I-40 / I-81 Corridor Feasibility Study

Systems Inventory and Data Collection

Technical Memorandum

March 26, 2007

EXECUTIVE SUMMARY

In 2005 the Tennessee Department of Transportation (TDOT) completed the State's first 25-Year Long Range Transportation Plan (PLAN *Go*). A major component of the 25-Year Vision Plan included the advancement of a 10-Year Strategic Investment Plan. The 10-Year Strategic Investment Plan established three interrelated core investment initiatives: Congestion Relief, Transportation Choices, and Key Corridors.

The Interstate 40/Interstate 81 (I-40/I-81) Corridor from Bristol to Memphis was identified through the statewide planning effort as a strategic statewide corridor and several projects along the corridor are included in the 10-Year Plan as a high priority. The purpose of the I-40/I-81 Corridor Feasibility Study is begin to develop a more detailed understanding of the deficiencies of the corridor and to develop corridor level multi-modal solutions to address these deficiencies. The study will consider improvements to the I-40/I-81 corridor, as well as looking at parallel arterials to I-40/I-81 that could be used for local travel, as well as rail lines that could be candidates for freight diversion from the interstate, and will also consider major inter-modal hubs located along the corridor.

The study's final product will be a prioritized listing of multi-modal projects that can be considered by TDOT for the Department's transportation improvement program. Identified multi-modal solutions will address capacity, operations and maintenance, safety, freight movement, inter-modal connections, and economic access issues along the study corridor.

The study area for the I-40/I-81 corridor extends from Bristol to Memphis, a distance of about 550 miles and traverses 27 of the 95 counties within Tennessee falling within nine of the twelve Rural Planning Organization (RPO) boundaries and eight of the eleven Metropolitan Planning Organization (MPO) and Transportation Planning Organization (TPO) areas. Numerous cities including Memphis, Jackson, Nashville, Lebanon, Cookeville, Crossville, Knoxville, Sevierville, Jefferson City, Ridgeway, Kingsport, Johnson City and Bristol are dependent upon this corridor for commerce, tourism, and daily access. The study area also includes parallel Class I railroads, including their junctions with short-line railroads.

Task 1, Systems Inventory and Data Collection, establishes the baseline conditions for the I-40/I-81 Corridor. The Executive Summary for this report focuses on issues and deficiencies which need immediate attention based on a review of existing data sources. The Technical Memorandum for Task 1 describes both short-term needs and long-range deficiencies. Task 2, Assessment of Deficiencies, involves development of a corridor-wide list of deficiencies based on analysis of information and data for the study corridor, with a primary focus on multi-modal improvements which could provide short-term benefits.

The Executive Summary describes issues and deficiencies for I-40 and I-81 for three planning horizons:

- Next five years, to about 2011;
- Next ten years, or approximately 2016; and
- 2030, the long-range planning horizon.

For the initial five-year period, information obtained from existing data sources is reviewed to identify issues or deficiencies based on the following categories:

- Roadway capacity deficiencies, as indicated by TDOT's Evaluation of Roadway Efficiency System (EVE), which estimates future levels of service based on historical trends of traffic growth. Typically, a level of service (LOS) D, E or F is considered a deficient segment in rural areas while LOS E or F is the congestion criterion applied in urban areas.
- Projects recommended by the MPOs and TPOs in their Long-Range Transportation Plans (LRTPs) and by TDOT from Interchange Justification Studies (IJS) to address capacity issues or to improve economic access to the study corridor.
- Critical accident rates. TDOT staff identified locations along the study corridor where accidents exceed the critical accident rate. TDOT's critical accident rate takes into account traffic exposure and is unique for each location. The use of this measure ensures that the accident rate at a location is not due to chance but to some unfavorable characteristic of local conditions.
- Transit improvements as proposed by the MPOs and TPOs in LRTPs.

All of the aforementioned categories, except for accident history, are used to present deficiencies or issues for the mid-range time period (2016).

For the planning horizon year of 2030, TDOT's statewide travel demand model and MPO models were used to identify freeway capacity issues by:

- applying the same vehicle-to-capacity ratios in the EVE program to estimate deficient LOSs, and
- determining LOS threshold volumes from tables that have been used by a number of state DOTs around the country as a way to quickly estimate LOS. The source of these LOS tables is the *2002 Quality/Level-of-Service Handbook*, prepared by the Florida Department of Transportation (FDOT).

ES.1 Five-Year Horizon

Table ES-0-1 summarizes the issues and deficiencies projected to occur over the next five years by evaluation category and geography.

Figure ES.1 through **Figure ES.12** indicate the areas where multi-modal solutions are needed in the short-term.

Table ES-0-1: Issues or Deficiencies for Five-Year Planning Horizon

Fig	ID	Route	From	To	Notes
Capacity Deficiencies Identified from EVE					
ES1	1	I-40	I-240 Midtown	Whitten Rd	Memphis
ES2	2	I-40	US 64	Canada Rd	East Memphis
ES5	3	I-40	Williamson/Cheatham CL	SR 45 (Old Hickory Blvd)	Nashville
ES6	4	I-40	S Mount Juliet Rd	US 70 (Sparta Pike)	Nashville
ES9	5	I-40	I-75	N Cherry St	Knoxville
ES9	6	I-40	I-640	Holston River	Knoxville
Short-Term Projects Identified in Plans and Reports					
ES1	7	I-40	At Canada		Interchange improvements recommended in Memphis LRTP
ES1	8	I-40	At I-240 East Memphis		Interchange improvements recommended in Memphis LRTP
ES1	9	I-40	At Covington Pike		Interchange improvements recommended in Memphis LRTP (re-design turn lane configuration)
ES6	66	I-40	At US-231		Direct access to downtown Lebanon as recommended in Nashville LRTP
ES9	10	I-40	I-275	Cherry Street	Widen from 4 to 6 lanes as recommended in Knoxville LRTP
ES10	11	I-81	At SR-341		Modify interchange as recommended in Knoxville LRTP (Exit 4)
ES12	12	I-81	At West State Street		Northbound off-ramp at exit 74 as recommended in Bristol LRTP
Critical Accident Locations					
ES1	13	I-40	AS/TN State Line	Levee Rd	6 segments, 15 spot locations
ES1	14	I-40	N Watkins St (Exit 2a)		1 spot location
ES1	15	I-40	Jackson Ave (Exit 8)		2 spot locations
ES1	16	I-40	Covington Pike (Exit 10)	Whitten Rd (Exit 14)	3 segments, 10 spot locations
ES1	17	I-40	Appling Rd (Exit 15)	N Germantown Pkwy (Exit 16)	1 segment, 8 spot locations
ES2	18	I-40	East of SR 222		1 spot location

Fig	ID	Route	From	To	Notes
			(Stanton Rd, Exit 42)		
ES2	19	I-40	East of SR 192 (Mercer Rd, Exit 60)		1 spot location
ES2	20	I-40	US 70 (Exit 66)	SR 138 (Providence Road - Exit 68)	1 segment, 1 spot location
ES3	21	I-40	West of SR 104 (Exit 101)		1 spot location
ES3	22	I-40	SR 114 (Camden Rd - Exit 116)		1 spot location
ES3	23	I-40	US 641 (Exit 126)		1 spot location
ES3	24	I-40	West of SR 191 (Birdsong Rd - Exit 133)		1 spot location
ES3	25	I-40	SR 191 (Birdsong Rd - Exit 133)	Benton/Humphreys CL	1 segment, 5 spot locations
ES3	26	I-40	West of SR 13 (Exit 143)		1 spot location
ES3	27	I-40	SR 13 (Exit 143)		1 spot location
ES4	28	I-40	West of SR 46 (Exit 172)		3 spot locations
ES4	29	I-40	West of SR 96 (Exit 182)	SR 96 (Exit 182)	3 spot locations
ES5	30	I-40	SR 249 (Luyben Hills Rd - Exit 188)		1 spot location
ES5	31	I-40	Cheatham/Davidson CL	McCrory Ln (Exit 192)	2 segments, 1 spot location
ES5	32	I-40	McCrory Ln (Exit 192)	West of Briley Pkwy (Exit 204)	8 spot locations
ES5	33	I-40	West of Briley Pkwy (Exit 204)	I-440 (Exit 206)	2 segments, 7 spot locations
ES5	34	I-40	I-440 (Exit 206)	I-65 (Exit 208)	1 segment, 3 spot locations
ES5	35	I-40	I-65 (Exit 208)	East of Briley Pkwy (Exit 204)	7 segments, 29 spot locations
ES5	36	I-40	East of Briley Pkwy (Exit 215)	East of Donelson Pike (Exit 216)	1 segment, 5 spot locations
ES5	37	I-40	East of Donelson Pike (Exit 216)	East of Old Hickory Blvd (Exit 221)	4 spot locations
ES6	38	I-40	SR 171 (Mt Juliet Rd - Exit 226)	SR 109 (Exit 232)	4 spot locations
ES6	39	I-40	SR 109 (Exit 232)	US 70 (Sarta Pike - Exit 239)	6 spot locations
ES6	40	I-40	Linwood Rd (Exit 245)	SR 141 (Exit 254)	3 spot locations
ES6	41	I-40	West of SR 53 (Gordonsville Hwy - Exit 258)	SR 96 (Medley Amonette Rd - Exit 268)	7 spot locations
ES7	42	I-40	SR 136 (Jefferson Ave - Exit 287)		1 spot location
ES7	43	I-40	US 70 N (Spring St - Exit 290)	US 70 N/SR 84 (Holly St - Exit 300)	1 segment, 2 spot locations
ES7	44	I-40	West of Plateau Rd	East of Plateau Rd	2 spot locations

Fig	ID	Route	From	To	Notes
			(Exit 311)	(Exit 311)	
ES8	45	I-40	Market St (Exit 329)	SR 299 (Westel Rd - Exit 338)	1 segment, 3 spot locations
ES8	46	I-40	SR 299 (Airport Rd - Exit 340)	US 27/SR 61 (Roane St - Exit 347)	2 segments, 10 spot locations
ES8	47	I-40	Pine Ridge Rd (Exit 350)		2 spot locations
ES8	48	I-40	East of SR 326 (Gallaher Rd - Exit 356)	East of US 321 (Exit 364)	4 spot locations
ES9	49	I-40	Lovell Rd (Exit - 374)		1 spot location
ES9	50	I-40	I-140 (Exit 376)	I-640 (Exit 385)	4 segments, 15 spot locations
ES9	51	I-40	I-275 (Exit 388)	5th St (Exit 389)	3 segments, 8 spot locations
ES9	52	I-40	US 11 W (Rutledge Pike - Exit 392)	Ashville Hwy (Exit 394)	2 segments, 9 spot locations
ES10	53	I-40	West of Snyder Rd (Exit 407)	Deep Springs Rd (Exit 412)	3 spot locations
ES10	54	I-40	Deep Springs Rd (Exit 412)	US 25 W/US 70 (Exit 415)	3 spot locations
ES10	55	I-40	US 25 W/US 70	SR 92 (Exit 417)	2 spot locations
ES10	56	I-40/ I-81	I-81 (Exit 421)		1 spot location
ES11	57	I-81	I-81 (Exit 421)	SR 341 (Exit 4)	1 spot location
ES11	58	I-81	Hamblen/Greene county line	SR 172 (Exit 36)	6 spot locations
ES11	59	I-81	SR 172 (Exit 36)	Greene/Washington county line	2 spot locations
ES12	60	I-81	Washington/Sullivan county line	I-181 (Exit 46)	3 spot locations
ES12	61	I-81	I-181 (Exit 46)	South Fork Holston River	3 spot locations
ES12	62	I-81	South Fork Holston River	Tennessee/ Virginia State line	2 spot locations
Transit Improvements Identified in Plans and Reports					
ES5	63	I-40	Downtown Nashville	Dickson	Commuter rail service
ES5	64	I-40	Downtown Nashville	East of Nashville	Improved headways on Routes 10, 16, 18, 24X, 31X and 38X; re-design Route 6 to serve commuter rail station; new express service to airport (Route 39X)
ES9 & ES10	65	I-40	Farragut	SR-66	New express bus service along I-40 east of Knoxville
New Interchanges or Interchange Improvements for Economic Development					
ES6	67	I-40	At Beckwith Lane		Access to developing area of Mt. Juliet as recommended in Nashville LRTP and TDOT IJS
ES7	68	I-40	At Mine Lick Creek		Cookeville

