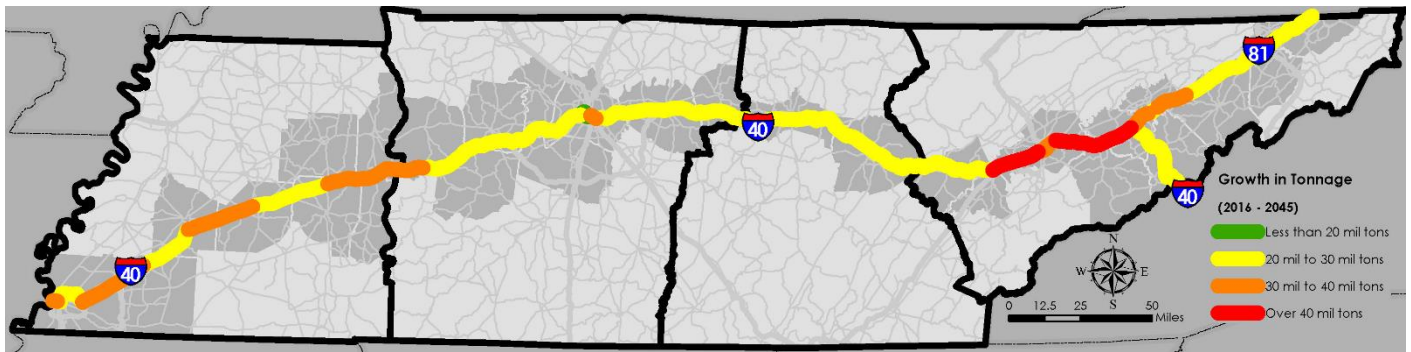
- **Automotive** – Although none of Tennessee's three major automotive manufacturers are directly adjacent to I-40 or I-81, they rely in part on the corridor, particularly in east Tennessee, with much of the traffic passing through the I-40/I-75 junction just outside Knoxville.
- **Advanced Manufacturing** – The advanced manufacturing industry includes industries like aerospace, electronics, machinery, pharmaceuticals, and precision instruments. Almost all interstates in Tennessee are highly utilized by this supply chain, with the highest volumes observed in east Tennessee along the portion of the I-40/81 corridor between Knoxville and Bristol.
- **Chemical Products and Plastics** – The majority of chemical and plastic products are derived from petroleum. I-81 is one of the top two heaviest travel routes in the state with regard to chemical and plastics products tonnage, along with I-26.
- **Agriculture** – Agricultural production occurs in all corners of the state, with more produce and grain farming in the flatter western portion of the state, and livestock in Middle and East Tennessee. The State Multimodal Freight Plan identifies I-40 as a major route for the transport of agricultural products throughout the state, but particularly in West Tennessee.

### Freight Bottlenecks

USDOT has adopted ten National Multimodal Freight Policy goals, which Tennessee has included in various plans. The first of these goals includes identifying improvements that reduce congestion and eliminate bottlenecks on the National Multimodal Freight Network (NMFN). TDOT has committed to supporting this goal by recommending improvements that would reduce congestion and transportation costs, and improve reliability and productivity of the state's industries.

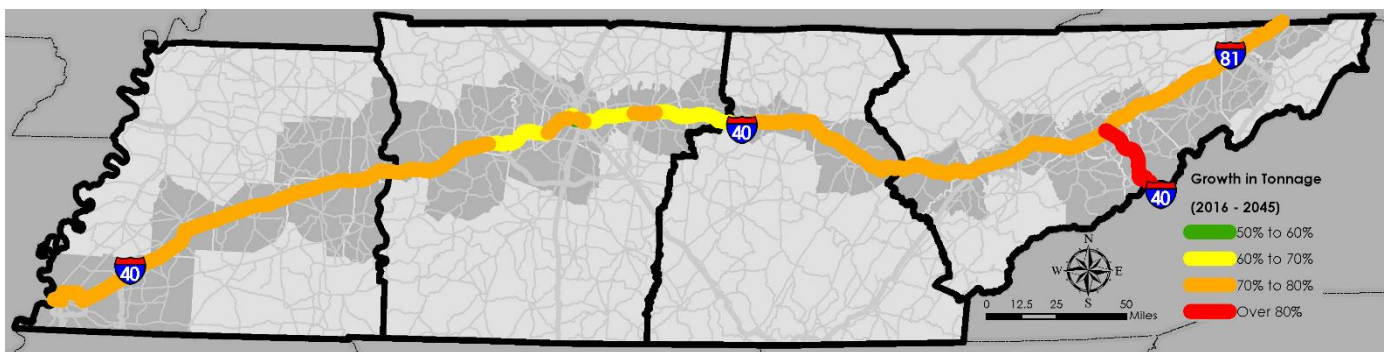
As shown in Figure 38 and Figure 39 below, total freight traveling along I-40 and I-81 is expected to increase significantly between 2016 and 2045. A corridor level review of TRANSEARCH data suggests that the most significant growth in freight tonnage will occur in Regions 1 and 4, with more than 40 million additional tons traveling by truckload in and around the Knoxville area. Most of the I-40/81 corridor is anticipated to experience more than 70 percent growth in freight tonnage. The projected growth in freight tonnage is even higher for the section of I-40 between the I-81 interchange and the North Carolina state line, with more than 80 percent growth expected over the next 20 years.

Figure 38. Growth in Freight Tonnage, 2016 to 2045



Source: Transearch, IHS, 2016 and 2045

Figure 39. Percent Growth in Freight Tonnage, 2016 to 2045



Source: Transearch, IHS, 2016 and 2045

The state’s Freight Plan identifies 32 highway bottlenecks for potential improvements across the state, based on a combination of speed, volume, and roadway Level of Service data. Each segment identified as a possible bottleneck met one of the following conditions: (1) the segment had a LOS of F and a truck volume greater than 5,000 trucks per day or (2) the segment had an average daily truck speed of less than 45 mph. As shown in Table 25, nine of the locations are on I-40, and four of them rank in the top ten worst bottlenecks statewide. The plan did not identify any bottlenecks on I-81.



# I-40/81 Multimodal Corridor Study

Table 25. Freight Bottlenecks Identified in Statewide Freight Plan

Rank	Region	County	Facility	From	To
2	4	Shelby	I-40	North Main St.	Chelsea Ave.
5	4	Shelby	I-40	Jackson Ave.	Covington Pk.
7	4	Shelby	I-40	I-240	Sycamore View Rd.
10	3	Davidson	I-40	Charlotte Pike	I-65
14	3	Davidson	I-40	I-24	SR-255 (Donelson Pk.)
15	3	Davidson	I-40	I-65	I-24
20	3	Wilson	I-40	E. of S. New Hope Rd.	E. of Beckwith Rd.
26	1	Knox	I-40	E. of Everett/Watt Rd.	I-275
27	1	Knox	I-40	SR-158	W. of North Cherry St.

Bottlenecks in Memphis and Nashville were categorized as largely a result of congestion, while bottlenecks in the eastern portions of the state are also influenced by varying geography and grades.

## Region 1

Region 1 has several facilities that are nationally designated for the efficient and safe movement of freight. Both I-40 and I-81 are on the federally-designated Primary Highway Freight Network (PHFS), which is part of the overall Interim National Multimodal Freight Network (NMFN). In this portion of the state, CSX rail lines typically travel north-south. CSX has a major rail yard in Unicoi County and a TRANSFLO Terminal Service Build Transfer Terminal in Knoxville.

The NS network spans nearly 20,000 miles in 22 states. In Tennessee, NS operates 847 route miles, primarily in the eastern portion of the state near Chattanooga, Knoxville, and Johnson City. Burkhart Yard near Knoxville is served by Norfolk Southern and also has a barge terminal on the Tennessee River. NS has also studied the potential for a future intermodal facility in east Tennessee along the Crescent Corridor, which runs through the Knoxville area as seen in Figure 37.

Both the McGhee Tyson Airport in Knoxville and the Tri-Cities Regional Airport are located along or near the corridor. McGhee Tyson Airport is a U.S. customs port of entry, covers over 2,000 acres of land and provides 9,000-foot runways to accommodate various aircraft types. The Tri-Cities Regional Airport covers approximately 1,225 acres including a 35-acre air cargo logistics center and a 75-foot wide taxiway system.

Truck trip origins and destinations in the Knoxville region are heavily concentrated along I-40, with the most highly concentrated areas occurring at the I-40/I-75 junction. The Knoxville/Lakeway Regional Freight Plan identifies significant clusters of trucking terminals in Knoxville near the I-40/Lovell Road interchange, along Middlebrook Pike near the I-40/I-640 western interchange (location of a petroleum tank farm), and in White Pine at the I-81/SR 341 interchange, where the newly relocated SR 66 will provide a more direct connection between Morristown and I-81. Major distribution centers identified include a Wal-Mart distribution center near the I-81/US 11E interchange in Greene County, and the H.T. Hackney distribution center at the I-40/Buttermilk Road interchange in Roane County, just west of the busy I-40/75 junction.

