Interstate 65 Multimodal Corridor Study

Technical Memorandum 3: Development of Feasible Multimodal Solutions

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I-65 MULTIMODAL CORRIDOR STUDY

Technical Memorandum 3: Development of Feasible Multimodal Solutions

1. Introduction

As part of the analysis of existing and projected conditions in the Interstate 65 (I-65) corridor, a Trend scenario was developed. This scenario serves as a baseline against which project recommendations can be evaluated. The Trend scenario consists of two key data inputs: 1) population and employment growth projections provided by TDOT and the Nashville Area Metropolitan Planning Organization (MPO); and 2) transportation projects currently programmed by TDOT and the Nashville Area MPO. These are projects currently under development with funding identified and programmed.

Based on the Trend scenario, the prior task analyzed the existing deficiencies and future needs in the I-65 corridor through Tennessee. The Trend scenario, which assumed current practices, plans, and policies remain unchanged, was analyzed across the following transportation issues, modes, and services:

- Land use and economic development
- Highway capacity and travel demand
- Safety
- Operations and maintenance/Intelligent transportation systems (ITS)
- Freight
- Transit
- Transportation Demand Management (TDM)
- Walking and bicycling

To address the identified deficiencies and needs, a series of multimodal solutions have been developed, analyzed, and evaluated. This technical memorandum reviews the proposed multimodal solutions, and, importantly, highlights both their potential impact on corridor-wide performance measures and public input on the proposed solutions. Before describing the proposed multimodal solutions, the first section of the memorandum summarizes the primary deficiencies and needs in the I-65 corridor.

2. Overview of Existing Deficiencies and Future Needs

Growth in middle Tennessee continues to place pressure and new demands on the transportation system throughout the I-65 corridor. While the highway system has historically served as the primary transportation option in the corridor, increasingly other transportation modes and systems are assuming more importance as major employment, commercial, and residential centers multiply and expand. The deficiencies and needs, or in the case of land use and development, opportunities and challenges, have been grouped into four general categories and are summarized on the following page. The analysis underscores the wide range of transportation deficiencies and needs, particularly in the counties experiencing the largest absolute and relative rates of growth.

- Growth and Development:
  - As shown in Table 2-1, the central sub-area, consisting of Davidson, Rutherford, Williamson, and Wilson Counties, accounts for 68 percent and 78 percent of projected population and employment growth, respectively, in the corridor through 2040.
  - More than 60 percent of workers in surrounding counties commute to Davidson County every day and more than 30 percent of Davidson County workers commute daily to Williamson County (Figure 2-1).
- Highways and Freight:
  - By 2040, Levels of Service D, E, and F are forecast on most of I-65 between Kentucky and Spring Hill (Figures 2-2 and 2-3).
  - Parallel and intersecting arterials are projected to approach or exceed capacity, including:
    - ✓ US 431/Hillsboro Pike/Lewisburg Pike
    - ✓ US 31/Franklin Pike/Columbia Pike
    - ✓ US41A/Nolensville Pike
    - ✓ SR 254/Old Hickory Boulevard
    - ✓ SR 96/Murfreesboro Road
    - ✓ SR 386/Vietnam Veterans Boulevard
  - By 2040, travel times are projected to double on much of the corridor between Nashville and Spring Hill.
  - Truck volumes are projected to increase by more than 50 percent on most of the roadway network by 2040.
  - Between 2013 and 2015, crashes increased 23 percent along I-65.
- Transit, Bike/Ped, and TDM:
  - Existing regional transit services are largely peak period and peak direction, limiting access to employment centers.
  - Park-and-Ride lots in the I-65 corridor are underutilized compared to systemwide rates, in part due to their location.
  - Development densities around existing and planned regional transit stops are low, limiting the ridership potential of both existing and planned services.
  - Bicycle and pedestrian facilities are needed for all ages and abilities to/from major activity centers.
  - Violation rates on high occupancy vehicle (HOV) lanes range from 63 percent to 96 percent. Figures 2-2 and 2-3 show the freeway segments where HOV facilities are experiencing high violation rates.
- System Operations and Maintenance:
  - Numerous ITS devices are in place on I-65 as part of the Tennessee Department of Transportation (TDOT) Smartway system.
  - Expansion of the Smartway system is proposed for two miles north of Exit 108/SR 76 and one mile south of Exit 59/I-840.
  - There are numerous additional ITS application opportunities in the I-65 corridor – for freeways, arterials, and transit.

Table 2-1. County Growth Trends

Sub-Area	County	2010 Population Total	2010 Employment Total	2020 Population Total	2020 Population Increase from 2010	2020 Employment Total	2020 Employment Increase from 2010	2030 Population Total	2030 Population Increase from 2010	2030 Employment Total	2030 Employment Increase from 2010	2040 Population Total	2040 Population Increase from 2010	2040 Employment Total	2040 Employment Increase from 2010
North	Cheatham	39,107	15,899	45,334	16%	19,351	22%	51,565	32%	22,813	43%	57,804	48%	26,281	65%
	Dickson	49,664	22,469	55,396	12%	25,839	15%	61,140	23%	29,129	30%	66,896	35%	32,608	45%
	Robertson	66,283	28,067	83,977	27%	33,591	20%	99,100	50%	39,857	42%	112,851	70%	47,190	68%
	Sumner	160,645	55,354	193,105	20%	66,686	20%	218,698	36%	80,227	45%	241,698	50%	95,970	73%
	Sub-Area Total	315,699	121,789	377,812	20%	145,467	19%	430,503	36%	172,026	41%	479,249	52%	202,049	66%
Central	Davidson	626,682	542,773	680,496	9%	635,738	17%	734,958	17%	745,177	37%	780,507	25%	869,137	60%
	Rutherford	262,604	133,803	384,504	46%	170,093	27%	497,364	89%	215,490	61%	602,977	130%	271,416	103%
	Williamson	183,182	120,266	309,328	69%	162,311	35%	426,801	133%	223,802	86%	537,377	193%	307,836	156%
	Wilson	113,993	51,640	157,139	38%	65,133	26%	196,478	72%	81,960	59%	233,085	104%	102,437	98%
	Sub-Area Total	1,186,461	848,481	1,531,467	29%	1,033,275	22%	1,855,601	56%	1,266,429	49%	2,153,946	82%	1,550,826	83%
South	Bedford	45,058	25,809	51,610	15%	29,345	14%	58,175	29%	32,892	27%	64,748	44%	36,448	41%
	Giles	29,485	14,153	31,048	5%	15,658	11%	32,620	11%	17,178	21%	34,199	16%	18,704	32%
	Hickman	24,690	6,543	26,773	8%	7,187	10%	28,866	17%	7,839	20%	30,967	25%	8,495	30%
	Lincoln	33,361	14,892	35,226	6%	16,287	9%	37,100	11%	17,690	19%	38,984	17%	19,104	28%
	Marshall	30,617	12,004	34,072	11%	12,836	7%	37,530	23%	13,672	14%	40,995	34%	14,520	21%
	Maury	80,956	39,996	94,861	17%	47,043	18%	106,276	31%	55,746	39%	116,514	44%	65,609	64%
	Sub-Area Total	244,167	113,397	273,590	12%	128,356	13%	300,567	23%	145,017	28%	326,407	34%	162,880	44%
STUDY AREA TOTAL		1,746,327	1,083,668	2,182,869	25%	1,307,098	21%	2,586,671	48%	1,583,472	46%	2,959,602	69%	1,915,755	77%