Fig	ID	Route	From	To	Notes
			Rd		

Figure ES.1: Memphis Area Issues/Deficiency

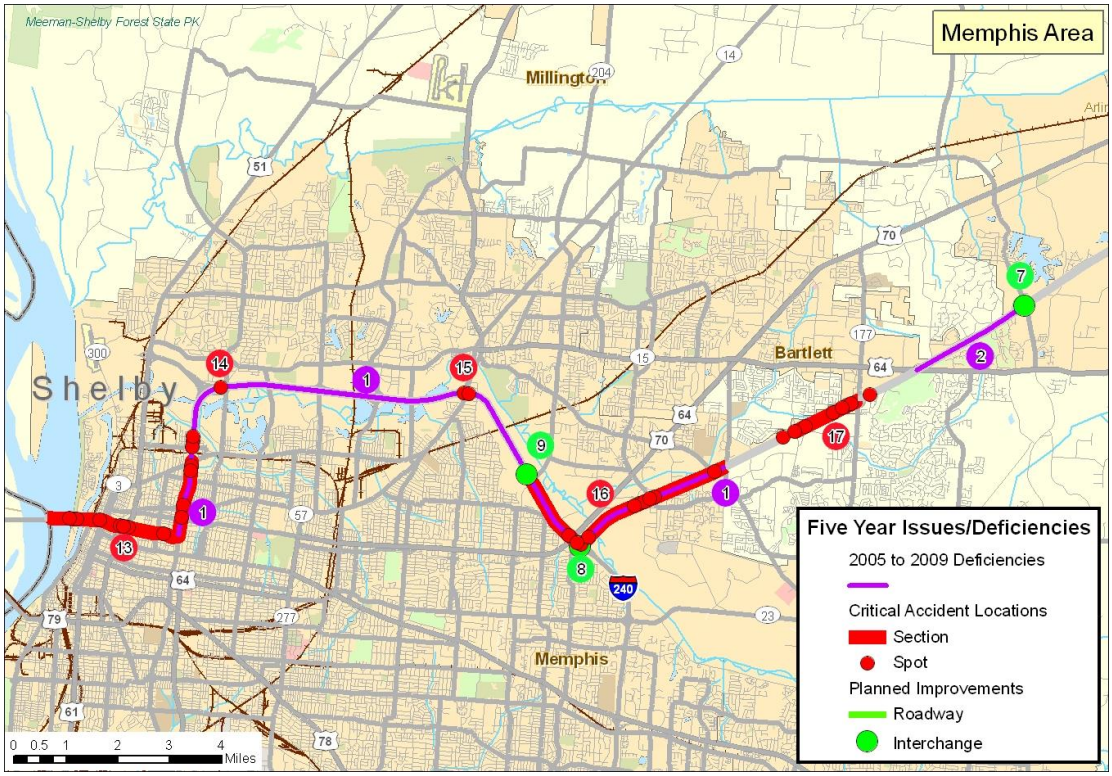


Figure ES.2: Brownsville Area Issues/Deficiency

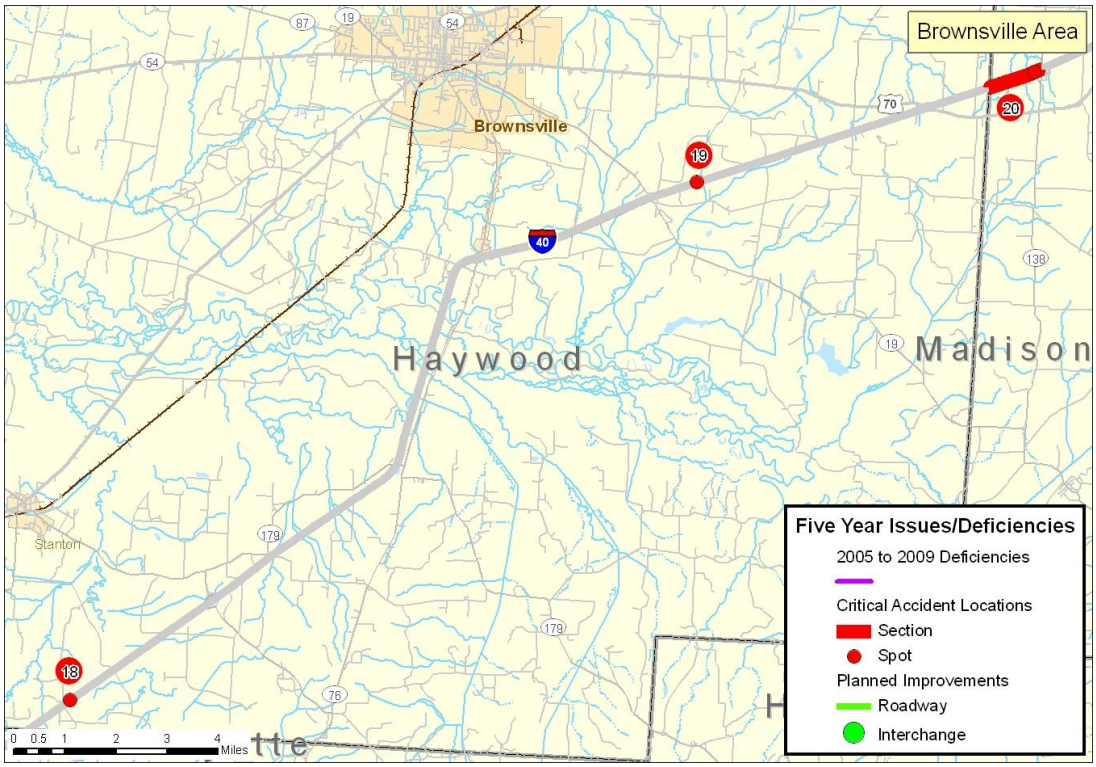


Figure ES.3: Jackson to Nashville Area Issues/Deficiency

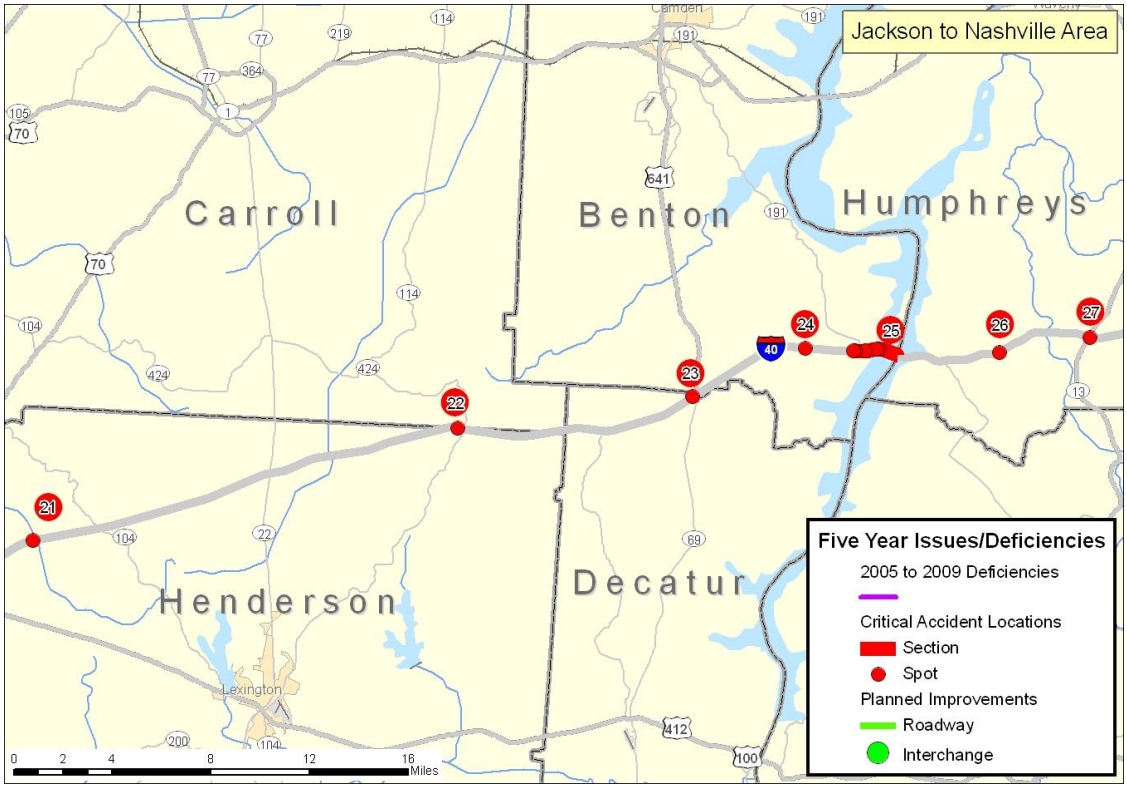


Figure ES.4: Dickson Area Issues/Deficiency

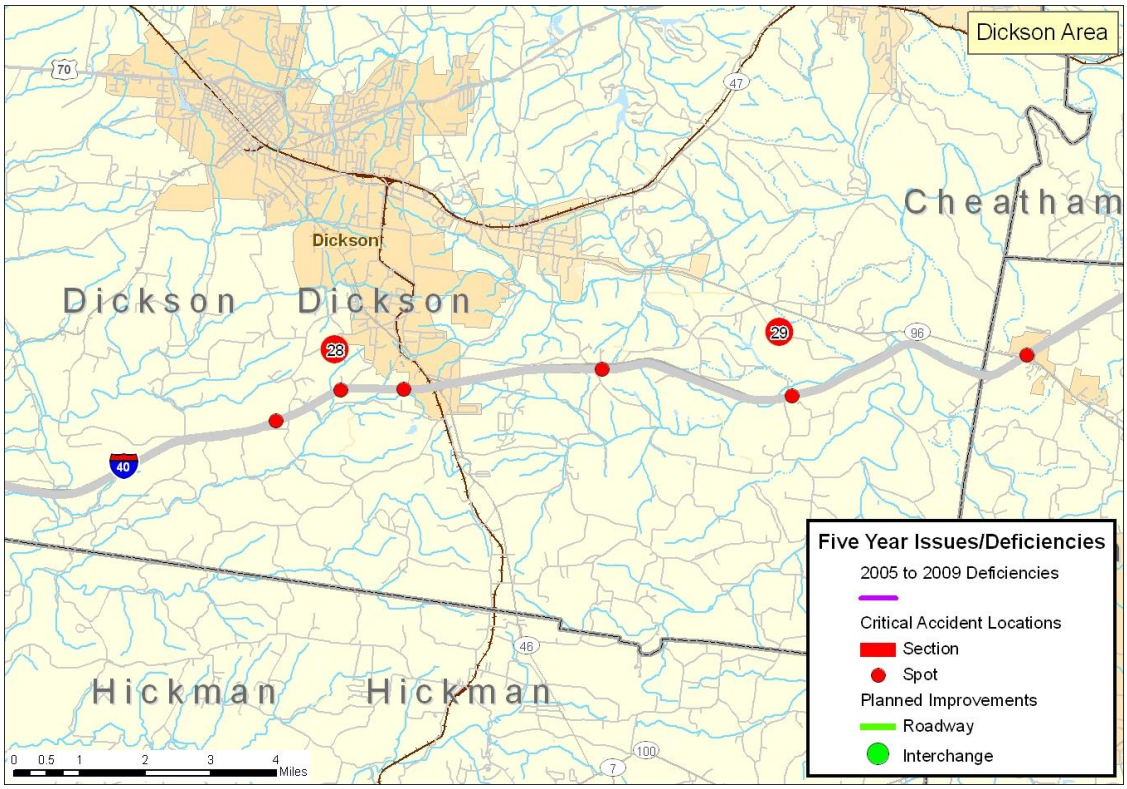


Figure ES. 5: Nashville Area Issues/Deficiency

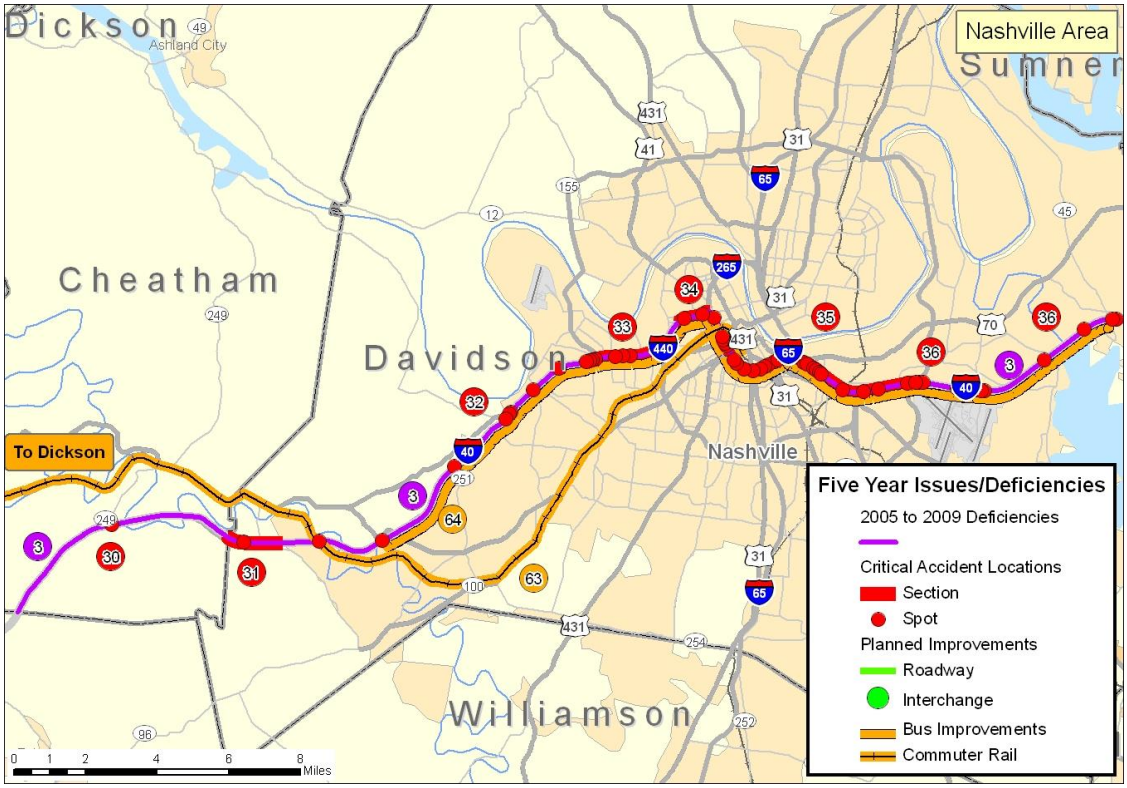


Figure ES.6: Lebanon to Gordonsville Area Issues/Deficiency

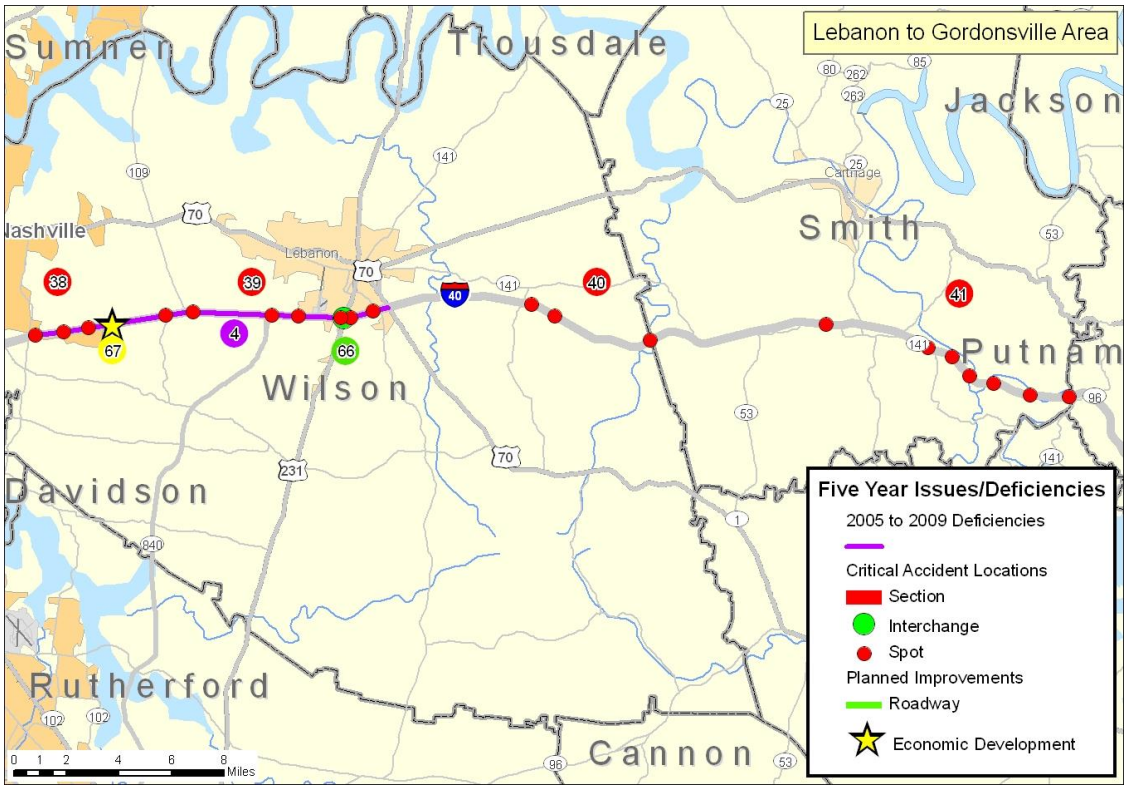


Figure ES.7: Cookeville to Crossville Area Issues/Deficiency

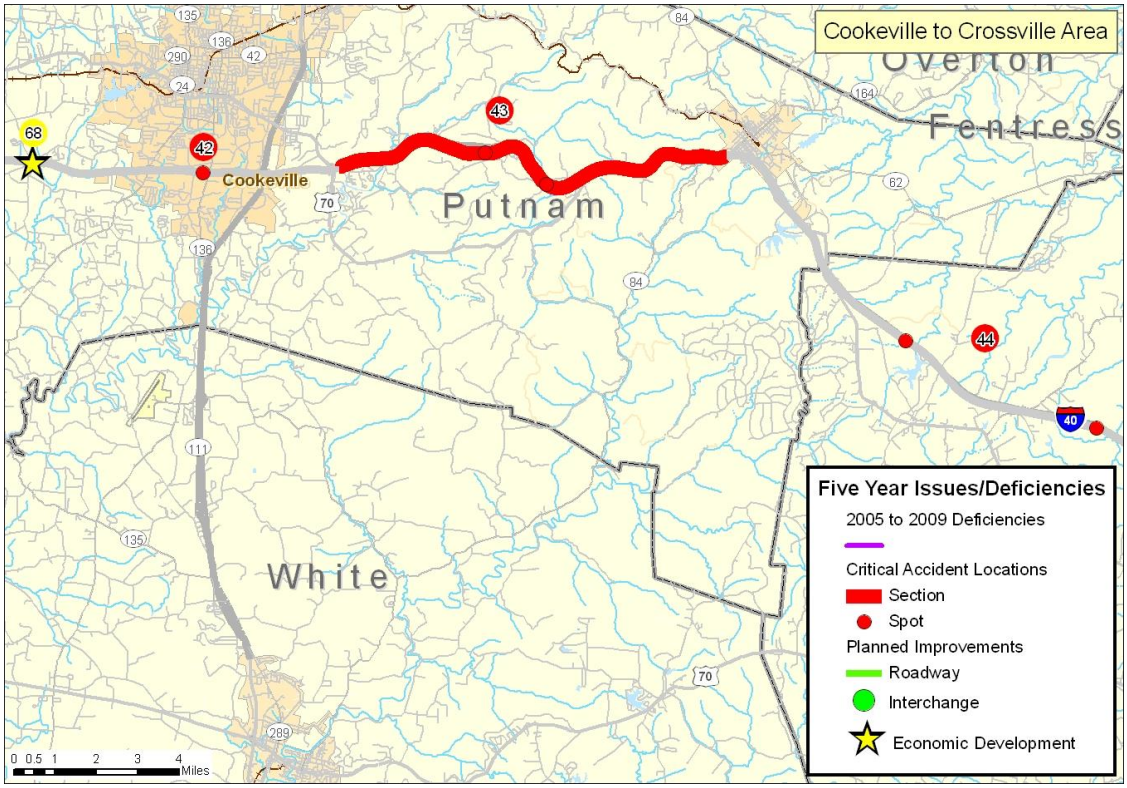


Figure ES.8: Crab Orchard to Oak Ridge Area Issues/Deficiency

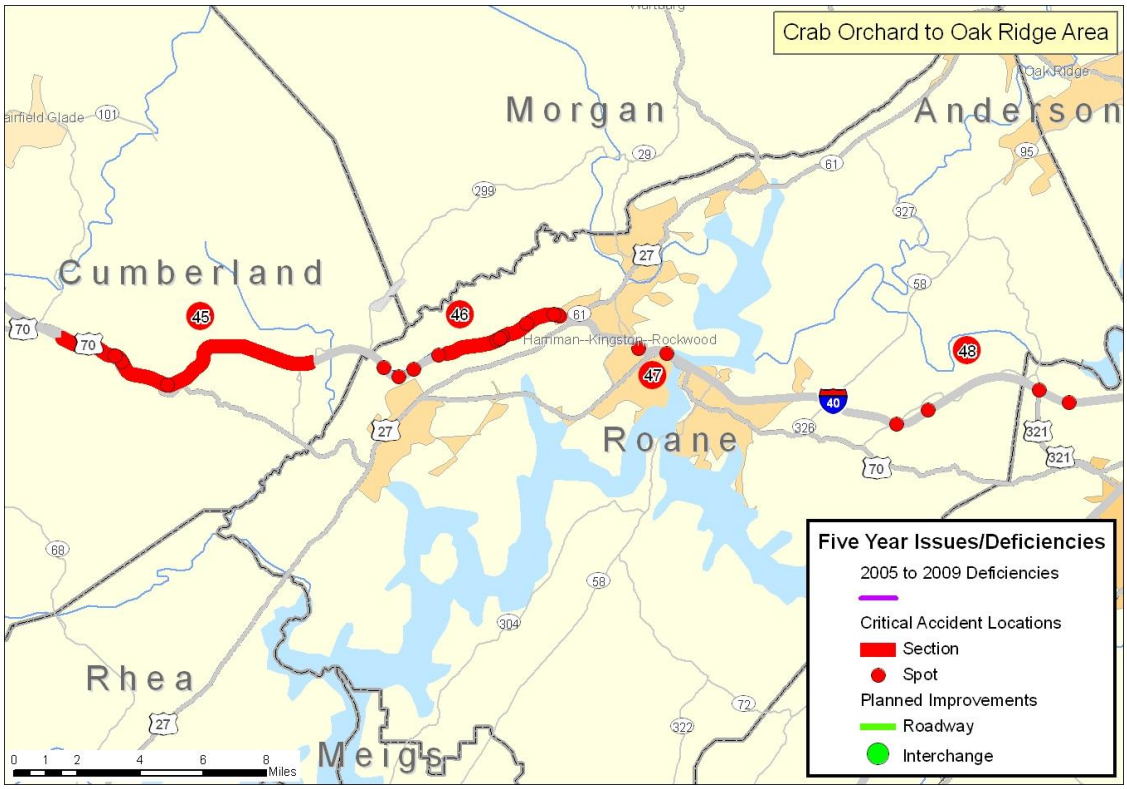


Figure ES.9: Knoxville Area Issues/Deficiency

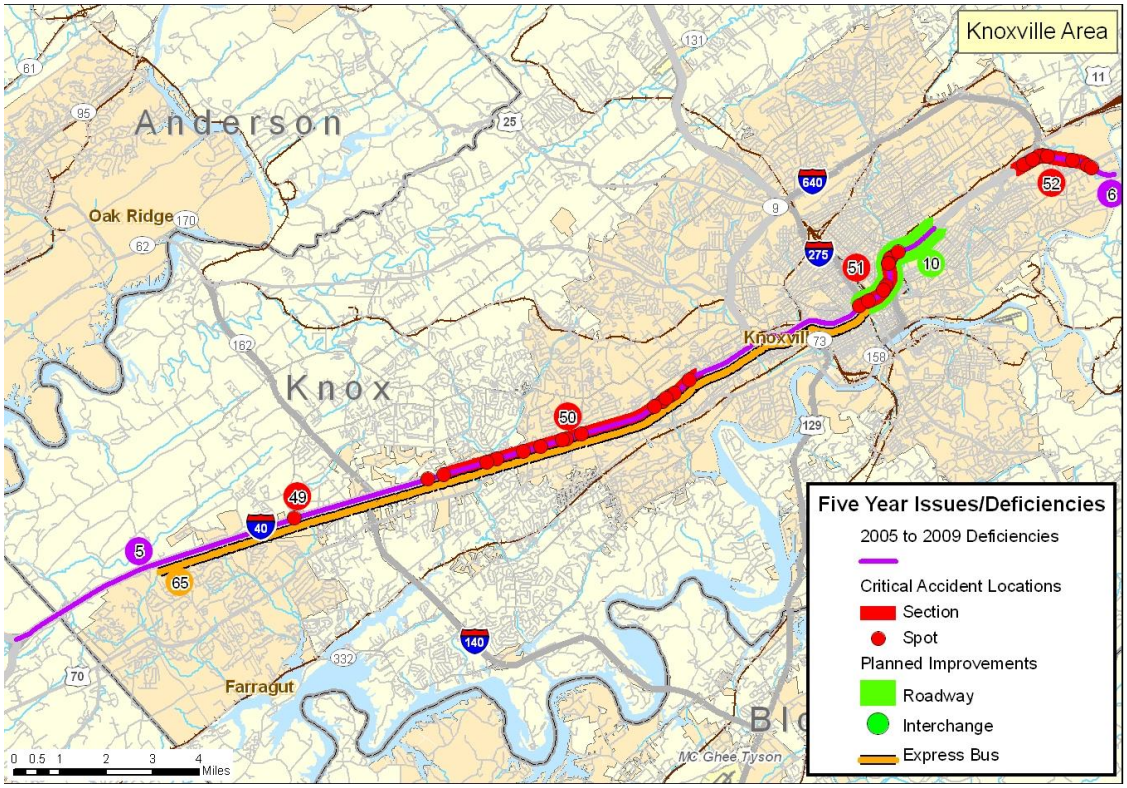


Figure ES.10: Sevierville to I-81 Area Issues/Deficiency

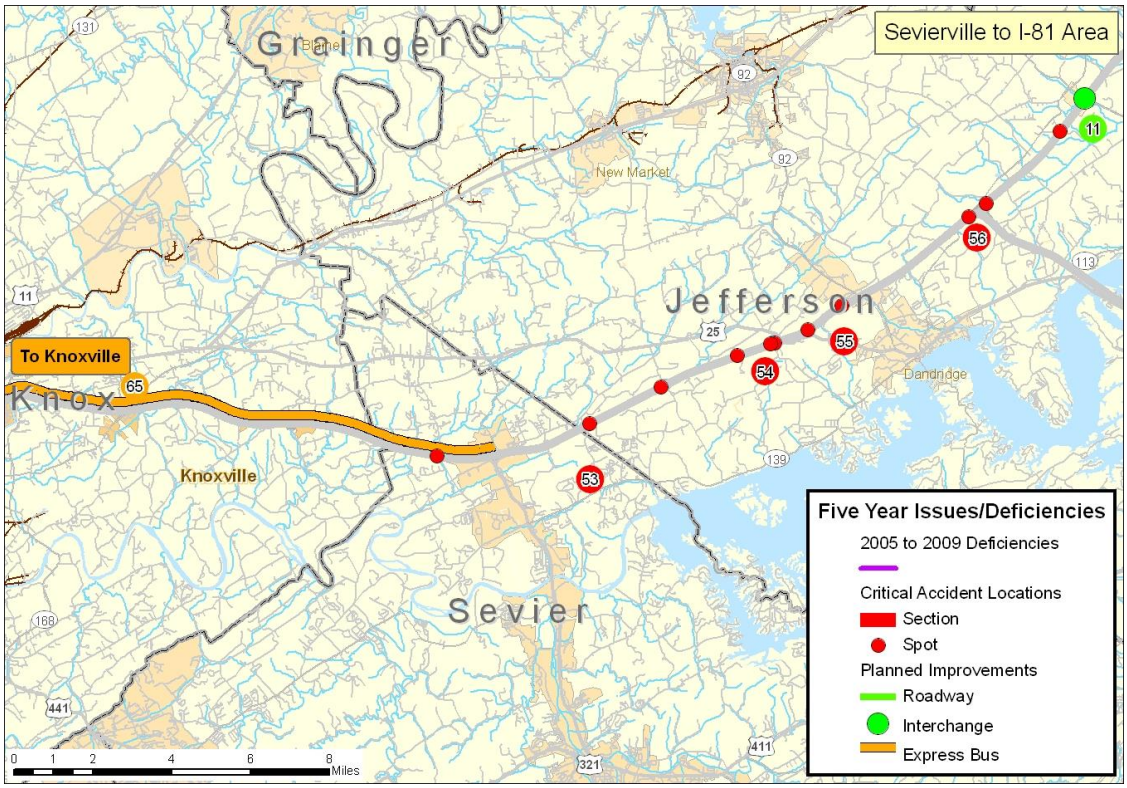


Figure ES.11: Green County Area Issues/Deficiency

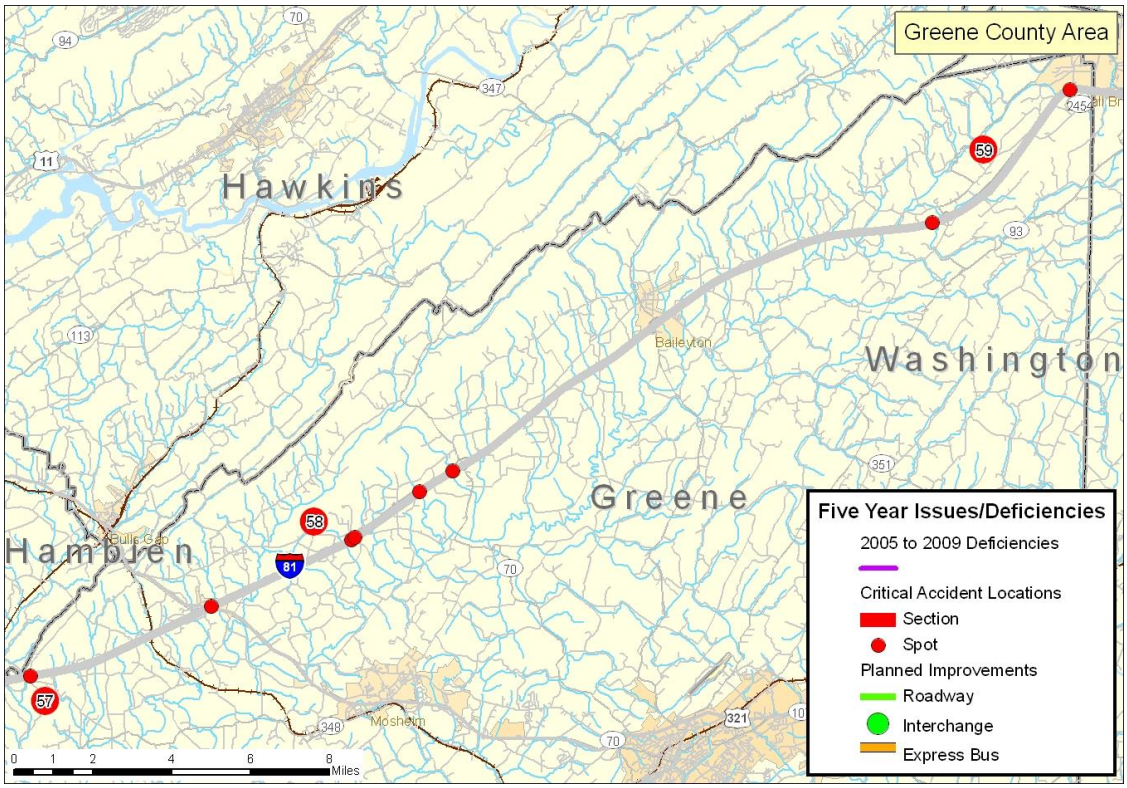
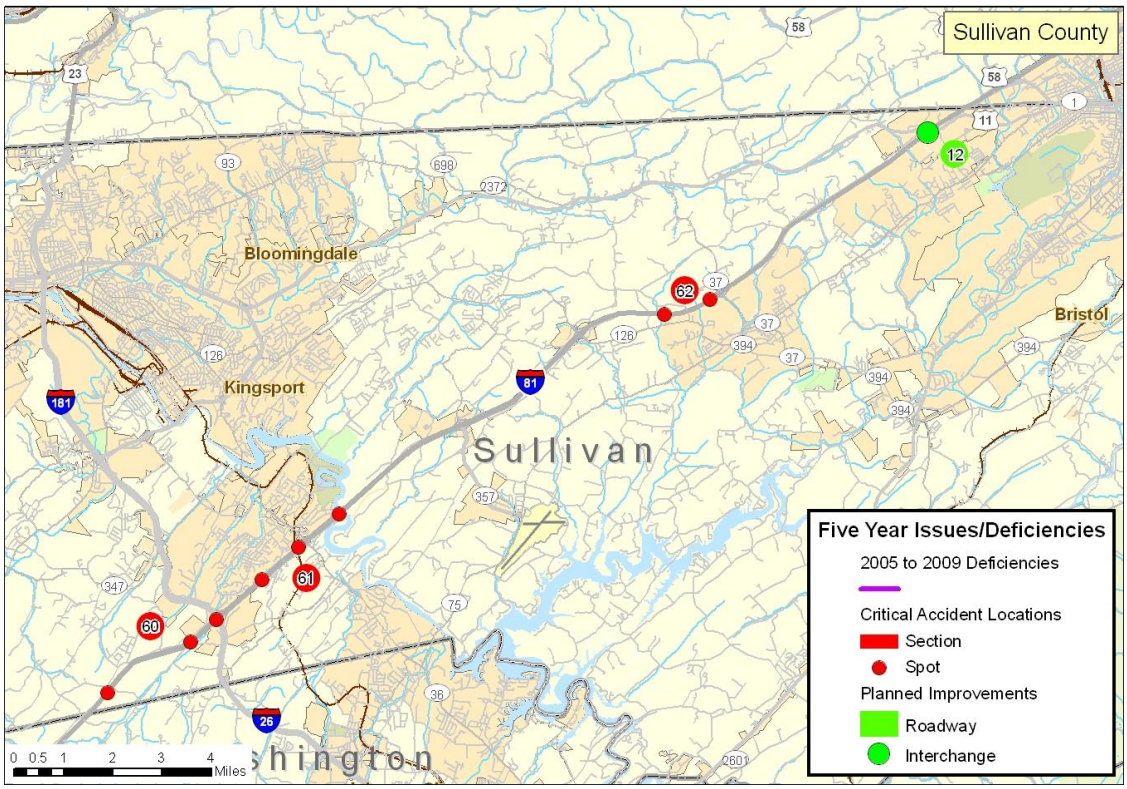


Figure ES.12: Sullivan County Area Issues/Deficiency



ES.2 Ten Year Horizon

Table ES-0-2 summarizes the issues and deficiencies projected to occur over the next ten years by evaluation category and geography.

Table ES-0-2: Issues or Deficiencies for Ten-Year Planning Horizon

Route	From	To	Notes
Capacity Deficiencies Based on EVE Analysis			
I-40	Canada Rd	SR 205 (New Airline Rd)	East Memphis
I-40	US 45 (Highland Ave)	Christmasville Rd	Jackson
I-40	SR 96 (Medley Amonette Rd)	West of SR 56 South	Putnam/Cumberland area
I-40	N Cherry St	US 11 W (Rutledge Pike)	Knoxville
I-40	Holston River	Strawberry Plains Pike	Knoxville
Mid-Term Projects Identified in Plans and Reports			
I-40	I-24	Donelson Pike	Widening for HOV lanes as recommended in Nashville LRTP
I-40	At SR-171		Widen WB on-ramp to 2 lanes, widen WB off ramp for 2LTL, revise signal timing, extend NB through lane between ramps as recommended in Nashville LRTP
I-40	Donelson Pike	Old Hickory Blvd	Widen from 6 to 8 lanes as recommended in Nashville LRTP

Route	From	To	Notes
I-40	At 28th/Jefferson		Redesign exits to allow both left & right turns as recommended in Nashville LRTP
I-40	At Broadway		Urban diamond interchange and 2-lane on-ramps as recommended in Nashville LRTP
I-40	US-70W	I-440	Widen to 8 lanes, including 2 HOV lanes, as recommended in Nashville LRTP
I-40	SR-840	US-70	Add HOV lane as recommended in Nashville LRTP
I-40	At SR-96		Reconstruct intersection to alleviate safety concerns as recommended in Nashville LRTP
I-40	Mt. Juliet Rd	SR-840	Add HOV lane as recommended in Nashville LRTP
I-40	At Donelson Pike/SR-2555		Re-align Donelson Pike, construct a SPUI; improved access to airport as recommended in Nashville LRTP
I-40	At Fessler's Lane		Widen from 6 lanes to 12; dual-dual roadway concept; full interchange at Fessler's Lane as recommended in Nashville LRTP; TDOT Advance Planning Report (APR) also prepared.
I-40	I-24 Midtown	Jackson	Widen from 6 to 8 lanes as recommended in Memphis LRTP
I-40	Jackson	Chelsea	Widen from 6 to 8 lanes as recommended in Memphis LRTP
I-40	Chelsea	101 Connector	Widen from 6 to 8 lanes as recommended in Memphis LRTP
I-40	US-64	Canada	Widen from 4 to 6 lanes as recommended in Memphis LRTP
I-40	Canada	Air Line	Widen form 4 to 6 lanes as recommended in Memphis LRTP
I-40	At US-64		Interchange improvements as recommended in Memphis LRTP
I-40	At I-75 & Campbell Station Rd		Modify interchange as recommended in Knoxville LRTP
I-81	In Urban Area		Add truck lanes particularly near SR-357 exit as recommended in Kingsport LRTP
New Interchanges or Interchange Improvements for Economic Development			
I-40	At Central Pike		Access to developing area of Mt. Juliet as recommended in Nashville LRTP

ES.3 2030 Planning Horizon

Table ES-0-3 summarizes the issues and deficiencies projected to occur by 2030.

Table ES-0-3: 2030 Issues or Deficiencies

Route	From	To	Notes *
Capacity Deficiencies Based on EVE Analysis			
I-40	Whitten Rd	Appling Rd	Memphis
I-40	SR 205 (New Airline	SR 222 (Stanton Rd)	East Memphis

Route	From	To	Notes *
	Rd)		
I-40	Lower Brownsville Rd	US 45 (Highland Ave)	Jackson
I-40	Christmasville Rd	SR 104	Jackson
I-40	Tennesse River Blue Creek Rd	Duck River Rd	Humphries/Dickson area
I-40	SR 3 (3rd St)	I-240 Midtown	Memphis
I-40	SR 46	Williams County Line Rd	Humphries/Dickson area
I-40	Old Hickory Blvd	S Mount Juliet Rd	Nashville
I-40	US 70 (Sparta Pike)	SR 53 (Gordonsville Hwy)	Nashville
I-40	West of SR 56 South	SR 111	Putnam/Cumberland area
I-40	US 70 (Spring St)	US 70 (Crossville Hwy)	Putnam/Cumberland area
I-40	Plateau Rd	Battown Rd	Putnam/Cumberland area
I-40	US 70	Ashburn Dr	Putnam/Cumberland area
I-40	Cumberland/Roane CL	I-75	Knoxville
I-40	US 11 W (Rutledge Pike)	I-640	Knoxville
I-40	Strawberry Plains Pike	SR 92	Knoxville
I-81	SR 160 (Enka Hwy)	SR 340 (Fish Hatchery Rd)	I-81 area
I-81	I-181	SR 126	I-81 area
Capacity Deficiencies Based on 2030 Model Forecasts			
I-40	SR 3 (3rd St)	I-240 Midtown	LOS, EVE
I-40	I-240 Midtown	Canada Rd	LOS, EVE
I-40	SR 205 (New Airline Rd)	SR 76 (Anderson Ave)	LOS, EVE, DOT
I-40	SR 76 (Anderson Ave)	US 70 (Brownsville Hwy)	LOS, DOT
I-40	US 70 (Brownsville Hwy)	SR 152 (Spring Creek Rd)	LOS, EVE, DOT
I-40	SR 104	SR 46	LOS, DOT
I-40	SR 46	SR 840	LOS, EVE, DOT
I-40	SR 840	SR 96	LOS, DOT
I-40	SR 96	SR 45 (Old Hickory Blvd)	LOS, EVE
I-40	SR 45 (Old Hickory Blvd)	SR 265 (Central Pike)	LOS
I-40	SR 265 (Central Pike)	SR 101 (Peavine Rd)	LOS, EVE, DOT
I-40	SR 101 (Peavine Rd)	Pine Ridge Rd	LOS, DOT
I-40	Pine Ridge Rd	US 321	LOS, EVE, DOT
I-40	US 321	I-75 South	LOS, DOT
I-40	I-75 South	Strawberry Plains Pike	LOS, EVE
I-40	Strawberry Plains Pike	Midway Rd	LOS
I-40	Midway Rd	SR 66 (Winfield Dunn Pky)	LOS, EVE, DOT

Route	From	To	Notes *
I-40	SR 66 (Winfield Dunn Pky)	Deep Springs Rd	LOS, DOT
I-40	Deep Springs Rd	I-81	LOS, EVE, DOT
I-81	I-40	SR 340 (Fish Hatchery Rd)	LOS, EVE, DOT
I-81	SR 340 (Fish Hatchery Rd)	US 11E (Robert F. Smith Pky)	LOS, DOT
I-81	Lonesome Pine Trl (SR 70)	Sullivan Gardens Rd (SR 93)	DOT
I-81	Sullivan Gardens Rd (SR 93)	Kendrick Creek Rd	LOS, DOT
I-81	Kendrick Creek Rd	I-181/I-26/US 23	DOT
I-81	I-181/I-26/US 23	Memorial Blvd	LOS, EVE
Long-Term Projects Identified in Plans and Reports			
I-40	I-440	I-65	Widen from 6 to 10 lanes, including 2 HOV lanes, as recommended in Nashville LRTP
I-40	12th Street	Charlotte	Construct HOV ramps to and from downtown Nashville as recommended in Nashville LRTP
I-40	At Shelby/Franklin		Construct HOV ramps to and from downtown Nashville as recommended in Nashville LRTP
I-40	Spence Lane		TDOT IJS completed
I-40	At 2nd and 4th		Re-align and segregate traffic at I-40/I-65 and 2nd/4th interchange as recommended in Nashville LRTP
I-40	At I-81		Modify interchange as recommended in Knoxville LRTP
I-81	Fort Henry Dr/SR-36	Tri-Cities Crossing	Widen to 8 lanes, including additional truck lanes from Holston River bridge to SR-357
New Interchanges or Interchange Improvements for Economic Development			
I-40	Buttermilk Road		Access to future industrial park; TDOT IJS completed
I-40	At SR 196 (Hickory White Road)		As recommended in Memphis LRTP and TDOT IJS

*LOS=FDOT LOS Thresholds; EVE=EVE V/C Ratios; DOT=TDOT LRTP (Rural only)

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1.0 INTRODUCTION

1.1 Project Background

In 2005 the Tennessee Department of Transportation (TDOT) completed the State's first 25-Year Long Range Transportation Plan (PLAN *Go*). A major component of the 25-Year Vision Plan included the advancement of a 10-Year Strategic Investment Plan. The 10-Year Strategic Investment Plan established three interrelated core investment initiatives: Congestion Relief, Transportation Choices, and Key Corridors.

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1.2 Purpose of Report

The Technical Memorandum for Task 1, Systems Inventory and Data Collection, establishes the baseline conditions for the I-40/I-81 Corridor. Information presented in this report is based simply on reviewing existing data sources. Task 2, Assessment of Deficiencies, involves development of a corridor-wide list of deficiencies based on analysis of information and data for the study corridor.

1.3 Organization and Content

Issues and deficiencies identified through a review of available information for I-40 and I-81 are presented as follows:

- Chapter 2, Congestion, summarizes roadway links that are forecast to be congested by 2030.

- Chapter 3, Operations and Maintenance, provides an overview of TDOT's Statewide Intelligent Transportation System (ITS) and Incident Management Programs. The chapter also identifies current ITS deployments and planned expansion.

- Chapter 4, Safety and Security, lists I-40/I-81 segments that have collision rates which exceed the state's critical accident rate.

- Chapter 5, Freight Movement and Diversion, provides an overview of work to date on shifting freight transportation from highways to rail in the study corridor.

- Chapter 6, Economic Access, identifies proposed interchanges along I-40 and I-81 to improve access to new developments.

- Chapter 7, Commuter Patterns, displays commuting patterns to Tennessee's urban areas based on an analysis of 2000 Census information for the state. This chapter also reviews existing and planned park and ride facilities in the study corridor and describes transit improvements included in transit plans for the urban areas.

- Chapter 8, Inter-Modal Facilities, identifies major inter-modal hubs within the I-40/I-81 corridor.

2.0 CONGESTION

The identification of I-40/I-81 segments projected to be deficient in future years used three sources of information:

- TDOT's Evaluation of Roadway Efficiency System (EVE), which estimates future levels of service based on historical trends of traffic growth. Typically, a level of service (LOS) D, E or F is considered a deficient segment in rural areas while LOS E or F is the congestion criterion applied in urban areas. EVE congestion results also are shown in five-year increments, an indicator of the urgency of the need for improvements.

- TDOT's Statewide Model and urban travel demand models for Nashville, Memphis, Knoxville, Jackson, Bristol, Kingsport, Johnson City, and Lakeway. This group of TransCAD models uses population and employment projections and committed roadway improvements to estimate 2030 congestion levels. Committed improvements include those in TDOT's TIP, which extends to 2008-2009.

- I-40/I-81 improvements included in the Long-Range Transportation Plans (LRTP) for the aforementioned urban areas located along the study corridor. The projects described in these plans are programmed to address future congestion along urban segments of I-40 and I-81.

Following the review of the above sources, segments of I-40 and I-81 were identified as being congested for one or more of the categories. These portions of I-40 and I-81 will warrant detailed analysis in Task 2.

2.1 Congested Segments Based on EVE

Figure 2.1 to **Figure 2.8** illustrate the location of deficient segments of I-40 and I-81 based on TDOT's EVE database. Segments are shown as deficient if the LOS was LOS D, E or F. The deficiencies were separated into three time periods: 2005 to 2009, 2010 to 2014, and 2015 to 2030.

Table 2-1 lists the segments illustrated on the map.