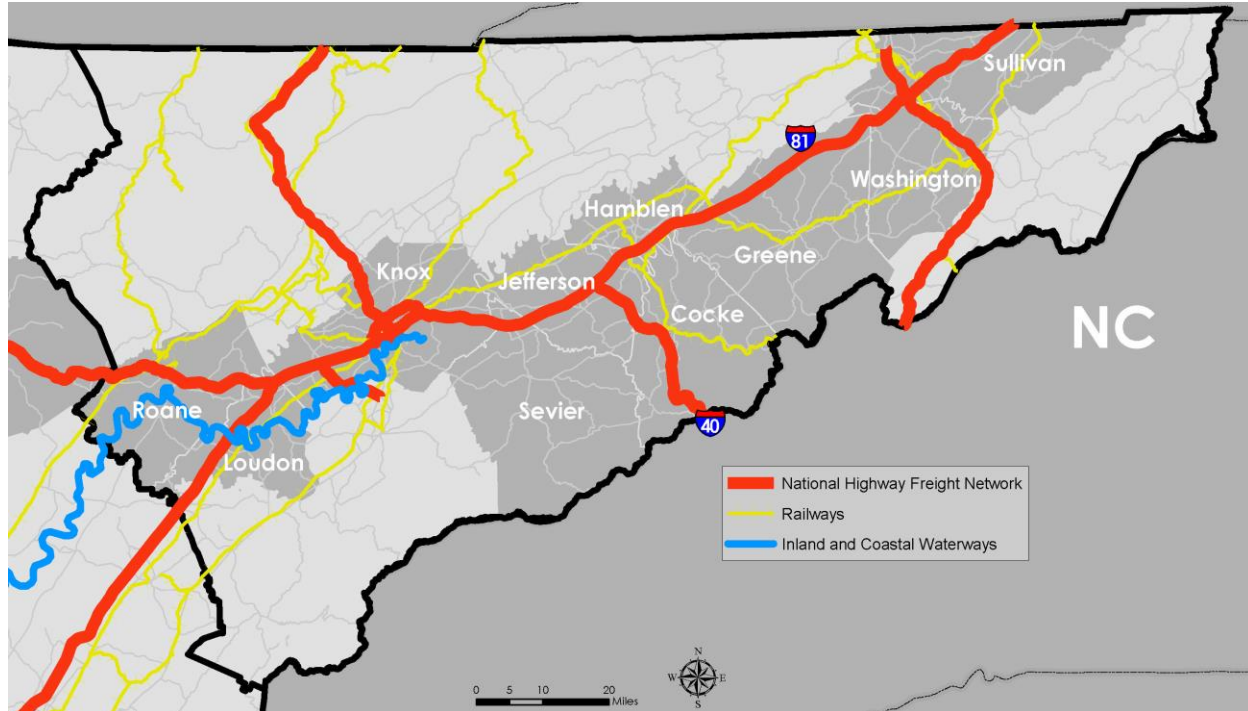


## I-40/81 Multimodal Corridor Study

The State Multimodal Freight Plan identifies two bottlenecks in the Knox County portion of the corridor that largely overlap with the areas of congestion identified in Chapter 4:

- I-40 from east of Watt Rd. to the I-40/I-275 interchange
- I-40 from SR-158 (James White Parkway) to west of North Cherry Street

Figure 40. Freight Infrastructure - Region 1



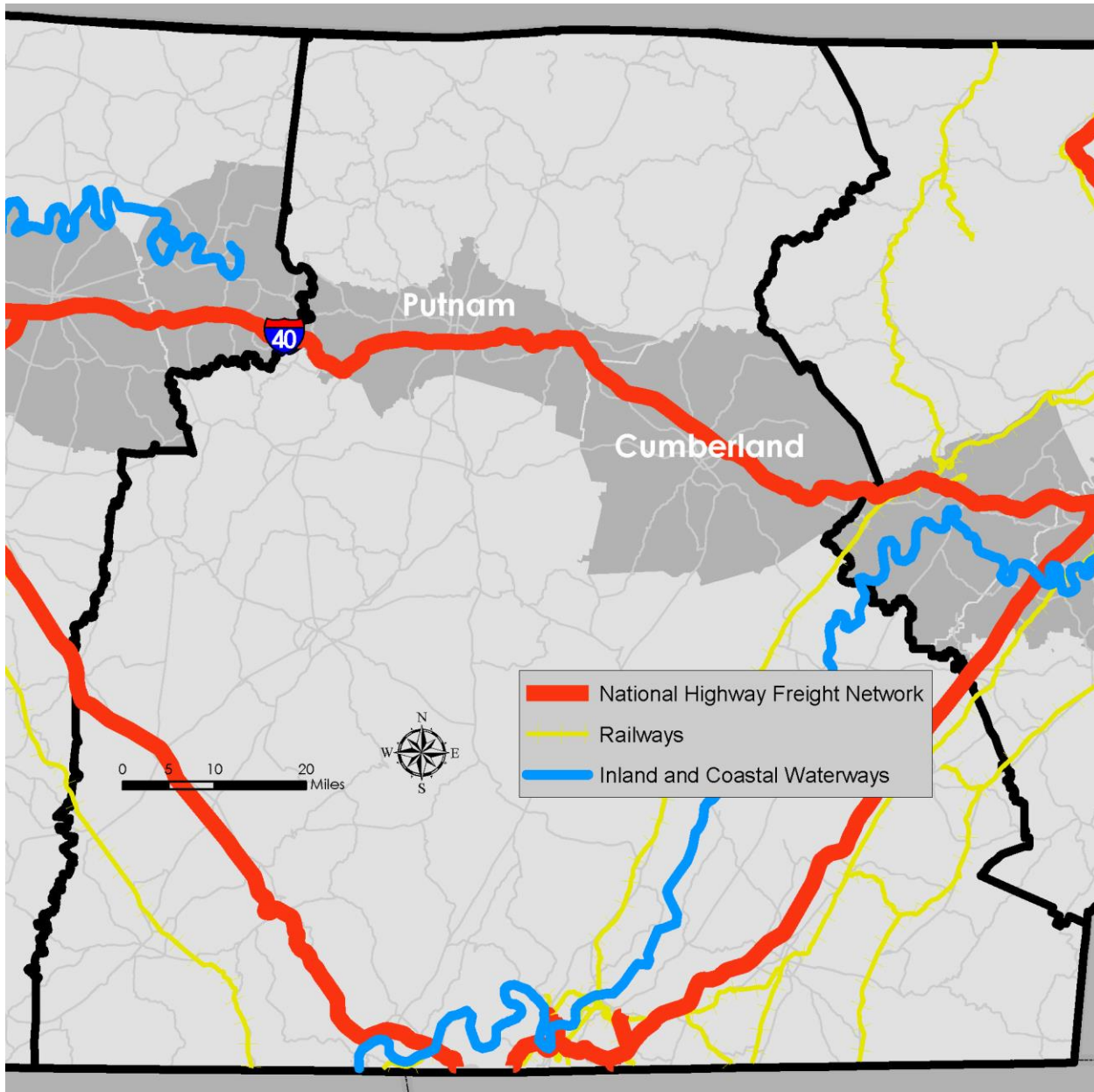
Source: Bureau of Transportation Statistics, Interim National Multimodal Freight Network

## Region 2

The I-40 corridor in Region 2 is also part of the designated PHFS. Freight movements in Region 2 are largely through-movements, although both Cookeville and Crossville have heavy retail and industrial development along I-40, including the newly constructed Tennessee Avenue interchange on the west side of Cookeville, which serves multiple industrial parks and the recently opened Academy Sports distribution center.

Norfolk Southern's Crescent Corridor also passes through the southeastern portion of Region 2 connecting Chattanooga and Knoxville, as shown by the railroad infrastructure in Figure 41.

Figure 41. Freight Infrastructure - Region 2



Source: Bureau of Transportation Statistics, Interim National Multimodal Freight Network

### Region 3

Freight is a foundational component of Middle Tennessee’s economy. Region 3 contains a number of freight intensive facilities that utilize the corridor, including manufacturing and distribution facilities like Nissan, Amazon, and Under Armor, as well as CSX’s Radnor Yard, the main intermodal rail yard in the region. Three private port terminals are situated along the Cumberland River, supporting important freight movement of heavy commodities like coal, sand, and stone that would otherwise be moved by truck or rail.