Figure 2-1. Existing Year (2016) County-to-County Work Flow

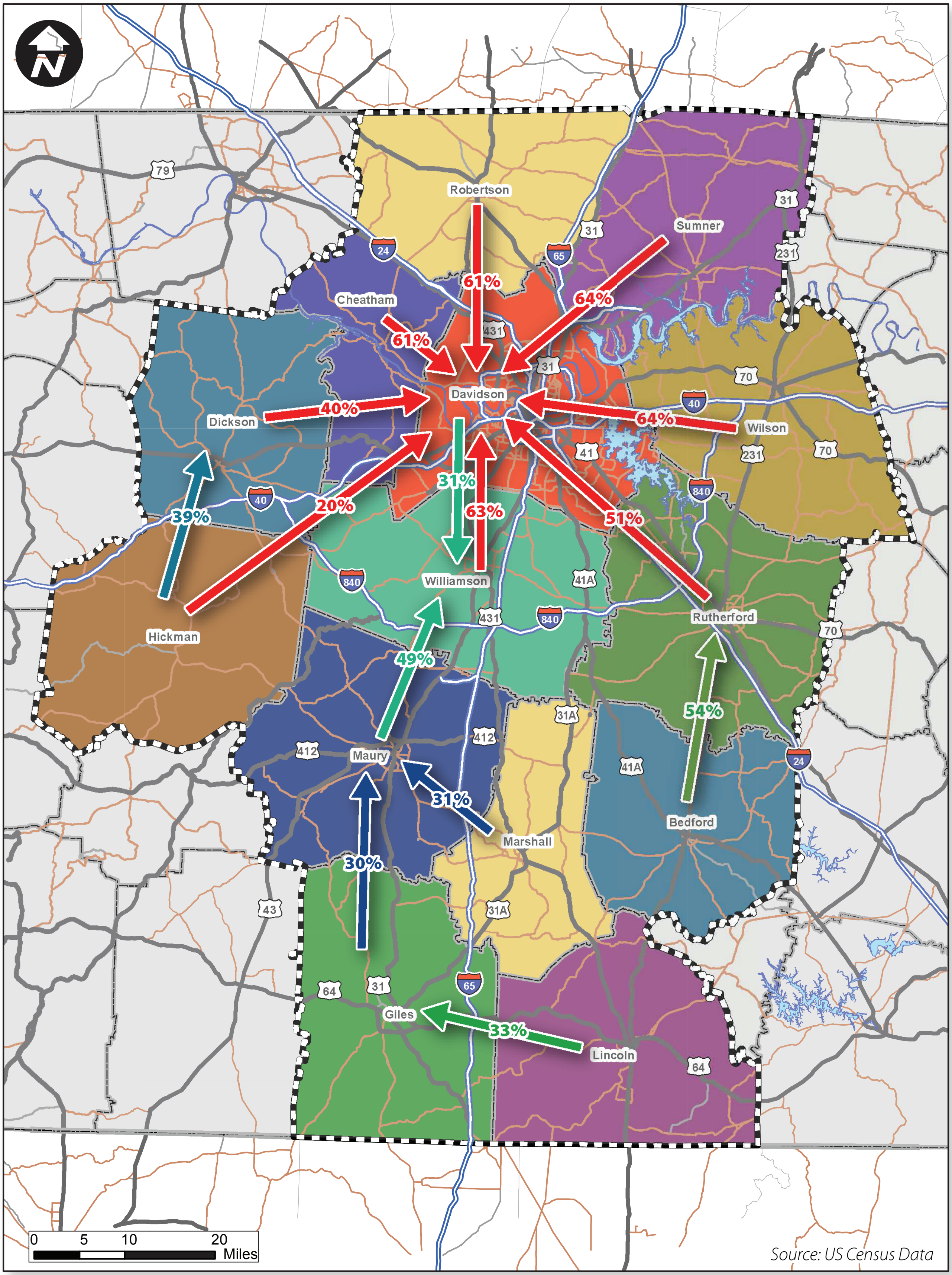


Figure 2-2. I-65 Deficiencies and Needs: North Sub-Area

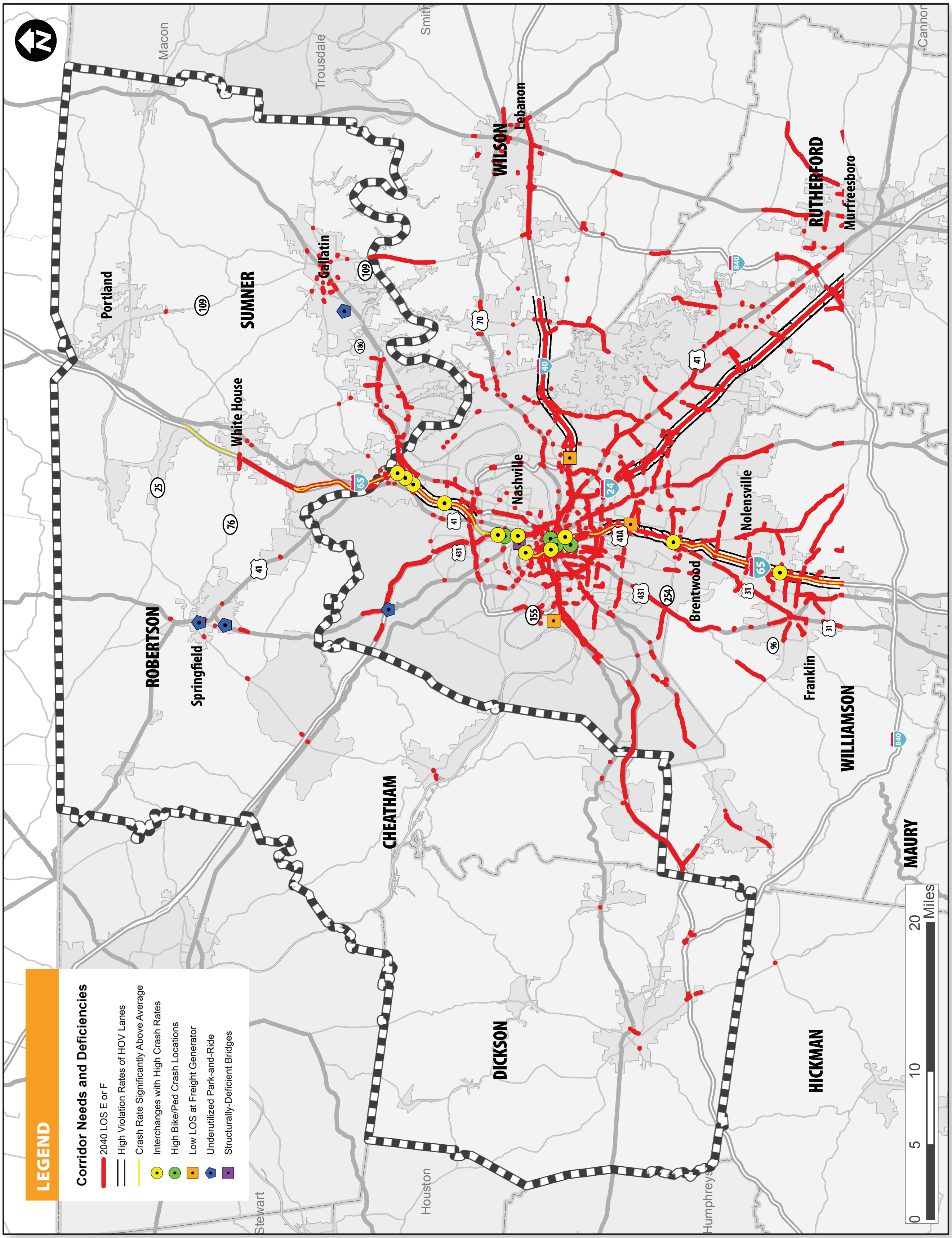


Figure 2-3. I-65 Deficiencies and Needs: Central Sub-Area

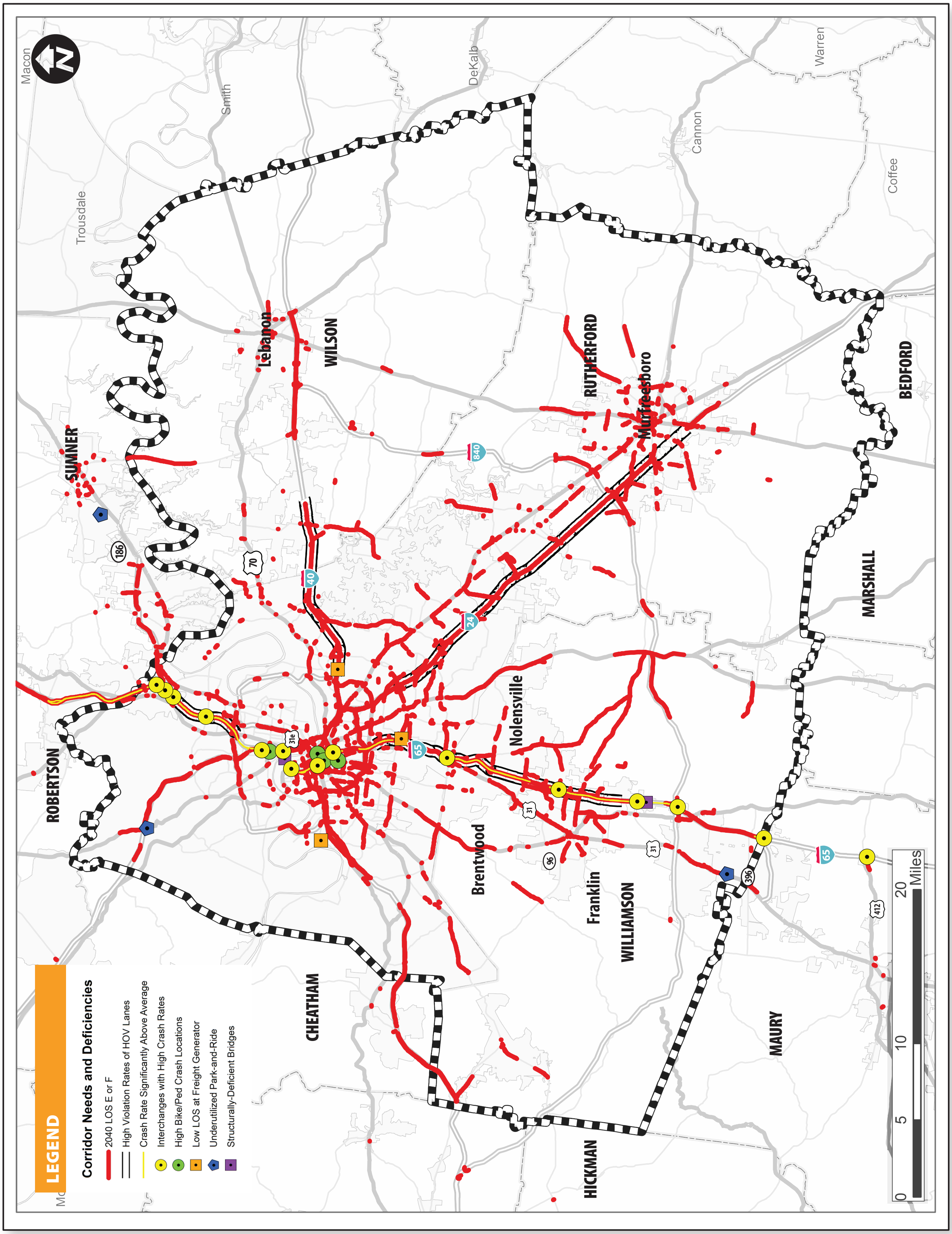
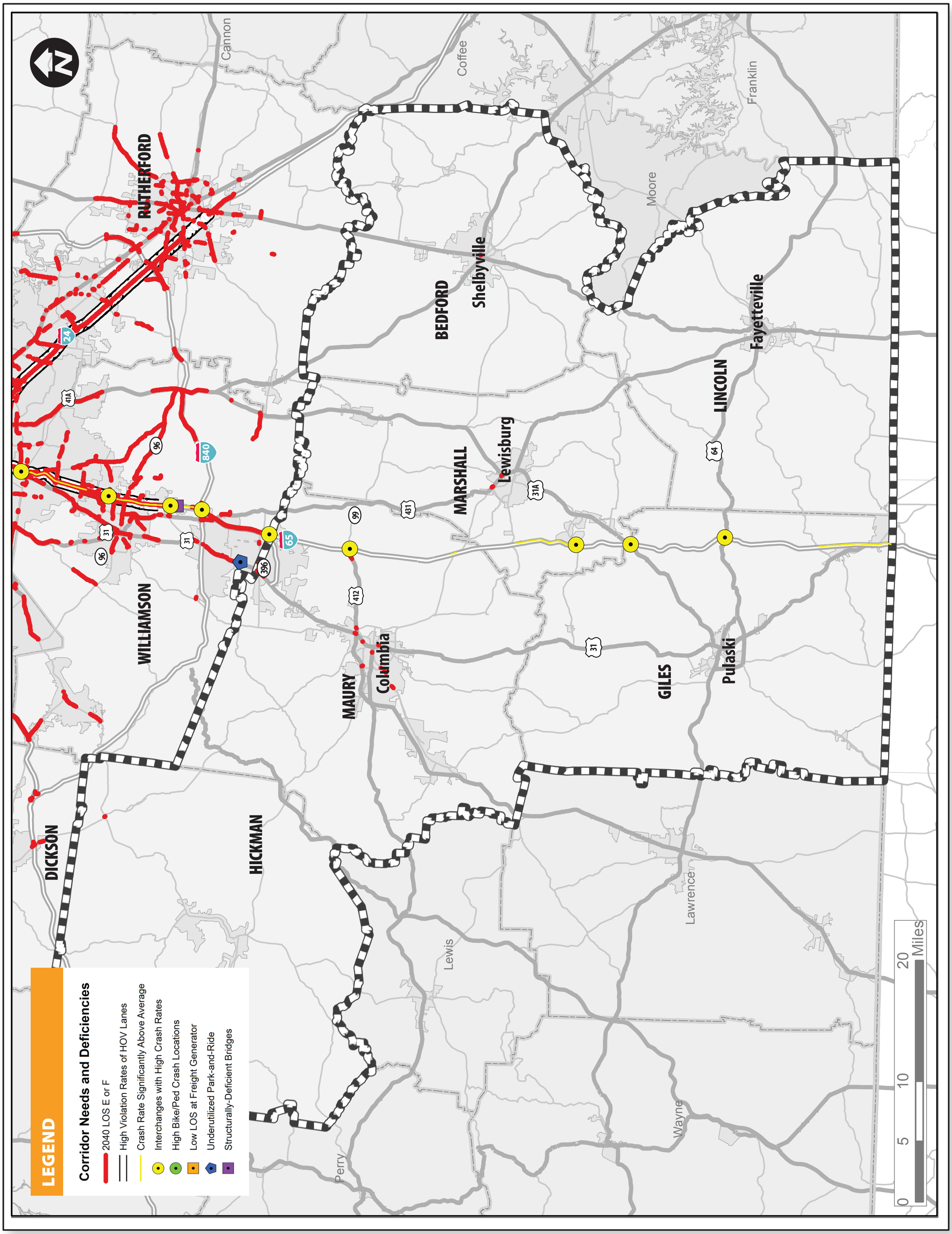


Figure 2-4. I-65 Deficiencies and Needs: South Sub-Area



3. Performance Measures

Underpinning the study's goals and objectives are a series of performance measures that serve as the basis for evaluating potential transportation solutions in the I-65 corridor. In conjunction with the Trend scenario, the performance measures establish a baseline against which future investments can be compared and evaluated. Table 3-1 reports the performance measures for the Base Year (2010) and Trend (2040) scenarios, which were obtained using the Tennessee Statewide Travel Demand Model, Version 2 (TSM).

The performance measures combine traditional transportation system performances, for example, Vehicle Miles Traveled (VMT) and Vehicle Hours Traveled (VHT), with performance measures that incorporate transportation options and land use impacts. Measures for tracking transportation options include:

- **Person Throughput –** the total number of daily auto and truck occupants and transit riders passing two different points or screenlines in the I-65 corridor – the Sumner/Davidson county line on the north and the Davidson/Williamson county line on the south;
- **Presence of Transit Oriented Development (TOD) at Stations –** the total number of people and jobs within a ¼ mile radius of existing and planned transit stations (existing stations are current RTA Park-and-Ride locations; future stations are based on recommendations outlined in the nMotion Transit Plan); and
- **People within a 5-minute Walk or Bicycle Ride to a Station –** the total population within a five-minute walking or bicycling travel time to existing and planned transit stations.

At the north screenline, approximately two-thirds of the projected increase in person throughput under the Trend scenario is related to higher traffic volumes fueled by population and employment growth, and one-third of the projected increase in person throughput is tied to planned new transit services between Sumner County and Davidson County. With fewer transit services planned between Davidson County and Williamson County, changes in person throughput at the south screenline are predominantly driven by higher traffic volumes.

The expansion of transit services and transit stations will, nevertheless, expand the potential market for transit ridership substantially across the I-65 corridor. In particular, the total number of people within a

Table 3-1. Base Year and Trend Performance Measures

Goal	Performance Measure	Unit	Base (2010)	Trend (2040)	Percent Change Base v. Trend
Moving Autos and Trucks	Auto Travel Times	Minutes	See "Table 4-3"		
	Auto Vehicle Miles Traveled (VMT)	Miles (1,000s)	173,652	279,757	61%
	Auto Vehicle Hours of Travel (VHT)	Hours (1,000s)	3,836	6,456	68%
	Auto Vehicle Hours of Delay (VHD)	Hours	101,746	431,384	324%
	Truck Vehicles Miles Traveled (VMT)	Miles (1,000s)	6,524	12,030	84%
	Truck Vehicle Hours of Travel (VHT)	Hours	123,726	327,961	165%
	Truck Vehicle Hours of Delay (VHD)	Hours	16,204	27,147	68%
Moving People	Person Throughput	Persons per Day - North	177,569	252,815	42%
		Persons per Day - South	205,076	275,077	34%
Safety	Presence of Countermeasures at Safety Hotspots	High, Medium, or Low	See "Safety Recommendations"		n/a
Land Use Coordination	Presence of TOD at Stations	Total People and Jobs	24,968	38,456	54%
Equity and Accessibility	People within a 5-Minute Walk or Bike Ride to a Station	Total People - Walk	7,329	31,880	335%
		Total People - Bike	61,154	228,969	274%
Air Quality/Emissions	Carbon Intensity	Pounds per Day per Person	99.07	96.35	-3%

five-minute walking and bicycling trip is projected to increase nearly fourfold and threefold, respectively, in the Trend scenario.

4. Highway Capacity and Safety

4.1 Mainline Improvements

As part of the mainline capacity improvements, the future2040 TSM was updated to include proposed projects. The mainline improvements were broken into two phases. Phase 1 included the following projects:

- Future projects recommended by the Nashville Area MPO , as identified in the MPO's 2040 Regional Transportation Plan (RTP);
- Future projects recommended by the State of Tennessee IMPROVE Act (2017); ;and
- Additional recommendations based on model review and existing/future bottlenecks.

Phase 2 included a refined version of Phase 1 projects as well as additional mainline improvements identified through stakeholder and public involvement. This section provides the results of the traffic analysis for the Phase 2 refinements and additions for the 2040 Build scenario. The list of mainline improvement projects is shown in Tables 4-1 (Highway Capacity) and 4-2 (Safety). The tables include projects that are part of the 2017 IMPROVE Act. TDOT's goal is for all IMPROVE Act projects to be let to construction by 2030. Additionally, projects listed in TDOT's current 3-year Comprehensive Multimodal Program are noted as well. These projects are currently in some stage of development. Figures 4-1, 4-2, and 4-3 show the project recommendations in each of the study's three sub-areas: North, Central, and South.

Table 4-1. Mainline Improvements: Highway Capacity

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
H-1*	I-65	SR-25	Kentucky State Line	Widening, 4 to 6 lanes	8.8	Robertson	North
H-2	I-65/SR-109 Prop/SR-41	N/A	N/A	Relocation of SR-109, new interchange at I-65, and widening of I-65 from south of new interchange to Kentucky state line	0.6	Sumner	North
H-3*	SR-109 Portland Bypass	SR-109 south of SR-76	SR-109 near Kirby Drive	Construct new 4 lane divided roadway	6.8	Sumner	North
H-4*	I-65	Bethel Road (SR-257)	SR-25	Widening, 4 to 6 lanes	8.7	Robertson	North
H-5*	SR-76	Charles Drive	New Hall Road	Widening, 2 to 4 lanes	2.1	Robertson	North
H-6	I-65	New interchange at New Hall Road in White House		New Interchange	N/A	Robertson	North
H-7	I-65 (SB only)	Blue Star Road (US-31)	Bethel Road (SR-257)	Widening, 2 to 3 lanes	5.2	Robertson	North
H-8*	NET Corridor Section 2 - Vietnam Veterans Pkwy (SR-386)	US-31E/ Saundersville Road	SR-109 Bypass	Transit Capital Expansion - Widening, 4 to 6 lanes for freeway Bus Rapid Transit service from Nashville to Gallatin (Project currently under study by TDOT)	6.9	Sumner	North
H-9	SR-109	North of the Cumberland River Bridge	SR-109 Portland Bypass south of Gallatin	Widen from 2 lanes to 4/5 lanes	1.3	Sumner	North

Table 4-1. (continued)

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
H-10#	I-65	Long Hollow Pike (SR-174)	Blue Star Road (US-31)	Widening, 4 to 6 lanes	1.8	Sumner	North
H-11*	Vietnam Veterans Pkwy (SR-386) at Forest Retreat Road	N/A	N/A	New Interchange (Project currently under study by TDOT.)	0.0	Sumner	North
H-12	I-65 at Springfield Highway (SR-11/US-41)	N/A	N/A	New Interchange	N/A	Davidson	Central
H-13*#	NET Corridor Section 1 - Vietnam Veterans Pkwy (SR-386)	I-65	US-31E/ Saundersville Road	Transit Capital Expansion - Widening, 4 to 6 lanes for freeway Bus Rapid Transit service from Nashville to Gallatin	8.9	Sumner	North
H-14	NET Corridor Transit - Ellington Pkwy (US 31E/ SR-6) and I-65	Ellington Pkwy (SR-6) southern terminus	SR-386	Construction of managed Lanes along Ellington Pkwy (SR-6) and I-65 for freeway Bus Rapid Transit service from Nashville to Gallatin	10.0	Davidson	Central
H-15*	I-24	I-65	Old Hickory Blvd (SR-45)	Widening, 4 to 6 lanes	4.3	Davidson	Central
H-16	I-65	Briley Parkway	Nashville Core	Extend HOV lanes	4.2	Davidson	Central
H-17	Dickerson Pike (US 41)	SR-155 (Briley Pkwy)	Spring St	Widening, 4 to 6 lanes	4.7	Davidson	Central
H-18*	Clarksville Hwy (US-41A/ SR-112)	SR-12 (Ashland City Hwy)	SR-155 (Briley Pkwy)	Widening, 2 to 5 lanes, with Multi-Use Trail	2.4	Davidson	Central
H-19*	Downtown Nashville Loop	N/A	N/A	Roadway/Junctions Reconstruction	12.2	Davidson	Central
H-20	I-65	I-40 (Exit 210)	I-40 (Exit 208)	Weaving Patterns	2.0	Davidson	Central
H-21	I-65	Armory Drive	Nashville Core	Extend HOV lanes	3.4	Davidson	Central
H-22*	I-24	I-40	I-840	Widening, I-40 to Haywood Lane - 8 to 10 lanes; Haywood Lane to I-840 - 6 to 8 lanes	23.2	Davidson and Rutherford	Central
H-23	Battery Lane/Harding Place at Franklin Rd/ Improvements	SR-6 (Franklin Rd.) at SR-255 (Harding Pl.) and Battery Lane		Capacity improvements for intersection approaches	0.7	Davidson	Central
H-24	Nolensville Pike	South of Old Hickory Blvd (SR-245)	South of Burkitt Road	Reconstruction and widening, 2 to 5 lanes	4.5	Davidson and Williamson	Central
H-25	I-65	Old Hickory Blvd (SR-254)	Concord Road (SR-253)	New Interchange	0.0	Williamson	Central
H-26	Franklin Road (US-31/SR-6)	Concord Road (SR-253)	Moores Lane (SR-441)	Widening, 2 to 5 lanes	2.3	Williamson	Central
H-27	Franklin Road (US-31/SR-6)	SR-441 (Moore's Lane)	Harpeth River Bridge	Widening, 2 to 5 lanes	3.7	Williamson	Central
H-28	Nolensville Road (SR-11)	Burkitt Road	I-840	Widening with realignment from south of Clovercroft Road to north of Sunset Road in Nolensville	10.6	Williamson	Central

Table 4-1. (continued)