Table 2-1: Deficient Segments based on EVE Data

ID	Route	From	To	Period	City/County
1	I-40	SR 3 (3rd St)	I-240 Midtown	2015 to 2030	Memphis
2	I-40	I-240 Midtown	Whitten Rd	2005 to 2009	Memphis
3	I-40	Whitten Rd	Appling Rd	2015 to 2030	Memphis
4	I-40	US 64	Canada Rd	2005 to 2009	Shelby/Fayette
5	I-40	Canada Rd	SR 205 (New Airline Rd)	2010 to 2014	Shelby/Fayette
6	I-40	SR 205 (New Airline Rd)	SR 222 (Stanton Rd)	2015 to 2030	Shelby/Fayette
7	I-40	Lower Brownsville Rd	US 45 (Highland Ave)	2015 to 2030	Jackson
8	I-40	US 45 (Highland Ave)	Christmasville Rd	2010 to 2014	Jackson
9	I-40	Christmasville Rd	SR 104	2015 to 2030	Jackson
10	I-40	Tennessee River Blue Creek Rd	Duck River Rd	2015 to 2030	Humphries/ Dickson
11	I-40	SR 46	Williams County Line Rd	2015 to 2030	Humphries/ Dickson
12	I-40	Williamson/Cheatham CL	SR 45 (Old Hickory Blvd)	2005 to 2009	Nashville
13	I-40	Old Hickory Blvd	S Mount Juliet Rd	2015 to 2030	Nashville
14	I-40	S Mount Juliet Rd	US 70 (Sparta Pike)	2005 to 2009	Nashville
15	I-40	US 70 (Sparta Pike)	SR 53 (Gordonsville Hwy)	2015 to 2030	Nashville
16	I-40	SR 96 (Medley Amonette Rd)	West of SR 56 South	2010 to 2014	Putnam/ Cumberland
17	I-40	West of SR 56 South	SR 111	2015 to 2030	Putnam/ Cumberland
18	I-40	US 70 (Spring St)	US 70 (Crossville Hwy)	2015 to 2030	Putnam/ Cumberland
19	I-40	Plateau Rd	Battown Rd	2015 to 2030	Putnam/ Cumberland
20	I-40	US 70	Ashburn Dr	2015 to 2030	Putnam/ Cumberland
21	I-40	Cumberland/Roane CL	I-75	2015 to 2030	Knoxville
22	I-40	I-75	N Cherry St	2005 to 2009	Knoxville
23	I-40	N Cherry St	US 11 W (Rutledge Pike)	2010 to 2014	Knoxville
24	I-40	US 11 W (Rutledge Pike)	I-640	2015 to 2030	Knoxville
25	I-40	I-640	Holston River	2005 to 2009	Knoxville
26	I-40	Holston River	Strawberry Plains Pike	2010 to 2014	Knoxville
27	I-40	Strawberry Plains Pike	SR 92	2015 to 2030	Knoxville
28	I-81	SR 160 (Enka Hwy)	SR 340 (Fish Hatchery Rd)	2015 to 2030	Tri-Cities
29	I-81	I-181	SR 126	2015 to 2030	Tri-Cities

Figure 2.1: Memphis Area EVE Data Deficiency

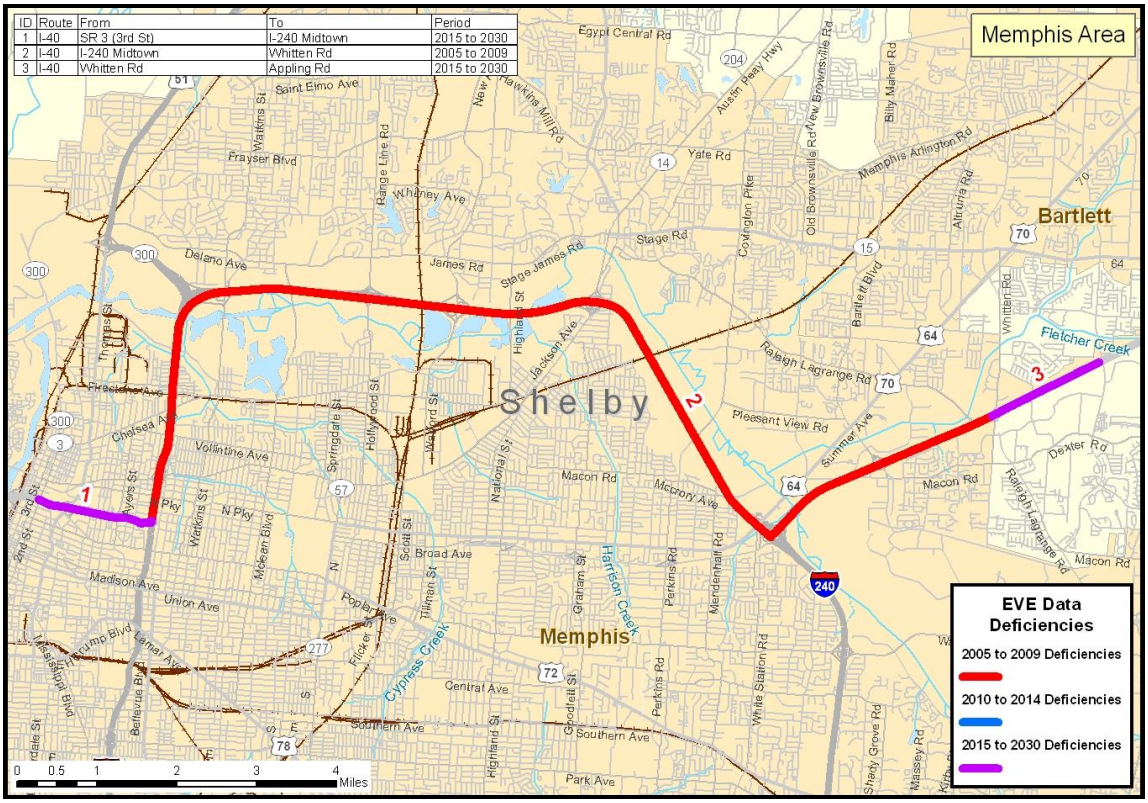


Figure 2.2: Shelby/Fayette Area EVE Data Deficiency

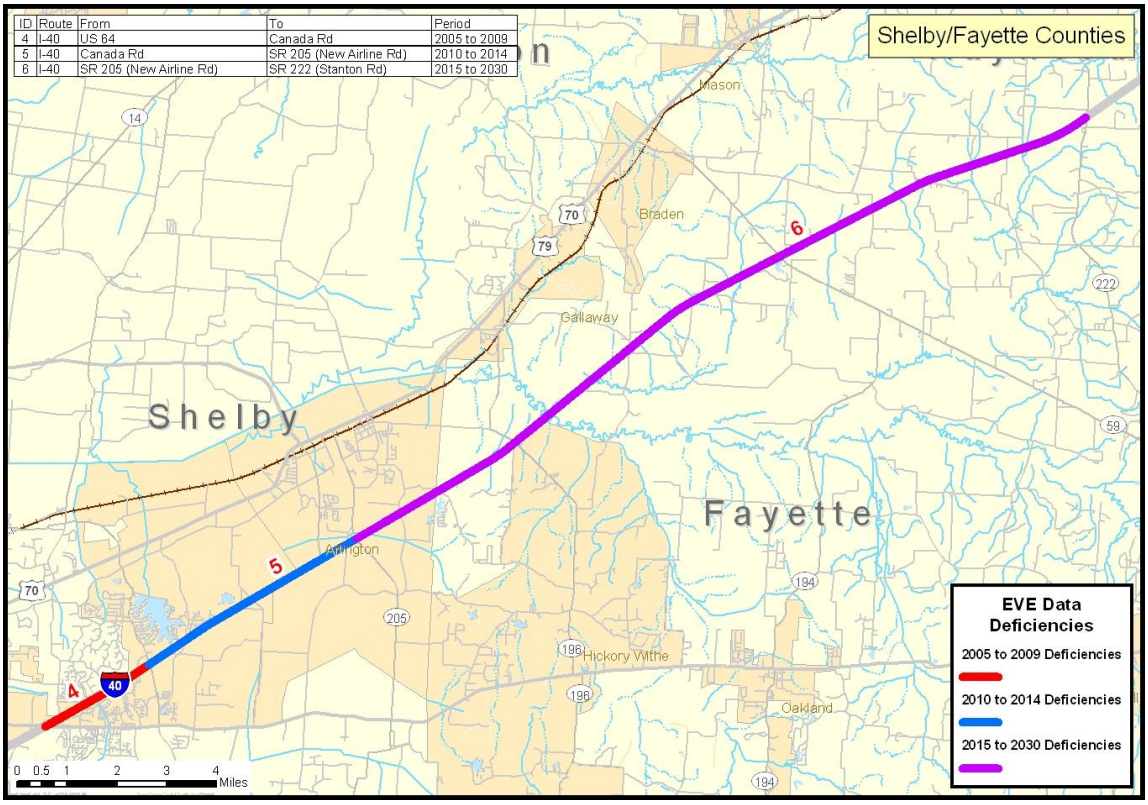


Figure 2.3: Jackson Area EVE Data Deficiency

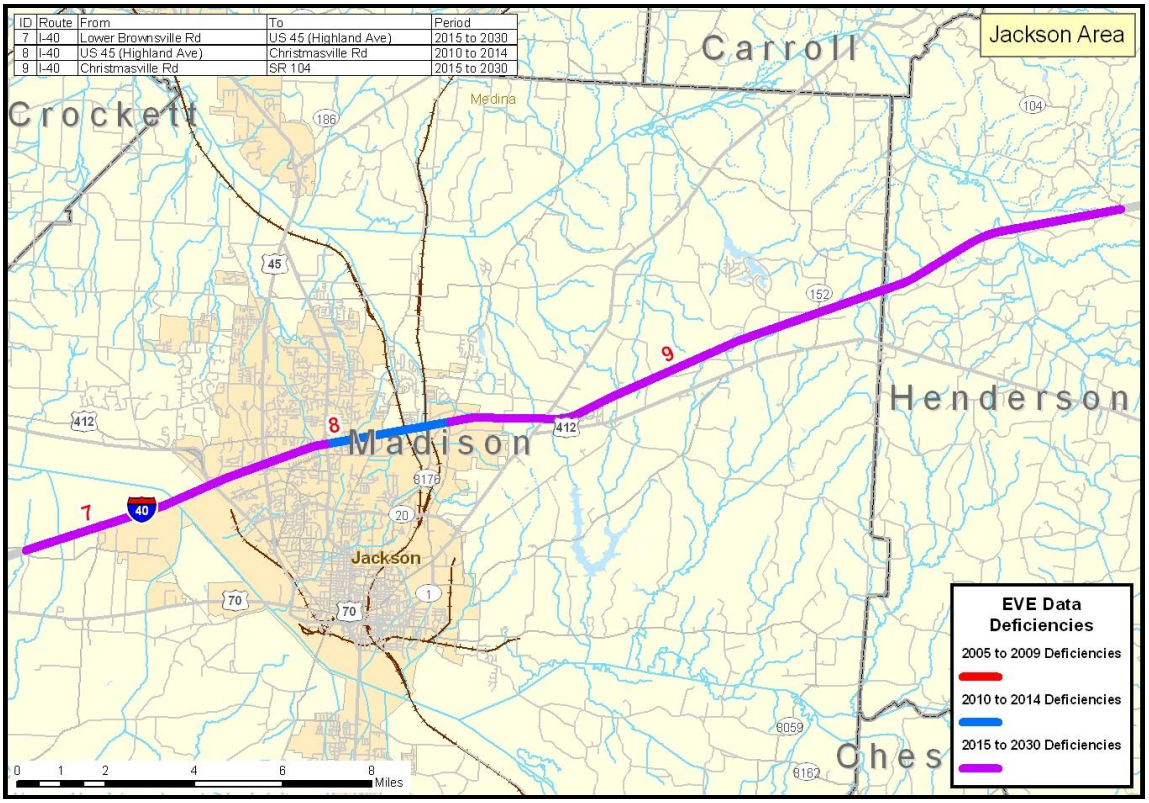


Figure 2.4: Humphries/Dickson Area EVE Data Deficiency

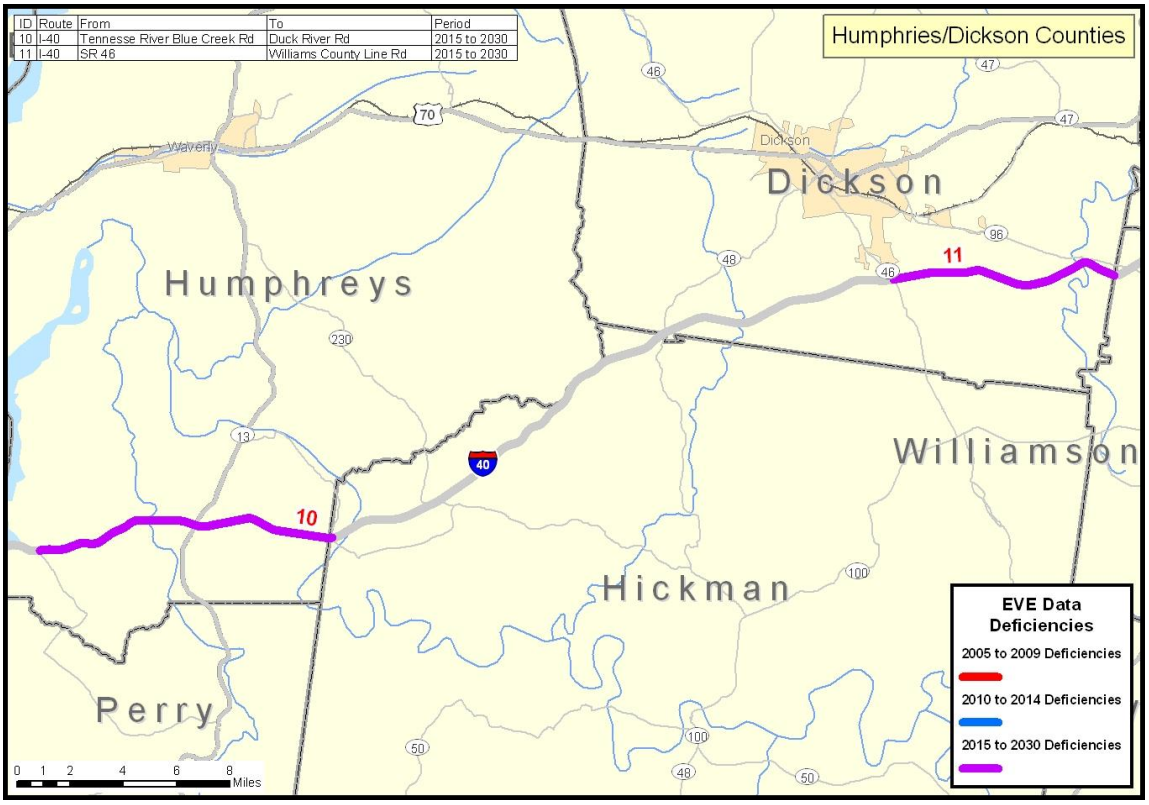


Figure 2.5: Nashville Area EVE Data Deficiency

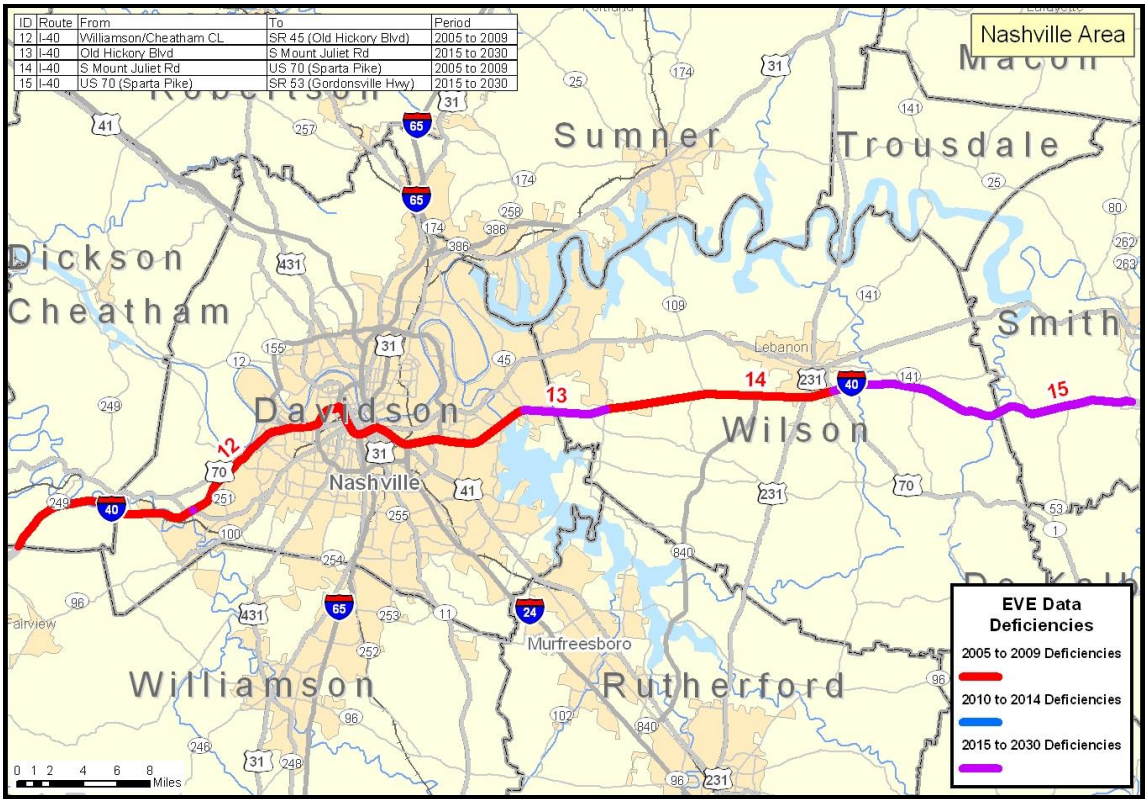


Figure 2.6: Putnam/Cumberland Area EVE Data Deficiency

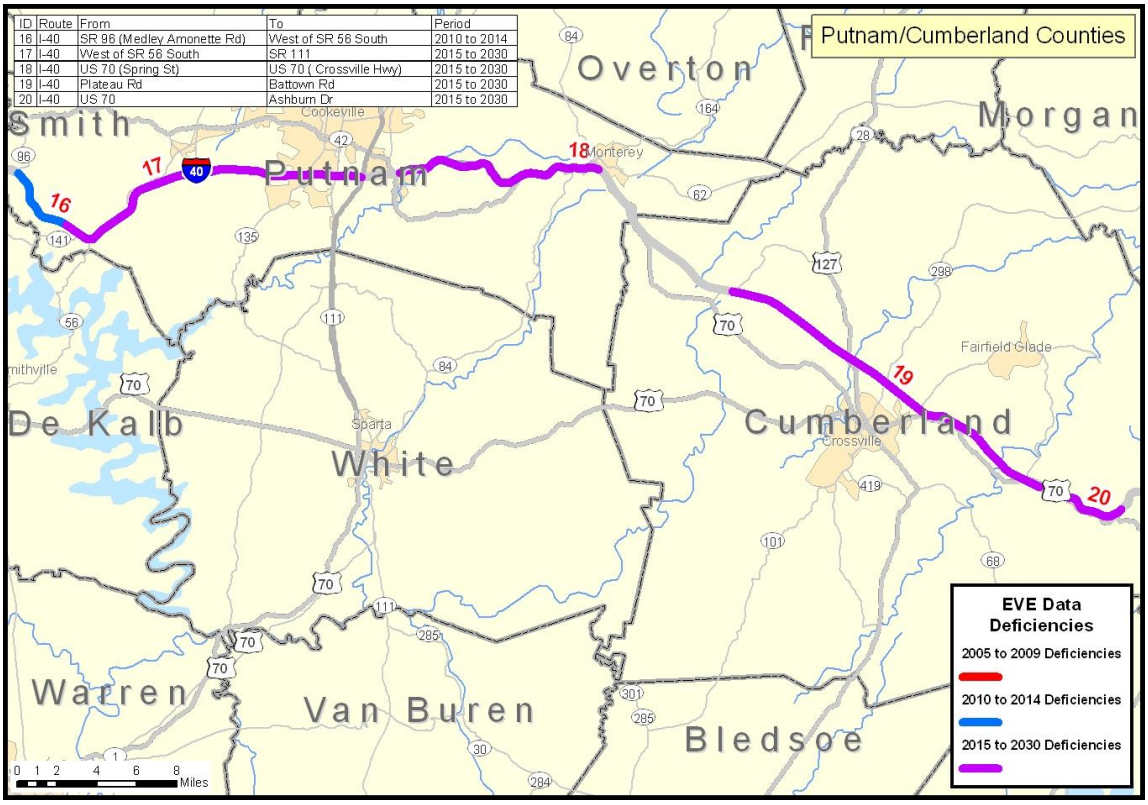


Figure 2.7: Knoxville Area EVE Data Deficiency

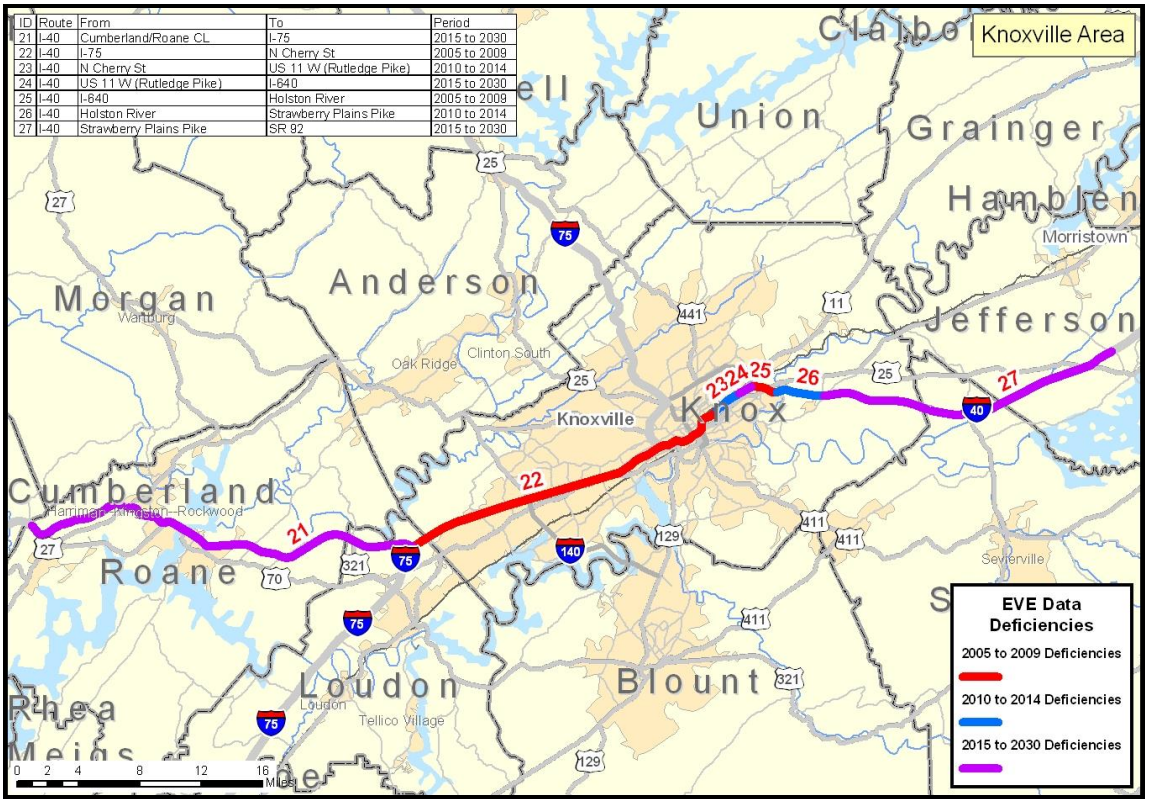
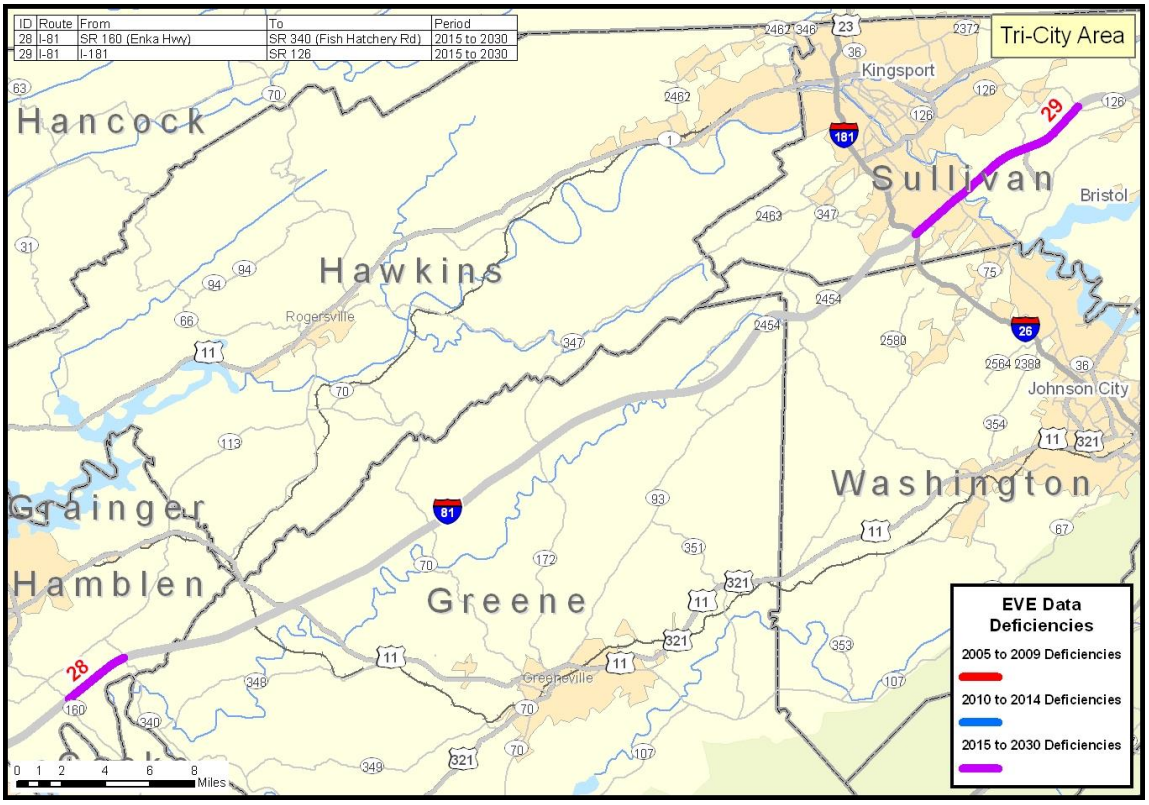


Figure 2.8: Tri-Cities Area EVE Data Deficiency

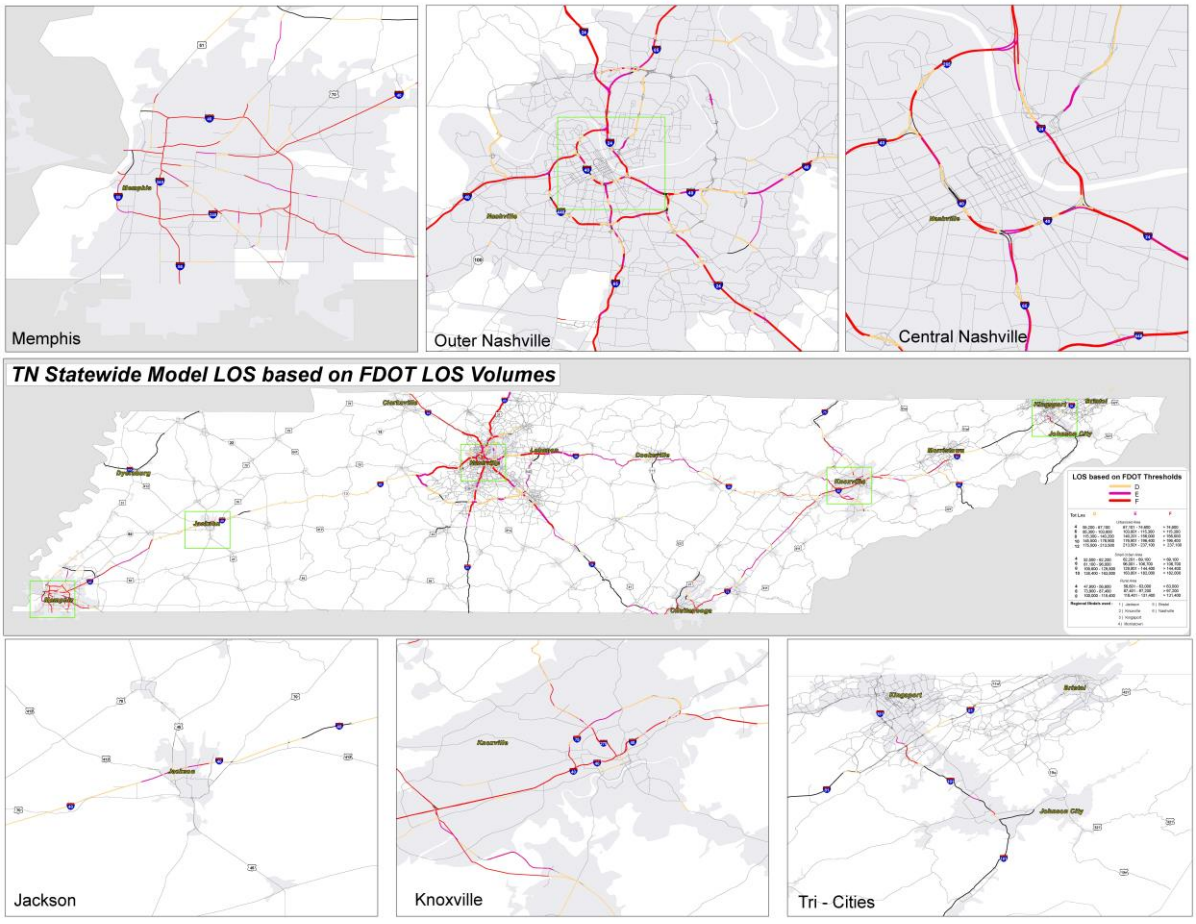


2.2 Congested Segments Based on Models

In addition to evaluating congestion based on estimates from the EVE database, the study team also obtained TDOT's Statewide Model and each of the MPOs' current models to identify areas of congestion based on travel demand forecasts. Since generalized LOS can be quantified using a variety of techniques, two methodologies were used to identify congestion and assess the consistency of different approaches.