## I-40/81 Multimodal Corridor Study

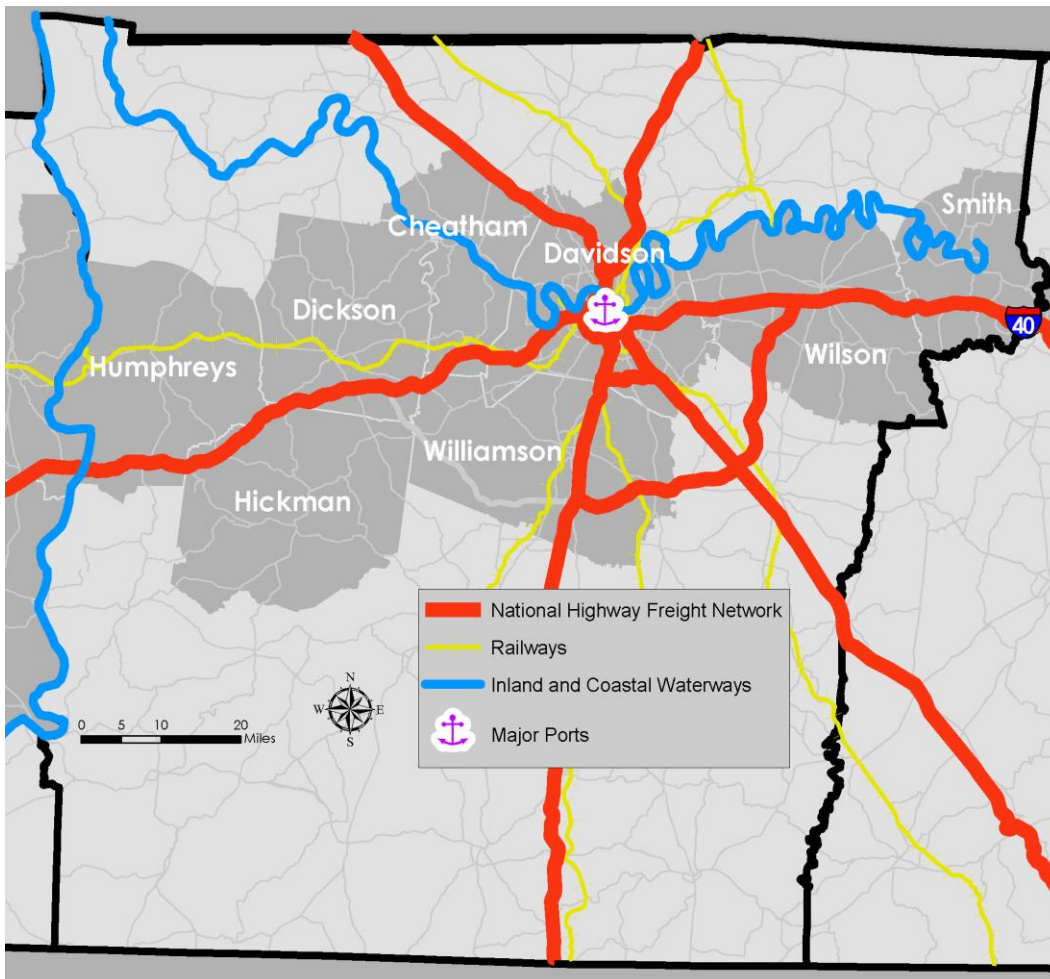
Although I-24 is the corridor identified by the Nashville MPO as a freight-intensive corridor, the organization’s regional freight plan also identifies three locations along I-40 that rank among the “Top 10” interstate truck count locations in the Nashville region:

- #3 – I-40 near the Davidson/Wilson county line
- #4 – Wilson County in southwest Lebanon
- #8 – Wilson County, just west of I-840

The Nashville MPO’s regional freight plan also identifies a cluster of freight activity along I-40 in Wilson County, including major Amazon and Under Armor distribution facilities. The completion of I-840 provides a southern alternative route to I-40, allowing through-trucks and local freight traffic in Wilson County to bypass the congestion of downtown Nashville.

Region 3’s only Class I rail carrier, CSX, operates primarily in a north-south direction and connects the region with Memphis and other southeastern cities as well as cities in the Midwest. The region is also home to three short line railroads. Radnor Yard is used for intermodal truck-to-rail transfers along with carload operations. From CSX’s hub in Nashville, it is possible to connect with most parts of the eastern United States.

Figure 42. Freight Infrastructure - Region 3



Source: Bureau of Transportation Statistics, Interim National Multimodal Freight Network



## I-40/81 Multimodal Corridor Study

### Region 4

Memphis is the largest intermodal freight hub in the state. I-40, which moves freight east-west through the region, intersects I-55 in Memphis. I-55 is a north-south freight corridor between Chicago and New Orleans connecting through Memphis. Memphis International Airport – home to FedEx – connects to more than 220 countries, serves 95 percent of the global economy in 24 to 48 hours, and is one of the busiest cargo airports in the world. This provides an invaluable connection for the industries located in Tennessee. The FedEx hub is capable of processing more than 500,000 packages per hour.

Six Class 1 railroads serve west Tennessee and five of them converge in Memphis: Burlington Northern Santa Fe (BNSF), Canadian National (CN), Norfolk Southern (NS), Union Pacific (UP), and CSX. Many short line railroads branch from these Class 1 lines to serve the west Tennessee region. BNSF has a 185-acre intermodal yard located southeast of downtown Memphis, within blocks of the airport, while CN and CSX both have intermodal facilities located within Frank C. Pidgeon Industrial Park, which is part of the International Port of Memphis.

Other freight infrastructure in the Memphis region includes the International Port of Memphis which serves 122 tenants who use the Mississippi River to move freight north and south, resulting in annual revenue of \$3.3 billion. NS has an intermodal facility in Rossville, near I-269, built in part with the federal TIGER grant mentioned previously in which NS and the State of Tennessee partnered to improve the efficiency of rail freight movement along the Crescent Corridor.

The highest concentrations of truck origins and destinations in the Memphis region are along the Lamar Avenue (SR 4, US 78) corridor between I-240 and the Mississippi state line. There are also high concentrations of truck origins and destinations along I-240 between Lamar Avenue and downtown Memphis.

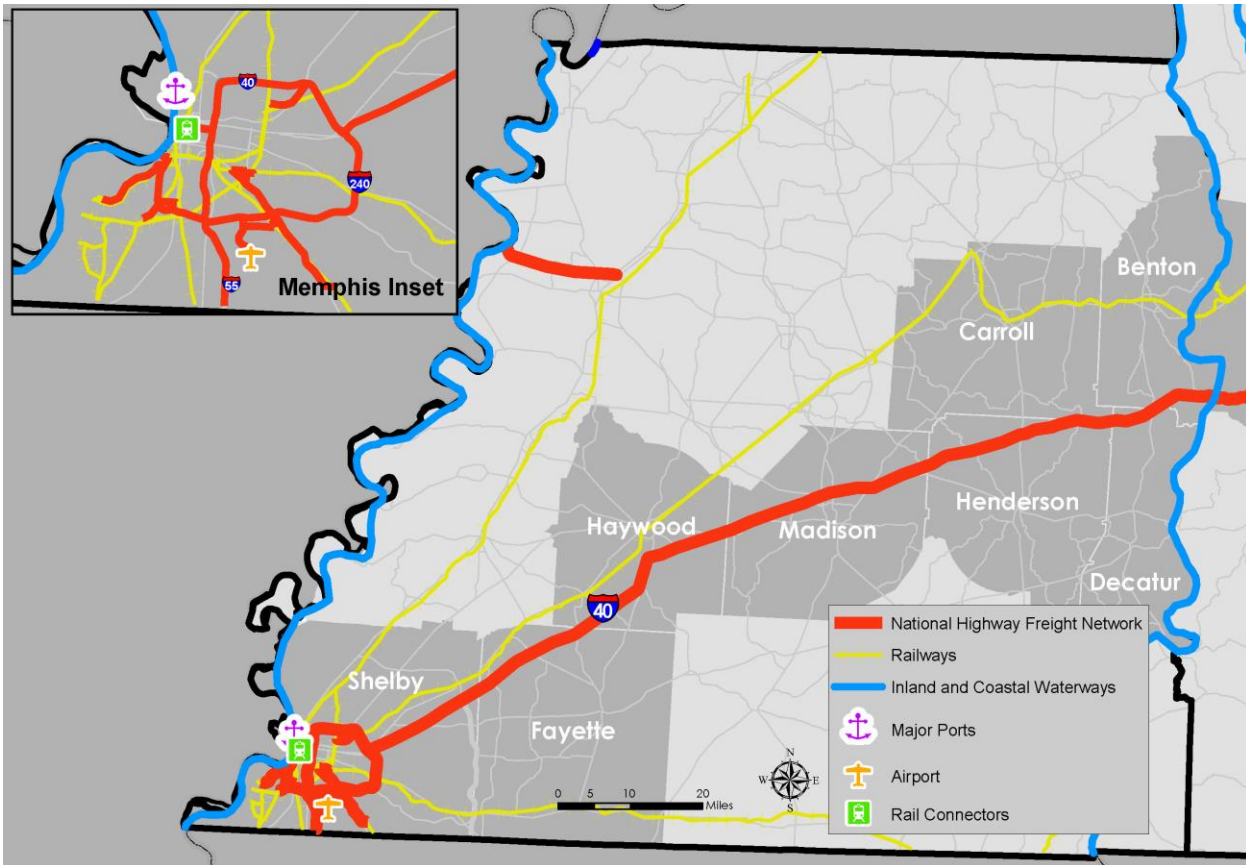
Three of the top ten freight bottlenecks statewide identified by TDOT are on I-40 in Shelby County:

- Between North Main Street and Chelsea Avenue
- Between Jackson Avenue and Covington Pike
- Between I-240 and Sycamore View Rd.

These largely overlap with congested segments identified earlier in this memo. In addition, the Memphis Urban Area MPO's Freight Plan includes a regional freight bottleneck analysis that includes two additional segments on the I-40 corridor, the first at the I-55 junction in northwest Memphis and another at I-40 at I-240 East.



Figure 43. Freight Infrastructure – Region 4



Source: Bureau of Transportation Statistics, Interim National Multimodal Freight Network

## Ports of Charleston and Savannah

The Port of Charleston is an important gateway for freight to and from the east coast of the United States. Truck and rail traffic originating at the port use the corridor for destinations along the corridor such as Nashville and Memphis. In 2018, the Port of Charleston began a \$529 million project to deepen the shipping channel from 45 feet to 52 feet, allowing some of the world’s largest container ships to call on the port even at low tide.

Not far from the Port of Charleston is the Port of Savannah, which is in the process of an expansion similar to that which is underway at Charleston. The Savannah Harbor Expansion Project (SHEP) will deepen the channel from 42 feet to 47 feet, allowing for larger vessels to call on the port at a cost of \$973 million. Begun in 2015, many elements of the project are complete or nearly complete, but the inner harbor dredging is still in the design phase. Because of Savannah’s proximity to I-40 and I-81, increased maritime volumes would result in highway and rail traffic increases into Tennessee and other locations west. As a result of these major infrastructure projects, freight volumes coming from the ports will continue to grow, emphasizing the need for inland port and intermodal facilities to collect and redistribute the goods regionally. Tennessee is considering the potential for inland ports to transfer freight from highway to rail, reducing congestion on the region’s already well-utilized interstates.