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
H-29*#	Mack Hatcher Pkwy (SR-397)	South of SR-96	US-431 (SR-106)	New construction, 4 lanes	3.3	Williamson	Central
H-30	East McEwen Drive	Near Cool Springs Blvd	Wilson Pike (SR-252)	Widening, 2 to 4 lanes	1.6	Williamson	Central
H-31	Smyrna/Williamson County Connector	I-24 at Rocky Fork Road	McEwen Drive Extension	New Roadway	12.0	Williamson and Rutherford	Central
H-32*	Mack Hatcher Pkwy (SR-397)	SR-96 east of Franklin	Columbia Pike (US-31/SR-6) south of Franklin	Widening, 2 to 4 lanes	3.2	Williamson	Central
H-33*	Columbia Pike (US-31/SR-6)	Fowlkes Street	Mack Hatcher Pkwy (SR-397)	Widening, 2 to 4 lanes	1.9	Williamson	Central
H-34*#	Murfreesboro Road (SR-96)	East of Arno Road	Wilson Pike (SR-252)	Widening, 2 to 5 lanes	5.8	Williamson	Central
H-35	Lewisburg Pike (SR-106/ US-431)	Mack Hatcher Pkwy (SR-397)	Donelson Creek Pkwy	Widening, 2 to 4 lanes	0.8	Williamson	Central
H-36	Peytonsville Road/Goose Creek Bypass (SR-248)	SR-106 (Lewisburg Pike)	West of I-65	Widen existing 2 lane road to 4/5 lane	0.8	Williamson	Central
H-37*#	Murfreesboro Road (SR-96)	East of Wilson Pike (SR-252)	I-840	Widening, 2 to 5 lanes	5.5	Williamson	Central
H-38*	Columbia Pike (US-31/SR-6)	I-840	Mack Hatcher Pkwy (SR-397)	Widening, 2 to 4 lanes	5.0	Williamson	Central
H-39*	Murfreesboro Road (SR-96)	I-840	Veterans Pkwy	Widening, 2 to 5 lanes	6.9	Williamson and Rutherford	Central
H-40	I-65	I-840	SR-396 (Saturn Parkway)	Widening, 4 to 6 lanes	5.8	Williamson	Central
H-41	Buckner Road Widening	Columbia Pike (SR-6/US-31)	Buckner Lane	Widening	1.9	Williamson	Central
H-42	Buckner Road Extension	Buckner Road	Lewisburg Pike (SR-106/US-431)	New Roadway with New Interchange at I-65	2.1	Williamson	Central
H-43	Saturn Pkwy (SR-396) Extension	US-31	Carters Creek Pike (SR-246) at I-840	New Roadway	6.0	Maury and Williamson	Central
H-44	Duplex Road (SR-247)	SR-6/US-31	0.1 mile west of I-65	Widen Duplex Rd. from 2 to 3 lanes with add'l improvements	3.1	Maury and Williamson	Central
H-45	I-65	Saturn Parkway (SR-396)	Bear Creek Pike (SR-99/US-412)	Widening, 4 to 6 lanes	6.9	Maury	South
H-46	Bear Creek Pike (SR-99/ US-412)	Nashville Highway (US-31)	US-431	Widening, 2 to 4 lanes	11.1	Maury	South

** Project included on IMPROVE Act project list*
 # Project included in 2018-2020 Comprehensive Multimodal Program

Table 4-2. Mainline Improvements: Safety

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
S-1	I-65 at SR-257 (Exit 104)	I-65 at SR-257 (Exit 104)		NB/Off Ramp Queuing	0.0	Robertson	North
S-2	I-65 at Bethel Road (SR-257) Interchange Lighting Improvements	I-65 at SR-257 (Exit 104)		Install interchange lightning	0.0	Sumner	North
S-3	Bethel Road (SR-257)	Lake Road	I-65	Widen shoulders and correct substandard horizontal geometries	2.3	Robertson	North
S-4	I-65 at US 31W Louisville Hwy (Exit 98)	I-65 at US 31W Louisville Hwy (Exit 98)		NB/Off Turn Lanes, SB/On Auxiliary Lane, NB/SB Signal Timing	0.0	Sumner	North
S-5	I-65 at US-31W (Exit 98)	I-65 at US-31W (Exit 98)		NB to WB Flyover	0.0	Sumner	North
S-6	I-65 Interchange Lighting at Rivergate Pkwy, Long Hollow Pk, US-31W	N/A	N/A	Interchange Lighting	N/A	Davidson	Central
S-7	I-65 at SR 174 Long Hollow Pike (Exit 97)	I-65 at SR 174 Long Hollow Pike (Exit 97)		SB/Off Turn Lanes, NB/SB Signal Timing	0.0	Davidson	North
S-8	I-65 at Trinity Lane (Exit 87)	I-65 at Trinity Lane (Exit 87)		NB/Off Ramp Auxiliary Lane Length	0.0	Davidson	Central
S-9	I-65 at Rosa L Parks Blvd (Exit 85)	I-65 at Rosa L Parks Blvd (Exit 85)		NB/Off Turn Lanes, SB/Off Turn Lanes, SB/On Turn Lanes	0.0	Davidson	Central
S-10	I-65 at Wedgewood Ave (Exit 81)"	I-65 at Wedgewood Ave (Exit 81)		SB/On Auxiliary Lane, NB/SB Signal Timing	0.0	Davidson	Central
S-11	I-65 at SR 254 Old Hickory Blvd (Exit 74)	I-65 at SR 254 Old Hickory Blvd (Exit 74)		Convert to to Diverging Diamond Interchange	0.0	Davidson	Central
S-12	I-65 at SR 253 Concord Rd (Exit 71)	I-65 at SR 253 Concord Rd (Exit 71)		NB/On Auxiliary Lane, SB/On Auxiliary Lane, NB/SB Signal Timing	0.0	Williamson	Central
S-13*	I-65 at Moores Lane	I-65 at Moores Lane		Interchange Modification	0.0	Williamson	Central
S-14	I-65 at SR 96 Murfreesboro Rd (Exit 65)	I-65 at SR 96 Murfreesboro Rd (Exit 65)		NB/Off Turn Lanes, SB/Off Turn Lanes, NB/SB Signal Timing	0.0	Williamson	Central
S-15	SR-96	Intersection with US-41A		Intersection Improvements	0.0	Williamson	Central
S-16	I-65 at SR 396 Saturn Parkway (Exit 53)	I-65 at SR 396 Saturn Parkway (Exit 53)		NB to WB Flyover	0.0	Maury	South
S-17	I-65 at US 412/SR 99 (Exit 46)	I-65 at US 412/SR 99 (Exit 46)		NB/SB Signalized Intersection	0.0	Maury	South
S-18	I-65 at SR 129 Lynnville Highway (Exit 27)	I-65 at SR 129 Lynnville Highway (Exit 27)		NB/On Turn Lane, SB/On Turn Lane	0.0	Marshall	South
S-19*	SR-99 (US-412) Interchange Modification	I-65 at SR 99 (US-412)		Interchange Modification	0.0	Maury	South
S-20	I-65 at SR 11/US 31A (Exit 22)	I-65 at SR 11/US 31A (Exit 22)		NB/SB Signalized Intersection	0.0	Giles	South
S-21	I-65 at SR 15/US 64 (Exit 14)	I-65 at SR 15/US 64 (Exit 14)		NB/SB Signalized Intersection	0.0	Giles	South
S-22*	Main Street (SR-7)	Union Hill Road (Ardmore)	Morrow Road (Ardmore)	Safety Improvements	0.9	Giles	South

** Project included on IMPROVE Act project list*

Figure 4-1. Mainline Improvements Map: North Sub-Area

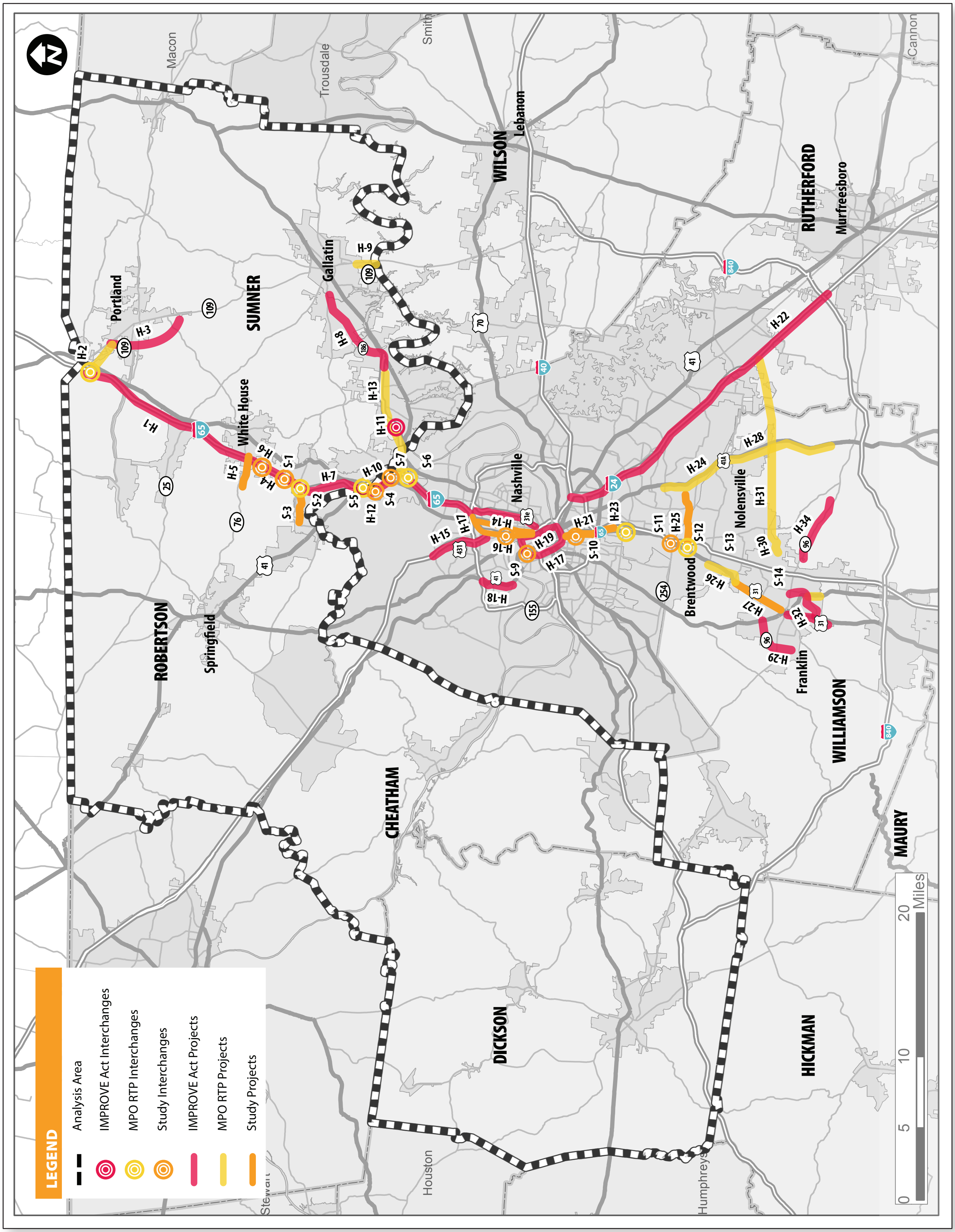


Figure 4-2. Mainline Improvements Map: Central Sub-Area

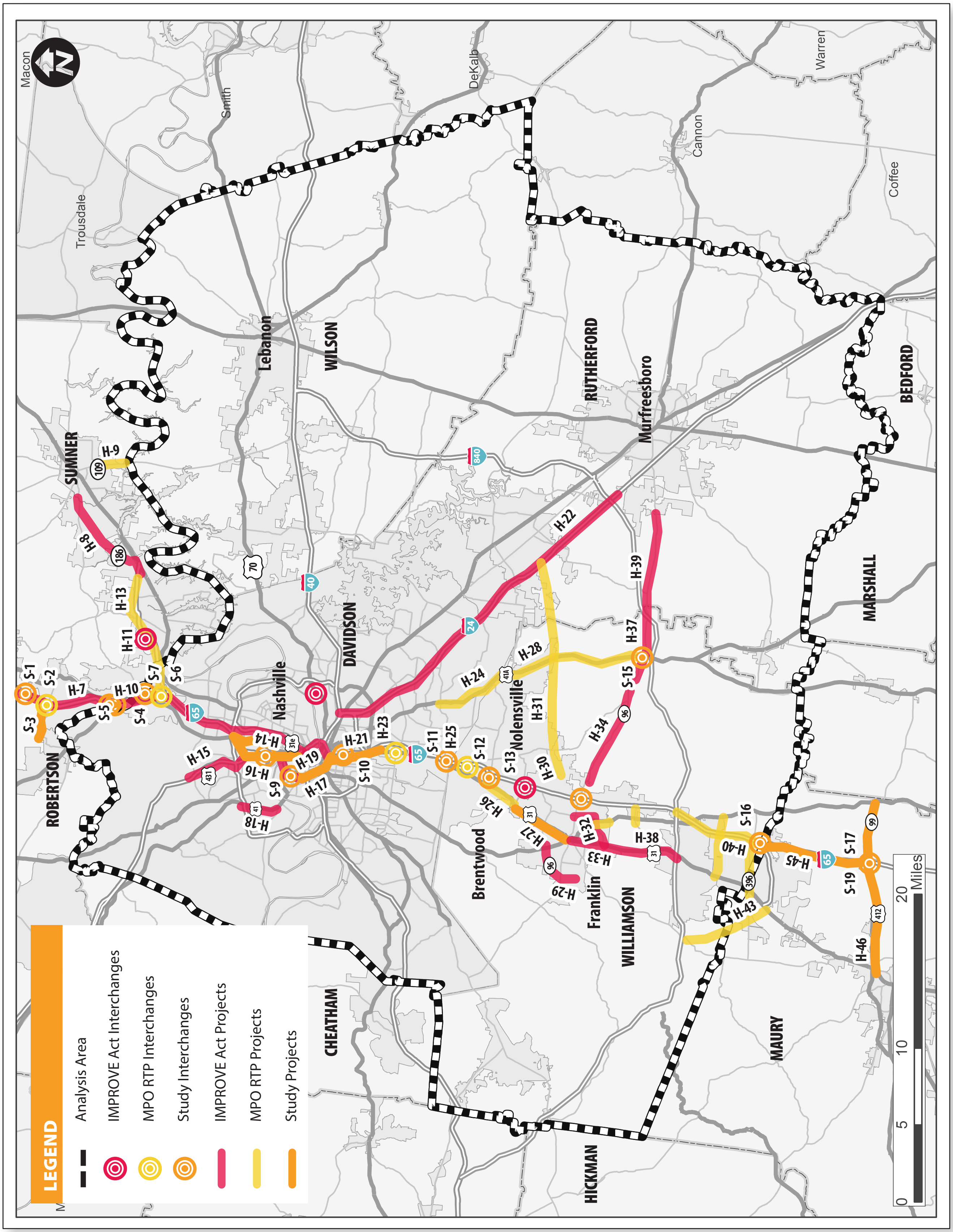
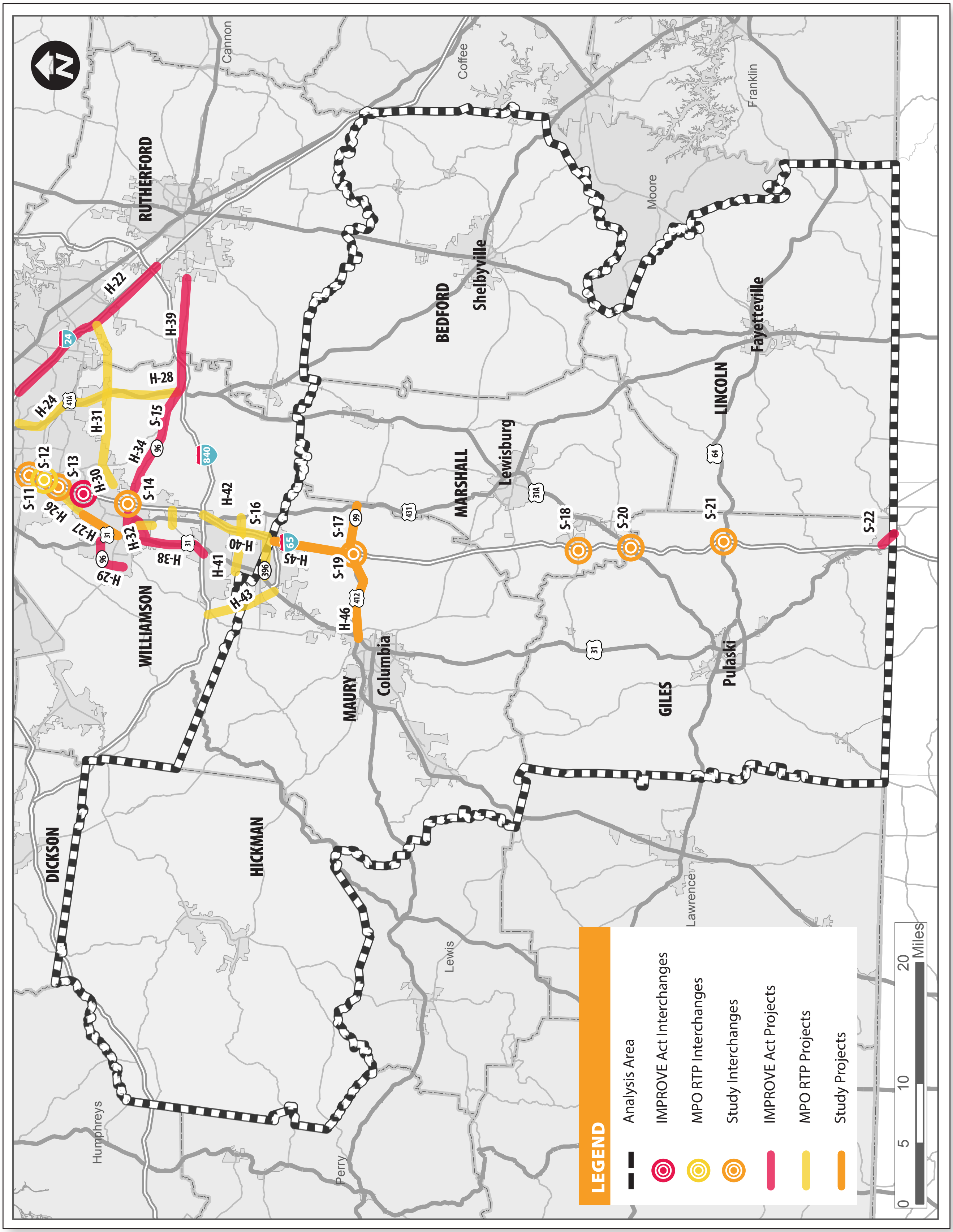