One approach uses LOS threshold volumes from tables that have been used by a number of state DOTs around the country as a way to quickly estimate LOS. The source of these LOS tables is the *2002 Quality/Level-of-Service Handbook*, prepared by the Florida Department of Transportation (FDOT). Model area types were used to identify whether LOS should be based on FDOT Tables for Urbanized Areas, Small Urban Areas, or Rural Areas. Where available, no build or existing-plus-committed loaded networks from MPO models were inter-spliced with the Statewide Model network. **Figure 2.9** depicts links color-coded by 2030 LOS D, E, and F based on model forecasts and FDOT generalized LOS tables. This map is a composite of the TDOT Statewide Model and all MPO models except for Memphis.

Figure 2.9: 2030 Model Estimated LOS based on FDOT Thresholds



A second methodology used to forecast areas of congestion was to use volume/capacity (v/c) ratios calculated from the models as the basis for identifying LOS D, E, and F segments. The EVE database was reviewed to identify approximate breakpoints for LOS categories based on v/c ratios. **Figure 2.10** depicts LOS D, E, and F segments on the Tennessee Interstate system using model-derived v/c ratios and LOS breakpoints based on the EVE database. Deficient segments are generally consistent for the two alternative LOS approaches. The FDOT threshold approach shows worse LOS in some cases than the v/c approach.

The results of these two methodologies were also compared to Figure 8-6 in the report entitled *Final Report: Tennessee Long-Range Transportation Plan, Synthetic Model*. The map in this report only depicts "unsatisfactory" segments, referenced as 2030 LOS D, E, or F, for rural highways. In the "synthetic model" report, a series of different v/c ratios were used to identify these unsatisfactory segments, based on the number of roadway lanes and area type (rural vs. small urban areas). This approach identifies most of the same segments identified using the FDOT LOS thresholds. This approach does not always match the EVE v/c approach as somewhat different v/c thresholds were identified for each LOS category.

Table 2-2 identifies deficient segments based on the three alternate methodologies, and all I-40 and I-81 segments listed in this table should be considered deficient.

Figure 2.10: 2030 Model Estimated LOS based on EVE V/C Ratios

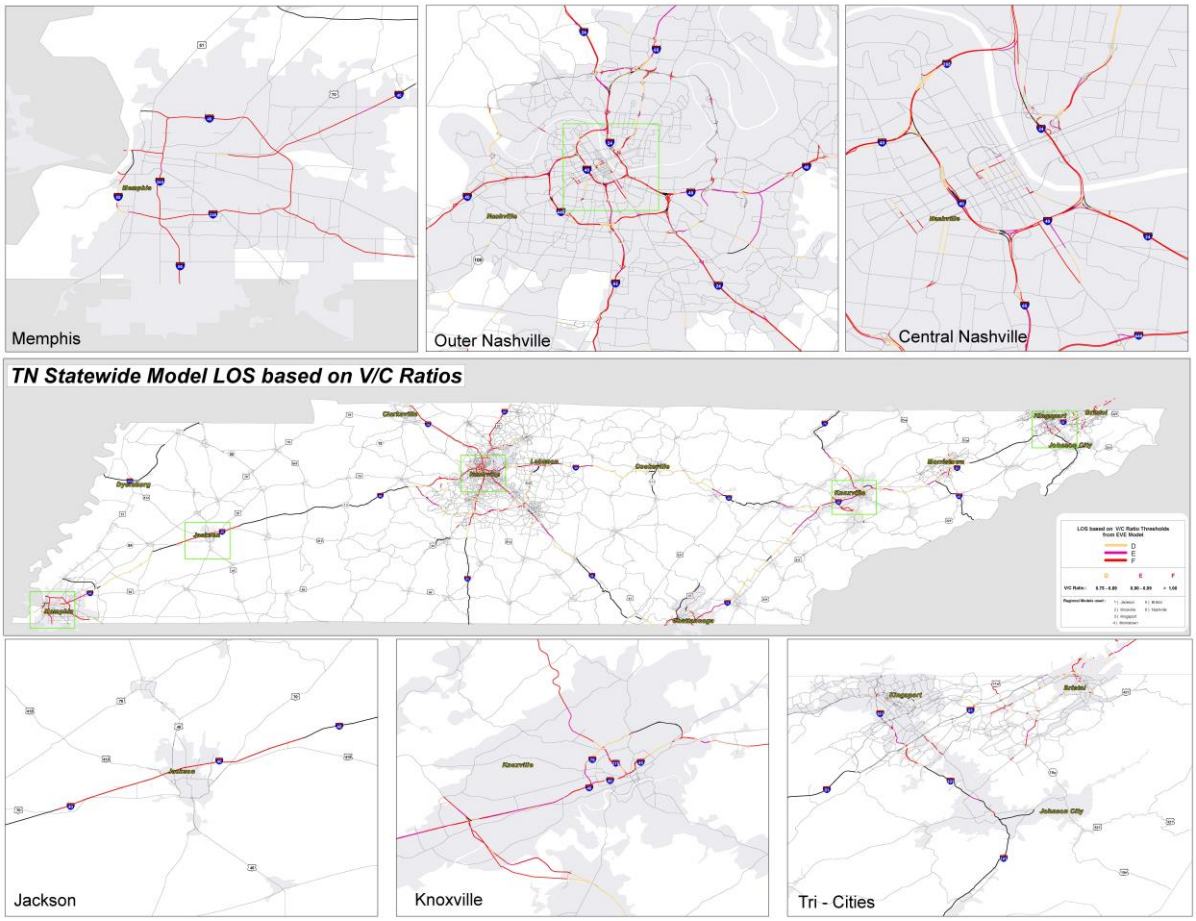


Table 2-2: Deficient Segments (LOS D, E, F) based on 2030 Model Forecasts

Route	From	To	Model(s)*
I-40	SR 3 (3rd St)	I-240 Midtown	LOS, EVE
I-40	I-240 Midtown	Canada Rd	LOS, EVE
I-40	SR 205 (New Airline Rd)	SR 76 (Anderson Ave)	LOS, EVE, DOT
I-40	SR 76 (Anderson Ave)	US 70 (Brownsville Hwy)	LOS, DOT
I-40	US 70 (Brownsville Hwy)	SR 152 (Spring Creek Rd)	LOS, EVE, DOT
I-40	SR 104	SR 46	LOS, DOT
I-40	SR 46	SR 840	LOS, EVE, DOT
I-40	SR 840	SR 96	LOS, DOT
I-40	SR 96	SR 45 (Old Hickory Blvd)	LOS, EVE
I-40	SR 45 (Old Hickory Blvd)	SR 265 (Central Pike)	LOS
I-40	SR 265 (Central Pike)	SR 101 (Peavine Rd)	LOS, EVE, DOT
I-40	SR 101 (Peavine Rd)	Pine Ridge Rd	LOS, DOT
I-40	Pine Ridge Rd	US 321	LOS, EVE, DOT
I-40	US 321	I-75 South	LOS, DOT
I-40	I-75 South	Strawberry Plains Pike	LOS, EVE
I-40	Strawberry Plains Pike	Midway Rd	LOS
I-40	Midway Rd	SR 66 (Winfield Dunn Pky)	LOS, EVE, DOT
I-40	SR 66 (Winfield Dunn Pky)	Deep Springs Rd	LOS, DOT
I-40	Deep Springs Rd	I-81	LOS, EVE, DOT
I-81	I-40	SR 340 (Fish Hatchery Rd)	LOS, EVE, DOT
I-81	SR 340 (Fish Hatchery Rd)	US 11E (Robert F. Smith Pky)	LOS, DOT
I-81	Lonesome Pine Trl (SR 70)	Sullivan Gardens Rd (SR 93)	DOT
I-81	Sullivan Gardens Rd (SR 93)	Kendrick Creek Rd	LOS, DOT
I-81	Kendrick Creek Rd	I-181/I-26/US 23	DOT
I-81	I-181/I-26/US 23	Memorial Blvd	LOS, EVE

*LOS=FDOT LOS Thresholds; EVE=EVE V/C Ratios; DOT=TDOT LRTP (Rural only)

2.3 Projects Identified in Plans and Reports

The LRTPs for Nashville, Knoxville, Memphis Jackson, Bristol and Kingsport Urban Areas included widening projects to address congestion issues along I-40 and I-81 as well as key arterials connecting to the study corridor. TDOT also has identified improvements to improve capacity at interchanges along the corridor as described in the department's Interchange Justification Studies (IJS). These projects are listed in **Table 2-3** and are shown in **Figure 2.11** through **Figure 2.13**.

Table 2-3: Projects to Address Deficiencies from Plans and Reports

ID	Source	Project Limits	Horizon Year	Proposed Improvement
1	Memphis LRTP	I-40 from I-24 Midtown to Jackson	2016	Widen I-40 from 6 lanes to 8
2	Memphis LRTP	I-40 from Jackson to Chelsea	2016	Widen I-40 from 6 lanes to 8
3	Memphis LRTP	I-40 from Chelsea to 101 Connector	2016	Widen I-40 from 6 lanes to 8
4	Memphis LRTP	I-40 at Covington Pike (interchange)	2006	Redesign turning lane configuration
5	Memphis LRTP	I-40 at I-240 East Memphis	2006	Interchange improvements
6	TDOT IJS	I-40 at Sycamore View		Interchange improvement

ID	Source	Project Limits	Horizon Year	Proposed Improvement
		Road		
7	Memphis LRTP	I-40 at US-64	2016	Interchange improvements
8	Memphis LRTP	I-40 from US-64 to Canada	2016	Widen I-40 from 4 lanes to 6
9	Memphis LRTP	I-40 at Canada	2006	Interchange improvements
10	Memphis LRTP	I-40 from Canada to Air Line	2016	Widen I-40 from 4 lanes to 6
11	Jackson LRTP	I-40 from Hollywood Dr to Law Rd (widening)	2026	Widen I-40 to six lanes
12	Nashville LRTP	I-40 at SR-96	2016	Reconstruct intersection to alleviate safety concerns
13	Nashville LRTP	I-40 west from US-70S to I-440 (widening, HOV lanes)	2016	Widen to 8 lanes, incl. 2 HOV lanes
14	Nashville LRTP	I-40 west at 28th/Jefferson	2016	Redesign exits to allow both L & R turns
15	Nashville LRTP	I-40 west from I-440 to I-65 (widening & HOV lanes)	2025	Widen from 6 lanes to 10 lanes, 2 being HOV lanes
16	Nashville LRTP	I-40 west from 12th to Charlotte (HOV connection)	2025	Construct HOV ramps to and from the CBD
17	Nashville LRTP	I-40 at Broadway	2016	Urban diamond interchange and 2-lane on-ramps
18	Nashville LRTP	I-40/I-65 at 2nd/4th	2025	Realign and segregate traffic for safety purposes at I-40/I-65 and 2nd/4th interchange
19	Nashville LRTP	I-40/I-24 at Shelby/Franklin (HOV connection)	2025	Construct HOV ramps to and from the CBD
20	Nashville LRTP, TDOT APR	I-40 at Fessler's Lane	2016	Widen from 6 lanes to 12 lanes, including a dual-dual roadway concept; full interchange at Fessler's Lane
21	TDOT IJS	I-40 at Spence Lane	----	Modify interchange
22	Nashville LRTP	I-40 east from I-24 to Donelson Pk (HOV lanes)	2016	Widening for HOV lanes
23	Nashville LRTP	I-40 at Donelson Pk/SR-255	2016	Re-align Donelson Pk and construct a SPUI
24	Nashville LRTP	I-40 east from Donelson Pk to Old Hickory Blvd (widening)	2016	Widen from 6 lanes to 8
25	Nashville LRTP	I-40 at SR-171	2016	Widen WB on ramp to 2 lanes, widen WB off ramp for 2LTL, revise signal timing, extend NB through lane between ramps.
26	Nashville LRTP	I-40 east of Mt Juliet Rd to SR-840 (HOV lane)	2016	Add HOV lane
27	Nashville LRTP	I-40 from SR-840 to US-70 (HOV lane)	2016	Add HOV lane
28	Nashville LRTP	I-40 at US-231	2006	Interchange and bypass

ID	Source	Project Limits	Horizon Year	Proposed Improvement
29	Knoxville LRTP	I-40/I-75 at Campbell Station Rd	2014	Modify interchange
30	Knoxville LRTP	I-40 from I-275 to Cherry St	2009	Widen 4-lane to 6-lane
31	Knoxville LRTP/TDOT IJS	I-40/I-81 interchange	2020	Modify interchange
32	Knoxville LRTP	I-81 at SR-341 (interchange)	2009	Modify interchange
33	TDOT IJS	I-81 at US-25E	2007	Interchange improvement
34	Kingsport LRTP	I-81 in Urban Area	2005-2015	Add truck lanes particularly near SR-357 exit
35	Kingsport LRTP	I-81 from Fort Henry Dr/SR-36 to Tri-Cities Crossing (exit 56)	2015-2030	Widen to 6 lanes with additional truck lanes from Holston River bridge to SR-357
36	Bristol LRTP	I-81 at W. State St		Northbound off-ramp at exit 74

Figure 2.11: Memphis Area Deficiency Projects

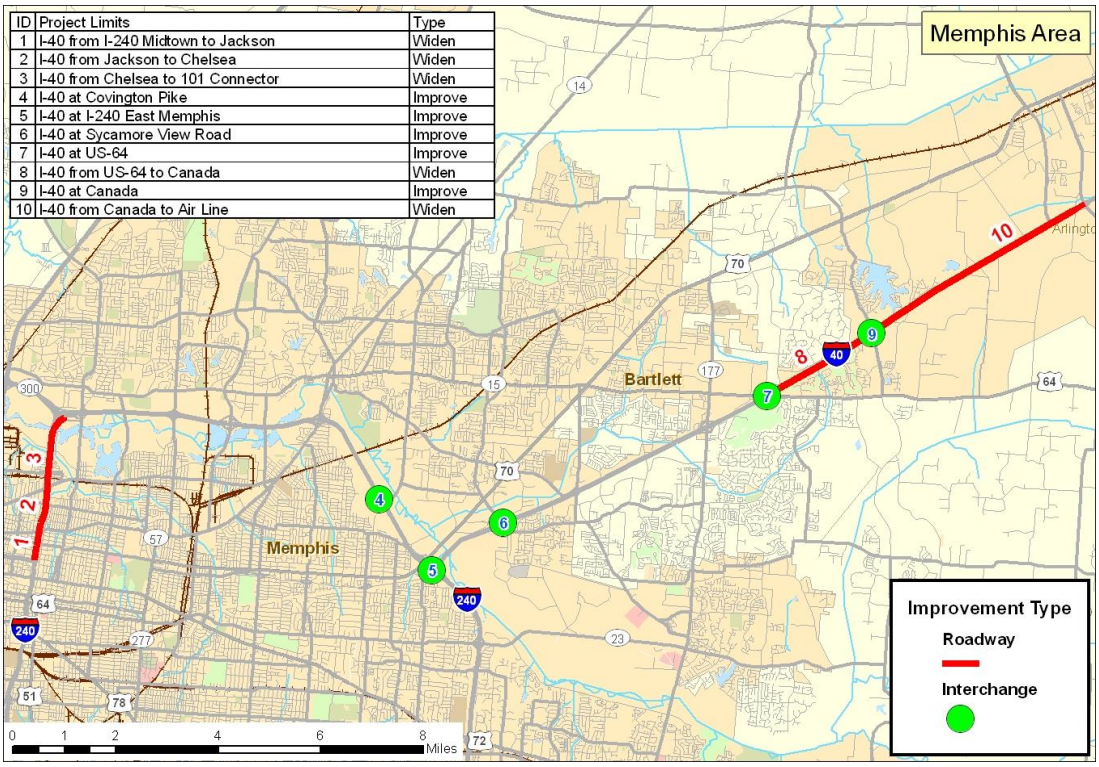


Figure 2.12: Nashville Area Deficiency Projects

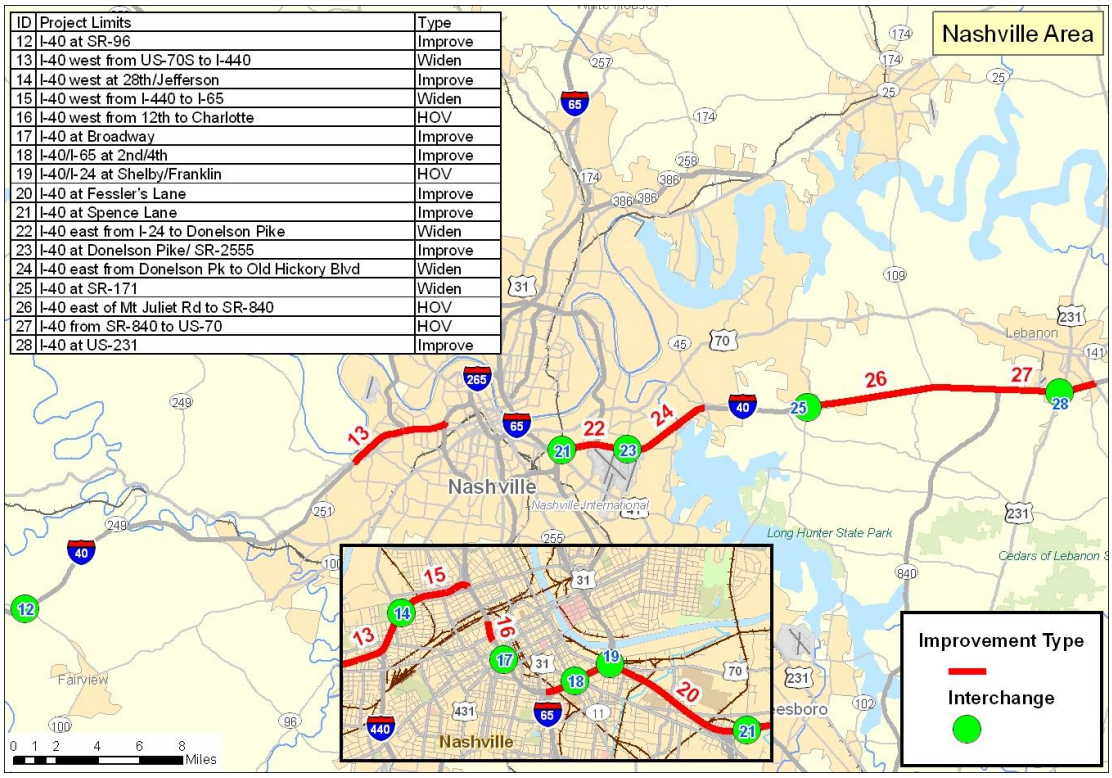
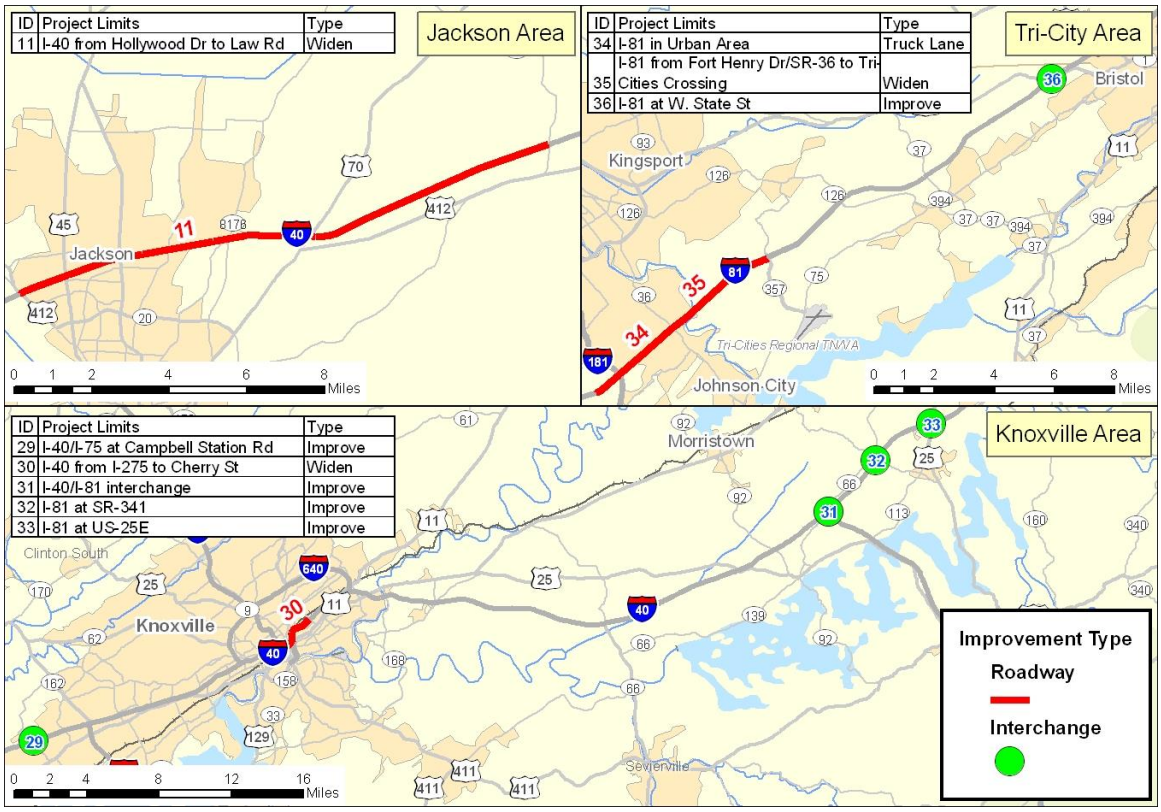


Figure 2.13: Jackson, Knoxville & Tri-Cities Deficiency Projects



3.0 OPERATIONS AND MAINTENANCE

3.1 TDOT's Intelligent Transportation System

3.1.1 TDOT Statewide ITS and Incident Management Program Overview

TDOT has constructed and operated ITS and Incident Management programs throughout the state for the past five years. The TDOT Incident Management program, HELP, was initiated in 2000 in Nashville and Knoxville. Initial ITS equipment deployment (the Phase 1 - Early Deployment) became operational in Nashville in 2003. Both programs, working hand in hand, have been expanding constantly since the initiation.

The HELP service patrol program initially began with incident management vehicles and drivers in Nashville and Knoxville in 2000. Within two years the HELP program was expanded to Memphis and Chattanooga. HELP operators have regular routes to patrol along the freeway system in each urban area. They are also dispatched by the Transportation Management Center (TMC) for the urban area when incidents are detected. The HELP operators also provide assistance as needed during major incidents outside their normal coverage area and during special events, such as the Bonneroo Music Festival.

The ITS program was completed and fully operational in Nashville in 2004. The Nashville system has about 60 CCTV cameras and 20 dynamic messages signs (DMS) that cover 36 miles of the freeway system. A second phase is under construction in Nashville that will add another 18 miles of coverage with a total of 83 CCTV cameras and 31 DMS. Highway Advisory Radio (HAR) is also included on segments of the freeway system. The Phase 2 project is expected to be operational in summer 2007.

The Knoxville Regional TMC was opened in 2005. It has approximately 67 CCTV cameras and 15 DMS covering 44 miles of freeways along I-40, I-75, I-275 and I-640. HAR is also deployed in several freeway segments.

In the Memphis region, TDOT is already operating an early deployment system of 25 CCTV cameras, 3 DMS plus HAR. This early deployment is focused on the I-40 and I-55 bridges over the Mississippi River at Memphis. The second phase of the Memphis ITS deployment, which will cover 90 miles of freeways in the Memphis region, is currently under construction and is expected to be operational in spring 2008. It will consist of a total (both phases) of approximately 117 CCTV cameras and 41 DMS. Several of these cameras and DMS are located in West Memphis, Arkansas on the eastbound approaches to the Mississippi River bridges.

TDOT is developing a number of rural ITS applications to assist in managing traffic in areas prone to incidents or severe weather. One of the first rural ITS applications in the US was deployed in 1994 on I-75 as it crosses the Hiwassee River at Calhoun, TN. This system detects low visibility conditions (fog) and provides warning messages to motorists, reduces the speed limit or, in extreme cases, closes the roadway automatically. Another long standing rural application is the Cumberland Gap tunnel control system on US-25E in Claiborne County. Additional CCTV and DMS are being added on I-81 to provide tunnel condition warnings. In March 2007, TDOT is planning to let a construction project to implement four rural projects on interstate highways in East Tennessee.

In the past two years, TDOT has expanded the ITS program in several ways. In 2006, TDOT initiated a statewide 511 telephone traveler information system. This 511 system is coupled with the information provided on the "SmartWay" web site. The 511 service and the web site is updated through a system called TDOT "SmartWay" Information System (TSIS) by the TMCs, by HELP dispatchers and by TDOT regional field staff as incidents and other traffic related events are identified. TDOT has deployed traveler information kiosks at Welcome Centers and Rest Stops throughout the state. A statewide weather reporting system was deployed, which consists of about 25 weather stations that are monitored by the TDOT Region Maintenance offices. Any weather conditions that may affect traffic are immediately reported to regional TMCs and to the statewide "SmartWay" web site and 511 system.

TDOT has created an ITS Coordinating Committee that meets regularly to discuss project status and upcoming activities and to maintain and update the TDOT ITS Strategic Plan. The 2005 update of the TDOT Strategic Plan identified several future projects under consideration including the identification of additional rural sites and applications, a Phase 3 project to add 50 miles of coverage to the Nashville freeway system, expansion of traveler information services to add email or pager alerts, development of a statewide communications infrastructure and possibly a statewide TMC, and the identification of local incident management activities and diversion routes in each county along Interstate routes.

3.1.2 ITS Deployments on I-40 and I-81

Currently there are three areas along I-40 that are managed by ITS equipment and HELP patrols. These are:

- I-40 in Knoxville, approximately 21 miles from MP 374 – Lovell Road to the Holston River MP 395. Also alternate routes I-275 and I-640 have full ITS coverage.

- I-40 in Nashville, approximately 10 miles from MP 203, west of Briley Parkway to MP 213, the I-40/I-24 interchange. Alternate routes I-24 and I-65 also have segments with full ITS coverage.

- I-40 in Memphis, approximately eight miles, including two miles in Tennessee from the I-40/I-240 interchange to the Mississippi River and six miles in Arkansas from the Mississippi River to the I-55 interchange. An alternate route, I-55, has camera and DMS coverage for eight miles including two miles in Tennessee beginning at South Parkway to the Mississippi River and in Arkansas from the river to the I-40 interchange.

The statewide 511 system and the SmartWay web site provide information on the entire length of I-81 and I-40 in Tennessee.

TDOT has several ITS expansion projects underway or about to start along I-40 and nearby alternate routes. In East Tennessee there are three rural areas along I-40 (the fourth current project is on I-75 at Jellico Mountain) that will add ITS equipment to enable TDOT to provide motorists with information. These areas are:

- I-81 around the I-26/I-181 interchange, which includes a HAR station and two DMS;

- I-40 around the I-81 interchange, which includes a HAR station and two DMS; and

- I-40 at Rockwood Mountain between MP 336 and 351, which includes 2 CCTV cameras, 2 HAR stations and one DMS.

The equipment in these projects will be controlled and managed by the Knoxville TMC and they are expected to be operational in 2008.

Another project is the Phase 2 deployment in the Nashville region. This project will extend CCTV camera coverage and detection for three miles eastward along I-40 to a point east of Donelson Pike and add full coverage of alternate route I-440 south and west of downtown Nashville.

The largest near term project will be the completion of the Phase 2 deployment in Memphis. When operational in 2008, coverage will be extended from the I-240 interchange in downtown Memphis (MP1) 20 miles eastward to Canada Road. Also alternate routes I-240 and I-55 will have full ITS coverage.

4.0 SAFETY AND SECURITY

TDOT staff identified locations along the study corridor where accidents exceed the critical accident rate. TDOT's critical accident rate takes into account traffic exposure and is unique for each location. The use of this measure ensures that the accident rate at a location is not due to chance but to some unfavorable characteristic of local conditions.

The TDOT data listed locations that exceed the critical accident rate. **Table 4-1** summarizes these locations along the study corridor. **Figure 4.1** to **Figure 4.12** are maps of the locations along I-40 and I-81.