# I-40/81 Multimodal Corridor Study

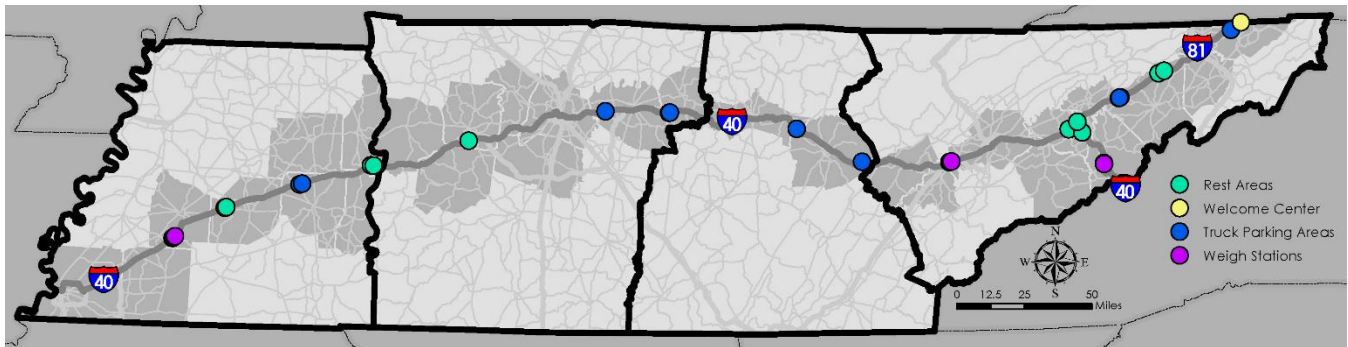
## Truck Parking and Other Facilities

When adequate truck parking is not available, drivers continue to drive or park in non-designated areas such as highway shoulders, interchange ramps, shopping centers, or vacant lots, which presents safety concerns.

Virginia DOT, as part of its I-81 Corridor Plan, recommended the creation of an I-81 corridor truck parking task force comprised of members representing the Virginia Department of Transportation, Department of Motor Vehicles, private travel center owners, economic development authorities, trucking associations, and representatives from local and regional governments and planning agencies. The purpose of the task force would be to identify site-specific issues and overcome obstacles to parking development, investigate opportunities to fund the expansion of public and private truck parking facilities in targeted locations, develop a truck parking information system for public rest areas initially and examine opportunities to partner with the private sector, and implement mobile technology to assist truck drivers with finding available and reserved parking.

As shown in Figure 44, there are 11 public rest areas provided on the corridor, eight on I-40 and three on I-81. There are also nine public truck parking areas – seven on I-40 and two on I-81, and seven weigh stations for trucks, six on I-40 and one on I-81. These facilities are mapped in Figure 44 below.<sup>14</sup> Although rest areas serve all motorists, widespread business closures due to the COVID-19 pandemic recently underscored the value of publicly operated rest areas for truck drivers who had nowhere else to use a restroom, purchase snacks, etc.

Figure 44. Truck-Related Interstate Infrastructure



Source: E-TRIMS

<sup>14</sup> Some facilities may overlap in map. For example, two rest areas or parking areas may be located at roughly the same point along the corridor, but serve different directions of travel. As a result, the number of visible facilities may not total to those listed in narrative.

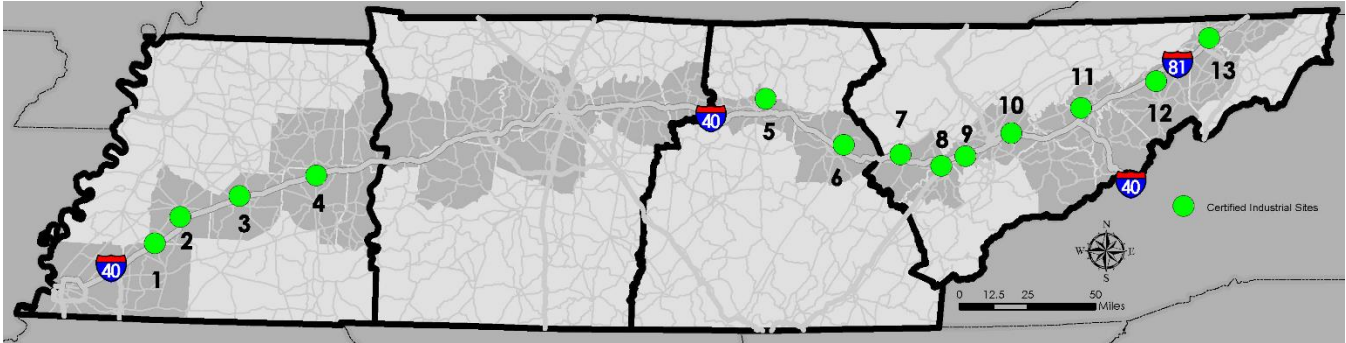
## 9. Economic Access and Land Use

Maintaining and improving access to the I-40 and I-81 corridor is critical to prosperity for our local, regional and state economies. Having access to a safe, high-speed roadway not only benefits the freight movements discussed in the previous section, but also provides mobility for people commuting long distances to jobs. For many businesses, proximity to the interstate provides major economic benefits, including accessibility to customers, visibility, and access to a greater number of potential employees. Planning for this corridor is a balance of providing these benefits of local and regional access, while not impairing the interstates' primary purpose to move long-distance traffic efficiently across the state and nation.

Local and regional plans outline a variety of potential developments expected to occur in and around the corridor over the next several years which will need to be taken into account in planning for the I-40/81 corridor. Figure 45 shows the location of major industrial sites on the immediate corridor that are certified and marketed by the Tennessee Department of Economic and Community Development. They include:

1. [Memphis Regional Megasite](#) – 25 miles from Memphis and 32 miles from Jackson, this 4,100-acre site has direct access to I-40 and lies at the interchange of SR 222 and I-40 and has onsite CSX rail that connects to five Class 1 systems.
2. [I-40 Advantage Industrial Park Site](#) – Located northeast of Memphis, this 140-acre site in Haywood County is less than five miles from I-40 off US 70/79.
3. [Airport Industrial Park Sites A and B](#) – Site A is 103 acres located just south of I-40 in Jackson, less than four miles from the interstate and less than one-half mile from McKellar-Sipes Regional Airport. A portion of the 180-acre Site B was selected by Pacific Industries, an automotive parts manufacturer, for a new facility which is currently under construction.
4. [Timberlake Industrial Site](#) – Timberlake Industrial Site boasts its accessibility to I-40 via SR 22. This Henderson County site is well-suited for a variety of manufacturing and distribution center projects. Total site acreage is 32 acres.
5. [State Road 111 Industrial Park](#) – State Road 111 Industrial Park is well-suited for food processing and other companies with large water and wastewater needs. The Overton County site is 36 acres and is located 12 miles north of I-40 on SR 111.
6. [Interchange Business Park](#) – Interchange Business Park is located in Crossville in Cumberland County. It is one mile from the I-40/US 127 interchange (Exit 317) and is strategically located between Nashville, Knoxville, and Chattanooga.
7. [Cardiff Valley Road Site](#) – This site is 45 acres with 26 acres of buildable land in Rockwood, Roane County.
8. [Jones Road Site](#) – This site is off SR 95 near its interchange with I-40 in Roane County, less than 3 miles from the interstate.
9. [Pellissippi Corporate Center Lots 11 and 12](#) – Located in west Knox County, this site is 33 acres with 28 developable acres and is located along Pellissippi Parkway with easy access to I-40.
10. [Eastbridge Business Park](#) – This site has 121 total acres in east Knox County and is about 6 miles from I-40 via either US 11E or US 11W.
11. [East Tennessee Progress Center](#) – This site has 42 developable acres on Howard Allen Road near the I-81/SR 32 interchange in Morristown.
12. [Hardin Industrial Complex - Phase II](#) – Located between the Tri-Cities and Knoxville and adjacent to SR-172, which provides access to I-81 (3 miles away), this site contains 20.5 total acres with 11.3 developable acres.
13. [Aerospace Park 1](#) – Located at the Tri-Cities Regional Airport, the site is less than 10 miles from the junction of I-81 and I-26 and has 21 acres of developable land.