Figure 4-3. Mainline Improvements Map: South Sub-Area



Volume to Capacity Ratios

A volume to capacity (V/C) ratio analysis is one tool to quantitatively assess the effectiveness of a corridor to handle vehicular traffic. The ratio compares the demand in a corridor with the corridor's designed capacity. Level of service (LOS) is a qualitative measure of the operating conditions of a roadway. The LOS of a facility is measured by a letter between A and F, with LOS A (V/C ratio less than 0.6) referring to a facility in good operational condition and LOS F (V/C ratio greater than 1.0) referring to a facility in failing operational condition. Figure 4-4 shows the V/C ratios of interstates in the study area under the 2040 Build scenario. To better understand the effects of the proposed mainline improvement projects on I-65, the V/C ratios for both the 2040 Trend and 2040 Build scenarios are compared in Figure 4-5. As Figure 4-5 illustrates, although the proposed mainline improvements represent a significant investment and improvement in areas, they will not solve congestion on I-65 between Franklin, Nashville, and Hendersonville.

Travel Time for Key Travel Markets

Ten origin-destination (O-D) pairs were identified as key travel markets for travel time analysis in the statewide travel demand model. Table 4-3 displays the travel times in the 2010, 2040 Trend, and 2040 Build scenarios based on the link-level travel time results of the statewide travel demand model. The average daily travel time increases from 27 minutes in 2010 to 42 minutes in the 2040 Trend scenario. Under the 2040 Build scenario, however, the average daily travel time will be reduced to 38 minutes, a decrease of eight percent, and average speeds will increase by nine percent. The largest travel time savings will be in the Spring Hill-Franklin travel market, a distance of 18.5 miles that realizes a 22 percent time reduction, and the Franklin-Brentwood travel market, a distance of 8.5 miles that will experience a 20 percent travel time savings.

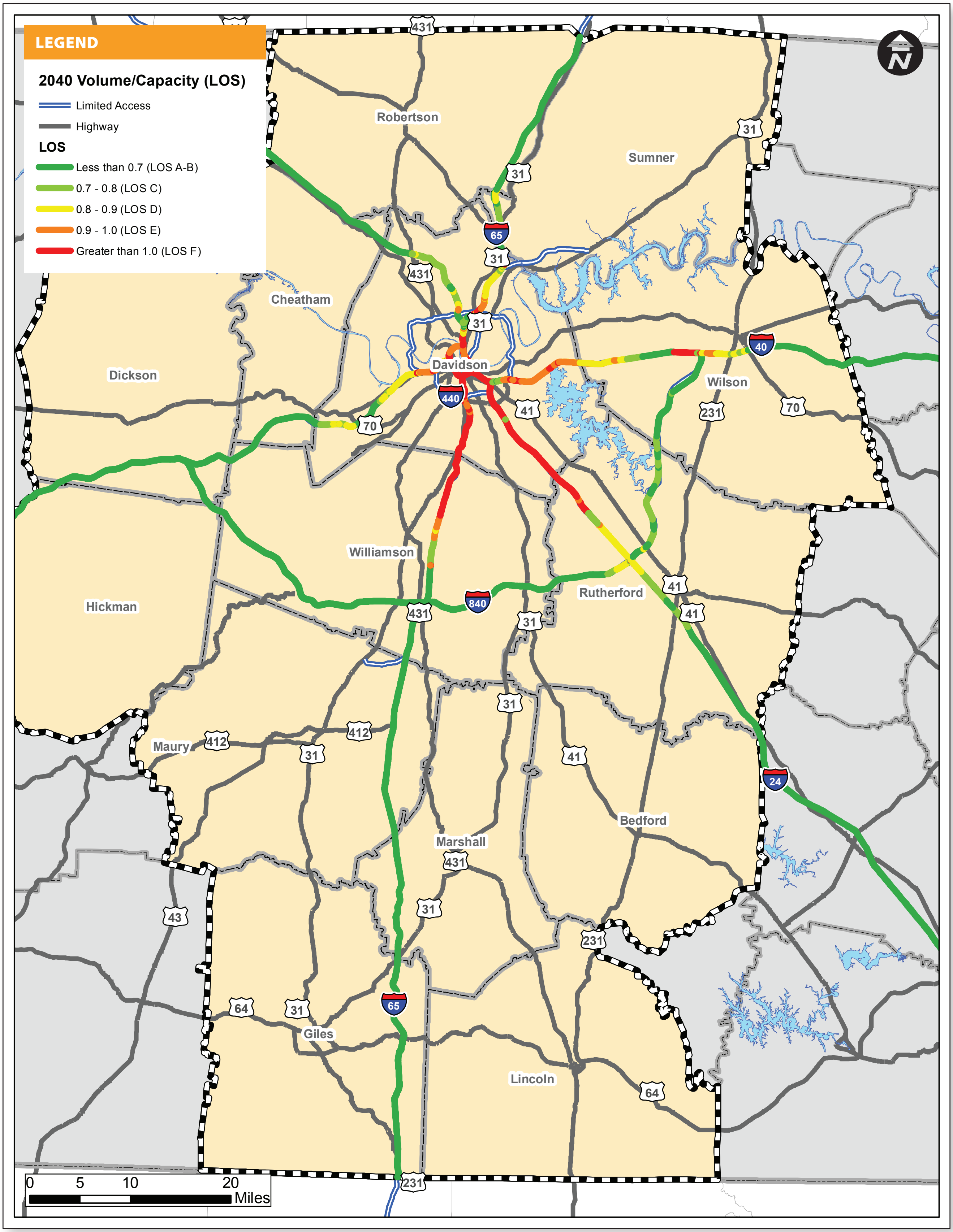
Network Performance

To better understand the impacts of the mainline improvements on a corridor wide scale, network traffic

Table 4-3. 2010 and 2040 Travel Time for Key Travel Markets

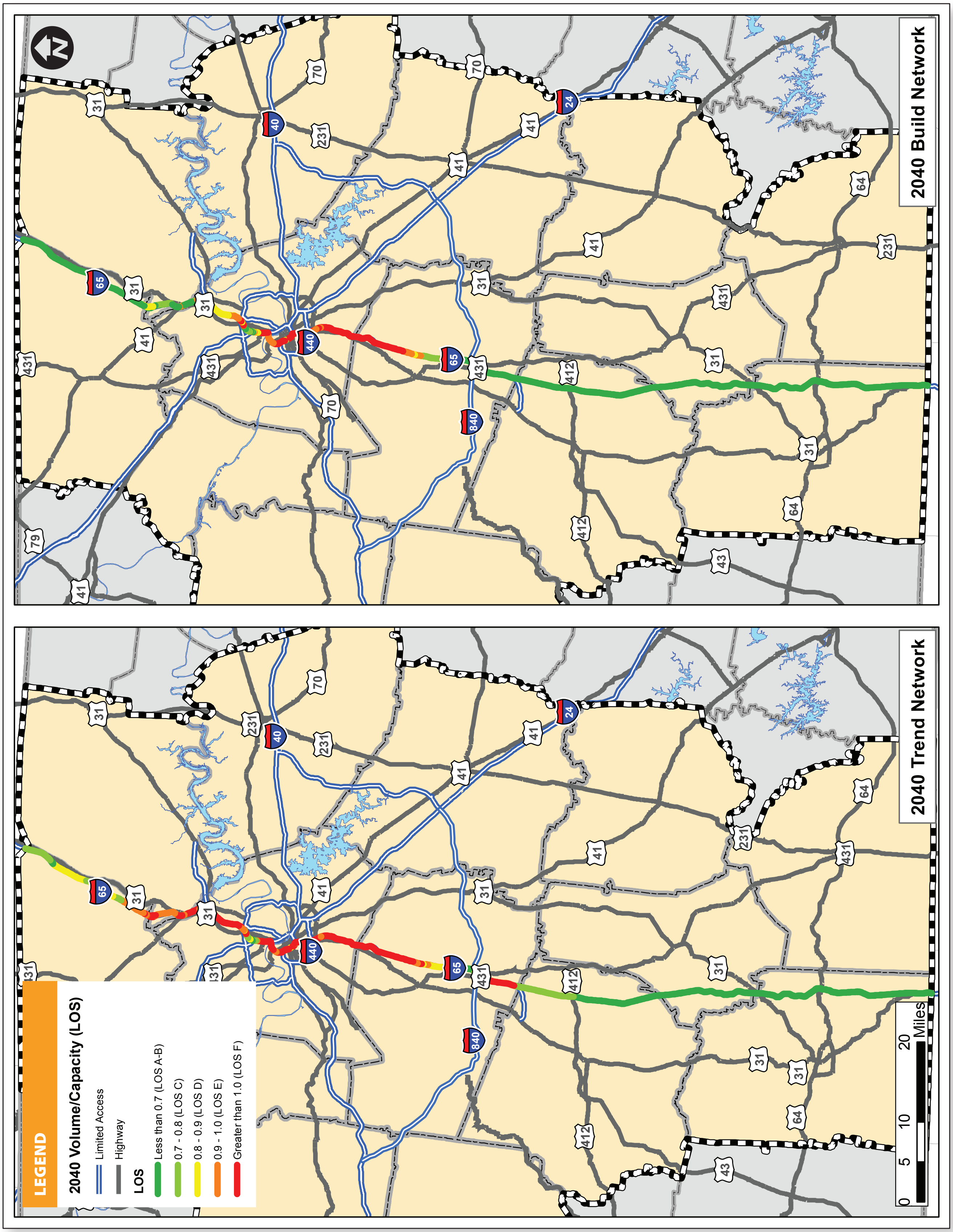
	Travel Time (minutes)			% Change		Speed (mph)			% Change
Market From-To	Base (2010)	Trend (2040)	Build (2040)	2040 Trend v. Build	Approximate Distance (mi)	Base (2010)	Trend (2040)	Build (2040)	2040 Trend v. Build
Franklin to Brentwood	10	21	17	-20%	8.5	51	24	30	25%
Brentwood to Franklin	11	22	20	-8%	8.5	46	23	25	9%
South Nashville to Franklin	22	37	36	-1%	16.5	45	27	27	1%
South Nashville to Nashville Core	16	30	29	-3%	8.5	32	17	18	3%
Franklin to Nashville Core	29	59	53	-10%	21.5	44	22	24	11%
Portland to Nashville Core	41	47	46	-2%	39.0	57	50	51	2%
Hendersonville to Nashville Core	25	32	31	-2%	18.5	44	35	35	2%
Spring Hill to Nashville Core	36	64	60	-6%	35.5	59	33	35	6%
Spring Hill to Franklin	20	36	28	-22%	18.5	56	31	40	29%
Giles County to Franklin	56	69	63	-9%	31.0	33	27	30	10%
Average	27	42	38	-8%	20.6	47	29	32	9%

Figure 4-4. Interstate LOS Map (2040 Build)



Source: Statewide Travel Demand Model, Version 2

Figure 4-5. 2040 Trend and 2040 Build LOS Comparison



Source: Statewide Travel Demand Model, Version 2

performance for Vehicle Miles Traveled (VMT), Vehicle Hours Traveled (VHT), average speed, and Vehicle Hours of Delay (VHD) are compared in Table 4-4. According to Table 4-4, the network VMT increases approximately 178,000 miles under the 2040 Build scenario compared to the 2040 Trend, an increase of one-tenth-of-one percent. This increase of VMT is expected given the capacity projects. However, due to the capacity improvements, VHT will decrease by around 35,000 hours, a one percent decrease, under the 2040 Build scenario compared to the 2040 Trend. Finally, the VHD will be reduced by around 41,000 hours, a 10 percent reduction. Urban interstates and urban principal arterial drive the decrease in VHD, with 10 and 12 percent decreases, respectively. The results indicate that the capacity projects will significantly improve the performance of the roadways and reduce overall network delay.