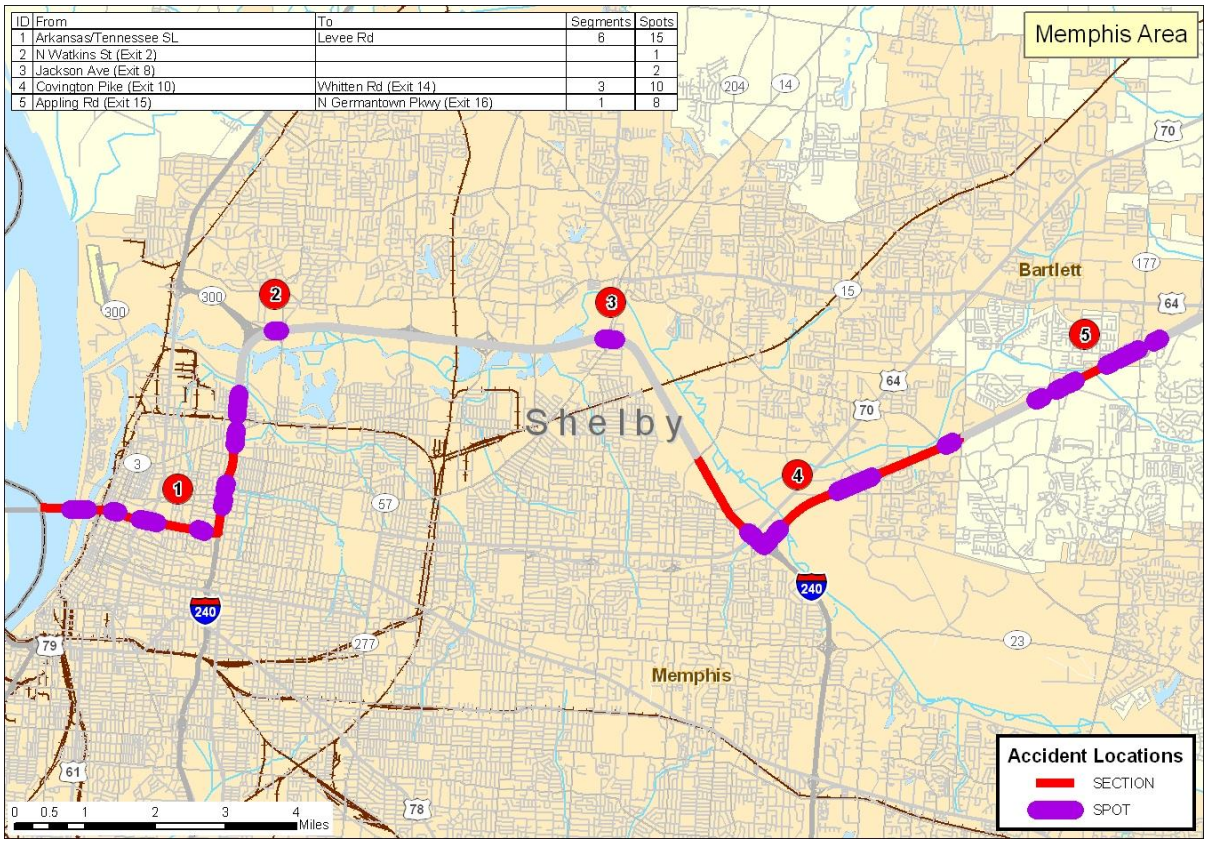
This document is covered by 23 USC Section 409, and its production pursuant to a public document records request does not waive the provisions of Section 409.

Table 4-1: Critical Accident Locations

ID	Route	From	To	Seg-ments	Spots
1	I-40	Arkansas/Tennessee SL	Levee Rd	6	15
2	I-40	N Watkins St (Exit 2)			1
3	I-40	Jackson Ave (Exit 8)			2
4	I-40	Covington Pike (Exit 10)	Whitten Rd (Exit 14)	3	10
5	I-40	Appling Rd (Exit 15)	N Germantown Pkwy (Exit 16)	1	8
6	I-40	East of SR 222 (Stanton Rd)			1
7	I-40	East of SR 192 (Mercer Rd)			1
8	I-40	US 70 (Exit 66)	SR 138 (Providence Road - Exit 68)	1	1
9	I-40	West of SR 104 (Exit 101)			1
10	I-40	SR 114 (Camden Rd - Exit 116)			1
11	I-40	US 641 (Exit 126)			1
12	I-40	West of SR 191 (Birdsong Rd - Exit 133)			1
13	I-40	SR 191 (Birdsong Rd - Exit 133)	Benton/Humphreys CL	1	5
14	I-40	West of SR 13 (Exit 143)			1
15	I-40	SR 13 (Exit 143)			1
16	I-40	West of SR 46 (Exit 172)			3
17	I-40	West of SR 96 (Exit 182)	SR 96 (Exit 182)		3
18	I-40	SR 249 (Luyben Hills Rd - Exit 188)			1
19	I-40	Cheatham/Davidson CL	McCrory Ln (Exit 192)	2	1
20	I-40	McCrory Ln (Exit 192)	West of Briley Pkwy (Exit 204)		8
21	I-40	West of Briley Pkwy (Exit 204)	I-440 (Exit 206)	2	7
22	I-40	I-440 (Exit 206)	I-65 (Exit 208)	1	3
23	I-40	I-65 (Exit 208)	East of Briley Pkwy (Exit 204)	7	29
24	I-40	East of Briley Pkwy (Exit 215)	East of Donelson Pike (Exit 216)	1	5
25	I-40	East of Donelson Pike (Exit 216)	East of Old Hickory Blvd (Exit 221)		4
26	I-40	SR 171 (Mt Juliet Rd - Exit 226)	SR 109 (Exit 232)		4

ID	Route	From	To	Seg-ments	Spots
27	I-40	SR 109 (Exit 232)	US 70 (Sarta Pike - Exit 239)		6
28	I-40	Linwood Rd (Exit 245)	SR 141 (Exit 254)		3
29	I-40	West of SR 53 (Gordonsville Hwy - Exit 258)	SR 96 (Medley Amonette Rd - Exit 268)		7
30	I-40	SR 136 (Jefferson Ave - Exit 287)			1
31	I-40	US 70 N (Spring St - Exit 290)	US 70 N/SR 84 (Holly St - Exit 300)	1	2
32	I-40	West of Plateau Rd (Exit 311)	East of Plateau Rd (Exit 311)		2
33	I-40	Market St (Exit 329)	SR 299 (Westel Rd - Exit 338)	1	3
34	I-40	SR 299 (Airport Rd - Exit 340)	US 27/SR 61 (Roane St - Exit 347)	2	10
35	I-40	Pine Ridge Rd (Exit 350)			2
36	I-40	East of SR 326 (Gallaher Rd - Exit 356)	East of US 321 (Exit 364)		4
37	I-40	Lovell Rd (Exit - 374)			1
38	I-40	I-140 (Exit 376)	I-640 (Exit 385)	4	15
39	I-40	I-275 (Exit 388)	5th St (Exit 389)	3	8
40	I-40	US 11 W (Rutledge Pike - Exit 392)	Ashville Hwy (Exit 394)	2	9
41	I-40	West of Snyder Rd (Exit 407)	Deep Springs Rd (Exit 412)		3
42	I-40	Deep Springs Rd (Exit 412)	US 25 W/US 70 (Exit 415)		3
43	I-40	US 25 W/US 70 (Exit 415)	SR 92 (Exit 417)		2
44	I-40	I-81 (Exit 421)			2
45	I-81	I-81 (Exit 421)	SR 341 (Exit 4)		1
46	I-81	Hamblen/Greene county line	SR 172 (Exit 36)		6
47	I-81	SR 172 (Exit 36)	Greene/Washington county line		2
48	I-81	Washington/Sullivan county line	I-181 (Exit 46)		3
49	I-81	I-181 (Exit 46)	South Fork Holston River		3
50	I-81	South Fork Holston River	Tennessee/ Virginia State line		2

Figure 4.1: Memphis Area Critical Accident Locations



ID	From	To	Segments	Spots
1	Arkansas/Tennessee SL	Levee Rd	6	15
2	N Watkins St (Exit 2)			1
3	Jackson Ave (Exit 8)			2
4	Covington Pike (Exit 10)	Whitten Rd (Exit 14)	3	10
5	Appling Rd (Exit 15)	N Germantown Pkwy (Exit 16)	1	8