Figure 45. State Certified Industrial Sites



Source: Tennessee Department of Economic and Community Development

A review of local and regional plans and major developments also identified the following initiatives with a significant impact to I-40/81:

- **I-81 Exit 74, The Pinnacle and Bristol Regional Medical Center** – The City of Bristol developed a plan for Exit 74 of I-81, where the Bristol Regional Medical Center is currently located. The purpose of this study was to plan for, prioritize, and foster future development in and around the Medical Center, drawing from the city’s Future Land Use Plan and Policy adopted in 2013. As part of that effort, the city adopted a policy to provide sufficient land and infrastructure to stimulate and support a mixed-use medical district with compatible commercial and residential growth in the vicinity of the hospital. The Pinnacle is a major retail and entertainment establishment that was currently under construction when the plan was published. It has since brought several retail, dining, and entertainment options to the community.
- **Tri-Cities Crossing, I-81 and I-26 interchange** – Tri-Cities crossing is a 400-acre industrial development location in Kingsport. Businesses including Mead Tractor, FedEx, and Kia Motors, are all currently located here.
- **I-40 at SR 255, Expansion of Nashville International Airport** – The Nashville International Airport anticipates that by 2023, passenger traffic will grow from approximately 19 million annually, to more than 23 million. The BNA Vision is a growth and expansion plan for the Nashville International Airport that includes additional airline gates, expanded ticketing and baggage areas, and additional security screening lanes, among other amenities. The plan anticipates this expansion will provide thousands of local jobs and invest millions into the economy of Middle Tennessee.
- **I-40 in downtown Nashville - Amazon Operations Center** – Amazon is currently constructing an operations center in downtown Nashville, expected to employ approximately 3,000 individuals. The hub will be part of a broader development in downtown Nashville, Nashville Yards, which will include a hotel, entertainment venues, and a park.
- **I-40 in north Memphis - Amazon Fulfillment Center** – Amazon is also investing in another distribution facility in Memphis, expected to provide upwards of 1,000 jobs. The site is off New Allen Road about four miles from I-40 Exit 6. The distribution center should be open and operating by the end of 2020 and represents an additional \$200 million investment in the city of Memphis, where Amazon already has two other distribution centers.



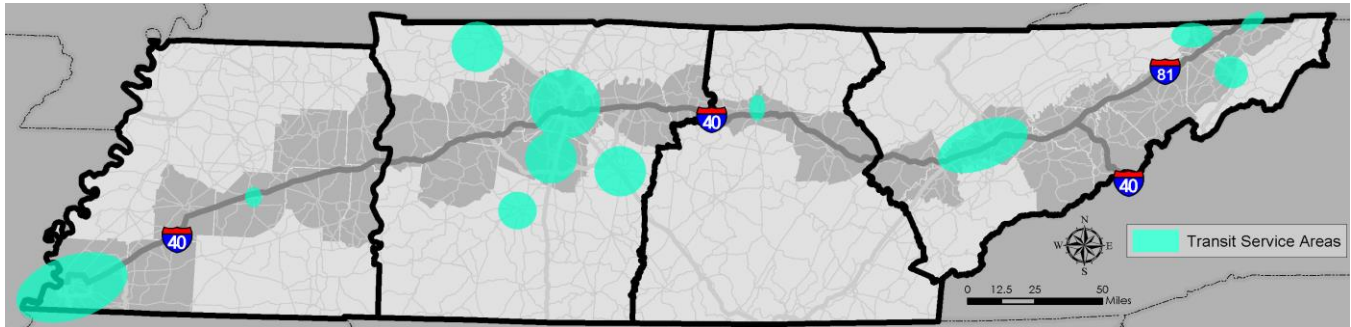
## **I-40/81 Multimodal Corridor Study**

On the far eastern end of the corridor, there has been previous discussion of a new I-40 interchange in Coker County at O'Neil Road. The concept reportedly originated from a proposed major development in the area which did not materialize due to the Great Recession. No information was found in local or regional plans to indicate plans for developing the area, and property records do not indicate major utilities are present.

## 10. Transit and Multimodal Connections

While TDOT does not own or operate transit in the state of Tennessee, paratransit, commuter, and human resource agency services utilize the I-40 and I-81 corridors to provide transportation to individuals for work, medical appointments, school, and other destinations. The map below highlights the service areas of transit agencies that provide fixed-route service that either utilizes the I-40/81 corridor or major routes parallel to it. A brief overview of services is provided below.

Figure 46. Location of Fixed-Route Transit



Source: Various Transit Agencies

### Fixed-Route Service

- [Kingsport Area Transit Service \(KATS\)](#) operates six vehicles across a fixed route service that includes six routes. Service is provided Monday through Friday from 7:30 am to 5:30 pm. The system also operates four vehicles for dial-a-ride passengers during the same service hours. This network serves local trips throughout the city of Kingsport as opposed to trips that would typically use I-81.
- [Bristol Tennessee Transit](#) offers fixed-route service from 6:15 am to 6:00 pm, Monday through Friday. The agency operates six routes, with several routes serving destinations adjacent to I-81 including The Pinnacle commercial center in Tennessee as well as the Falls commercial center on the Virginia side.
- The [Memphis Area Transit Authority](#) provides public transportation for the Memphis area and operates fixed-route buses, paratransit vehicles, and vintage rail trolleys. 2018 ridership across all modes was 6.7 million passenger trips. Service extends into the neighboring communities of Bartlett, Lakeland, and Germantown. The Wolfchase Limited Stop route operates along I-40 between Stage Rd. and downtown. Several routes converge (44, 45, 53) just off I-40 at Southwest Tennessee Community College’s Macon Cove campus, located near the I-40/Sycamore View Road interchange.
- [WeGo Public Transit](#) provides public transportation in the Nashville region and operates fixed-route buses and paratransit service. 2018 ridership was 9.8 million passenger trips. WeGo operates several routes that run parallel to I-40 or use I-40. Route 18 runs between downtown Nashville and the airport and utilizes I-40 for much of its route. Route 38 to Antioch also utilizes I-40 west as it heads back to downtown from Antioch. Both Route 6 to Hermitage, and Route 34 to and from Opry Mills, utilize SR 24 (Lebanon Pike), a major parallel route to I-40.
- [Regional Transportation Authority \(RTA\)](#) of Middle Tennessee operates 10 regional bus routes in Middle Tennessee as well as the Music City Star regional commuter rail service between Nashville and Lebanon. The Music City Star rail line runs roughly parallel to I-40 and carried over 600,000 riders in 2018. These are largely commuters who would be using I-40 for their daily commute if not for the rail service. RTA also operates a commuter service between



## I-40/81 Multimodal Corridor Study

downtown Nashville and Dickson that largely utilizes I-40 (Route 88). RTA operates several regional park and ride lots and a vanpool program through contract with the TMA Group.

- [Knoxville Area Transit System \(KAT\)](#) provides service via fixed-route buses, trolleys, and paratransit and carries around 2.7 million passengers per year throughout Knoxville. No routes operate on I-40, though several operate on parallel highways, including Route 90 Crosstown which operates largely on SR 169 (Middlebrook Pike) and Cedar Lane, Route 11 which runs on SR 1 west of downtown (Kingston Pike), and Route 31 which runs on SR 1 east of downtown (Magnolia Avenue.)
- [Jackson Transit Authority](#) operates fixed-route service and paratransit Monday through Saturday from 6:00 am to 10:30 pm. No routes operate on the interstates; however the Northside, Hollywood/Plaza, and Hollywood/Walmart routes operate on the parallel routes of Vann Drive, Carriage House Drive, and Old Hickory Boulevard.
- [Cookeville Area Transit System](#) (CATS) provides a deviated fixed-route bus service in Cookeville, picking up and dropping off riders at designated points along the route. CATS service, provided through contract with the Upper Cumberland Human Resource Agency, operates three routes primarily north of I-40 and does not operate any buses on the interstate.
- [Lakeway Transit](#) will be the first fixed-route system to operate in the Lakeway area. The first routes will be within Morristown. Three routes are proposed, all of which serve local destinations in Morristown. None of the routes travel on the corridor.

### Demand Response and Other Service

- Tennessee's [Human Resource Agencies](#) provide public transportation to rural residents of all ages (anyone can ride), giving first priority to senior citizens, disabled persons, and low income persons with medical needs. Public transportation services offered by the Tennessee HRAs include rural public transit, vanpools, Jobs Access/Reverse Commute, and intercity bus service. HRAs serving the I-40/81 corridors include:
  - First Tennessee HRA – serving Washington and Sullivan counties in Region 1
  - East Tennessee HRA – serving Roane, Loudon, Knox, Sevier, Jefferson, Hamblen, Cocke, and Greene counties in Region 1
  - Upper Cumberland HRA – serving Smith, Putnam, and Cumberland counties in Regions 2 and 3
  - Mid Cumberland HRA – serving Humphreys, Dickson, Cheatham, Williamson, and Wilson counties in Region 3
  - Southwest HRA – serving Haywood and Madison counties along the corridor in Region 4
  - Delta HRA – serving Fayette County and a portion of rural Shelby County along the corridor in Region 4
- [Knox County Community Action Committee \(CAC\)](#) provides demand response service to residents of Knox County who live outside the City of Knoxville, individuals who live in the City of Knoxville outside of the KAT service area, and city residents not served by the KAT fixed-route system.
- Shelby County operates the [Memphis Area Ride Share Program](#), which provides a free online service that matches people with options for their daily work commute. Rideshare options include carpooling, vanpooling, and public transportation. Transportation is provided to medical appointments, grocery shopping, employment, and training.



## I-40/81 Multimodal Corridor Study

Other agencies, like the University of Tennessee's TN Vans program, provide transportation mobility services to public agencies, private groups, and non-profit organizations throughout the state. TN Vans is operated by the Center for Transportation Research at the University of Tennessee, Knoxville, and also provides vehicles to communities through its agency purchase program.