Another key, high-level performance measure is the change in person throughput. Table 4-5 compares the person throughput at six different screenlines along

Table 4-4. 2010, 2040 Trend, and 2040 Build Network Performance Measures

		VMT				
	Parameter	2010	2040 Trend	% Change (from 2010)	2040 Build	% Change (from Trend)
Functional Class	**R. Interstate (1)**	26,259,283	39,563,179	50.7%	39,882,986	0.8%
	R. Prin. Arterial (2)	14,985,509	29,109,831	94.3%	29,239,396	0.4%
	R. Minor Arterial (6)	13,544,516	24,686,616	82.3%	24,663,658	0.1%
	R. Major Collector (7)	8,878,405	16,641,207	87.4%	16,384,300	-1.5%
	R. Minor Collector (8)	8,112,124	15,723,364	93.8%	15,756,041	0.2%
	R. Local Road (9)	236,733	337,615	42.6%	326,775	-3.2%
	U. Interstate (11)	34,499,701	45,694,349	32.4%	45,189,277	-1.1%
	U. Other Freeway (12)	5,696,550	8,951,797	57.1%	9,113,479	1.8%
	U. Prin. Arterial (14)	29,817,822	44,352,312	48.7%	44,904,202	1.2%
	U. Minor Arterial (16)	22,877,501	37,172,455	62.5%	37,074,464	0.3%
	U. Collector (17)	8,396,876	16,804,683	100.1%	16,662,162	0.8%
	U. Local Road (19)	347,330	719,937	107.3%	739,097	2.7%
	All	**173,652,351**	**279,757,343**	**61.1%**	**279,935,836**	**0.1%**

		VHT				
	Parameter	2010	2040 Trend	% Change (from 2010)	2040 Build	% Change (from Trend)
Functional Class	**R. Interstate (1)**	348,467	526,663	51.1%	530,519	0.7%
	R. Prin. Arterial (2)	263,555	504,742	91.5%	507,067	0.5%
	R. Minor Arterial (6)	267,321	489,159	83.0%	487,620	0.3%
	R. Major Collector (7)	185,537	348,385	87.8%	343,022	1.5%
	R. Minor Collector (8)	186,119	361,407	94.2%	363,684	0.6%
	R. Local Road (9)	5,387	7,670	42.4%	7,435	3.1%
	U. Interstate (11)	585,403	861,215	47.1%	832,610	3.3%
	U. Other Freeway (12)	93,878	152,196	62.1%	155,400	2.1%
	U. Prin. Arterial (14)	895,827	1,422,171	58.8%	1,422,836	0.0%
	U. Minor Arterial (16)	729,791	1,215,310	66.5%	1,210,715	-0.4%
	U. Collector (17)	263,868	541,346	105.2%	534,099	-1.3%
	U. Local Road (19)	11,270	25,270	124.2%	25,379	0.4%
	All	**3,836,424**	**6,455,533**	**68.3%**	**6,420,387**	**-0.5%**

Table 4-4. Continued

	Parameter	Average Speed (mph) 2010	2040 Trend	% Change (from 2010)	2040 Build	% Change (from Trend)	VHD 2010	2040 Trend	% Change (from 2010)	2040 Build	% Change (from Trend)
Functional Class	**R. Interstate (1)**	75	75	-0.3%	75	-0.2%	467	3,357	618.4%	3,104	-7.6%
	R. Prin. Arterial (2)	57	58	1.4%	58	1.4%	83	1,243	1,389.5%	1,238	-0.4%
	R. Minor Arterial (6)	51	50	-0.4%	51	-0.2%	168	5,158	2,971.9%	4,239	-17.8%
	R. Major Collector (7)	48	48	-0.2%	48	-0.2%	25	894	3,534.3%	805	-10.0%
	R. Minor Collector (8)	44	44	-0.2%	43	-0.6%	80	1,349	1,585.9%	1,230	-8.8%
	R. Local Road (9)	44	44	0.2%	44	0.0%	0	22	4,887.9%	8	-65.6%
	U. Interstate (11)	59	53	-10.0%	54	-7.9%	73,021	189,118	159.0%	167,129	-11.6%
	U. Other Freeway (12)	61	59	-3.1%	59	-3.4%	2,957	11,700	295.6%	11,556	-1.2%
	U. Prin. Arterial (14)	33	31	-6.3%	32	-5.2%	16,246	127,210	683.0%	114,189	-10.2%
	U. Minor Arterial (16)	31	31	-2.4%	31	-2.3%	7,772	62,975	710.3%	61,679	-2.1%
	U. Collector (17)	32	31	-2.5%	31	-2.0%	874	25,951	2,870.0%	23,049	-11.2%
	U. Local Road (19)	31	28	-7.6%	29	-5.5%	52	2,406	4,512.8%	2,152	-10.5%
	All	45	43	-4.3%	44	-3.7%	101,746	431,384	324.0%	390,377	-9.5%

Table 4-5. Auto and Truck Person Throughput at Screenlines

Screenlines: I-65 Only							
		Daily Person Throughput					
Screenline	Location	2010	2040 Trend	% Change (from 2010)	2040 Build	% Change (from Trend)
1	Kentucky State Line	33,708	43,072	27.8%	47,406	10.1%
2	White House	44,802	54,698	22.1%	63,835	16.7%
3	Millersville	43,554	52,152	19.7%	59,597	14.3%
4	Brentwood	114,538	152,283	33.0%	160,192	5.2%
5	Spring Hill	42,931	60,816	41.7%	66,960	2.7%
6	Alabama State Line	11,669	19,729	69.1%	20,265	9.3%
	Average	48,534	63,792	31.4%	69,709	9.3%

I-65 for the 2010, 2040 Trend and 2040 Build scenarios. The person throughput along I-65 will increase at all six screenlines for autos and trucks. The corridor-wide increase in person throughput under the 2040 Build scenario is approximately 5,900 additional people, a nine percent increase, compared to 2040 Trend.

4.2 Interchange Improvements

Micro Level Operational, Capacity, and Safety Improvements

In Task 2, seven interchange locations were identified for operational, capacity, and safety improvements. Turning Movement Counts (TMC) were acquired for these locations for further microsimulation analysis. Also, five additional interchange locations were evaluated for targeted safety improvements based on crash hotspot data. The morning and afternoon peak hour operations were modeled in Synchro where possible and recommendations were made to increase the LOS for the intersections. Where applicable, Crash Modification Factors (CMF) were also used to quantify the safety benefits of each proposed improvement. A CMF is a multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure at a specific site. (For more information on Crash Modification Factors (CMF), refer to http://www.cmfclearinghouse.org) The results of the analysis are summarized in Table 4-6. The recommendations derived from this analysis are included in the safety project recommendations in Table 4-2.

As Table 4-6 indicates, the frequency of crashes will be reduced by approximately 20 and 30 percent in most of the locations, which can be interpreted as

Table 4-6. Interchange Improvement Results

	Interchange		Existing Intersection Level of Service (Delay in sec)		Build Intersection Level of Service (Delay in sec)			
No.	Road	Ramp Location	AM	PM	AM	PM	Interchange Daily Delay Savings (hr)	CMF
1	Exit 98: US 31 W	I-65 NB	B (12.7)	B (15.6)	B (12.1)	B (14.8)	7.4	0.705
		I-65 SB	D (36.3)	A (6.8)	C (34.4)	A (3.4)		n/a
2	Exit 97: SR-174 Long Hollow Pike	I-65 NB	B (15.8)	D (38.3)	B (15.6)	D (35.5)	60.1	n/a
		I-65 SB	D (41.6)	C (30)	B (19.0)	B (17.6)		0.705
3	Exit 85: Rosa L Parks Blvd	I-65 NB	E (55.7)	F (80.7)	D (50.4)	C (26.8)	265.1	0.803
		I-65 SB	E (73.2)	E (70.7)	D (37.3)	D (39.2)		0.803
4	Exit 81: Wedgewood Ave	I-65 NB	D (44.8)	C (25)	C (25.0)	B (17.9)	112.8	n/a
		I-65 SB	D (40.2)	D (53)	C (20.1)	C (27.6)		n/a
5	Exit 74: SR-254 Old Hickory Blvd	I-65 NB	D (49.4)	E (73.6)	D (42.1)	E (62.5)	286.9	n/a
		I-65 SB	F (170.0)	F (176.5)	F (134.5)	F (150.1)		n/a
6	Exit 71: SR-253 Concord Rd	I-65 NB	F (119.0)	D (43.6)	E (67.50	C (24.2)	183.3	n/a
		I-65 SB	C (28.2)	F (115.6)	C (27.3)	F (91.6)		n/a
7	Exit 65: SR-96 Murfreesboro Rd	I-65 NB	F (109.9)	C (29.2)	D (41.4)	C (24.1)	219.2	n/a
		I-65 SB	C (28.2)	E (56.9)	C (28.1)	D (44.0)		0.803
F	Exit 53: SR-396/Saturn Pkwy Interchange	I-65 NB	-	-	-	-	-	0.700
		I-65 SB	-	-	-	-		n/a
G	Exit 46: US-412/SR-99 Interchange I-24 West	I-65 NB	-	-	-	-	-	0.656
		I-65 SB	-	-	-	-		0.656
H	Exit 27: SR-129/Lynnville Highway Interchange I-24 West	I-65 NB	-	-	-	-	-	n/a
		I-65 SB	-	-	-	-		n/a
I	Exit 22: SR-11/US-31A Interchange I-24 West	I-65 NB	-	-	-	-	-	0.656
		I-65 SB	-	-	-	-		0.656
J	Exit 14: US-64/SR-15 Interchange I-24 West	I-65 NB	-	-	-	-	-	0.656
		I-65 SB	-	-	-	-		0.656

a reduction of fatal, injury, and property damage crashes. Additionally, for most of the projects, the planning level cost estimate is relatively low, meaning that most of these improvements could be implemented in the short-term and at a relatively low cost. Comprehensive data collection and analysis is recommended before making the decision to move forward with the projects shown in this table.

Macro Level Operational Improvements

A recurring comment at public workshops was the issue of improving the weaving areas around downtown Nashville along I-65. Currently, I-65 northbound merges from the left with I-40 northbound south of downtown Nashville. After several off-ramps and on-ramps serving the downtown area, I-65 exits to the right of I-65/I-40 and I-40 exits to the left. The geometry generates a large-scale weaving area during the afternoon peak hour. One potential solution for this weaving area is to redesign the western interchange at the end of the weave, making the I-40 exit to the right and I-65 exit to the left. Figure 4-6 shows the new traffic configuration for the interchange, with I-40 westbound traffic accessing the ramp from the center and right lanes, and I-65 northbound traffic accessing the ramp from the center and left lanes.

The peak hour counts along I-65, I-40, and the downtown ramps were evaluated for further macro level analysis of a potential solution. VISSIM was used to model the entire network as the tool is able to measure complex and large scale weaving patterns such as those that occur between multiple interchanges. Synchro lacks these analytical capabilities. The modeling was done for existing year 2017 data, and the results are shown in Table 4-7.

According to Table 4-7, the proposed improvement will have a negligible effect on the area during the morning peak hour as the weaving is not an issue during this time. However, the improvement would improve afternoon total delay by three percent and increase the average speed by two percent, which suggests potential merits for further analysis. A detailed analysis with origin-destination data is recommended for future analysis should TDOT decided to investigate the benefits of this proposed project.

Table 4-7. Weaving Analysis: Downtown Nashville

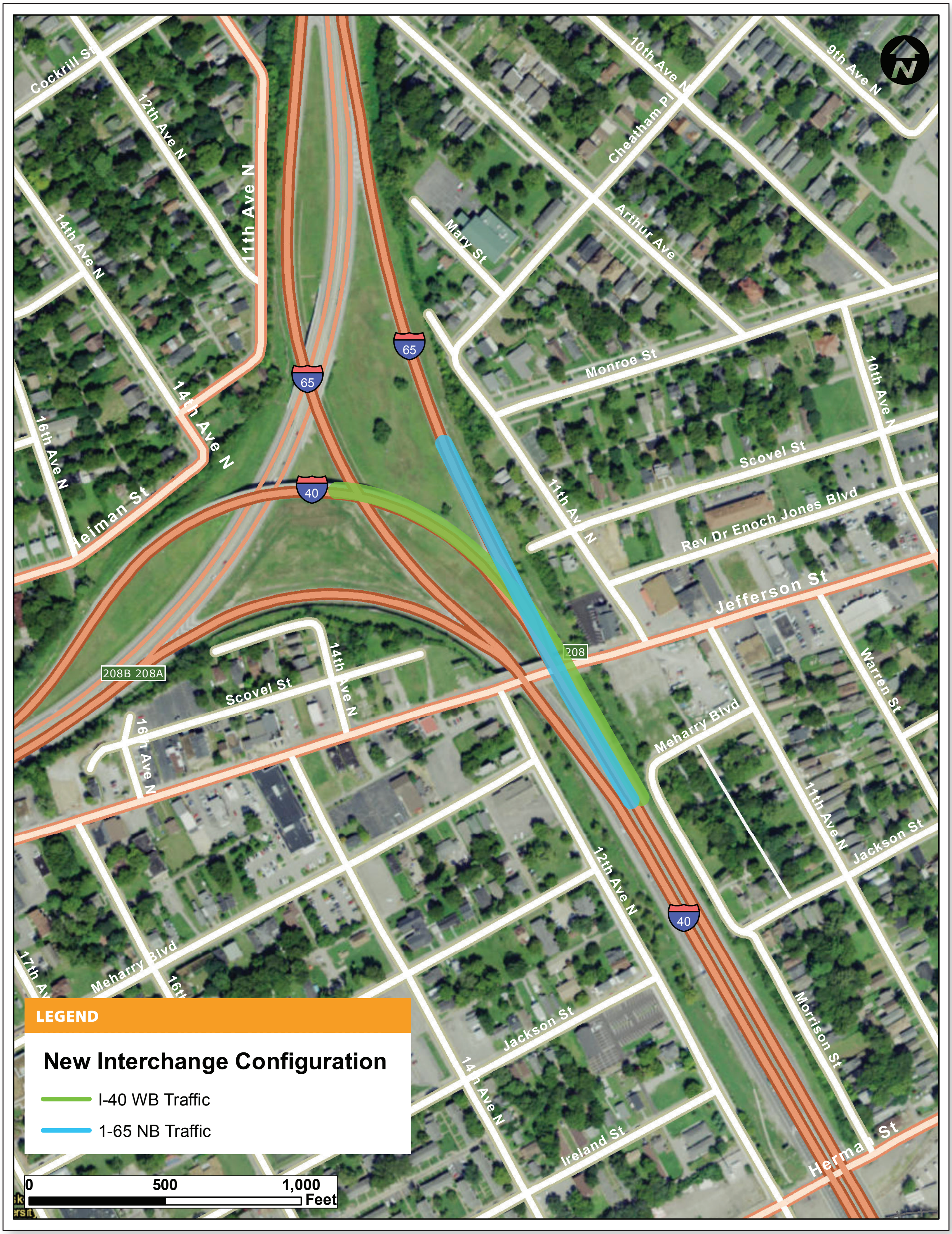
	AM			PM		
Peak Hour Performance	No-Build	Build	Improvement	No-Build	Build	Improvement
Average Delay Per Vehicle (sec)	77.40	77.40	0%	145.40	140.50	-3%
Average Speed (mph)	29.80	29.90	-0%	23.80	24.30	2%
VMT (mi)	10,827.00	10,847.00	-0%	14,152.00	14,163.00	0%
VHT (hr)	362.73	363.10	-0%	593.95	583.46	-2%
Total Delay (hr)	**158.61**	**158.58**	**0%**	**327.18**	**316.49**	**-3%**

Table 4-8. Crash Type and Frequency

Year	Number of Crashes	Angle	Rear-End	Fatalities	Injuries
2002	4	2	2	0	1
2003	3	1	2	0	4
2004	2	2	0	0	0
2005	3	3	0	0	5
2006	1	1	0	0	0
2007	1	0	1	0	0
2008	1	0	1	0	0
2009	7	5	2	0	1
2010	5	3	2	0	3

Year	Number of Crashes	Angle	Rear-End	Fatalities	Injuries
2011	5	3	2	0	1
2012	3	1	2	0	0
2013	4	2	2	0	1
2014	6	5	1	0	2
2015	3	2	1	0	0
2016	2	1	1	0	0
2017	1	1	0	0	4
Total	**51**	**32**	**19**	**0**	**22**
Average per year	**3.2**	**2**	**1.2**	**0**	**1.4**

Figure 4-6. New I-40/I-65 Interchange Configuration



Other Safety Improvements Projects

Based on public comments, the intersection of State Route (SR) 96 and SR 11 was also analyzed for safety improvements. The intersection is currently operating as an all-way stop-controlled intersection with relatively high crash rates. The crash history from 2002 to 2017 was provided by TDOT, with a total of 51 crashes occurring during the fifteen-year period. No fatal crashes were reported; however, 22 injuries were reported. Of the 51 reported crashes, 32 crashes (63 percent) were angle and 19 (37 percent) were read-end crashes. Table 4-8 shows the crash types and frequency of crashes at this location.

The majority of the crashes shown on Table 4-8, specifically the angle crashes, could be avoided by changing the control type from stop sign controlled to signalized. The CMF for this improvement is 0.656 for all crash types, meaning that the frequencies of both angle and rear-end crashes are estimated to be reduced by approximately 35 percent. Using the current dollar values for property damage crashes and injuries, the estimated saving would be around $470,000 per year. This value is well above the cost of installation and maintenance of a signalized intersection.

4.3 High Occupancy Vehicle (HOV) Enforcement Analysis

Due to the high violation rates on I-65, the existing HOV lanes are operating as additional General Purpose (GP) lanes, and consequently, the V/C ratios on the HOV lanes are similar to the GP lanes. Previous studies show that the violation rate along I-65 is between 60 and 90 percent. The high violation rates eliminate the intended benefit for HOV-eligible vehicles since there are very little travel time saving benefits.

Two possible improvements to the operation of the HOV lanes is to increase fines and increase enforcement. To estimate the effect of these potential improvements, the number of multiple occupant (HOV-eligible) vehicles was estimated on each link. In the absence of data on I-65, the existing count on I-24 in the vicinity of Nashville between Exits 56 and 57 collected in March 2016 was used. No mode shift assumptions were included in the analysis. A brief summary of the counts is shown in Table 4-9.

Per Table 4-9, approximately 16 percent of vehicles on I-24 have two or more occupants (HOV eligible).