Figure 4.2: Brownsville Critical Accident Locations

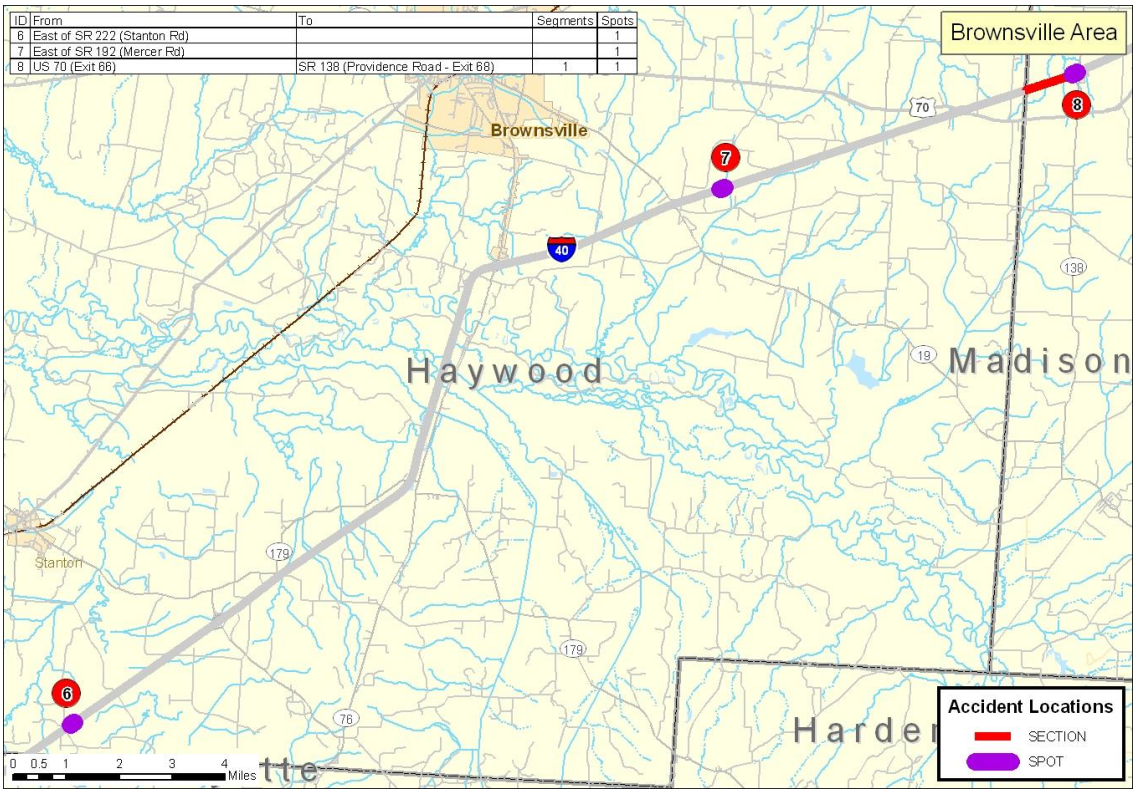


Figure 4.3: Jackson to Nashville Critical Accident Locations

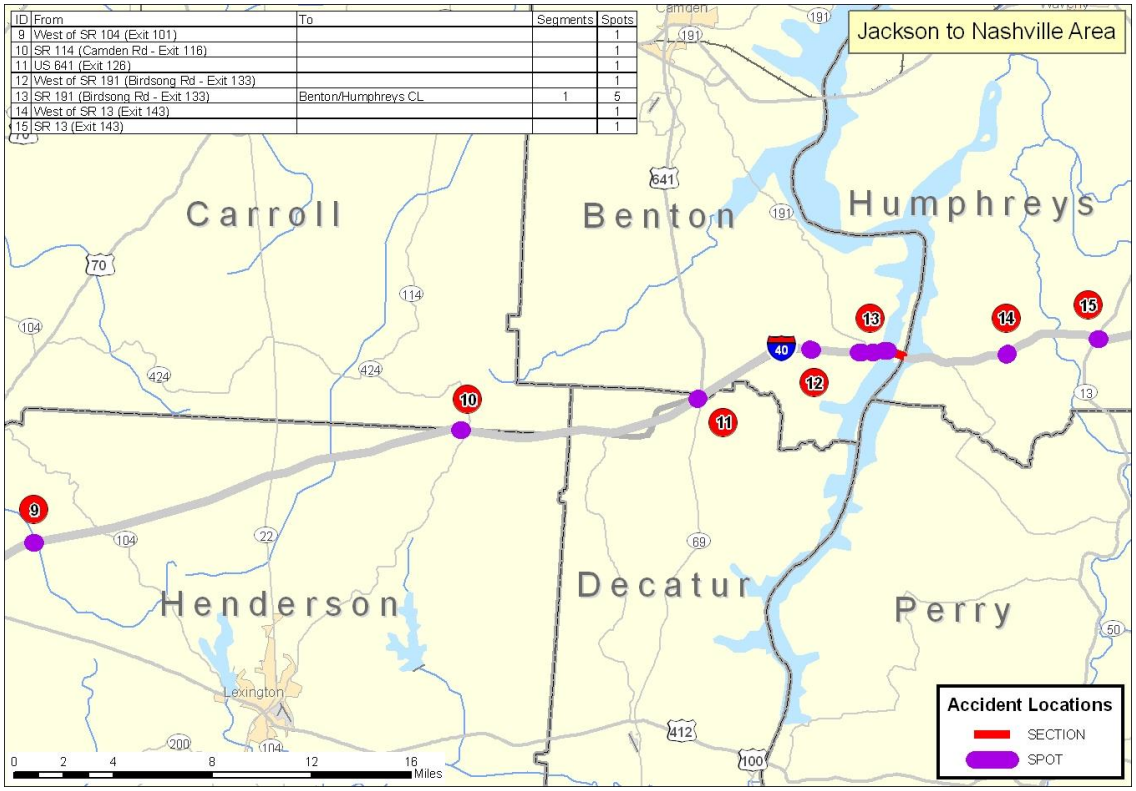


Figure 4.4: Dickson Critical Accident Locations

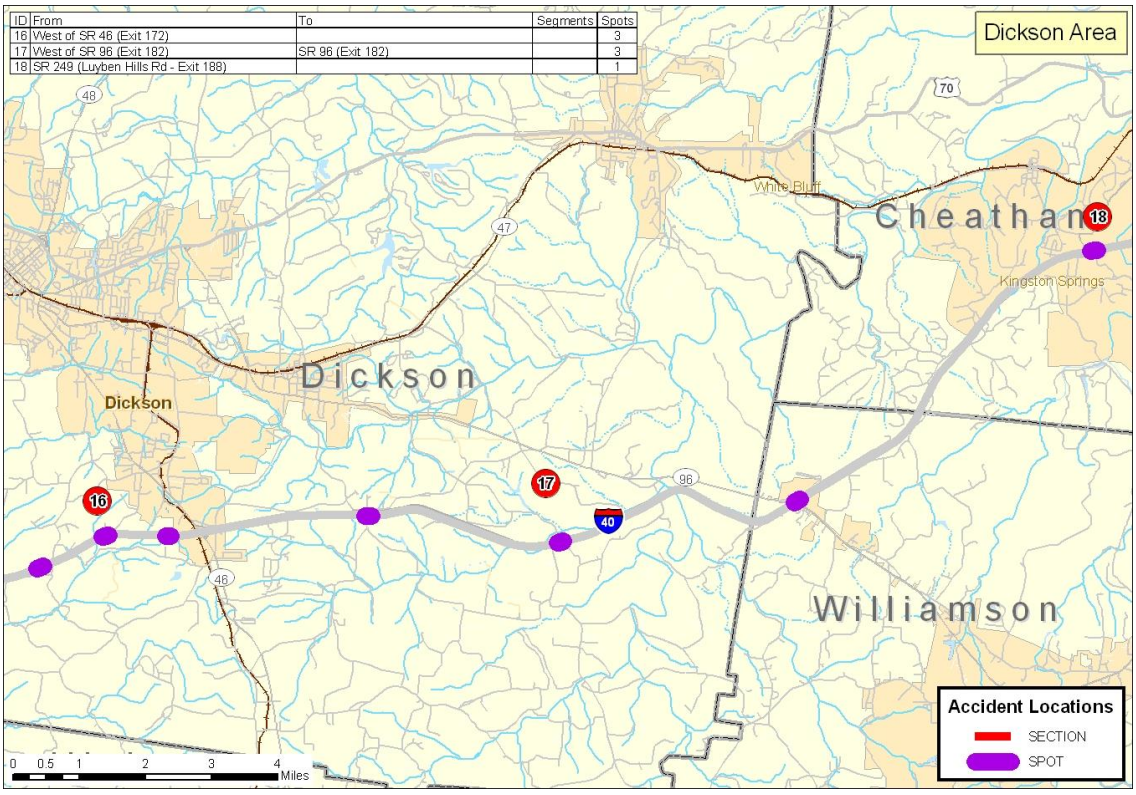


Figure 4.5: Nashville Critical Accident Locations

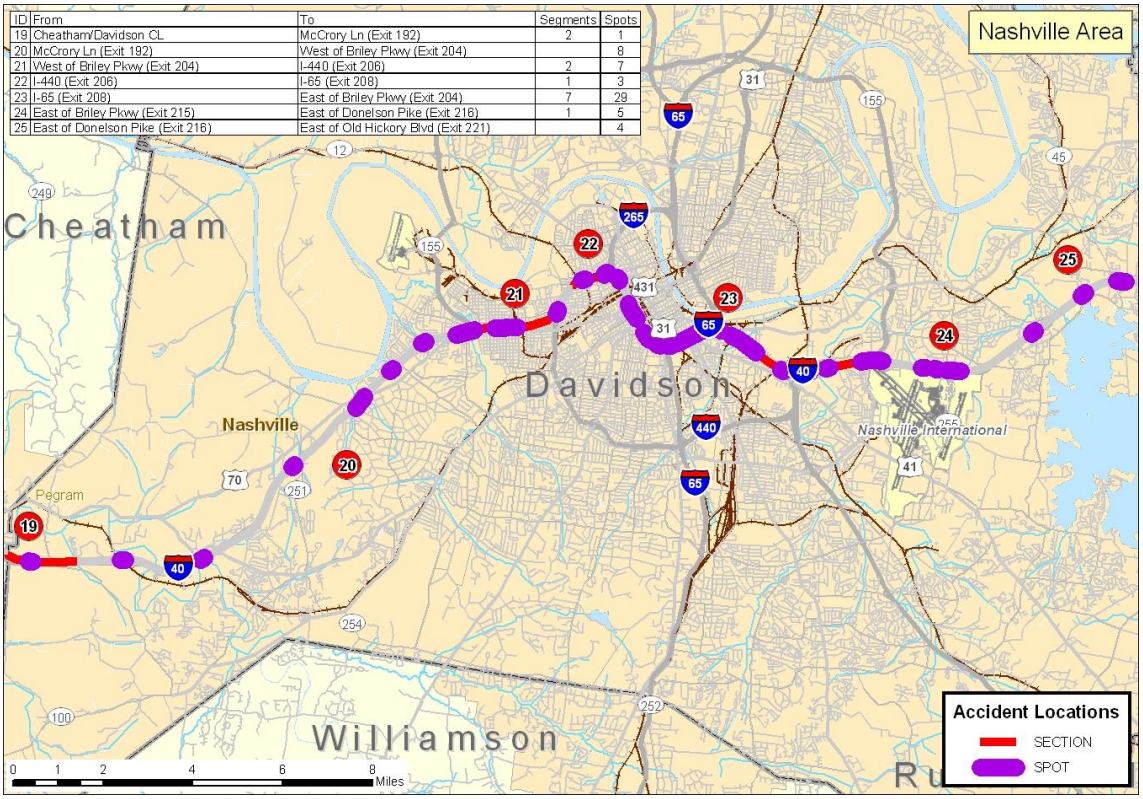


Figure 4.6: Lebanon to Gordonsville Critical Accident Locations

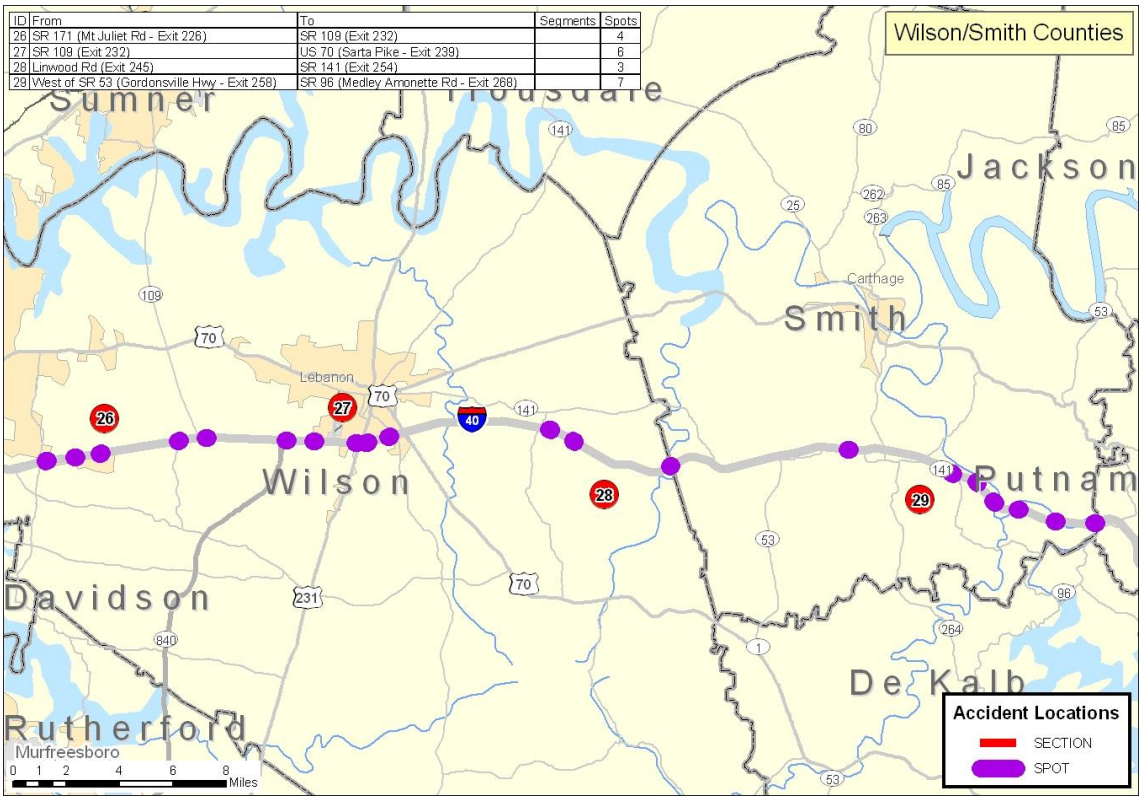


Figure 4.7: Cookeville to Crossville Critical Accident Locations

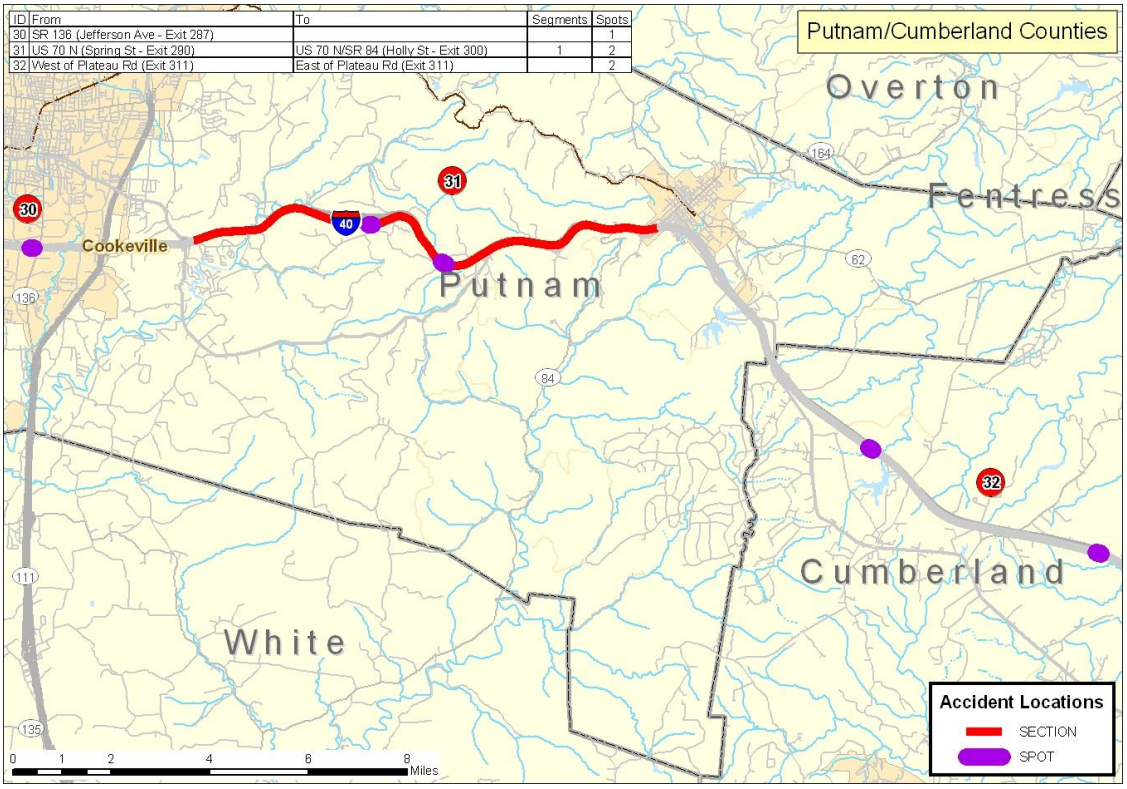


Figure 4.8: Crab Orchard to Oak Ridge Critical Accident Locations

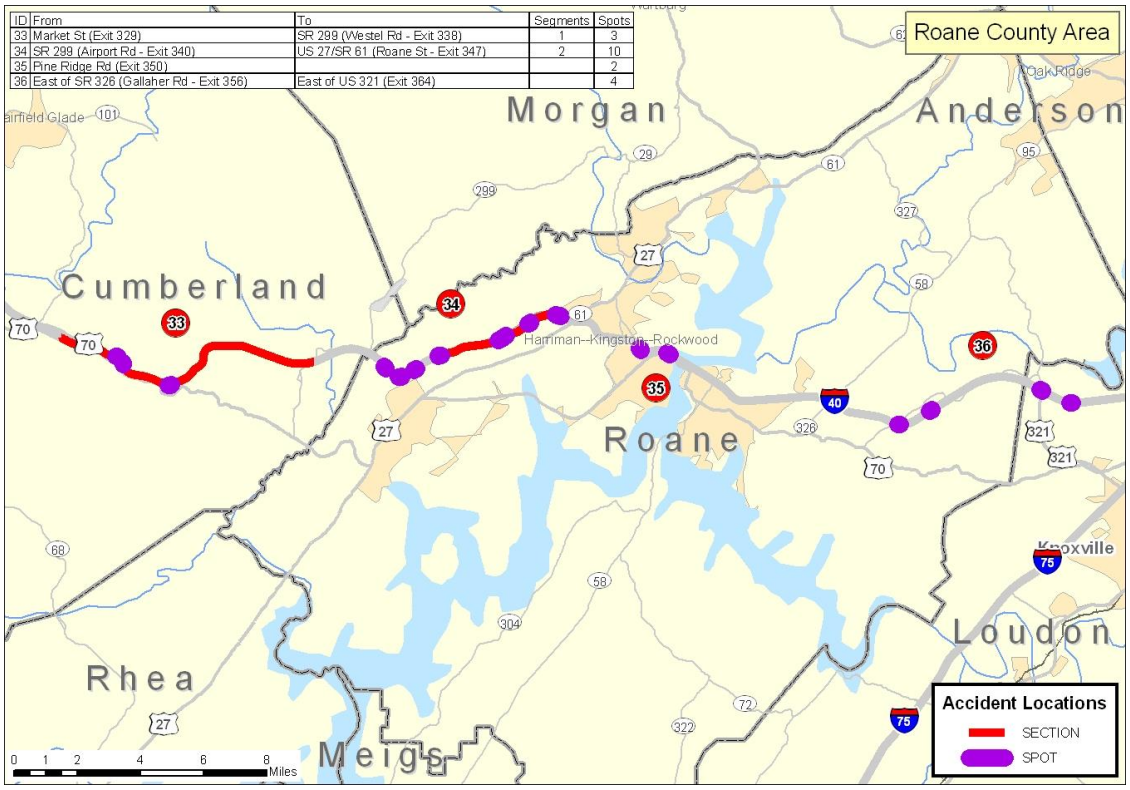


Figure 4.9: Knoxville Critical Accident Locations

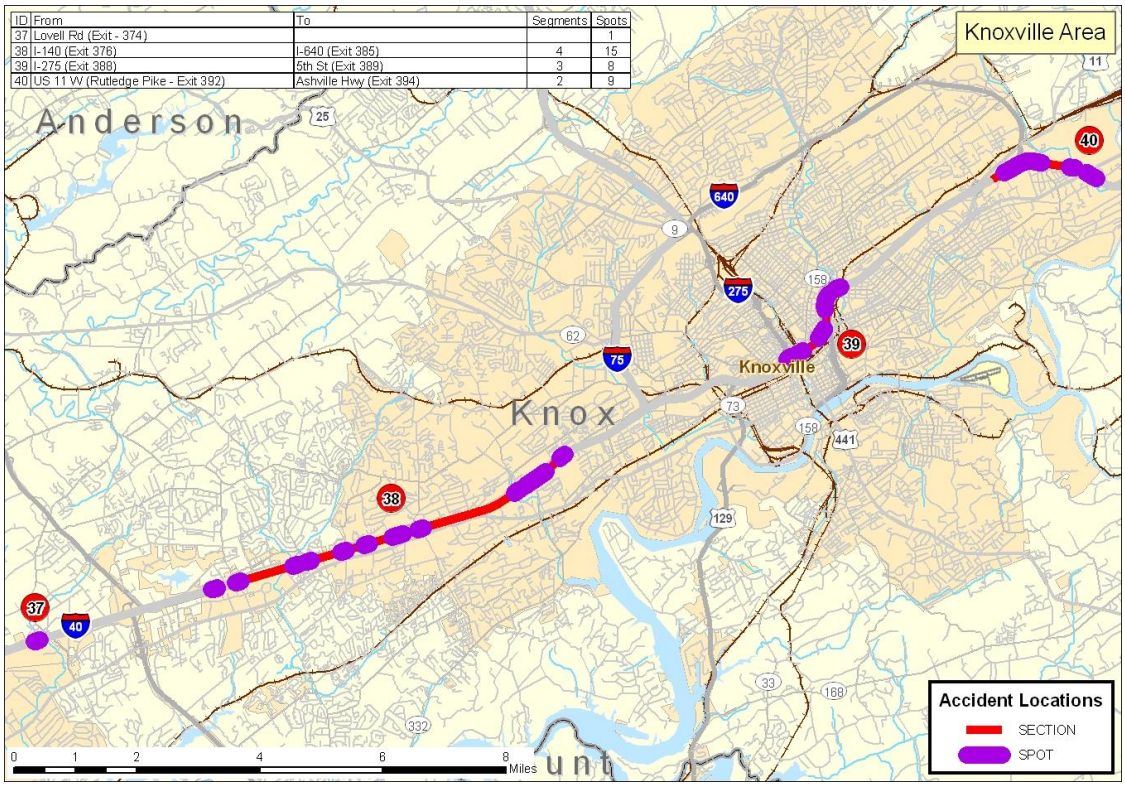


Figure 4.10: Sevierville to I-81 Critical Accident Locations

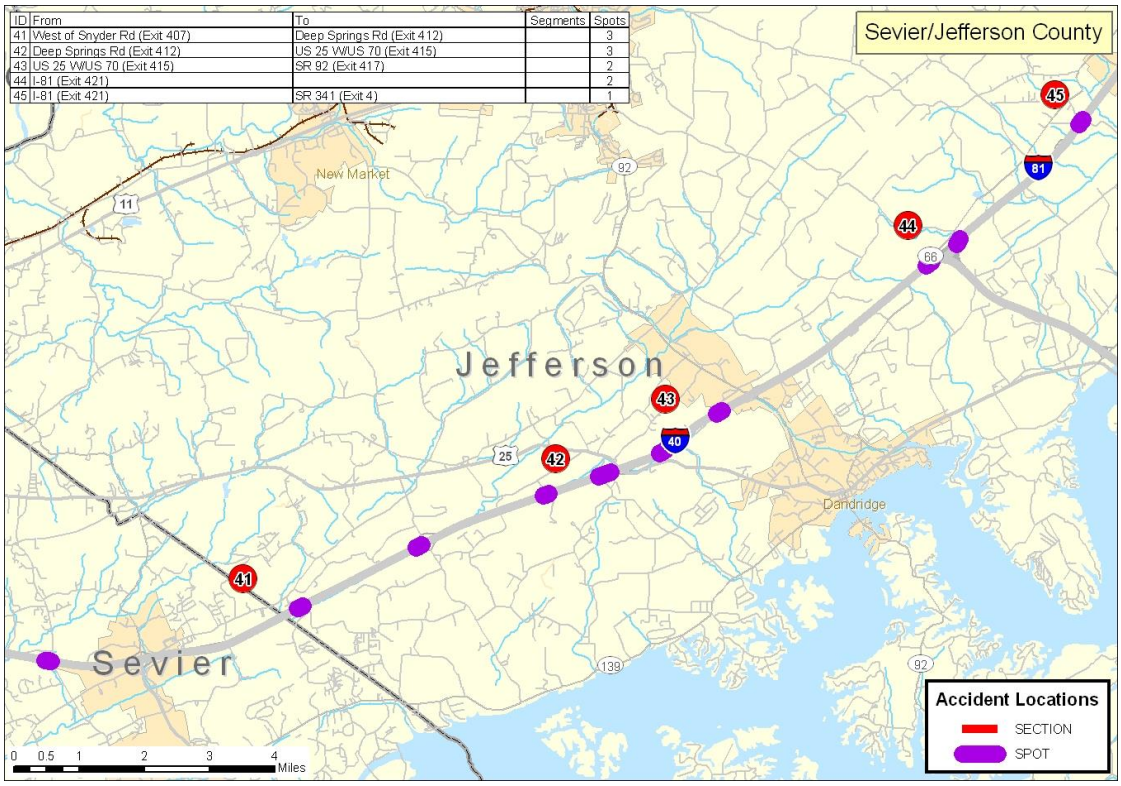


Figure 4.11: Green County Critical Accident Locations

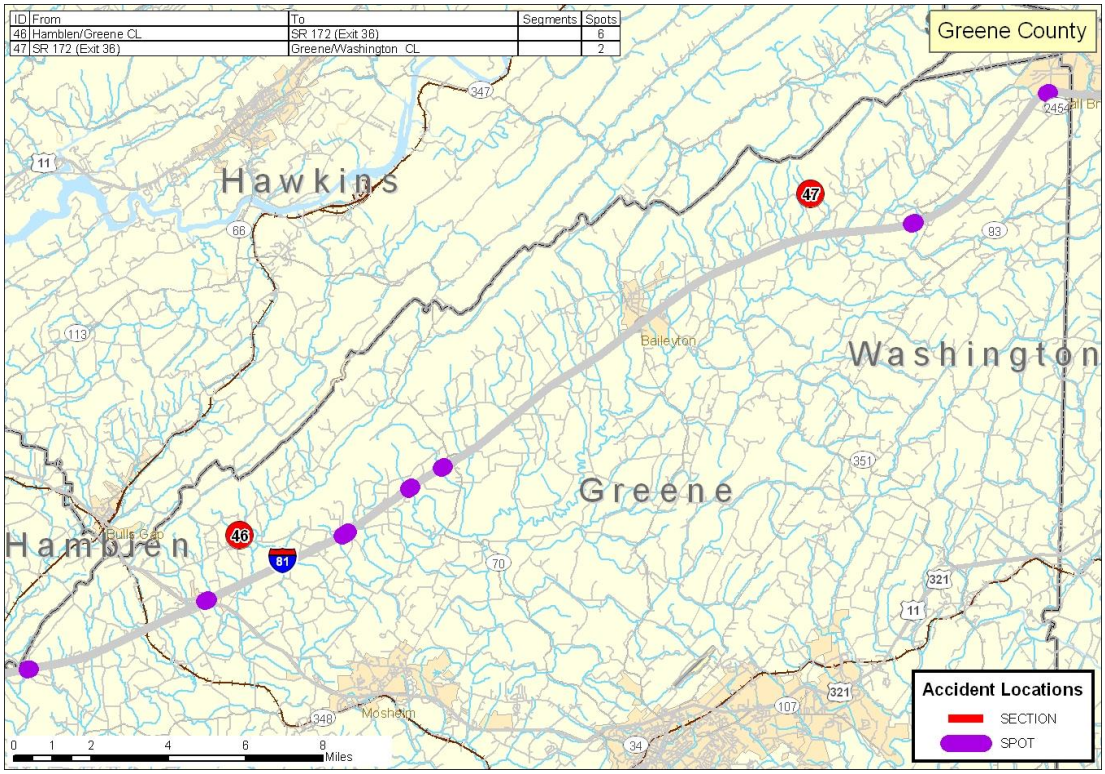
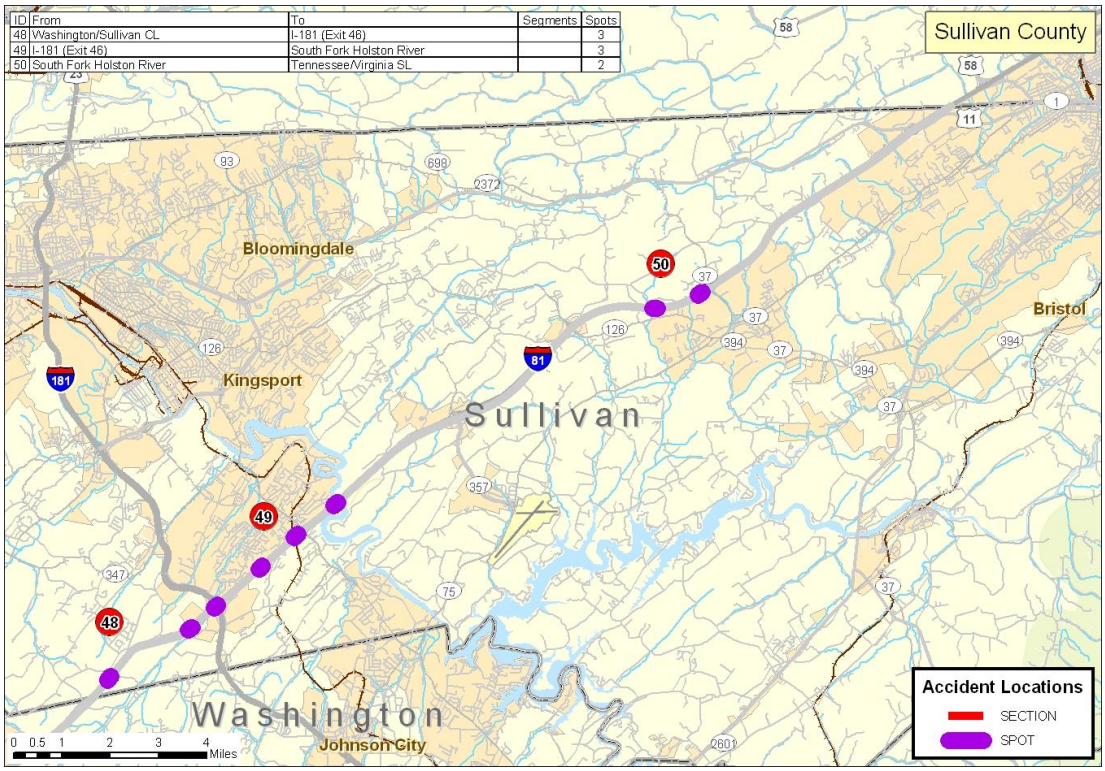


Figure 4.12: Sullivan County Critical Accident Locations



5.0 FREIGHT MOVEMENT AND DIVERSION

5.1 Truck Movement in Tennessee

There is a significant amount of information available about truck movement in Tennessee. This information is available from the statewide long range transportation plan, national freight databases and local truck data collection efforts. However, there is little information available specifically regarding truck movements along the I-40/I-81 corridor. TDOT developed a synthetic travel demand model to estimate truck activity throughout the state, and this model can also be used to make observations regarding the performance of the corridor. This section summarizes truck activity along the corridor using information provided by the statewide long range transportation plan and the statewide travel demand model.

5.1.1 Truck Issues in Tennessee Long Range Transportation Plan

The Tennessee Long Range Transportation Plan (LRTP) includes a chapter on modal needs which identified several statewide issues across each of the freight and passenger modes. Overall, trucks carry 74 percent of the total freight in the state, and the vast majority of the truck movement occurs on the interstate system. The LRTP reports that the interstate system represents 1.2 percent of the total road mileage in the state which can be contrasted with the estimate of 80 percent of the state's truck VMT traveling on the interstate system. On some rural interstate segments, trucks can be up to 30 to 40 percent of total daily traffic. Additionally, the vast majority of truck movements in Tennessee are through trips. All of these pieces of information stress the importance of the I-40/I-81 corridor in terms of moving freight across and through the state. This corridor is the sole east-west interstate system in the state and it routinely reports high volumes and percentages of trucks. This indicates that truck movements are likely a major cause of deficiencies in the corridor. Conversely, any deficiencies that are present on the corridor will have a disproportionately large impact on truck traffic.

5.1.2 Summary of Results on Statewide Travel Demand Model

A synthetic travel demand model was developed for the Tennessee LRTP that focused on the portion of the state highway system serving the rural and small areas. This model is discussed in more detail in a later section. However, the model output shows four key results related to truck travel discussed in the LRTP:

1. Truck freeway VMT is projected to increase by 129 percent between 2003 and 2030, more than twice as high as the 60 percent projected increase for total VMT. Therefore, issues related to trucks are likely to be more severe in the future.

2. The operational performance of the freeway system that trucks rely upon to deliver goods is decreasing. Average freeway speeds of the freeway system in the state are currently 66 miles per hour (mph) and projected to drop to 57 mph in 2030. Total freeway delay is projected to increase eight-fold between 2003 and 2030 (**Table 5-1**).

3. Intercity travel times are projected to increase between 16 to 34 percent along the I-40/I-81 corridor (**Table 5-2**). Because truck trips represent a disproportionately higher percent of the intercity trips, this will have a significant impact on truck travel times.

4. Approximately 74 percent of the system mileage on the I-40/I-81 corridor is projected to be LOS E or F in 2030 and another 16 percent of the corridor is projected to be at LOS D in 2030 (**Table 5-3**).

Table 5-1: Selected Synthetic Model Output

PARAMETER	2003 EXISTING NETWORK	2030 E+C NETWORK	% CHANGE
Avg. Freeway Equilibrium Speed	66.4	56.5	-14.9
Total Freeway Delay (Hours)	15,086	130,763	766.8
Truck Freeway Daily VMT	5,789,700	13,250,600	128.9
Truck Freeway Volume Per Lane Mile	1,980	4,560	130.3

Table 5-2: Tennessee Intercity Travel Times

ORIGIN-DESTINATION PAIR	2003 EXISTING NETWORK TRAVEL TIMES (Hrs:Mins)	2030 E+C NETWORK TRAVEL TIMES (Hrs:Mins)	% CHANGE
I-40: Memphis to Nashville	3:39	4:53	33.8
I-40: Nashville to Knoxville	3:13	4:01	24.9
I-40/I-81: Knoxville to Bristol	2:02	2:21	15.6

Table 5-3: Summary of 2030 I-40/I-81 Interstate Traffic Service

INTERSTATE SEGMENT	APPROXIMATE LENGTH (miles)	2030 TRAFFIC SERVICE FOR THE E+C NETWORK			
		LOS D		LOS E/F	
		Miles	% of Total	Miles	% of Total
I-40: Memphis to Nashville	149	38	26	95	64
I-40 Nashville to Knoxville	116	0	0	116	100
I-40/I-81 to North Carolina	32	8	25	24	75
I-81/I-40 Bristol to Knoxville	62	11	18	32	52
Total	359	57	16	267	74

Note: Segment lengths based on rural and small urban portions of the corridors.

5.2 Rail Issues and Studies in Tennessee

Freight rail has been studied extensively in Tennessee, primarily based on the potential to divert freight carried by trucks to be carried by rail, thereby alleviating demand for highway infrastructure in the state. In this section, we will summarize the information available regarding rail operations from the Tennessee LRTP, the Tennessee State Rail Plan, and a review of the State Rail Plan with a particular focus on the I-40/I-81 corridor.

5.2.1 Rail Operations Discussed in Tennessee LRTP

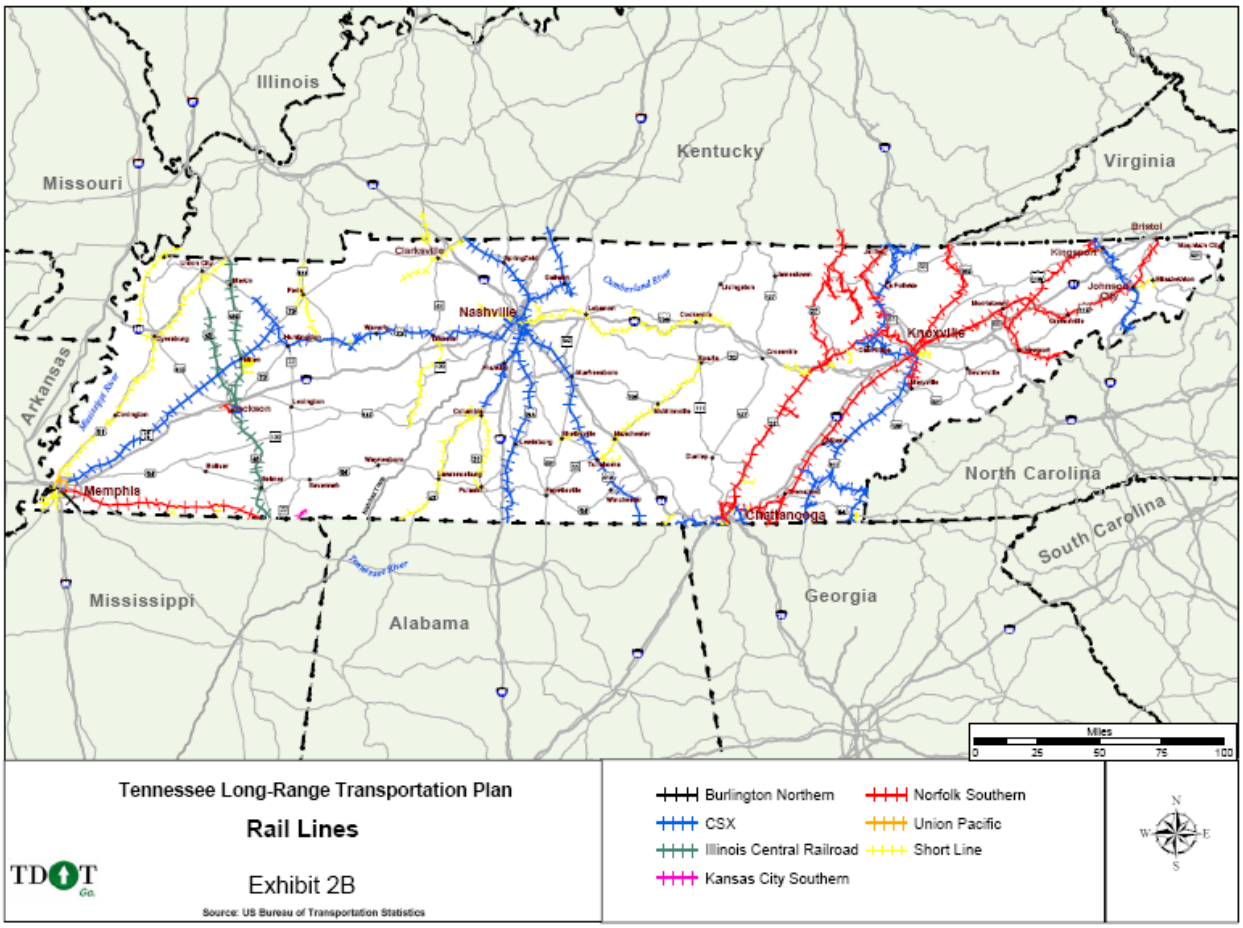
The LRTP documents that there are six Class I railroads operating on more than 2,335 miles of track in Tennessee. CSX and Norfolk Southern are the dominant carriers, with

85 percent of the Class I miles (Figure 5.1). There are also 19 shortline railroads providing service over branch lines and connecting to the Class I railroads. The shortline railroads operate more than 746 miles of track (roughly one-third the amount of the Class I railroads). In 1999, Class I railroads moved 57 million tons of freight (more than 1.9 million carloads). In 2001, shortline railroads shipped 4 million tons of freight (48,000 carloads). Most rail movements through the state occur in one of many north-south corridors. There is relatively limited east-west freight movement by rail. According to the LRTP, rail freight volumes are projected to increase by about 50 percent over current levels by 2030.

None of the Class I railroads report any height clearance or double stack train issues in Tennessee. The key system issue for Tennessee freight rail related to the I-40/I-81 corridor is that there is abandoned track between Nashville and Knoxville whose restoration would permit east-west intrastate and interstate rail movement. It should be noted that Norfolk Southern operates a line that extends southeast out of Memphis and connects to Knoxville via an alignment that runs east-west through Huntsville rather than through Tennessee. Therefore, there is east-west connectivity for the eastern and western ends of the state, but no east-west connectivity for Nashville.

The primary mainline capacity issues for the rail system are related to the movement of mining and agricultural products. Bulk rail cars for mining and agricultural products are now often loaded to 315,000 pounds and much of the rail infrastructure in Tennessee must be upgraded to accommodate this increased weight. This contrasts with typical intermodal containers which weigh much less than bulk rail cars due to the need for the containers to also be carried by trucks which are weight restricted to 80,000 pounds total or roughly 44,000 pounds per container. The Tennessee LRTP reports that there are some particular line segments that are important to intermodal and passenger movements, and these lines are experiencing capacity issues. These segments will be analyzed further in Task 2 of this study. Additionally, in the urban areas, the demand for commuter rail, either local or Amtrak, is creating scheduling demands on the Class I segments in those urban regions that may require additional main line track to be added.

Figure 5.1: Tennessee Rail Infrastructure



5.2.2 I-40/I-81 Corridor Rail Issues: Tennessee Rail System Plan

The *Tennessee Rail System Plan* analyzed the gap in Tennessee's east-west rail infrastructure between Nashville and Knoxville, over the Cumberland Plateau. The route that once connected these two cities has been abandoned. To restore east-west service between these two cities would require physically replacing rails between Algood (east of Nashville) and Oliver Springs (west of Knoxville). This has the potential to divert freight from truck to rail and reduce the number of trucks traveling on the I-40/I-81 corridor. Restoring rail service over the plateau would also allow for passenger rail service to be implemented.

The focus of the Rail Plan's analysis evaluated three competing Trans-Tennessee routings, including: (1) the existing (southern) alignment, (2) the existing alignment with improvements, and (3) the alternative (northern) alignment. The Rail Plan estimated that the cost of creating the southern alignment is relatively low, with a net present value of approximately $123 million. However, the route also operates with poor transit times, so that it does not compete well with alternative transportation infrastructures (both highway and rail). As a consequence, the estimated present value of the projected benefit stream is only $147 million, yielding a benefit-cost ratio of 1.19.

The analysis of the northern alignment includes the costs and benefits of both passenger and freight transport via the routing. Travel time reductions are large enough so that some portion of the existing I-40/I-81 truck traffic was considered to be divertible to the new rail

line. The analysis did not attempt to calculate the expected level of truck diversions from I-40. Instead it estimated benefits and costs based on diversion rates of between 5 and 40 percent. The northern alignment is considerably more expensive, with a present value of freight-only costs ranging between $1.2 and $1.5 billion, depending on traffic volumes. However, the present value of the savings attributable to the much more substantial northern alignment diversions ranged between $1.0 and $7.5 billion, so that the benefit-cost ratios ranged between 0.78 and 5.06. This is a considerably wide range for an estimate of benefit-cost ratios and indicates that further analysis is needed to refine variables and more accurately forecast the impact of the new alignment. Estimated benefits and costs for the southern alignment are shown in **Table 5-4**, while similar estimates for the northern alignment are shown in **Table 5-5**.

Table 5-4: Southern Alignment

ANNUAL BENEFITS AND COSTS	Thousands of 2001 Dollars
Benefits	
Impact on Shipping Costs	$5,779
Rail Operations Cost Differential	$31
Highway Maintenance Reduction	$1,741
Accident Savings	$93
Highway Congestion Savings	$1,123
State Fees/Revenues	$266
Total Benefits	$9,036
Costs	
Total Capital Costs	$118,042
Freight O&M Costs	$541
Total Costs	$118,583
Benefit-Cost Analysis	
NPV Benefits	$147,357
NPV Costs	$124,335
Total NPV	$23,021
Benefit-Cost Ratio	1.19

Source: Tennessee Rail System Plan

Table 5-5: Northern Alignment

ANNUAL BENEFITS AND COSTS	DIVERSIONS		
	5% for hire, 2.5% for private truck	20% for hire, 10% for private truck	40% for hire, 20% for private truck
Benefits (thousands of 2002 dollars)			
Impact on Shipping Costs	$43,945	$175,778	$351,557
Rail Operations Cost Differential	$31	$31	$31
Highway Maintenance Reduction	$7,118	$28,474	$56,955
Accident Savings	$381	$1,523	$3,046
Highway Congestion Savings	$4,197	$16,787	$33,579

State Fees/Revenues	$4,047	$6,944	$10,807
Total Benefits	$59,179	$229,538	$455,975
Costs (thousands of 2002 dollars)			
Capital Costs	$841,989	$841,989	$841,989
Freight O&M Cost	$495	$10,558	$18,236
Total Costs	$842,485	$852,548	$860,225
Benefit-Cost Caculation (thousands of 2002 dollars)			
NPV Benefits	$979,565	$3,765,460	$7,480,055
NPV Costs	$1,259,422	$1,352,641	$1,476,952
Total NPV	$-279,858	$2,412,819	$6,003,104
Benefit-Cost Ratio	0.78	2.78	5.06

Source: Tennessee Rail System Plan

The Rail System Plan concluded that the Trans-Tennessee corridor was not feasible. This conclusion was made on the basis that most truck movements on Tennessee's interstates were from through trips. No foreseeable rail improvements could be implemented on facilities inside Tennessee that could produce enough commodity diversion to significantly improve operating conditions on the interstate system. The plan further concluded that if comprehensive national, regional, or multi-state rail system initiatives became available in the future, rail network improvements inside Tennessee may become more effective for diverting freight from the highway network. With an improved national network, the study indicates that resulting freight diversions would likely preserve interstate system capacity for somewhere between one to five years.

5.2.3 I-40/I-81 Corridor Rail Issues: University of Tennessee Evaluation

The University of Tennessee Center for Business and Economic Research (CBER) studied rail options in the state documented in a report titled "An Evaluation of the Tennessee Rail Plan's Treatment of the Trans-Tennessee Rail Routing." This study utilized freight networks, network improvements, underlying assumptions, and analytical methods that were different than those used within the Tennessee Rail System Plan analysis. These assumptions included the following:

- Network improvements across Tennessee, Virginia and Pennsylvania along a route that roughly parallels I-81, and in Virginia between Lynchburg and Norfolk.
- Traffic can only enter or leave the rail network at locations where there are currently mechanized intermodal facilities (with the exception that the study team simulated the availability of intermodal services at a facility located at or near Knoxville at TDOT's request).
- Investments in track and signals would make it possible to provide truck-competitive levels of service to the rail lines being studied (similar to Tennessee Rail System Plan).
- Only traffic that moves to and from counties where intermodal facilities exist (or contiguous counties) is treated as divertible.
- Competing route alternatives will not change from the base year to 2030.

- Container traffic will continue to grow at 8 percent annually through 2030.

The CBER analysis estimated cost savings attributable to moving highway traffic to rail and savings to current intermodal shipments that could be moved at lower costs. The savings summarized in **Table 5-6** are based on a time horizon that spans between 2015 and 2039, with construction commencing in 2010. Benefits are discounted using two alternative inflation-adjusted discount rates of 3 and 7 percent. The CBER study also re-estimates the "external" benefits that would likely accrue to the more general population. These include improvements in air quality, less highway congestion, fewer accidents, and reduced pavement costs.

Table 5-6: CBER Estimates of Trans-Tennessee Corridor Savings and Benefits

SOURCES	Average Unit Savings	Average Annual Savings	Present Value (Thousands of 2002 Dollars)	
			3% Discount Rate	7% Discount Rate
Tennessee Intermodal Traffic	$120	139,904	$239,808	$99,738
Truck-to-Rail Diversions	759	96,391	$620,693	$258,150
Non-Tennessee Intermodal	12	2,002,127	$313,849	$130,532
TOTAL			$1,174,350	$488,420
SOURCES OF EXTERNAL BENEFITS			**Present Value (Thousands of 2002 Dollars)**	
			3% Discount Rate	**Average Unit Savings**
Reduced Noise Pollution			$2,650	$1,102
Improved Air Quality			$16,901	$7,029
Reduced Congestion Cost			$21,292	$8,855
Reduced Pavement Maintenance			$72,559	$30,177
Reduced Crash Costs			$3,942	$1,640
TOTAL			$117,344	$48,803

Source: Tennessee Rail System Plan

The CBER study reports that while the methodologies and networks vary considerably between its study and the Tennessee Rail System Plan, the findings do not differ substantially. However, there are still several conclusions from the CBER research as follows:

- The inclusion of a Knoxville facility heavily influences the amount of truck-to-rail diversion.

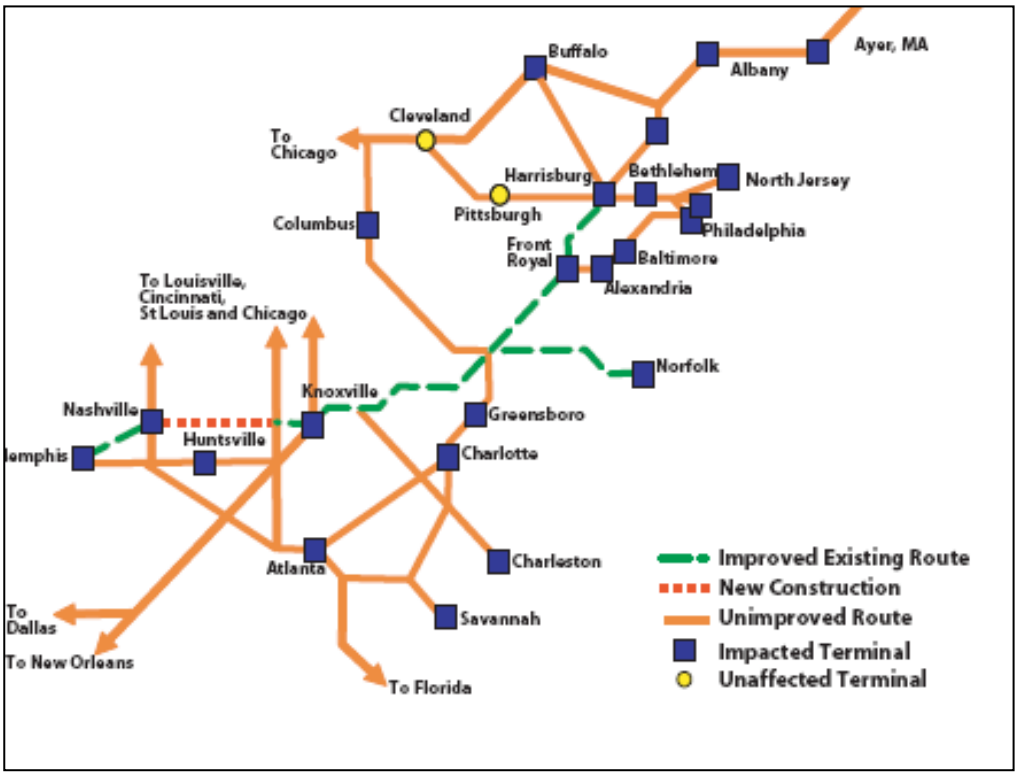
- Both the benefits accrued in Knoxville and the benefits accrued in Memphis are attainable via an infrastructure alternative, involving the improvement of the existing NS routing between Knoxville and Memphis.

- The rail lines in Virginia and North Carolina must also undergo significant improvements to make the Trans-Tennessee routing viable (**Figure 5.2**).

- To successfully divert truck traffic, rail service quality must be comparable to truck service quality. This level of service is best captured on the northern alignment and further consideration of a Trans-Tennessee routing should focus exclusively on this alignment.

The final conclusion of the study is that given foreseeable freight flows, the necessity of the Trans-Tennessee routing is not eminent. However, the study stated that the project's future utility may turn out to be quite high and policymakers would be well-advised to preserve the opportunity to pursue the Trans-Tennessee rail routing at some future date.