### Intercity Transit

TDOT's Tennessee Intercity Bus Needs Assessment (2017) includes any identified needs for intercity bus service, as included in regional Coordinated Public Transit-Human Services Transportation Plans (CPT-HSTP). While regional transportation authorities (RTAs) and intercity bus providers (Greyhound, etc.) adequately meet needs according to the assessment, both the Mid-Cumberland and Upper Cumberland HRAs have indicated the need for enhanced service through their regional CPT-HSTP. Currently, Upper Cumberland HRA provides intercity express service along I-40 between Cookeville and Nashville. The scheduled route service runs three times per day between the hours of 6:00 am and 6:30 pm, providing access to the Nashville International Airport, the Nashville Greyhound bus station, Silver Point in Putnam County, Carthage, and Lebanon. It is funded by the Federal Transit Administration, TDOT, local human service contracts, fares, local revenues, and in-kind contributions. All 14 counties are served with connections to UCHRA's Nashville I-40 express. The Upper Cumberland region also reports recent success in providing intercity bus service connecting Knoxville-Murfreesboro-McMinnville and Nashville-McMinnville-Celina. However, the region has identified the need for additional service to the Nashville area, particularly a Nashville-Celina- Lafayette connection.

Greyhound operates 14 schedules in Tennessee and has service which stops in Athens, Bristol, Chattanooga, Clarksville, Cleveland, Cookeville, Crossville, Greeneville, Jackson, Johnson City, Knoxville, Manchester, Memphis, Morristown, Murfreesboro and Nashville.

Other intercity bus carriers have operations in the Memphis area, although they do not significantly utilize I-40 or I-81 for their trips:

- Delta Bus Lines operates one round trip between Memphis and Baton Rouge, LA and another between Memphis and Jackson, MS via the Mississippi Delta. Memphis is its only stop in Tennessee.
- Miller/ Hoosier Ride provides a daily round trip between Indianapolis, IN and Memphis making intermediate stops in the Tennessee communities of Union City, Dyersburg, and Covington.

Recently, Amtrak has shown interest in new service between Nashville and Atlanta, with a future eye to the potential for extending service between Nashville and Memphis.<sup>15</sup> Tennessee only has one existing Amtrak route with stops in Memphis and Newbern-Dyersburg, in the western portion of the state.

Currently, there are 19 intercity bus stops in the state that offer connections to other locations throughout the US.

---

<sup>15</sup> (<https://www.newschannel5.com/news/amtrak-pitches-passenger-train-from-nashville-to-atlanta>)





## I-40/81 Multimodal Corridor Study

Table 26. Intercity Bus Stops on the Corridor

Location	Trips	Origin/Destination
Bristol	4	Nashville; Richmond
Cookeville	4	Nashville; Richmond
Crossville	4	Nashville; Richmond
Greeneville	2	Nashville; Richmond
Jackson	7	Cleveland; Dallas; Richmond
Johnson City	4	Nashville; Richmond
Knoxville	14	Atlanta, Cincinnati, Dallas, Detroit, Raleigh, Richmond, Winston-Salem
Memphis	33	Atlanta; Baton Rouge; Chicago; Cleveland; Dallas;
Morristown	2	Nashville; Richmond
Nashville	55	Atlanta; Chicago; Cleveland; Detroit; Louisville; Montgomery; Richmond; St Louis; Tallahassee

Source: Tennessee Intercity Bus Needs Assessment, August 2017

There are also several non-interlining carriers operating in the state. The FTA does not consider these carriers “intercity bus” as they require a new ticket for each segment of a trip, and cannot connect riders seamlessly with other intercity bus services. Bus Ticket, Inc, Megabus, New York to Tennessee Bus, Tornado, and Wanda Coach are these carriers. Communities served by non-interlining carriers along the corridor include:

Table 27. Communities Served by Non-Interlining Carriers

Stop Location	Carrier
Dickson	Tornado
Jackson	Bus Ticket Inc., Tornado, Wanda Coach
Knoxville	Bus Ticket Inc., New York to Tennessee Bus, Wanda Coach
Memphis	Bus Ticket Inc., Megabus, Wanda Coach
Nashville	Bus Ticket Inc., Megabus, New York to Tennessee Bus, Wanda Coach

Source: Tennessee Intercity Bus Needs Assessment, August 2017

Several communities along the corridor provide local transit connections at the intercity bus facilities including Bristol, Cookeville, Jackson, Knoxville, Memphis, and Nashville.



### 11. Transportation Technologies and Transportation Demand Management

Emerging technologies have rapidly enabled innovations in transportation modes and services. While technologies like transportation network companies (TNCs) like Lyft and Uber, connected vehicles and infrastructure, electric vehicles and infrastructure, and autonomous vehicle advancements have already influenced individual behavior, travel patterns, and built environments, their continued impact is uncertain. What is certain is that these technologies will have an influence on everything from land use, transit, the environment, and the economy, and will require changes in planning, policy, and operations at the city, regional, and state level.

#### Connected Vehicles

Connected vehicles (CVs) communicate with each other and with other infrastructure through Dedicated Short Range Communications (DSRC) wireless infrastructure and vehicle-to-infrastructure (V2I) technology. These connections offer opportunities for enhanced efficiency of movement, as well as data collection on transportation system users' travel patterns to better inform transportation planning.

Whether fully autonomous or not, CVs offer safety and efficiency opportunities in both passenger vehicles and freight delivery. For example, truck platooning – enabled when a “lead truck” can communicate with others in a convoy spaced closely behind it – lowers fuel consumption and offers more efficient usage of road space, reducing congestion and thus improving the driving experience for passenger vehicles as well. Tennessee has passed legislation that permits vehicle platooning if motorists provide notification to TDOT and the Tennessee Department of Safety & Homeland Security, including a plan for the general operation of the platoon.<sup>16</sup> TDOT has collaborated with private trucking fleet operators to conduct successful tests along portions of I-40. Use of truck platooning is best suited for long-distance trips through rural areas, where heavy traffic is less likely to attempt to break into the chain, and where trucks are less likely to need to leave the chain to make stops for delivery and/or pickup.

#### Autonomous Vehicles

While the federal government has provided guidance on autonomous vehicles through the National Highway Transportation Safety Administration (NHTSA), no national legislation has passed regulating their deployment. In 2017, the US House of Representatives passed the SELF DRIVE Act, laying out a broad framework for autonomous vehicles throughout the country. The Senate version, the AV START Act, has been delayed by numerous senators due to concerns about safety and pre-emption. As Congress works to pass national legislation, thirty-six states and the District of Columbia have already adopted some form of regulation concerning autonomous vehicles, utilizing legislation and executive orders to do so. The most stringent of these rules comes from California, whose regulations include requiring regular disengagement reports and public posting of any crashes in the testing process. On the opposite side of the spectrum, states like Michigan have opened their doors to autonomous vehicles with the promise of changing legislation as needed to allow increased testing and deployment.

The most immediate potential benefit of automated vehicles is highway safety, since most crashes involve human error. There is also a potential to increase better mobility for those who are physically and/or legally unable to drive themselves, including children and some senior citizens. The impacts of AVs on regional development patterns is unknown; some planners believe they may lead to increased

<sup>16</sup> <https://www.tn.gov/tdot/transportation-freight-and-logistics-home/vehicle-platooning.html>.



## I-40/81 Multimodal Corridor Study

sprawl, since people might not mind a lengthy commute if they are able to focus on work or entertainment instead of actively driving.

### Integrated Corridor Management

The vision of Integrated Corridor Management (ICM) is that transportation networks can realize significant improvements in the efficient movement of people and goods through institutional collaboration and aggressive, proactive integration of existing infrastructure along major corridors. ICM combines two fundamental concepts: active management and integration. Active management involves monitoring and assessing the performance of the system and, at the same time, dynamically implementing actions and providing services in response to fluctuations in demand.

TDOT is currently implementing ICM strategies along I-24 as part of the I-24 SMART Corridor Initiative between Nashville and Murfreesboro in Middle Tennessee. As designed, the project pairs I-24 with the parallel arterial route, SR 1 (US 70, Murfreesboro Road) and manages traffic on them in an integrated manner. The project will add ramp metering to parts of I-24 and will upgrade traffic signals and optimize signal timing on SR 1. Information message boards will be installed on both routes to provide drivers with accurate, real-time information.<sup>17</sup> There may be feasibility for this approach in certain areas of the I-40/81 corridor.

### Transportation Demand Management

TDOT's current 25-year Long-Range Transportation Plan Mobility Policy Paper established the foundation that the state's transportation system should encompass mobility options and travel choices that promote a strong transportation system connecting residents to jobs, schools, services and attractions. The Plan describes the provision of viable alternatives to the SOV as a central element of TDOT's vision of an efficient and effective multimodal transportation system. Travel Demand Management (TDM) represents low-cost alternatives that can help TDOT expand and enhance mobility, system efficiency, and environmental protection by reducing congestion and improving air quality.

Example strategies – specifically, those eligible for funding through the Congestion Mitigation and Air Quality Improvement Program (CMAQ) – range from traveler information services, shuttles, employer-based programming, parking initiatives, public education and outreach activities, telework promotion, transportation management associations (TMAs), carpool and vanpool services (ridematching, marketing, guaranteed ride home, subsidies), and car sharing. In addition, the use of technology directly intersects TDM and represents a significant opportunity to change travel behaviors. Examples of related technology include:

- Private sector mobile applications for ride booking that are supplementing and replacing traditional ridematching
- Services (e.g., Waze) that are integrating with local transportation agencies
- Connected and autonomous vehicles that will impact SOV travel and air quality
- Intelligent digital signage to encourage alternative mode use
- “Big data” sets including INRIX, AirSage, BlueTOAD, and StreetLight to further direct TDM efforts based on commuting patterns and origin/destination data
- The influence of Smart Cities on commute behavior and increasing throughput efficiency

<sup>17</sup> <https://www.tn.gov/tdot/projects/region-3/i-24-smart-corridor.html>



# I-40/81 Multimodal Corridor Study

TDOT's recently completed Statewide Transportation Demand Management (TDM) Plan evaluated TDM options and service delivery methods that would work best for different regions across the state. Its key recommendations, based on statewide stakeholder engagement, commuter and employer surveying, and analysis of national best practices, include:

- Introduce a standard Commuter Program structure
- Establish a statewide TDM brand
- Identify a statewide TDM coordinator (team)
- Maintain core TDM services for regional implementation
- Increase accountability
- Develop standard operating procedures for administration of TDM projects

TDM programs currently exist in the Chattanooga, Knoxville, Memphis and Nashville metropolitan areas. The first program in the state was launched in 1988 by the TMA Group, headquartered in Brentwood but now serving a multi-county region in Middle Tennessee, while the newest program is Nashville Connector, which kicked off in late 2018. Key program offerings and program scopes vary significantly, with some programs focused solely on vanpools, others based on employer outreach services, and some utilizing rideshare matching databases and commuter incentives.