Table 4-9. HOV Eligible Vehicles

Time of Day	Single Occupant Vehicles	Multiple Occupant Vehicles	Total Vehicles	% Multiple Occupant Vehicles
7AM - 9AM	2,702	749	3,451	22%
4PM - 6PM	3,027	320	3,347	10%
Total	5,729	1,069	6,798	16%
Split	84%	16%		

For this study, it is assumed that I-65 has the same distribution. Applying the 16 percent factor to the daily volume of each link from the 2040 statewide model results in the number of HOV-eligible vehicles on each link along I-65 where an HOV lane exists. If the HOV lanes are enforced, it is further assumed that 100 percent of the HOV eligible vehicles will use HOV lanes. Given that assumption, the following alternatives were tested:

- **Zero violation:** 100 percent of HOV-eligible vehicles use HOV lanes;
- **20 percent violation:** 100 percent of HOV-eligible vehicles plus an additional 20 percent of vehicles use HOV lanes; and
- **50 percent violation:** 100 percent of HOV-eligible vehicles plus an additional 50 percent of vehicles use HOV lanes.

Zero Violation

In this alternative, the law is effectively enforced, and the number of violations is negligible. Figure 4-7 shows the results of this analysis. Without enforcement, the HOV lanes have the same 2040 V/C ratio as the GP lanes, and they fail in most segments. However, the zero violation V/C ratios are at LOS D or better. Of course, the GP lanes are also affected under this scenario. Since the V/C ratios on the GP lanes will be higher in the zero percent violation scenario, LOS will deteriorate by approximately 11 percent (Table 4-10).

20 Percent Violation

In this alternative, the law is moderately enforced, and the number of violations does not exceed 20 percent of the HOV eligible vehicles. Per Figure 4-8, the 2040 HOV lanes with 20 percent violation largely operate at LOS E or better as compared to mostly failing under a no enforcement alternative. As with the zero violation scenario, V/C ratios are higher on the GP lanes, resulting in a six percent increase (Table 4-10).

50 Percent Violation

In this alternative, the law is poorly enforced, and the number of violations is significantly high at 50 percent of the HOV eligible vehicles. In Figure 4-9, the 2040 HOV lanes with 50 percent violation are operating slightly better or similarly to the HOV lanes operating without enforcement. The trend of LOS deterioration shows that at around 50 percent violation, HOV-eligible vehicles would not see the HOV lanes as attractive and start using the GP lanes, since the time savings will not be different. The V/C ratios and LOS values are similar between no enforcement and 50 percent violation, illustrating that at an approximately 50 percent violation rate HOV lanes lose their effectiveness. By adopting best practices in violation laws and policies (see Section 9, Transportation Demand Management), HOV violation rates can be more effectively managed and can generate mode shifts from single occupant vehicles to multiple occupant vehicles.

Table 4-10. HOV Eligible Vehicles and General Purpose Lane LOS

HOV Enforcement Level	General Purpose Lane Average V/C	General Purpose Lane Percent Change in V/C
No Enforcement	0.990	n/a
Zero Violation	1.096	11%
20% Violation	1.054	6%
50% Violation	0.992	0%

Source: Statewide Travel Demand Model

4.4 Parallel Arterials

Eight routes were also identified as potential parallel routes that can operate as bypass or alternative incident management corridors. Four of these eight routes are on the north side of Nashville. The routes are:

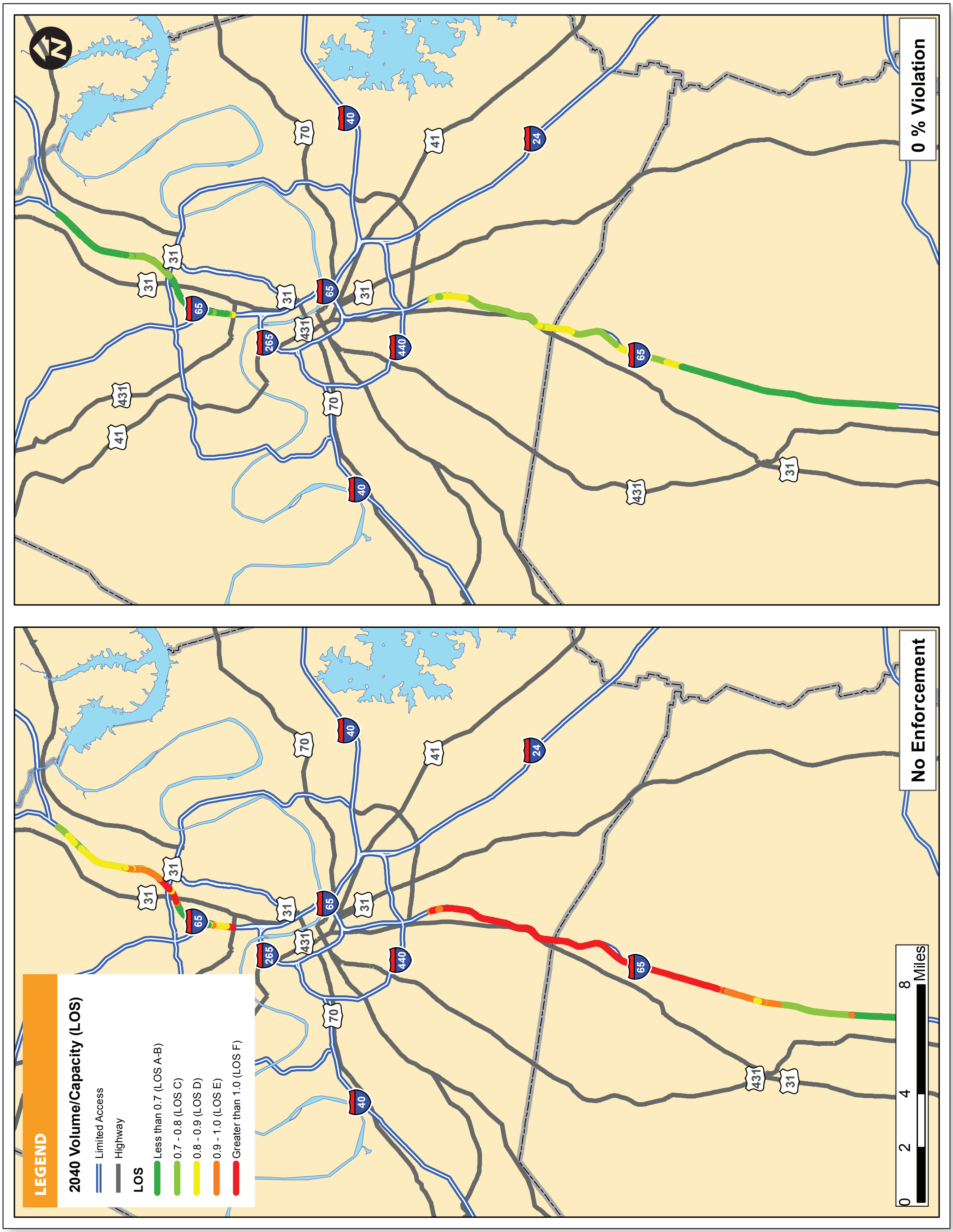
- Brick Church Pike;
- US-41;
- US-31E; and
- Gallatin Pike.

The remaining four routes serve south of Nashville. These routes are:

- Granny White Pike;
- US-31;
- Powell Avenue; and
- US-41A.

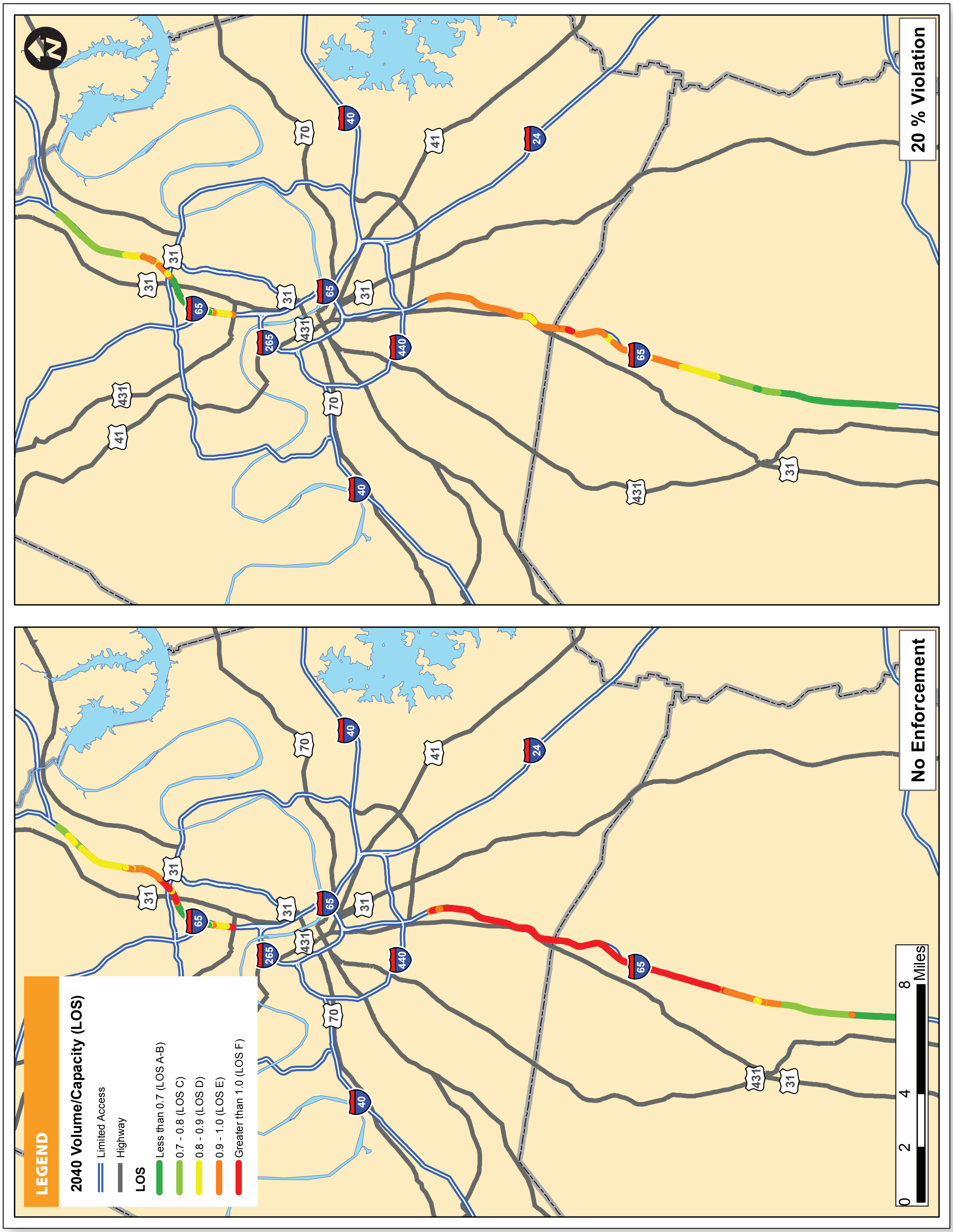
Most of these routes do not have the capacity to accommodate the entire I-65 volume. However, in case of emergency a single route or a combination of routes could be used as alternatives to I-65. To understand the conditions of these routes the LOS of these corridors are mapped with I-65 in Figure 4-9. According to the 2040 V/C ratios from the TSM model, these parallel routes operate at a much better LOS than I-65. Therefore, these routes generally have available capacity and could be considered as acceptable alternatives for I-65 should a need exist. More detailed analysis including LOS analysis during the morning and afternoon peak hours is highly recommended to understand the reliability of these routes as the statewide model is limited to daily V/C ratios. Active arterial management, discussed in Section 5 (Intelligent Transportation Systems) will play an important role in maximizing the combined operational performance of I-65 and parallel arterials.

Figure 4-7. HOV Lane Level of Service: Zero Percent Violation



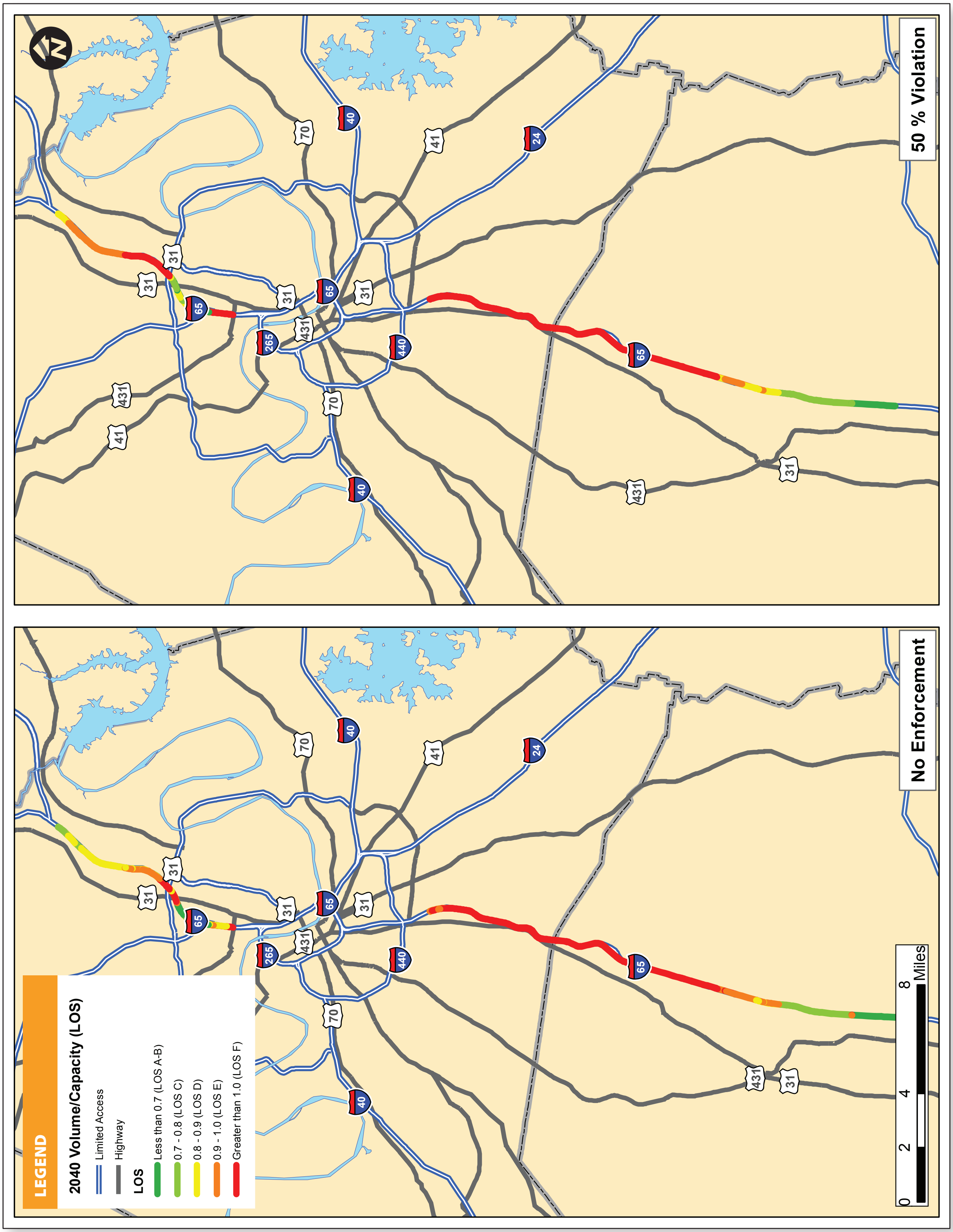
Source: Statewide Travel Demand Model, Version 2