Figure 5.2: Schematic of Rail Network and Improvements in CBER Research



Source: *An Evaluation of the Tennessee Rail Plan's Treatment of the Trans-Tennessee Rail Routing.*

5.3 Tennessee Freight Model Capabilities

As part of the technical analysis of the 2030 Tennessee LRTP, a statewide freight model was developed to better understand how freight is shipped across the state. The functional capabilities of the model include the ability to analyze both truck and rail. The model

operates using county-level freight flows within Tennessee based on a 2001 TRANSEARCH database produced by Reebie Associates (now part of Global Insights) for over 700 commodities based on three- and four-digit Standard Transportation Commodity Codes. Freight flows outside of Tennessee were based on geographic regions of business economic areas, state, census region, border crossing location or port. There is no mode choice mechanism in the Statewide Freight model. Therefore, the amount of goods shipped by truck and rail will not change in response to changes in the assumptions of future modal networks.

The model is designed to estimate intercity and statewide freight moves not intra-city freight moves. The commodity flow trip table in the model is a 120-by-120 interchange matrix with 95 Tennessee counties and 25 regions outside Tennessee. To be consistent with the statewide synthetic model, this table was disaggregated into a 1397-by-1397 zonal trip table based on employment shares. This disaggregated trip table was assigned by TransCAD onto the synthetic model's highway network. Final truck trip tables were reformulated based on comments from TDOT staff and an origin-destination matrix estimator (ODME) function within TransCAD so that the model truck volume output most closely matched with truck count data in TRIMS. These truck trip tables were further refined based on commodity-specific payload and percentage empty estimates. Annual truck trips were converted to daily truck trips based on a conversion factor of 300. Validation was based on a VMT comparison between ground counts and assigned truck volumes along with a reasonability check with the Federal Highway Administration Freight Analysis Framework data.

The truck component of the model estimated 10 percent more VMT for the state than the count data indicate (14.3 million truck VMT compared to 13.1 million truck VMT). This was considered sufficient to validate the total model, but it was also validated by comparing truck VMT between the 4 TDOT zones. A corridor specific analysis of the model output shows that the model estimated that 45 percent of the truck VMT in the state was on I-40 which is sufficiently close to the 44 percent of truck VMT on I-40 that is estimated using truck counts. This indicates that the model is adequate in estimating aggregate truck activity on I-40. On I-81, the model seems to overestimate truck VMT slightly by estimating that 8 percent of the state truck VMT is on I-81, while the truck counts indicate that only 6 percent of the statewide truck VMT is on I-81. While this is acceptable for a statewide model, it will be kept in consideration as the model is used to estimate truck activity on the I-81 porttion of the corridor.

Similarly, rail flows were disaggregated to a 44-zone network and assigned to a national rail network using TransCAD. All counties were connected to the rail network by model access links even though not every county has direct rail service with the assumption that each county can be served by rail spurs. The rationale for developing these links is not specified, but it is likely related to the necessity to route all rail flows, even those in counties with no rail lines. Additionally, it is possible that these links were developed to incorporate the possibility of intermodal service used to connect the freight with the larger rail network.

To forecast freight flows to the year 2030, freight volume was correlated to employment with the incorporation of sector-specific worker productivity factors developed based on historical data captured by the Bureau of Labor Statistics. This allowed for freight to be estimated based on forecasts of employment in each county developed for the LRTP based on input-output tables maintained by the U.S. Department of Commerce. Truck and rail commodity flow tables were then developed using a frataring process for each zone and commodity group. The frataring process is used to balance the number and location of trip ends such

that each zone has the same number of vehicles attracted and produced over the course of a day. The 2030 model output indicates that through truck trips are the fastest growing of all truck trip types with a 125 percent growth between 2003 and 2030. Internal truck trips are the slowest growing truck trip type with an 81 percent growth during the same time period. Overall, truck VMT is forecast to virtually double between 2003 and 2030. Statistics were not provided specifically for truck VMT on the I-40/I-81 corridor in the model report.

5.4 Freight Issues and Studies in Tennessee MPO Plans

As part of their regular LRTP updates, MPOs identify and prioritize their transportation needs for the 20-year planning period. MPO LRTPs and Long-Range Freight Plans were reviewed for planned freight improvements along the I-40/I-81 corridor.

5.4.1 Knoxville Freight Plan

The Knoxville Regional Transportation Planning Organization is the Transportation Planning Organization for the Knoxville Urban Area, defined by the urbanized areas of Knox, Blount, Loundon, and Sevier Counties. Currently, a separate plan for freight and goods movement in the Knoxville region does not exist. The LRTP provides some background and identifies the existing freight industry in the region. The Knoxville Regional TPO is currently developing a Regional Freight Movement Plan, which is expected to be complete in Spring 2007.

Roadways

Major highways in the Knoxville Region include I-40, I-75, I-81, and I-640. Existing and committed roadway projects along the I-40/I-81 corridor in the Knoxville Region include the widening of sections of I-40 in Knoxville from the West Hills Interchange to Papermill Dr Interchange. Trucking accounts for over 30 percent of the average daily traffic on portions of the rural interstate in the Knoxville Region.

Railways

Norfolk Southern (NS) and CSX Transportation (CSX) are the Class I railroads in the Knoxville region. The Knoxville & Holton River Railroad (K&HR) Company operates rail spur connections from NS railroad tracks near the University of Tennessee to the Forks of River Industrial Park.

McGhee Tyson Airport

The Air Cargo Complex at McGhee Tyson Airport in Blount County serves the majority of air cargo and commercial passenger aviation in the region. The Gatlinburg/Pigeon Forge Airport also handles a small amount of air cargo operations.

Tennessee River System

The Tennessee Valley Authority's (TVA) system of dams and locks make commercial navigation of the Tennessee River System possible. Fort Loudon and Melton Hill Locks are major facilities in the region. The Fort Loudon Terminal Company south of the Fort Loudon Dam handles the transfer of bulk goods between barge, rail, and truck. The Tellico Public Use Terminal handles barge to truck or truck to barge transfers on Tellico Lake.

Pipeline

National pipelines controlled by Colonial Pipeline Company, Plantation Pipeline Company, and Shell Pipeline Company transport petroleum products from refineries located along the Gulf of Mexico to terminals located on Middlebrook Pike in the City of Knoxville.

Intermodal Facilities

Currently there are no classified intermodal facilities in the Knoxville Region.

5.4.2 Nashville Freight Plan

The Nashville Area Regional Freight and Goods Movement Study, December 2004 was conducted by the Nashville Area Metropolitan Planning Organization (NAMPO) to institutionalize freight needs into the NAMPO planning process. Freight related strategies, policies, and projects specific to the I-40 corridor in the Nashville area (including Davidson, Rutherford, Sumner, Wilson, and Williamson Counties) are presented in this section. Highway, rail, air, and barge facilities are readily available in the Nashville area, making it a major hub for distribution.

Roadways

There are three major interstate highways in the Nashville area: I-40, I-24, and I-65. About two-thirds of truck traffic in this area is estimated to be pass-through traffic.

Railways

The NAMPO area is served by only one Class I railroad, CSX Transportation, and its affiliated intermodal unit. At this time, there is no rail line east from Nashville to Knoxville competing with the I-40 corridor for which a major freight function is to feed into I-81. Two shortline railways, the Nashville & Eastern and the Nashville and Western, also serve the NAMPO area. Recently, a short section of track between Nashville and Lebanon has been improved to Class I service as part of the Nashville Star commuter rail line development.

Nashville International Airport

The Nashville Air Cargo Link all-cargo complex provides cargo connections to meet high speed transportation needs of area industries. Due to the proximity of UPS and FedEx air facility hubs in nearby cities, potential air shipments are transported by truck from Nashville via I-65 to the north and I-40 to the west.

Cumberland River Barges

The Cumberland River waterway is navigable by barge from Nashville east to Celina and downriver to the American heartland and the Gulf of Mexico.

5.4.3 Memphis Long Range Transportation Plan

The Memphis Area MPO includes Shelby County, Tennessee and northern DeSoto County, Mississippi. The Memphis area includes the intersection of I-40 and I-55, five Class I freight railroads, the Memphis International Airport, and the International Port of Memphis. Together, the combination of these modes allow for efficient movement of goods through Memphis to other areas of the United States. The 2003-2026 Long-Range Transportation Plan (LRTP) adopted in March 2004 includes a section on long-range freight planning - encouraging growth in freight transportation and facilities improvements in the Memphis MPO area. These are described below.

Roadways

I-40 is one of three major interstates currently serving the Memphis area. I-40 converges with I-55 and I-240 in the Memphis area, allowing the area to serve as a hub for truck freight movement. In addition, construction of proposed I-69 and I-269 through the Memphis area would provide additional corridors facilitating international freight movement between Canada and Mexico. The 2026 LRTP identified projects to relieve congestion along I-240, I-55, and US-78 and associated feeder roads and interchanges as well as construction of I-69/269 through the MPO area. Specific roadway improvements on I-40 were not identified.

Railways

Five Class 1 freight railroads: the Burlington Northern Santa Fe (BNSF), Union Pacific (UP), Canadian National (CN), Norfolk Southern (NS), and CSX Transportation (CSX) each operate intermodal terminals in and provide service to the Memphis MPO area. Amtrak also operates passenger service from Chicago to New Orleans along the CN tracks. The UP main tracks run parallel to the I-40 corridor west of Memphis to Ebony, Arkansas. East of Memphis, the CSX main tracks run parallel to the I-40 corridor through Shelby County and into Brownsville.

The 2026 LRTP identified major railway congestion points in the Memphis area including the IC Crossing south of Downtown and the KC Junction southeast of Downtown. Railroad capacity issues resulting from the growth of containerized freight and limitations in the effective transfer of containers were also identified in the 2026 LRTP. To address these capacity issues, development agreements have been made for the Memphis Intermodal Terminal, a $25 million state-of-the-art intermodal facility funded by CN and CSX. BNSF is also planning to modernize and expand its operations at the Tennessee Yard or construct a new facility of its current operation in the State.

Highway projects in the area improving access for truck-to-rail movements as well as rail employees and service vehicles were identified. Among these are major roadway projects along I-55 and US-78 and construction of I-69. Rail overpass projects along the BNSF and CN lines as well as the construction of the Germantown Road overpass over CSX in Bartlett were also identified in the 2026 LRTP.

Memphis International Airport

The Memphis International Airport handles over three million metric tons of cargo annually. The airport is home to the FedEx Corporation whose sorting activity handles more than 95 percent of the airport's total cargo tonnage. To address congestion and accessibility issues resulting from future growth in air cargo and passenger enplanements at the Memphis International Airport, the 2026 LRTP identified projects along I-240, I-55, and the proposed I-69.

International Port of Memphis (IPM)

One of the largest inland ports in the United States, the International Port of Memphis (IPM) includes the Tennessee and Arkansas sides of the Mississippi River from River Mile 725 to River Mile 740. A direct pipeline carries jet fuel from the Premcor petroleum refinery located under IPM jurisdiction to the Memphis International Airport. Major issues impacting IPM include access for industries on President's Island and increasing competition for space along waterways. Improvements to I-55 and local access points to the IPM were identified in the 2026 LRTP to alleviate access issues.

Intermodal Facilities

The 2026 LRTP identified intermodal projects along I-69 and I-269, the Memphis Intermodal Terminal, Shelby Drive, and the Third Bridge.

5.5 Freight Issues and Plans in Neighboring States

As part of the Tennessee LRTP, TDOT conducted an external state survey to collect information on transportation planning efforts underway and recently completed with each of its eight bordering states. This survey was distributed to state planning officials in each state as well as to bordering MPOs and to the Fort Campbell military installation. It addressed topics including current, pending, and planned projects relating to highways, transit, ITS and 511 services, public transportation, bicycle facilities, railroads, waterways, toll roads and public/private partnership projects. Virginia borders Tennessee along the I-81 corridor and Arkansas borders Tennessee along the western end of the I-40 corridor, so these two states are most important for this corridor study

The Virginia DOT is widening I-81 from Bristol to six lanes. Virginia is studying dedicated truck lanes and project options to divert some freight to rail such as a possible rail line in conjunction with I-81. The Virginia DOT is also considering tolls for trucks along I-81 as part of the NEPA study for this corridor. There are plans to develop an intermodal (train/truck) terminal in an industrial park just north up to I-77/I-81. The Heartland Corridor initiative proposes the expansion of a major rail freight corridor stretching from Norfolk to Chicago and constructing an intermodal transfer facility adjacent to I-81 to alleviate congestion. Norfolk International Terminals and the Virginia Port Authority are planning expansion and significant growth in the amount of freight that their facilities will be able to accommodate. Much of the truck and rail traffic from these facilities ends up on the Tennessee truck and rail network. However, no study has been conducted to estimate the volume of these trucks.

The Arkansas DOT is investigating a third river crossing in the Memphis area (south of the existing crossings) to connect to either Mississippi or Tennessee off of I-55 and potentially connect to I-69, and is considering multimodal corridor features. A toll bridge from Osceola to Millington, Tennessee, is also being considered. Tolling is also being considered for construction of the Bella Vista Bypass (Highway 71/Future Interstate 49) in northwest Arkansas. Intermodal facilities are being planned at Russellville, Van Buren and just outside of Monticello which are all near the Tennessee border. The West Memphis airport plans an additional runway which will increase air cargo emanating from this facility.

6.0 ECONOMIC ACCESS

The need for additional access to I-40 and I-81 was identified from a review of the LRTPs from the urban areas in the study corridor. This chapter also includes new interchanges based on Interchange Justification Studies (IJS) prepared by TDOT staff.

Table 6-1 lists the new interchanges or interchange improvements identified to increase access to areas along the study corridor. **Figure 6.1** to **Figure 6.3** show the location of these proposed interchange projects on I-40 and I-81.

Table 6-1: New Interchanges or Interchange Improvements for Economic Access

PROJECT	SOURCE	HORIZON YEAR	NOTES
1) I-40 at SR 196 (Hickory White Rd)	Memphis LRTP, TDOT IJS		
2) I-40 at Central Pike	Nashville LRTP	2016	Access to developing area of Mt. Juliet
3) I-40 at Beckwith Lane	Nashville LRTP, TDOT IJS	2006	Access to developing area of Mt. Juliet
4) I-40 at Mine Lick Creek Rd	TDOT IJS	2009	
5) I-40 at Buttermilk Rd	TDOT IJS		Access to future industrial park

Figure 6.1: Memphis Area Economic Access Improvements

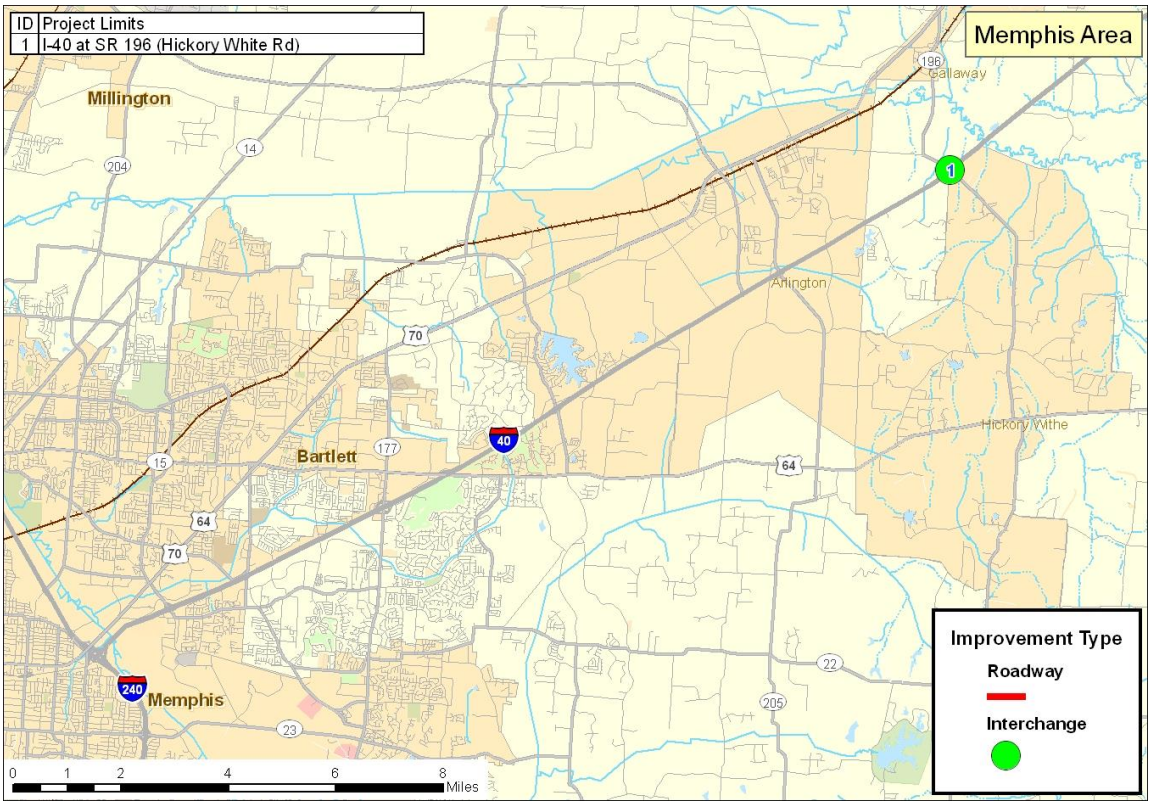


Figure 6.2: Nashville Area Economic Access Improvements

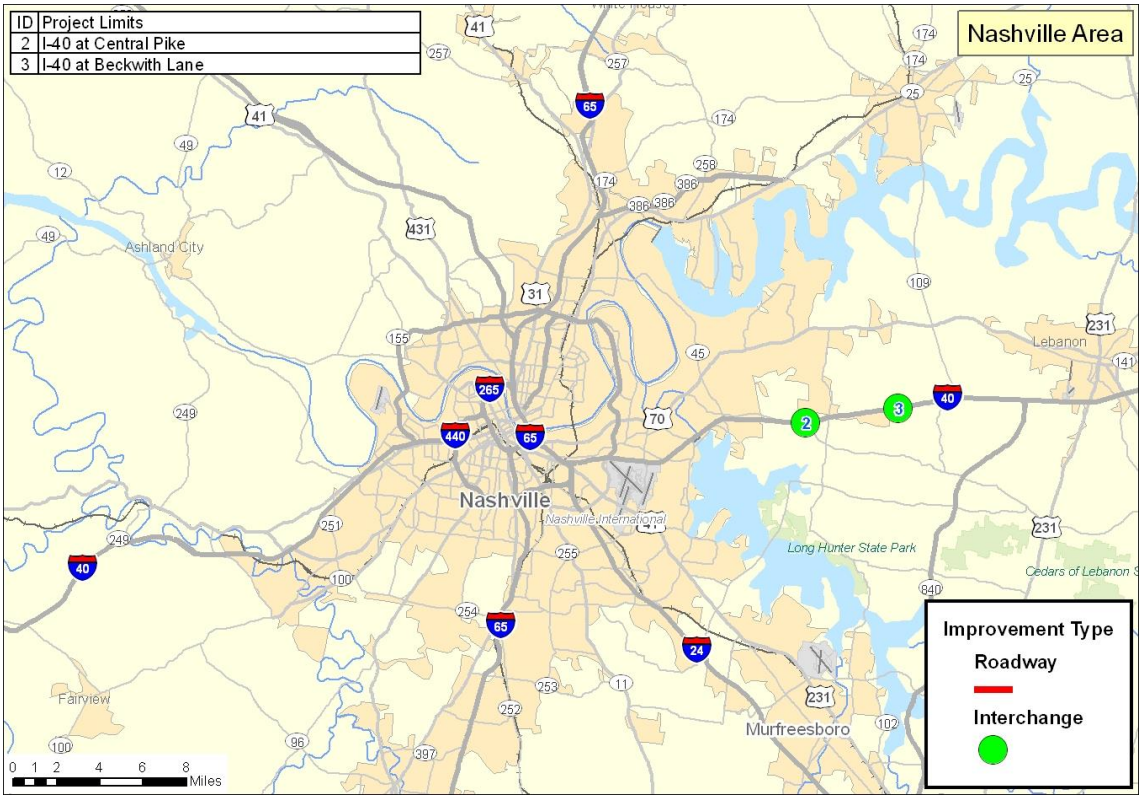
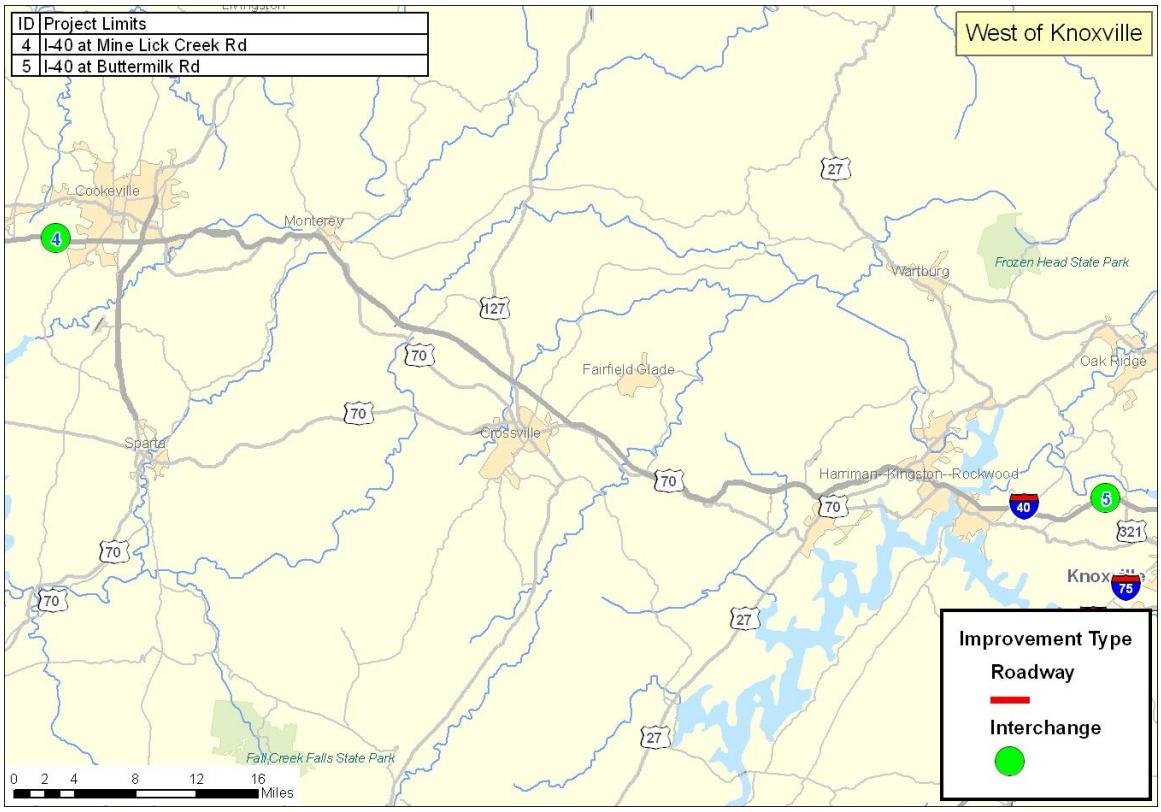


Figure 6.3: West of Knoxville Area Economic Access Improvements



7.0 COMMUTER PATTERNS

Commuting patterns were reviewed using 2000 Census data from the Census Transportation Planning Package (CTPP) for each metropolitan planning organization (MPO) along the I-40 corridor. Commuter sheds were created for each MPO area based on likely travel routes to the central business district (CBD). The commuter sheds were developed in an attempt to isolate areas that have residence that would typically use I-40 as part of their commuting route to the metropolitan areas CBD.

It was assumed that residences living relatively close to the CBD would be less likely to use the interstate system. This area was defined as the central area. A CBD was defined within the central area as a major destination point for commuters. Other major destination points may exist; however, the CBD was considered the most likely candidate for considering improvements to alternative modes of transportation or providing incentives for car pooling.

Existing and proposed park-and-ride facilities within a five-mile radius of existing interchanges were identified within each metropolitan area. In some areas, the regional long-range transportation plan designated funding for future park-and-ride facilities, but specific locations of these lots have not been established.

7.1 Memphis

The Memphis MPO includes the City of Memphis and Shelby County. The Memphis MPO region was divided into four general commuter sheds: North: I-40, East: I-40, South, and Central **(**

Figure 7.1). It was assumed that most commuters traveling from the North and East commuter sheds would potentially use I-40 as part of their commuter route to the CBD. The South commuter shed area would more likely use I-55 and I-240 to reach the CBD. It is assumed that those living in the Central area would use local routes.

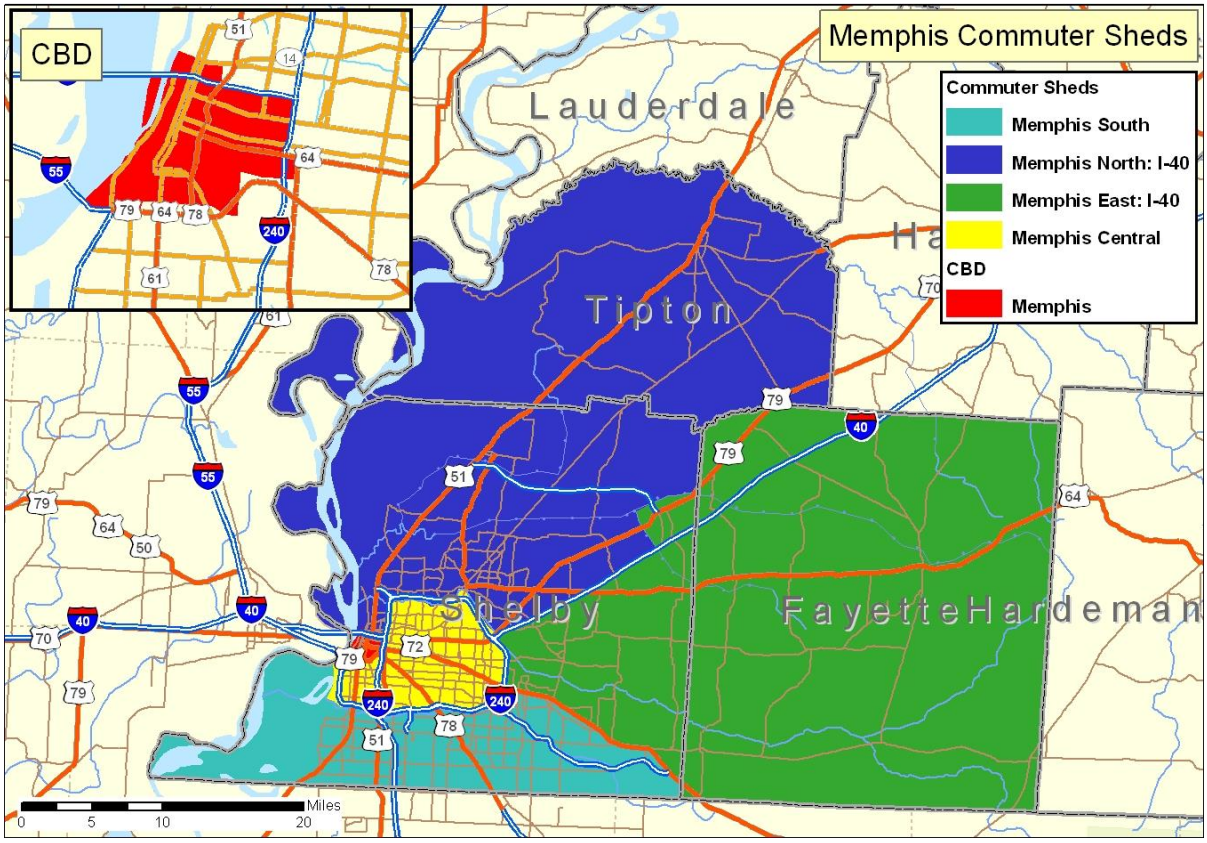
The CTPP database indicates 173,998 commute trips with a destination within Shelby County (**Table 7-1**).