Table 28. Existing TDM Programs

TDM Program	Service Area	Services Provided
The Transportation Management Association (TMA) Group	Middle Tennessee	Vanpool, Schoolpool, Emergency Ride Home
WeGo / Regional Transportation Authority of Middle Tennessee (RTA)	Middle Tennessee	EZRide, Vanpool, Emergency Ride Home
Metro Nashville / Davidson County	Metro Nashville / Davidson County	Employer Outreach, Regional Call Center, Guaranteed Ride Home, Parking Demand Management
Hytch	Middle Tennessee	Carpool Ridematching
Smart Trips	Knoxville	Promotion, Outreach, Ridematching, Emergency Ride Home
Memphis Area Rideshare	Memphis	Vanpool, Outreach and Education, Emergency Ride Home
Commute Options	Memphis	Outreach, Parking Management, Bike-sharing, TDM Support



# I-40/81 Multimodal Corridor Study

## Appendices

### I-40/81 Corridor Interchange Inventory

Table A-29. Region 1 Interchange Inventory for I-40

Exit	Interchanging Road	Type and Configuration		Communities Served
340	SR 299 (Airport Rd.)	Service	Diamond	Oakdale; Rockwood
347	SR 61 (US 27)	Service	Partial Cloverleaf	Harriman; Rockwood
350	SR 29 (Pine Ridge Rd.)	Service	Diamond	Harriman; Midtown
352	SR 58 (Kentucky St.)	Service	Partial Cloverleaf	Kingston
355	Lawnville Rd.	Service	Diamond	Kingston
356	SR 58 (Gallaher Rd.)	Service	Partial Cloverleaf	Oak Ridge
360	Buttermilk Rd.	Service	Diamond	N/A
362	Industrial Park Rd.	Service	Diamond	N/A
364	SR 75/93 (US 321)	Service	Diamond	Lenoir City; Oak Ridge
<b>368</b>	<b>Interstate 75</b>	<b>System</b>	<b>Directional</b>	<b>Chattanooga</b>
369	Watt Rd.	Service	Diamond	Farragut; Karns
373	Campbell Station Rd.	Service	Diamond	Concord; Farragut
374	SR 131 (Lovell Rd.)	Service	Diamond	Farragut; Karns
<b>376</b>	<b>Interstate 140 (SR 162)</b>	<b>System</b>	<b>Complex</b>	<b>Alcoa; Maryville; Oak Ridge</b>
378	Cedar Bluff Rd.	Service	Partial Cloverleaf	Knoxville
379	Bridgewater Rd. / Gallaher View Rd. / Walker Springs Rd.	Service	Weave	Knoxville
380	Montvue Rd.	Service	Trumpet	Knoxville
383	SR 332 (Northshore Dr.) / Papermill Dr. / Weisgarber Rd.	Service	Complex	Knoxville
<b>385</b>	<b>Interstates 75/640</b>	<b>System</b>	<b>Semi-Directional</b>	<b>Asheville; Lexington</b>



# I-40/81 Multimodal Corridor Study

Exit	Interchanging Road	Type and Configuration		Communities Served
386	SR 115 (US 129, Alcoa Hwy.) / University Ave. / Middlebrook Pike	System	Complex	Alcoa; Maryville
387	SR 62 (Western Ave.) / 17 <sup>th</sup> St.	Service	Complex	Knoxville
<b>387A</b>	<b>Interstate 275</b>	<b>System</b>	<b>Complex</b>	<b>Lexington</b>
388	SR 33 (US 441, Henley St.)	Service	Complex	Knoxville
388A	SR 33/158 (US 441, James White Pkwy.)	System	Semi-Directional	Knoxville
389	Hall of Fame Dr.	Service	Diamond	Knoxville
390	Cherry St.	Service	Diamond	Knoxville
392	SR 1 (US 11W, Rutledge Ave.)	Service	Partial Cloverleaf	Knoxville; Mascot
<b>393</b>	<b>Interstate 640 / SR 9 (US 25W)</b>	<b>System</b>	<b>Semi-Directional</b>	<b>Lexington; Nashville</b>
394	SR 9/168 (US 11E/25W/70, Asheville Hwy.)	Service	Diamond	Knoxville; Strawberry Plains
398	Strawberry Plains Pike	Service	Diamond	Knoxville; Strawberry Plains
402	Midway Rd.	Service	Diamond	Midway
407	SR 66 (Winfield Dunn Pkwy.)	Service	Diverging Diamond	Gatlinburg; Pigeon Forge; Sevierville
412	Deep Springs Rd.	Service	Diamond	N/A
415	SR 9/66 (US 25W/70)	Service	Partial Cloverleaf	Dandridge
417	SR 92	Service	Diamond	Dandridge; Jefferson City
<b>421</b>	<b>Interstate 81</b>	<b>System</b>	<b>Directional</b>	<b>Bristol; Roanoke</b>
424	SR 113	Service	Partial Cloverleaf	Dandridge; White Pine
432	SR 9 (US 25W/70/411)	Service	Complex	Newport; Sevierville
435	SR 32 (US 321, Cosby Hwy.)	Service	Diamond	Cosby; Gatlinburg; Newport; Pittman Center



# I-40/81 Multimodal Corridor Study

Exit	Interchanging Road	Type and Configuration		Communities Served
440	SR 73 (US 321, Hartford Rd.)	Service	Diamond	Cosby; Gatlinburg; Newport; Pittman Center
443	SR 339 (Foothills Pkwy.)	Service	Trumpet	N/A
447	Hartford Rd.	Service	Partial Cloverleaf	Hartford
451	Waterville Rd.	Service	Diamond	N/A

Table A-30. Region 1 Interchange Inventory for I-81

Exit	Interchanging Road	Type and Configuration		Communities Served
<b>1</b>	<b>Interstate 40</b>	<b>System</b>	<b>Directional</b>	<b>Asheville; Knoxville</b>
4	SR 341 (White Pine Rd.)	Service	Diamond	White Pine
8	SR 32/113 (US 25E)	Service	Partial Cloverleaf	Morristown; White Pine
12	SR 160 (Enka Rd.)	Service	Diamond	Lowland; Morristown
15	SR 340 (Fish Hatchery Rd.)	Service	Diamond	Parrottsville
23	SR 34 (US 11E, Andrew Johnson Hwy.)	Service	Diamond	Bulls Gap; Greeneville; Morristown; Mosheim
30	SR 70	Service	Diamond	Greeneville; Rogersville
36	SR 172 (Baileyton Rd.)	Service	Diamond	Baileyton; Greeneville
44	Jearoldstown Rd.	Service	Diamond	Jearoldstown
50	SR 93	Service	Partial Cloverleaf	Fall Branch; Jonesborough; Kingsport
56	Tri-Cities Crossing	Service	Partial Cloverleaf	Colonial Heights
<b>57</b>	<b>Interstate 26 (US 23)</b>	<b>System</b>	<b>Cloverleaf</b>	<b>Asheville; Johnson City; Kingsport</b>
59	SR 36 (Fort Henry Dr.)	Service	Diamond	Colonial Heights; Johnson City; Kingsport
63	SR 357 (Airport Pkwy.)	Service	Diamond	N/A
66	SR 126 (Memorial Blvd.)	Service	Diamond	Blountville; Kingsport



# I-40/81 Multimodal Corridor Study

Exit	Interchanging Road	Type and Configuration		Communities Served
69	SR 394	Service	Diamond	Blountville; Bristol
74	SR 1 (US 11W)	Service	Cloverleaf	Bristol; Kingsport

Table A-31. Region 2 Interchange Inventory for I-40

Exit	Interchanging Road	Type and Configuration		Communities Served
268	SR 96 (Buffalo Valley Rd.)	Service	Diamond	Smithville
273	SR 56/141	Service	Diamond	Smithville
276	Old Baxter Rd.	Service	Diamond	Baxter
280	SR 56	Service	Diamond	Baxter
283	Highland Park Blvd. / Tennessee Ave.	Service	Diamond	Cookeville
286	SR 135 (S. Willow Ave.)	Service	Diamond	Cookeville
287	SR 136 (S. Jefferson Ave.)	Service	Diamond	Cookeville
288	SR 111	Service	Diamond	Algood; Livingston; Sparta
290	SR 24 (US 70N)	Service	Partial Cloverleaf	Cookeville; Monterrey
300	SR 24/84 (US 70N)	Service	Partial Cloverleaf	Livingston; Monterrey
301	SR 24 (US 70N)	Service	Diamond	Jamestown; Livingston; Monterrey
311	Plateau Rd.	Service	Diamond	Crossville
317	SR 28 (US 127)	Service	Diamond	Crossville; Jamestown
320	SR 298 (Genesis Rd.)	Service	Diamond	Crossville; Wartburg
322	SR 101 (Peavine Rd.)	Service	Diamond	Crossville; Fairfield Glade
329	Market St.	Service	Diamond	Crab Orchard
338	SR 299 (Westel Rd.)	Service	Diamond	Rockwood