Figure 4-8. HOV Lane Level of Service: 20 Percent Violation



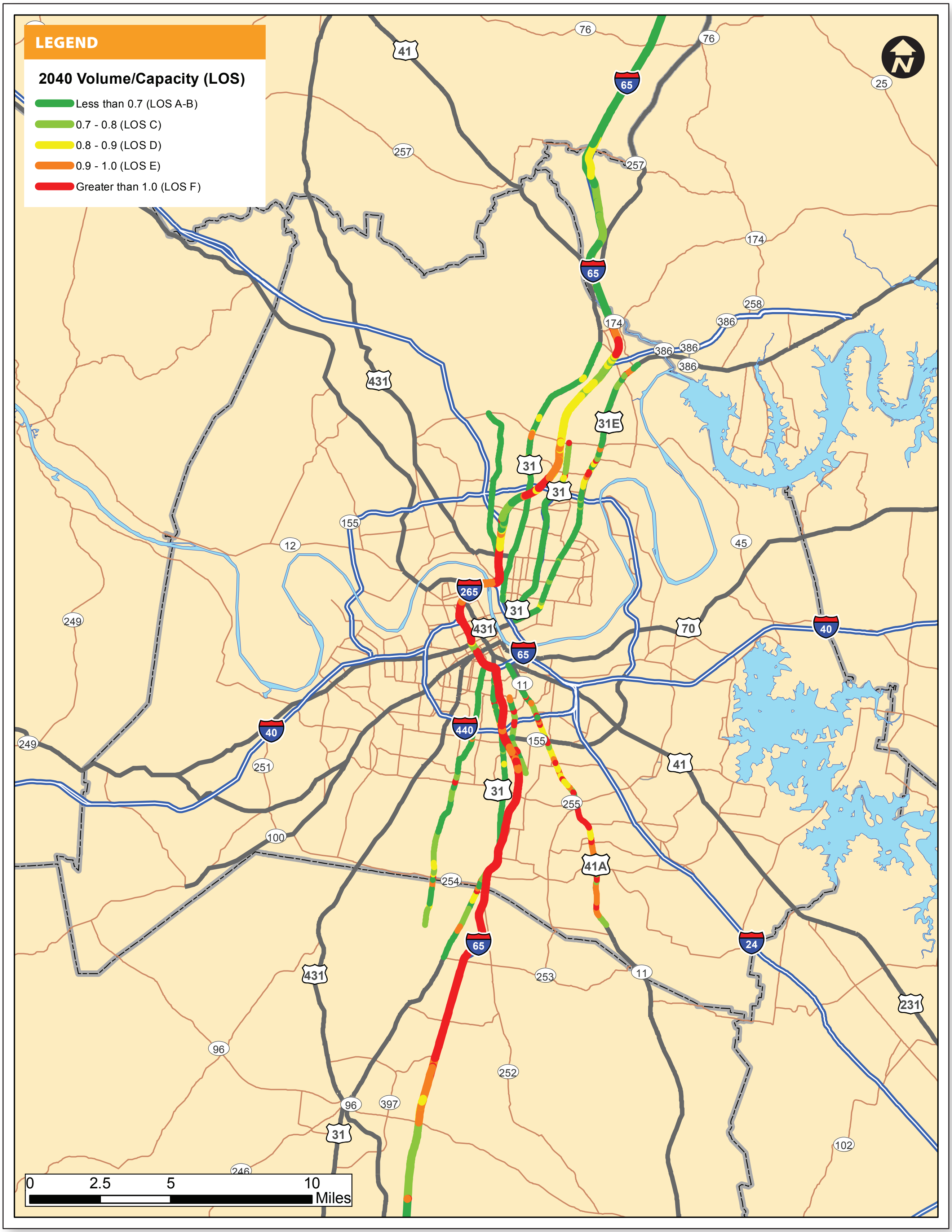
Source: Statewide Travel Demand Model, Version 2

Figure 4-9. HOV Lane Level of Service: 50 Percent Violation



Source: Statewide Travel Demand Model, Version 2

Figure 4-10. Parallel Routes Level of Service (2040 Build)



Source: Statewide Travel Demand Model, Version 2

5. Intelligent Transportation Systems (ITS)

After examining the ITS needs in the I-65 corridor, potential solutions were identified for the corridor overall as well as each subarea. ITS solutions include both physical device deployments and operational strategies. Table 5-1 and Figures 5-1, 5-2, and 5-3 illustrate the proposed ITS improvements.

5.1 Corridor Wide Solutions

Safety

A significant number of crashes, both rear-end and sideswipe, have been identified throughout the I-65 corridor. Areas with higher numbers of incidents include:

- **North Sub-Area:** South of Goodlettsville from north of the I-24 interchange to the SR 386 merge area;
- **Central Sub-Area:** South Downtown Nashville Loop (the area between the I-40/I-65 interchanges); and
- **South Sub-Area:** Cool Springs interchange.

To address rear-end incidents along I-65, additional dynamic message signs (DMS) are recommended at strategic locations to provide drivers with information on downstream conditions. Possible messages include "Incident – Slow Traffic Ahead," "Congestion - Reduce Speed Ahead," and "Accident Right Lane Closed Move Left." By informing drivers of the need to reduce speeds well ahead of the incident, the potential for rear-end collisions can be reduced providing safer roadways for all motorists. Additionally, if messages about major incidents can be provided on a DMS well ahead of the incident and before major decision points, truck drivers and other motorists can adjust their routes accordingly. Several studies have shown that drivers with travel time information can better "manage their expectations," reducing driver frustration and enhancing driver safety.

Connected Vehicles/Dedicated Short Range Communications (DSRC)

It is recommended that all new ITS device deployments have DSRC reader equipment installed to capitalize on connected vehicle technology benefits. DSRC is a two-way short/medium range wireless communication that allows for very high data transmission between vehicles (vehicle-to-vehicle or V2V) and with infrastructure (vehicle-to-infrastructure or V2I). By installing DSRC technology in conjunction with other field devices, TDOT will able to harness data generated from vehicles that utilize the state highway system. The data will allow TDOT to provide more detailed information directly to drivers as well as give the department a better understanding of existing conditions including road weather, emissions, and safety conditions. By outfitting TDOT HELP trucks and other TDOT vehicles with on-board DSRC units, TDOT will be able to gather data for their roadways without waiting for the public to fully adopt the technology.

Freight/Truck

By identifying the needs of the freight community, ITS solutions can enhance the experience of truck drivers. Potential freight-related ITS opportunities include virtual weigh stations and smart truck parking. Currently there is only one weigh station on the I-65 corridor near the Kentucky border, which could be converted to a virtual station. By pre-screening for certain operating characteristics, such as speed and height, virtual weigh stations can improve the enforcement of commercial motor vehicles over traditional random selection and monitor conditions continuously. Additional stations could be added between the existing station and the Alabama border to allow for better regulation of overweight vehicles and in turn extend the life of the existing pavement along I-65. Smart truck parking locations along the corridor would provide dedicated areas for trucks and aid in eliminating trucks parking on ramps. Potential locations for this deployment include the existing rest areas near Exit 22/US 31A, Exit 46/US 412, and at the Kentucky state line.

Traffic Incident Management Strategies

A dedicated Traffic Incident Management (TIM) team is another operation solution that could be deployed along I-65. TIM programs are used to reduce incident-related travel delays. While regional TIM teams exist in Tennessee, the proposed team would be a group

Table 5-1. ITS Improvements

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
0-1	Rapid Incident Scene Clearance (RISC)	Kentucky	Alabama	Contractual incentive-based program and operational policy to support open roads initiative related to truck crashes; North and South options	122.0	All	North, Central, and South
0-2	Conversion to Virtual Weigh Stations	Kentucky	Alabama	Portland weigh station	122.0	All	North, Central, and South
0-3	Smart Truck Parking	Kentucky	Alabama	Location TBD; Potential sites include the existing rest areas near Exit 22, Exit 46, and the Kentucky state line	122.0	All	North, Central, and South
0-4	I-65 Traffic Incident Management (TIM) Team	Kentucky	Alabama	North and South options	122.0	All	North, Central, and South
0-5	I-65 North ITS	Exit 108	Kentucky border	Install CCTV, DMS, and detection devices including fiber optic connections on I-65; Suggested DMS locations: SR-25/Main St (Exit 112) NB and SB, and SR-52 (Exit 117) SB.	13.0	Sumner	North
0-6	Connected Vehicle Technology Deployment	I-840	SR-76 (Exit 108)	Install DSRC radios	49.0	Davidson, Robertson, Sumner, and Williamson	North and Central
0-7	Adaptive Ramp Metering (ARM)	Exit 108 (SR-76)	Exit 90 (SR-155)	Install adaptive ramp metering devices and additional detection at 6 ramp locations in each direction	18.0	Davidson, Robertson, and Sumner Counties	North and Central
0-8	Adaptive Ramp Metering (ARM)	Exit 88 (I-24)	Exit 80 (US-440)	Install adaptive ramp metering devices and additional detection at 6 ramp locations in each direction	8.0	Davidson	Central
0-9	Dynamic on-ramp assignment - Southbound	Charlotte Ave	I-40/I-65 Split	Add arterial DMS along 14th Ave, add interstate shields or use gantries for junction pre-positioning on on-ramps and interstate facilities	1.0	Davidson	Central
0-10	Dynamic on-ramp assignment - Northbound	Broadway (US-70A)	I-40/I-65 Split	Add arterial DMS along 14th Ave, add interstate shields and deploy lane control gantries for junction pre-positioning on on-ramps and interstate facilities	1.0	Davidson	Central
0-11	Adaptive Ramp Metering (ARM)	Exit 80 (US-440)	Exit 53 (SR-396)	Install adaptive ramp metering devices and additional detection at 9 ramp locations in each direction	27.0	Davidson and Williamson	Central and South
0-12	Active Arterial Management US 31 E/Gallatin Pike	Rivergate Pkwy	Spring Street	Last mile connectivity between intersections, install detection for all intersections, MOUs, and Consultant Operations to optimize signal timing and detect incidents along corridor	10.0	Davidson	North and Central
0-13	Active Arterial Management (AAM) Dickerson Pike	US-31 W/ Louisville Hwy	US-431/ Trinity Ln	Last mile connectivity between intersections, install detection for all intersections, MOUs, and Consultant Operations to optimize signal timing and detect incidents along corridor	10.0	Davidson and Sumner	North and Central
0-14	Active Arterial Management (AAM) Franklin Rd	Demonbreun	Mack Hatcher	Last mile connectivity between intersections, install detection for all intersections, MOUs, and Consultant Operations to optimize signal timing and detect incidents along corridor	18.0	Davidson and Williamson	Central
0-15	Active Arterial Management (AAM) Nolesville Pike (US-41)	Korean Veterans Blvd	Old Hickory Blvd	Last mile connectivity between intersections, install detection for all intersections, MOUs, and Consultant Operations to optimize signal timing and detect incidents along corridor	9.0	Davidson	Central

Table 5-1. (continued)

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
0-16	Active Arterial Management (AAM) Old Hickory Blvd	Hillsboro Rd (US-431)	US-41	Last mile connectivity between intersections, install detection for all intersections, MOUs, and Consultant Operations to optimize signal timing and detect incidents along corridor	15.0	Davidson	Central
0-17	Active Arterial Management (AAM) Hillsboro Rd (US-431)	Broadway (US-70A)	Mack Hatcher	Last mile connectivity between intersections, install detection for all intersections, MOUs, and Consultant Operations to optimize signal timing and detect incidents along corridor	16.0	Davidson and Williamson	Central
0-18	Active Arterial Management (AAM) Nolensville Pike (US-41)	I-840	US-231/ Colloredo Blvd/Lane Pkwy	Last mile connectivity between intersections, install detection for all intersections, MOUs, and Consultant Operations to optimize signal timing and detect incidents along corridor	28.0	Williamson, Rutherford, and Bedford	South
0-19	I-65 South ITS	MM 57.6	Alabama border	Install CCTV, DMS, and detection devices including fiber optic connections on I-65; Suggested DMS locations: SR-396/Saturn Pkwy (Exit 53) NB and SB, SR-50/New Lewisburg Hwy (Exit 37) NB and SB, and SR-11/Alt US-31/Sam Davis Hwy (Exit 22) NB.	67.0	Maury and Giles	South

that was solely focused on the I-65 corridor. Since needs differ across the corridor, a team for the north component and the south component would be appropriate.

Additionally, a Rapid Incident Scene Clearance (RISC) strategy could be deployed along the corridor to aid in the removal of trucks that are involved in incidents. This strategy is a contractual, incentive-based program that utilizes heavy duty wreckers when there are incidents that involve a rollover blocking one or more lanes, an incident with multiple trucks, lost loads that impact travel along the corridor, and incidents that involve impacts with or on top of barrier walls, guardrails, or bridge supports. The strategy includes operational policy as well that supports the open roads initiatives with incentives provided for meeting clearance performance measures. Similar to the TIM teams, a north and south option could be deployed to address the different needs of the corridor.

Interstate System Management and Operations Strategies

Additional closed-circuit television (CCTV), detection, and DMS installed from Exit 108/SR 78 to the Kentucky border and from I-840 to the Alabama border would provide the department with additional information on these sections of the corridor and preposition them for future operational strategies that may need to be deployed. Currently real-time information about these two areas is limited to third party data and driver calls. By deploying additional devices, the department would be able to monitor traffic congestion and deploy mitigating strategies. Deployments to the state lines will also allow the for coordinated operations with the adjoining states.

5.2 North Sub-Area Solutions

The northern section of I-65 experiences directional congestion in the AM and PM peak periods as drivers travel to and from the Nashville area. By 2040, LOS for this area is estimated to be at LOS D and E for much of the corridor. To address these deficiencies and needs, two operational strategies are proposed: adaptive ramp metering and active arterial management.

Although adaptive ramp metering (ARM) should be considered primarily for the central section of I-65, some ARM deployment will be required in the northern section for a successful operational strategy in the central section. ARM can be deployed via two different algorithms: corridor adaptive ramp metering (CARMA) and system-wide adaptive ramp metering (SWARM). CARMA meters ramps based on mainline speeds and local controller conditions to optimize metering and allow for the maximum