Table 7-1: Commuting Patterns to Memphis CBD

From	To CBD Total	To CBD Single Occupant Vehicles	To CBD Single Occupant Vehicles (Percent)
North Region (I-40)	5,187	4,452	86%
East Region (I-40)	2,477	2,209	89%
South Region	4,630	3,809	82%
Central	6,355	5,186	82%
CBD	850	307	36%
Other	1,074	916	85%

Total	20,573	16,879	82%

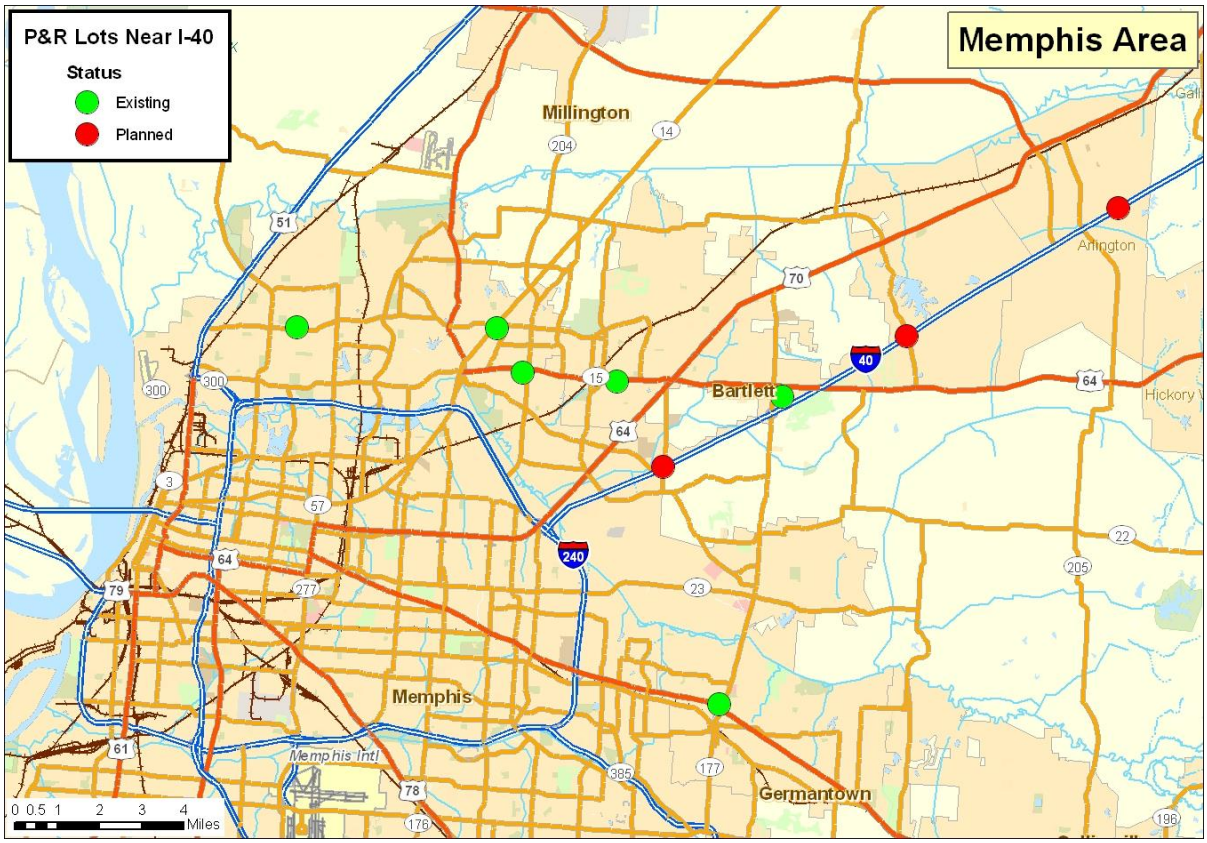
Figure 7.1: Memphis Area Commuter Sheds



Of these trips, 20,573 (12 percent) have a destination within the CBD. The two regions covering the I-40 corridor represents 37 percent of those commuting to the CBD. Eight-two percent of all commuters destined for the CBD drive alone. For the two regions covering the I-40 corridor, 87 percent drive alone to the CBD.

Figure 7.2 shows the location of park and ride facilities near I-40. There are three proposed lots at select interchanges leading east from Memphis. One location was identified as a "planned" facility site in the Memphis MPO LRTP but now appears operational.

Figure 7.2: Memphis Area Park-and-Ride Facilities



7.2 Jackson

The Jackson MPO includes the City of Jackson and Madison County. The Jackson MPO region was divided into five general commuter sheds: East: I-40, West: I-40, North, South, and Central (**Figure 7.3**). It was assumed that most commuters traveling from the East and West commuter sheds would potentially use I-40 as part of their commuter route to the CBD. The North and South commuter shed area would more likely use US 45 to reach the CBD. It is assumed that those living in the Central area would use local routes.

The CTPP database indicates 34,630 commute trips with a destination within Madison County (**Table 7-2**). Of these trips, 8,375 (24 percent) have a destination within the CBD. The two regions covering the I-40 corridor represents 15 percent of those commuting to the CBD. Eight-six percent of all commuters destined for the CBD drive alone. For the two regions covering the I-40 corridor, 90 percent drive alone to the CBD. **Figure 7.4** shows the location of the one proposed park and ride facility near Jackson.

Table 7-2: Commuting Patterns to Jackson CBD

From	To CBD Total	To CBD Single Occupant Vehicles	To CBD Single Occupant Vehicles (Percent)
East Region (I-40)	1,028	931	91%
West Region (I-40)	200	175	88%
North Region	3,424	3,204	94%
South Region	1,483	1,282	86%
Central	585	520	89%
CBD	1,535	1,038	68%
Other	120	90	75%
Total	8,375	7,240	86%

Figure 7.3: Jackson Area Commuter Sheds

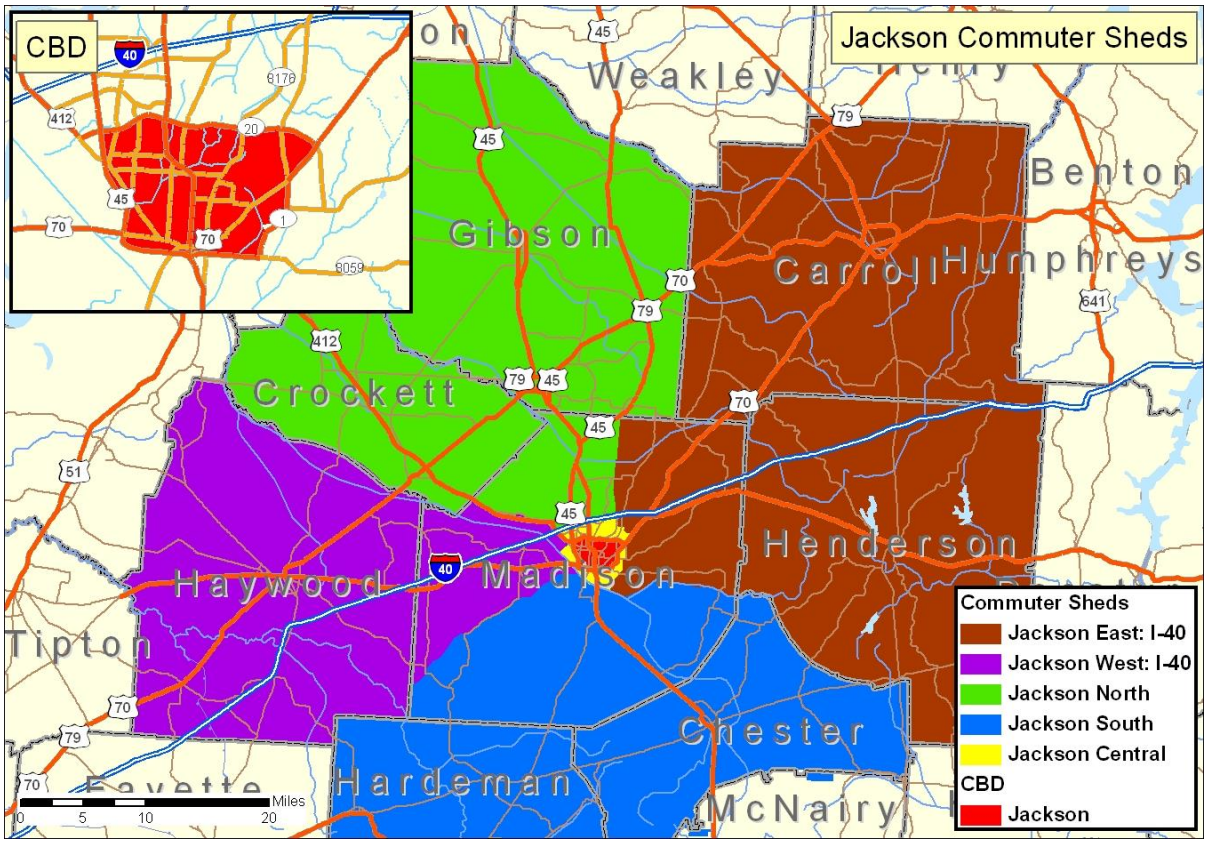
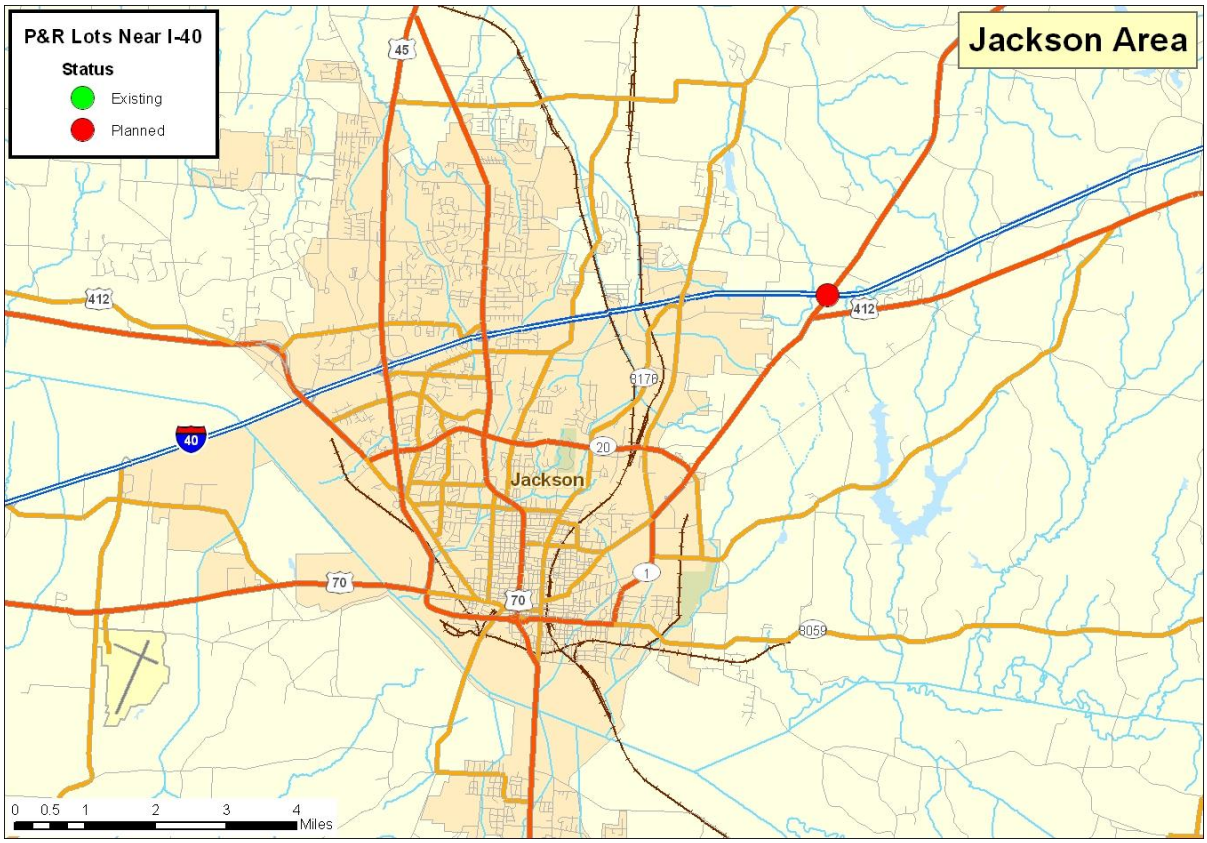


Figure 7.4: Jackson Area Park-and-Ride Facilities



7.3 Nashville

The Nashville MPO includes the City of Nashville and Davidson, Rutherford, Sumner, Williamson, Wilson and parts of Maury and Robertson counties. The Nashville MPO region was divided into seven general commuter sheds: East: I-40, West: I-40, North I-24, North I-65, South I-24, South I-65, and Central (**Figure 7.5**). It was assumed that most commuters traveling from the East and West commuter sheds would potentially use I-40 as part of their commuter route to the CBD. The North and South commuter shed area would more likely use I-24 and I-65 to reach the CBD. It is assumed that those living in the Central are would use local routes.

The CTPP database indicates 149,209 commute trips with a destination within Davidson County (**Table 7-3**). Of these trips, 35,617 (24 percent) have a destination within the CBD. The two regions covering the I-40 corridor represents 34 percent of those commuting to the CBD. Seventy-nine percent of all commuters destined for the CBD drive alone. For the two regions covering the I-40 corridor, 84 percent drive alone to the CBD.

Figure 7.6 shows the location of the existing and proposed park and ride facility in the Nashville area. There are several agencies responsible for maintaining these facilities. Only one planned facility is identified on the map. The Nashville MPO LRTP indicates funding for future park and ride facilities, however specific locations have not been identified.

Table 7-3: Commuting Patterns to Nashville CBD

From	To CBD Total	To CBD Single Occupant Vehicles	To CBD Single Occupant Vehicles (Percent)
East Region: I-40	4,354	3,437	79%
West Region: I-40	7,890	6,916	88%
North Region: I-24	1,545	1,132	73%
North Region: I-65	4,150	3,286	79%
South Region: I-24	5,580	4,589	82%
South Region: I-65	6,470	5,615	87%
Central	4,835	2,944	61%
CBD	400	84	21%
Other	393	245	62%
Total	35,617	28,248	79%

Figure 7.5: Nashville Area Commuter Sheds

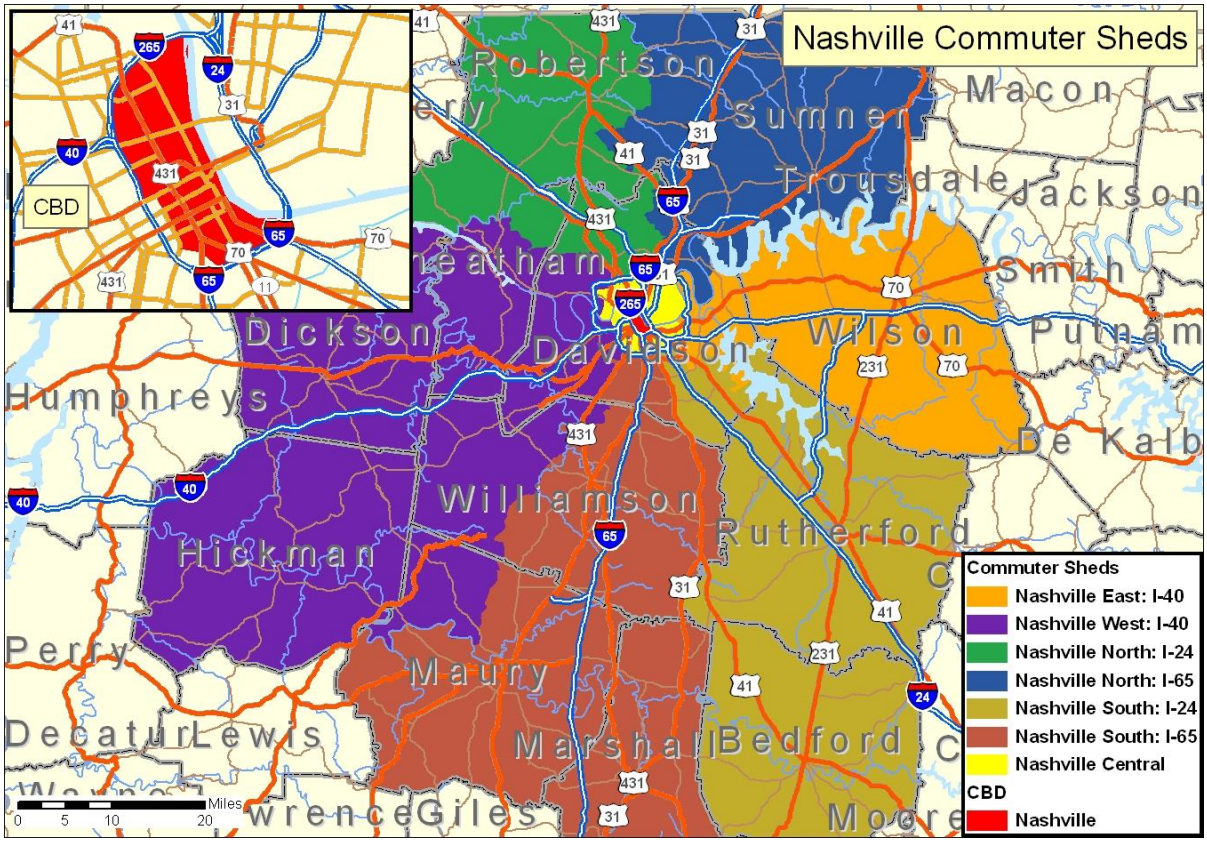
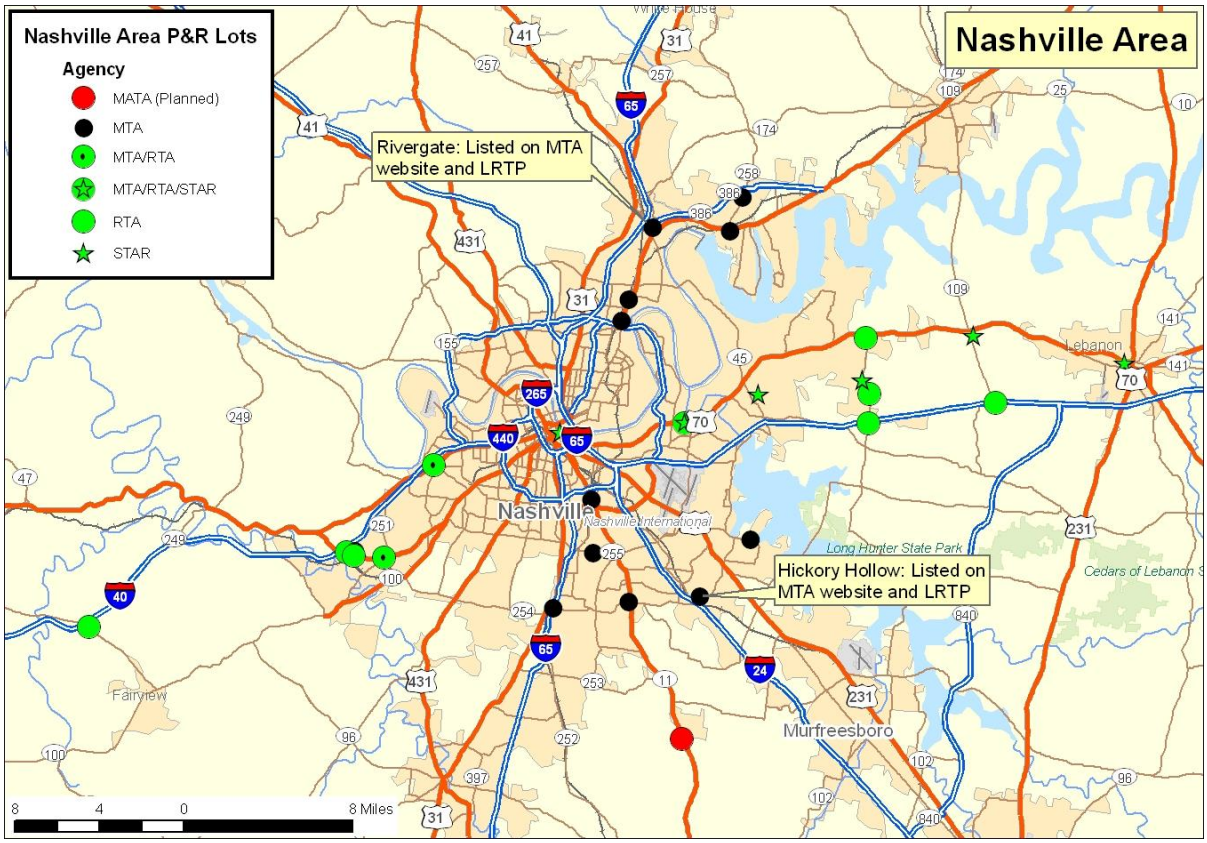


Figure 7.6: Nashville Area Park-and-Ride Facilities



7.3.1 Proposed Transit Improvements

Several plans prepared for the Nashville Urban Area identify transit service improvements to address the existing commuting patterns in the region along the I-40 corridor

Commuter Rail Services

The first commuter rail line in the Nashville Urban Area was opened in October 2006, to the east of the CBD, using the existing Nashville & Eastern short line railroad corridor. This commuter rail line, with six stations, provides as an alternative to commuter travel by car on I-40 between Lebanon and downtown Nashville. The 2003 Nashville Urban Area Transit Development Plan contains a long-term recommendation for a commuter express corridor extending west from Downtown Nashville to Dickson to help relieve travel congestion on I-40. The Tennessee Transit Tomorrow plan (2004) referenced the expansion of commuter rail services in the I-40 west corridor.

Express Bus Services

The five-year Service Improvement Plan for the Metropolitan Transit Authority (MTA), prepared in 2005, includes eight bus route improvements for existing routes that are either parallel to or on I-40. Most routes are planned for improved headways; two routes would have routing changes to provide better service. Routes 10. 16, 18, 24x, 31x, and 38x would have decreased headways. Route 6 to Donelson would have its routing adjusted to provide access to the new commuter rail station (Music City Star station). Route 39x is a proposed Airport Express with service along I-40.

7.4 Knoxville

The Knoxville MPO includes the City of Knoxville and Knox, Blount, Loudon, and Sevier counties. The Knoxville MPO region was divided into five general commuter sheds: East: I-40, West: I-40, North, South, and Central (**Figure 7.7**). It was assumed that most commuters traveling from the East and West commuter sheds would potentially use I-40 as part of their commuter route to the CBD. The North commuter shed area would more likely use I-75 and US 11 to reach the CBD and the South commuter shed area would more likely use US 129 and US 411. It is assumed that those living in the Central are would use local routes.

The CTPP database indicates 93,179 commute trips with a destination within Knox County (**Table 7-4**). Of these trips, 20,205 (22 percent) have a destination within the CBD. The two regions covering the I-40 corridor represents 32 percent of those commuting to the CBD. Seventy-eight percent of all commuters destined for the CBD drive alone. For the two regions covering the I-40 corridor, 90 percent drive alone to the CBD.

7.4.1 Proposed Transit Improvements

The LRTP for the Knoxville Urban Area includes new express bus service along I-40 between Farragut and SR-66 east of Knoxville to provide an alternative to single-occupant vehicle travel in this corridor. The start-up of this new service is identified as an immediate need in the Knoxville LRTP.

Table 7-4: Commuting Patterns to Knoxville CBD

From	To CBD Total	To CBD Single Occupant Vehicles	To CBD Single Occupant Vehicles (Percent)
East Region: I-40	4,354	3,437	79%
West Region: I-40	7,890	6,916	88%
North Region: I-24	1,545	1,132	73%
North Region: I-65	4,150	3,286	79%
South Region: I-24	5,580	4,589	82%
South Region: I-65	6,470	5,615	87%
Central	4,835	2,944	61%
CBD	400	84	21%
Other	393	245	62%
Total	35,617	28,248	79%

Figure 7.8 shows the location of the existing and proposed park and ride facility in the Knoxville area.

Figure 7.7: Knoxville Area Commuter Sheds

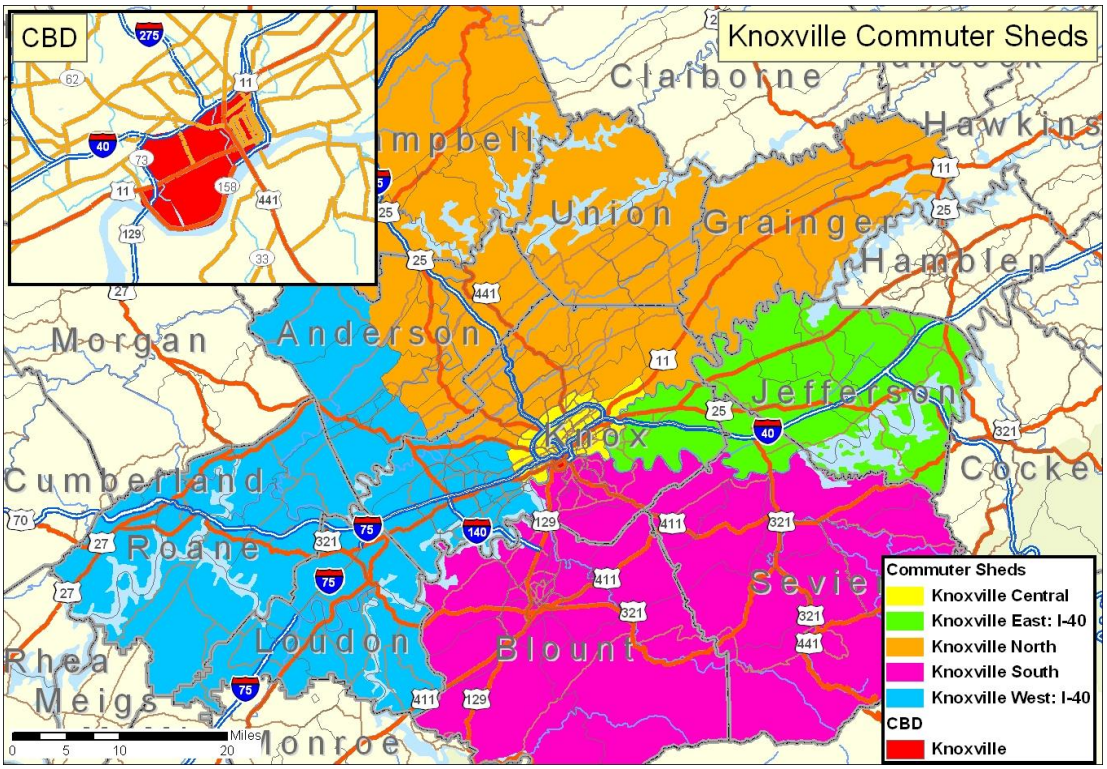
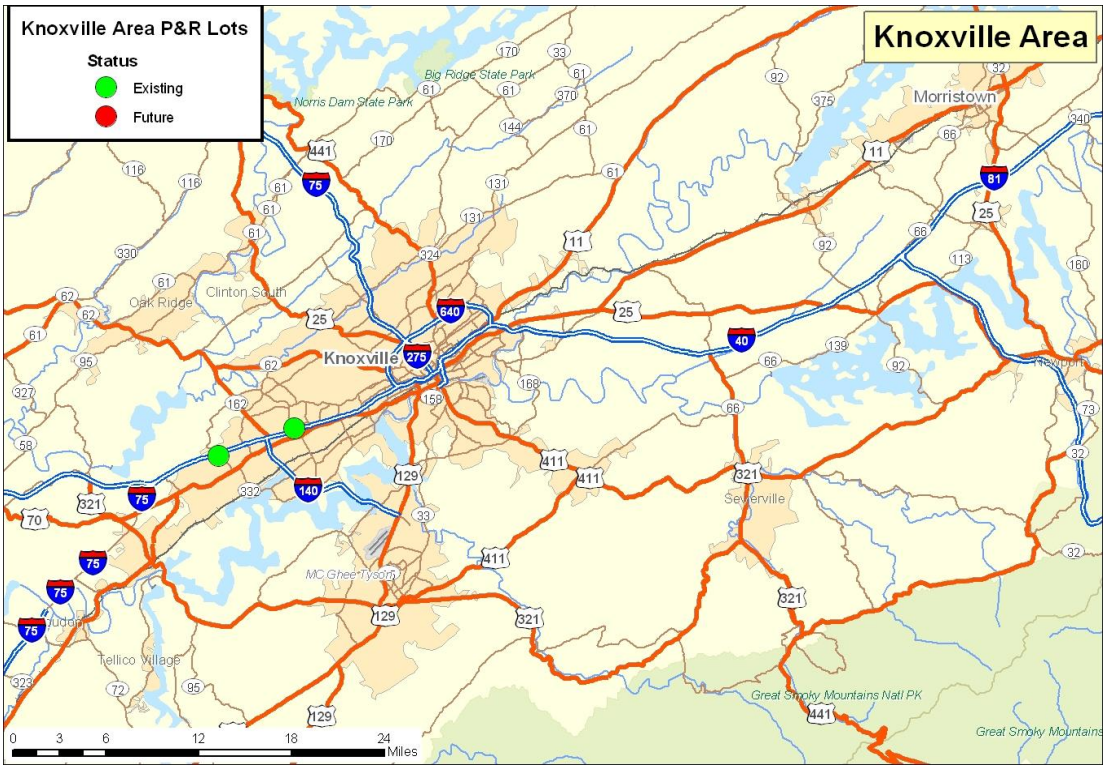


Figure 7.8: Knoxville Area Park-and-Ride Facilities



8.0 INTERMODAL FACILITIES

The present intermodal facility system serving the State of Tennessee is comprised of ten facilities in select urbanized areas (**Table 8-1**). Most notably, the Memphis metropolitan area has six intermodal facilities, including two for both BNSF and CSX. The intermodal yards in Marion, Arkansas are located just west of the Mississippi River, but still within the Memphis region. There is also a NS facility in Huntsville, Alabama just south of the Tennessee border with Alabama. This facility is included because trucks accessing this facility also have the ability to easily service shippers located in Tennessee. It is also important to note that all of the other nine intermodal facilities are located along the I-40/I-81 corridor. These intermodal facilities will be mapped in Task 2 as part of the identification of congestion deficiencies in intermodal movements.

Table 8-1: Intermodal Yards in Tennessee

RAILROAD	NAME OF YARD	LOCATION	DESIGN LIFT CAPACITY (containers)	YEAR 2000 LIFTS
BNSF	Tennessee Yards	Memphis	100,000	148,521
BNSF	Marion Yards	Marion, AR	100,000	72,556
Canadian National/Illinois Central	Johnston Yards	Memphis	125,000	n/a
CSX	Johnston Yards	Memphis	70,000	60,692
CSX	Leewood Yards	Memphis	20,000	15,525
CSX	Radner Yards	Nashville	100,000	83,589
CSX	Kingsport Yards*	Kingsport	50,000	26,000
Norfolk Southern	Forrest Yards	Memphis	100,000	75,000
Norfolk Southern	Huntsville Yard	Huntsville, AL	n/a	n/a
Union Pacific	Marion Yard	Marion, AR	450,000	251,000

*only serves Eastman Kodak

As noted in the Tennessee Rail System Plan, intermodal congestion is increasingly common due to the trends to consolidating intermodal facilities and moving to an airline-style, hub and spoke system. Additionally, the growth of intermodal containers (8 percent per year) has caused traffic to spike at some of the remaining facilities straining their capacity and creating equipment shortages in cars, trailers and power units. The newly constructed Memphis Super Terminal will address some of the intermodal congestion issues but only for the region surrounding Memphis.