# I-40/81 Multimodal Corridor Study

Table A-32. Region 3 Interchange Inventory for I-40

Exit	Interchanging Road	Type and Configuration		Communities Served
137	Cuba Landing Rd.	Service	Diamond	Cuba Landing
143	SR 13	Service	Diamond	Linden; Waverly
148	SR 50/229	Service	Diamond	Centerville
152	SR 230	Service	Diamond	Bucksnot
163	SR 48	Service	Diamond	Centerville; Dickson
172	SR 46	Service	Partial Cloverleaf	Bon Aqua; Columbia; Dickson
<b>176</b>	<b>Interstate 840</b>	<b>System</b>	<b>Complex</b>	<b>Franklin; Knoxville</b>
182	SR 96	Service	Partial Cloverleaf	Dickson; Fairview; Franklin
188	SR 249	Service	Diamond	Ashland City; Kingston Springs; Pegram
192	McCrary Ln.	Service	Diamond	Pegram
196	SR 1 (US 70S)	Service	Partial Cloverleaf	Bellevue; Newsom Station
199	SR 251 (Old Hickory Blvd.)	Service	Diamond	Bellevue
201	SR 24 (US 70, Charlotte Pike)	Service	Partial Cloverleaf	West Nashville
<b>204</b>	<b>SR 155 (Briley Pkwy. / White Bridge Rd.)</b>	<b>System</b>	<b>Complex</b>	<b>West Nashville</b>
205	46 <sup>th</sup> Ave. / 51 <sup>st</sup> Ave.	Service	Diamond	West Nashville
<b>206</b>	<b>Interstate 440</b>	<b>System</b>	<b>Semi-Directional</b>	<b>Chattanooga; Knoxville</b>
207	28 <sup>th</sup> Ave. / Jefferson St.	Service	Weave	Nashville
<b>208</b>	<b>Interstate 65</b>	<b>System</b>	<b>Semi-Directional</b>	<b>Clarksville; Louisville</b>
209	SR 1 (US 70S/431, Broadway) / SR 24 (US 70, Charlotte Ave.) / Church St. / Demonbreun St.	Service	Weave	Nashville
<b>210</b>	<b>Interstate 65</b>	<b>System</b>	<b>Directional</b>	<b>Huntsville</b>
210C	SR 11 (US 31/41A,	Service	Diamond	Nashville



# I-40/81 Multimodal Corridor Study

Exit	Interchanging Road	Type and Configuration		Communities Served
	2 <sup>nd</sup> Ave. / 4 <sup>th</sup> Ave.)			
<b>211</b>	<b>Interstate 24</b>	<b>System</b>	<b>Directional</b>	<b>Clarksville; Louisville</b>
212	Fesslers Ln.	Service	Weave	Nashville
<b>213</b>	<b>Interstates 24/440</b>	<b>System</b>	<b>Complex</b>	<b>Chattanooga</b>
<b>215</b>	<b>SR 155 (Briley Parkway)</b>	<b>System</b>	<b>Complex</b>	<b>Nashville</b>
216	SR 255 (Donelson Pike)	Service	Partial Cloverleaf	Nashville
219	Stewarts Ferry Pike	Service	Diamond	Nashville
221	SR 45 (Old Hickory Blvd.)	Service	Diamond	Nashville
226	SR 171 (Mt. Juliet Rd.)	Service	Partial Cloverleaf	La Vergne; Mount Juliet
229	Beckwith Rd. / Golden Bear Gateway	Service	Partial Cloverleaf	Mount Juliet
232	SR 109	Service	Partial Cloverleaf	Gallatin
<b>235</b>	<b>Interstate 840</b>	<b>System</b>	<b>Complex</b>	<b>Memphis; Murfreesboro</b>
236	South Hartmann Dr.	Service	Diamond	Lebanon
238	SR 10 (US 231, Cumberland St.)	Service	Diamond	Hartsville; Lebanon; Murfreesboro
239	SR 26 (US 70, Sparta Pike)	Service	Partial Cloverleaf	Lebanon; Watertown
245	Linwood Rd.	Service	Diamond	Tuckers Crossroads; Watertown
254	SR 141	Service	Diamond	Alexandria
258	SR 53	Service	Diamond	Carthage; Gordonsville

Table A-33. Region 4 Interchange Inventory for I-40

Exit	Interchanging Road	Type and Configuration		Communities Served
1	Riverside Dr. / Front St.	Service	Semi-Directional	Memphis



# I-40/81 Multimodal Corridor Study

Exit	Interchanging Road	Type and Configuration		Communities Served
1A	2 <sup>nd</sup> St. / 3 <sup>rd</sup> St.	Service (Partial)	Semi-Directional	Memphis
1B	SR 1 (US 51, Danny Thomas Blvd.)	Service	Partial Cloverleaf	Memphis
<b>1E</b>	<b>Interstate 240</b>	<b>System</b>	<b>Semi-Directional</b>	<b>Jackson; Little Rock</b>
1F	SR 14 (Jackson Ave.)	Service (Partial)	Partial Cloverleaf	Memphis
2	Chelsea Ave. / Smith Ave.	Service	Diamond	Memphis
<b>2A</b>	<b>SR 3 (US 51)</b>	<b>System</b>	<b>Directional</b>	<b>Memphis; Millington</b>
3	Watkins St.	Service	Partial Cloverleaf	Memphis
5	Hollywood St.	Service	Partial Cloverleaf	Memphis
6	Warford St.	Service	Partial Cloverleaf	Memphis
8	SR 14 (Austin Peay Hwy.)	Service	Partial Cloverleaf	Memphis
10	SR 204 (Covington Pike)	Service	Diamond	Memphis
12	Sycamore View Rd.	Service	Partial Cloverleaf	Bartlett
12A	SR 1 (US 64/70/79, Summer Ave.) / White Station Rd.	Service	Partial Cloverleaf	Brownsville; Memphis
<b>12B</b>	<b>Interstate 240 / Sam Cooper Blvd.</b>	<b>System</b>	<b>Complex</b>	<b>Jackson; Little Rock; Memphis</b>
14	Whitten Rd.	Service	Diamond	Bartlett
15	Appling Rd.	Service	Partial Cloverleaf	Bartlett
16	SR 177 (Germantown Rd.)	Service	Partial Cloverleaf	Germantown
18	SR 15 (US 64)	Service	Partial Cloverleaf	Bartlett; Bolivar; Somerville
20	Canada Rd.	Service	Single-Point	Lakeland
<b>24</b>	<b>Interstate 269 (SR 385)</b>	<b>System (C-D)</b>	<b>Cloverleaf</b>	<b>Millington; Collierville</b>



# I-40/81 Multimodal Corridor Study

Exit	Interchanging Road	Type and Configuration		Communities Served
25	SR 205 (Airline Rd.)	Service (C-D)	Diamond	Arlington; Collierville
28	SR 196 (Hickory Withe Rd.)	Service	Diamond	Gallaway; Oakland
35	SR 59	Service	Diamond	Covington; Somerville
42	SR 222 (Stanton-Somerville Rd.)	Service	Diamond	Somerville; Stanton
47	SR 179 (Stanton-Dancyville Rd.)	Service	Diamond	Dancyville; Stanton
52	Stanton-Koko Rd.	Service	Partial Cloverleaf	Stanton; Whiteville
56	SR 76 (Anderson Ave.)	Service	Diamond	Brownsville; Somerville
60	SR 19 (Mercer Rd.)	Service	Diamond	Brownsville; Toone
66	SR 1 (US 70)	Service	Diamond	Brownsville; Ripley
68	SR 138 (Providence Rd.)	Service	Diamond	Toone
74	Lower Brownsville Rd.	Service	Partial Cloverleaf	Brownsville; Jackson
76	SR 223	Service	Trumpet	Jackson; Toone
79	SR 20 (US 412, Hollywood Dr.)	Service	Partial Cloverleaf	Alamo; Bells; Dyersburg; Jackson
80	SR 186 (US 45 Bypass)	Service	Partial Cloverleaf	Humboldt; Jackson
82	SR 5 (US 45, Highland Dr.)	Service	Single-Point Urban	Jackson; Milan
83	Campbell St.	Service	Diamond	Jackson
85	Christmasville Rd. / Dr. F. E. Wright Dr.	Service	Diamond	Huntingdon; Jackson
87	SR 1 (US 70/412)	Service	Diamond	Huntingdon; Jackson; McKenzie
93	SR 152 (Law Rd.)	Service	Diamond	Lexington; Medina
101	SR 104	Service	Diamond	Atwood; Lexington
108	SR 22	Service	Diamond	Huntingdon; Lexington; Parker's Crossroads
116	SR 114	Service	Diamond	Hollow Rock; Lexington



## I-40/81 Multimodal Corridor Study

Exit	Interchanging Road	Type and Configuration		Communities Served
126	SR 69 (US 641)	Service	Diamond	Camden; Paris; Parsons
133	SR 191 (Birdsong Rd.)	Service	Partial Cloverleaf	Camden