Figure 5-1. ITS Improvements Map: North Sub-Area

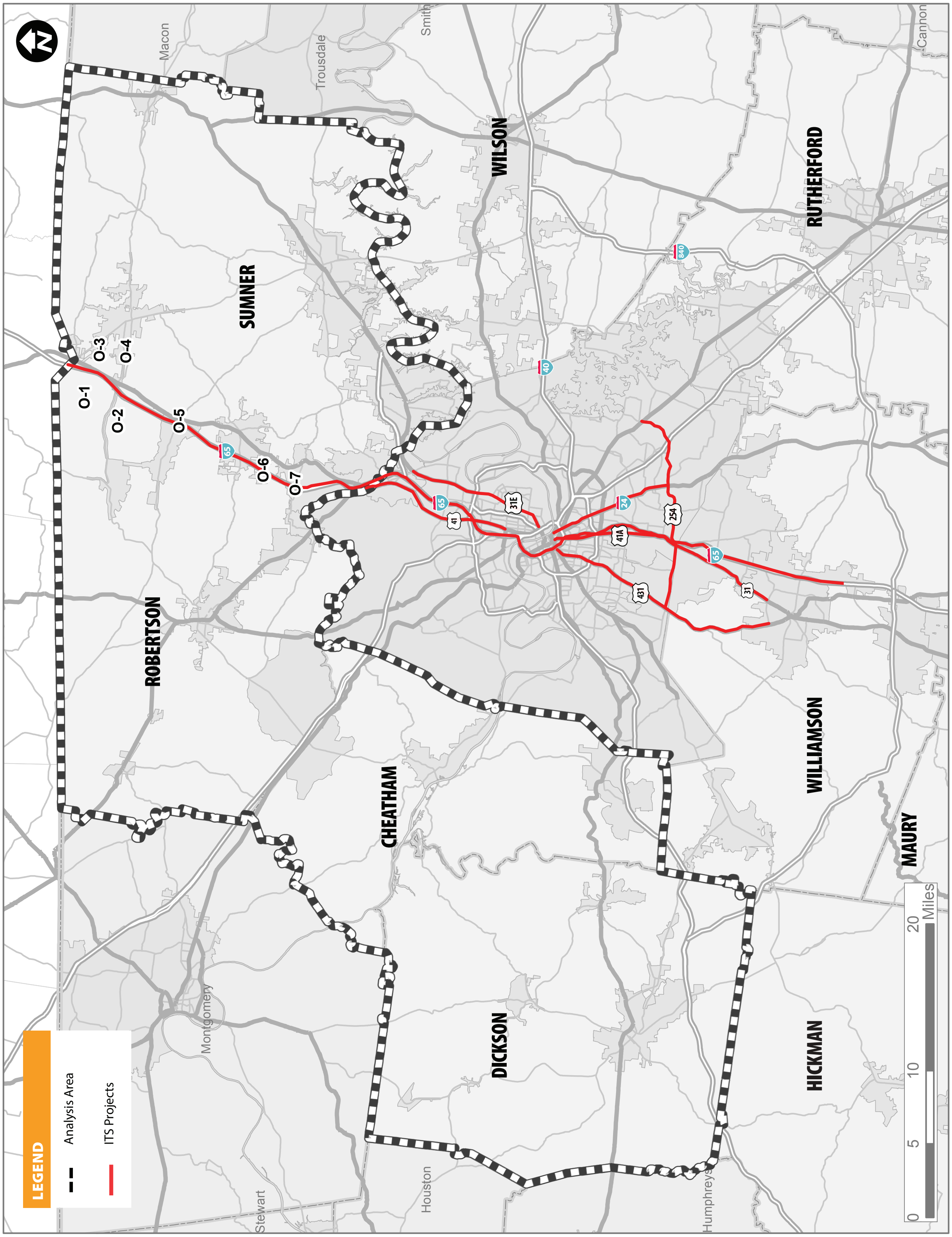


Figure 5-2. ITS Improvements Map: Central Sub-Area

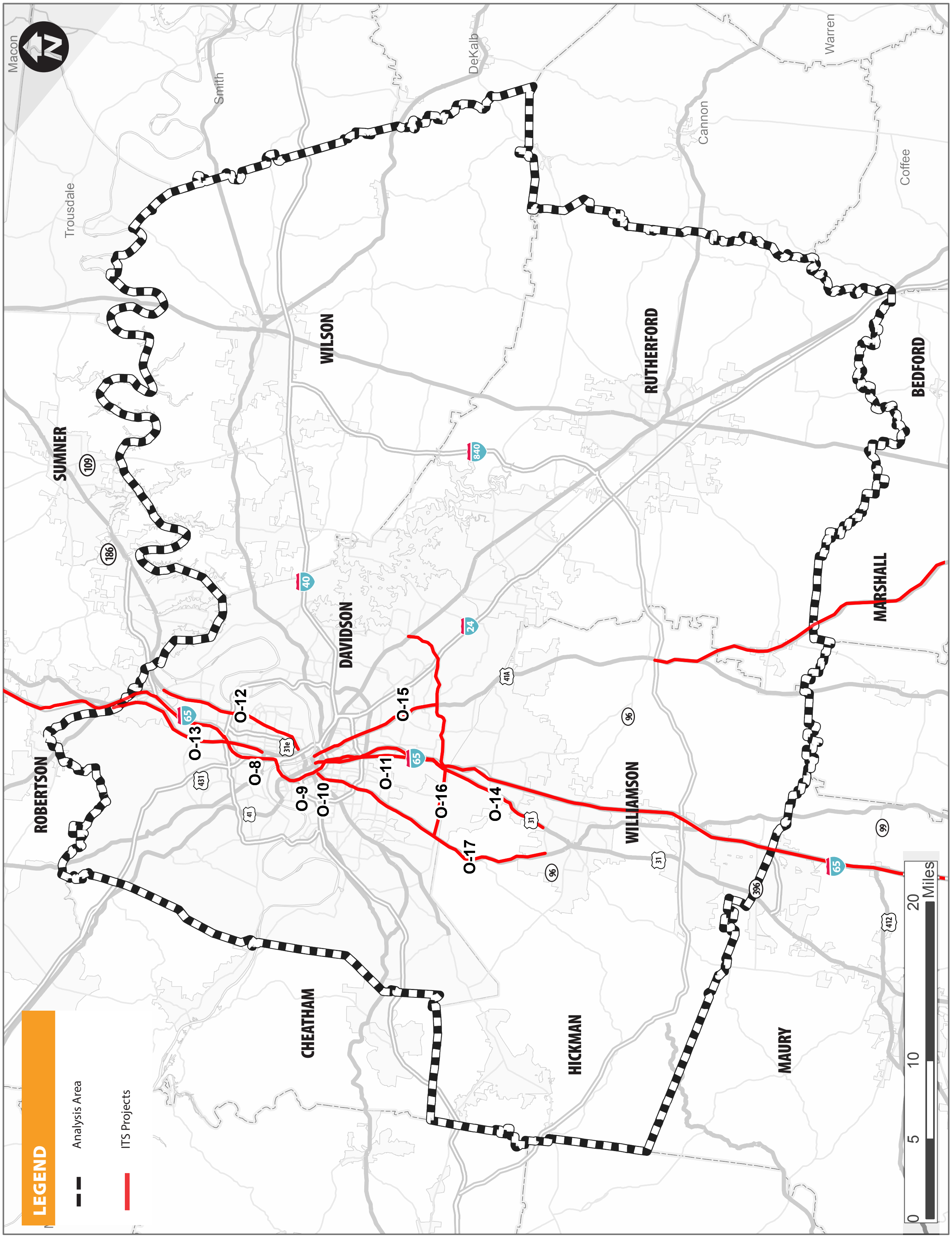
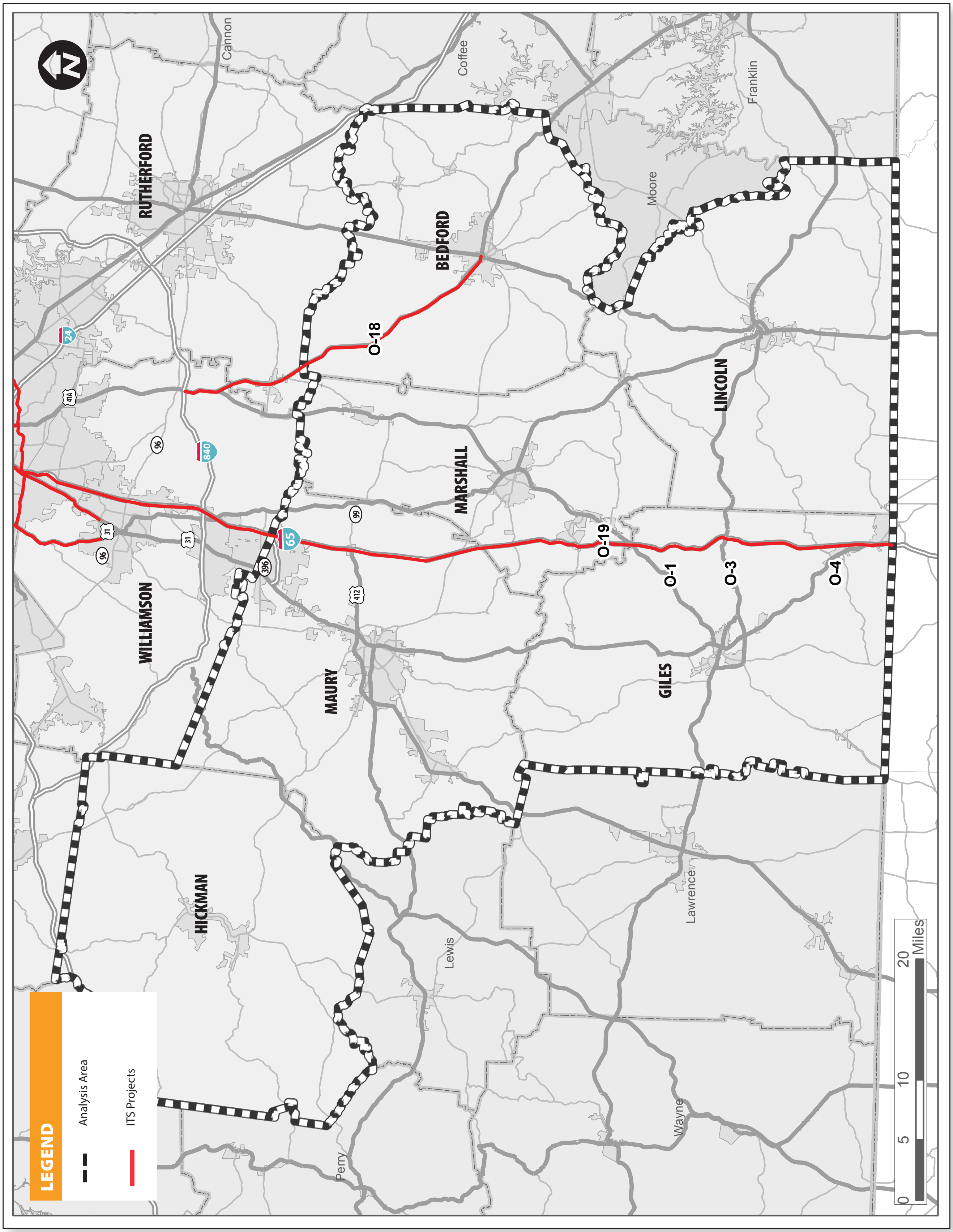


Figure 5-3. ITS Improvements Map: South Sub-Area



vehicles to enter the facility when speeds are high on the mainline and allow no vehicles when speeds are near optimal. SWARM meters based on current density, required density, and the number of vehicles that should be added or removed from the facility between ramps. For this strategy, upstream ramps are called to action when a single ramp has exceeded its capacity. This option allows for locally, manually, and varied algorithms to be utilized along a corridor, which makes it a good candidate for I-65. Recommended locations for this operational deployment would include the interchanges of SR 386/Vietnam Veterans Boulevard (Exit 95) and US 31W/Louisville Highway (Exit 98). As population grows north of Nashville, additional interchanges may need to be added to the ramp metering strategy including SR 257/Bethel Road (Exit 104) and SR 76 (Exit 108). Deployments would require mainline and ramp detection, metering devices, and coordination with signalized intersections on the arterials that feed the entrance ramps.

To aid in alleviating the congestion on I-65 in the northern section, active arterial management (AAM) is also proposed on Dickerson Pike from US 31W/ Louisville Highway to US 431/Trinity Lane. The goal of AAM is to increase throughput on corridors by minimizing congestion and reducing delays. AAM optimizes signal timings and addresses the real-time conditions of the corridor. By optimizing travel along Dickerson Pike, drivers will have an alternative route to I-65 for travel to and from Nashville. To maximize the benefit of utilizing an alternative route, drivers would need to know that travel times along the alternative would meet or outperform the travel times of I-65. Another potential AAM parallel corridor in the north section is US 31W/ Gallatin Pike from Rivergate Parkway to Spring Street. Both alternative route options would require memoranda of understanding (MOUs) with the signal maintaining agencies, operational support to optimize the signal timings and detect incidents along the corridor, and last mile connectivity.

5.3 Central Sub-Area Solutions

Within the central section, there are several on- and off-ramps that are closely spaced together, particularly in the downtown Nashville area. This spacing creates a significant number of weaves and bottleneck conditions as noted in Section 4. To address these conditions as well as the congestion along this section of I-65, ARM is a potential solution due to its ability to reduce overall freeway congestion by limiting the number of vehicles entering the facility and minimizing platoons that can create difficult merge conditions. One caveat for ARM's success is the need to coordinate signal timing within adjacent intersections. Deployments would require mainline and ramp detection, metering devices, and coordination with signalized intersections on adjacent arterials. Similar to the need for the northern section's ARM, deployments to the south of the central section will be needed to support this strategy. For the central section of I-65, ramp metering strategies would be potential solutions at the following locations:

- **North of Downtown:** SR-386/Vietnam Veterans Boulevard (Exit 95), SR-45/Old Hickory Boulevard (Exit 92), US-41/Dickerson Pike (Exit 90A), and US-431/Trinity Lane (Exit 87);
- **Downtown:** US-41A/Rosa L. Parks Boulevard (Exit 85), Charlotte Avenue/US-70, Church Street, Broadway, and Demonbreun Street; and
- **South of Downtown:** Wedgewood Avenue (Exit 81), Armory Drive (Exit 79), SR-255/Harding Place (Exit 78), and SR-254/Old Hickory Boulevard (Exit 74A and 74B).

The south loop area between the I-40 and I-65 junctions has been identified as an area of particular focus for potential ITS strategies. In addition to ARM, the deployment of dynamic ramp assignments/ closures to the southbound on-ramps between Charlotte Avenue and the south I-40/I-65 interchange and to the northbound on-ramps between US 70A/ Broadway and the north I-40/I-65 interchange could be introduced. The intent of this strategy is to allow drivers time to negotiate the merging conditions and then enter the marked lane for either I-40 or I-65. This recommendation would limit the need for drivers to cross multiple lanes of traffic after entering the interstate in order to get into the correct lane for their destination. Arterial DMS along 14th Avenue and George L. Davis Boulevard, and possibly along Broadway, Church Street, and Charlotte Avenue, would need to be deployed to inform drivers of the change in operations for the on-ramps. Additionally, gantries (overhead structures) and/or painted interstate shields would need to be deployed on the on-ramps and interstate to inform drivers of the correct on-ramp to use during managed times as well as what lanes should be utilized for each interstate. For the northbound direction, the strategy would likely only need to be deployed in the PM peak periods; however, for the southbound direction, the strategy could be deployed in the AM and PM peak periods.

AAM strategies could provide congestion relief for I-65's central section, including the following corridors:

- US-31/Franklin Road;
- US-41/Nolensville Pike;
- SR-254/Old Hickory Boulevard; and
- US-431/Hillsboro Road.

To the west of I-65, the options include Franklin Road from Demonbreun Street to US 431/Mack Hatcher Memorial Parkway and US 431/Hillsboro Road from US 70A/Broadway to Mack Hatcher Memorial Parkway. Both options would require coordination with Metro Nashville-Davidson County, the City of Brentwood, and the City of Franklin in order to have an effective operational strategy. To the east of I-65, US 41/Nolensville Pike from Korean Veterans Boulevard to SR 254/Old Hickory Boulevard would require coordination with Metro Nashville and the City of Brentwood for operation. SR 254/Old Hickory Boulevard from US 431/Hillsboro Road to US 41/Nolensville Pike could also provide congestion relief as a connector between the two AAM corridors. For each of the AAM corridors, MOUs, last mile connectivity between intersections, and signal timing optimization and incident detection would be needed.

Within the Cool Springs area, ARM has been identified as a potential solution. Additional opportunities include the use of hard shoulder running and transit signal priority (TSP). Potential ARM deployments include the following locations:

- SR-253/Concord Road (Exit 71);
- SR-441/Moores Lane (Exit 69);
- Cool Springs Boulevard (Exit 68);
- McEwen Drive (Exit 67); and
- SR-96/Murfreesboro Road (Exit 65).

As Williamson County's population continues to grow, ARM strategies may also be appropriate for deployment at the interchanges from SR 248/Goose Creek Bypass/Peytonsville Road (Exit 61) to SR 396/Saturn Parkway (Exit 53). US 41 is also an opportunity for AAM between US 231/Colloredo Boulevard in the south sub-area and I-840 due to the growth anticipated in the Shelbyville area. By coordinating with the municipalities along the corridor and surrounding areas, drivers will have additional options when traveling to and from the Franklin and Nashville business districts.

Hard shoulder running applications in the locations surrounding the Cool Springs area would be an appropriate effective strategy. The area is expected to see significant increases in trips in the future and hard shoulder running would expand the capacity of I-65. It is recommended that this strategy only be for light vehicles due to the existing pavement and geometric constraints of the roadway. Finally, the implementation of TSP to support future express bus routes along Mallory Lane and Carothers Parkway within the Cool Springs Area would enhance the service and minimize impacts on normal traffic operations.

6. Freight

This section identifies freight-related mobility constraints in the study area and develops a set of potential solutions that can improve freight mobility and enhance efficient and safe freight movement. These improvements will ultimately promote access to economic areas and generators. The recommendations are based on projected freight demand from various sources. In addition to mainline and interchange improvements, there are number of system management and operation strategies than can expand freight options, including:

- Managed lanes;
- Parallel corridors;
- Freight arterial bottlenecks;
- Dedicated freight corridors;
- Speed modifications;
- Freight diversion strategies; and
- Traffic management strategies.

6.1 Mainline Improvements

Figure 6-1 illustrates interstate highway sections within the study area that may require capacity expansion to address volume-to-capacity (V/C) ratios greater or equal to 0.8 (LOS D) and truck percentages (TP) greater than 20 percent. Highway capacity improvements identified in Section 4 will address the primary area of concern on I-65 north of SR 386/ Vietnam Veterans Boulevard. Complementing the capacity projects, Table 6-1 and Figure 6-2 highlight a series of recommended improvements to mitigate freight bottlenecks in Davidson County.

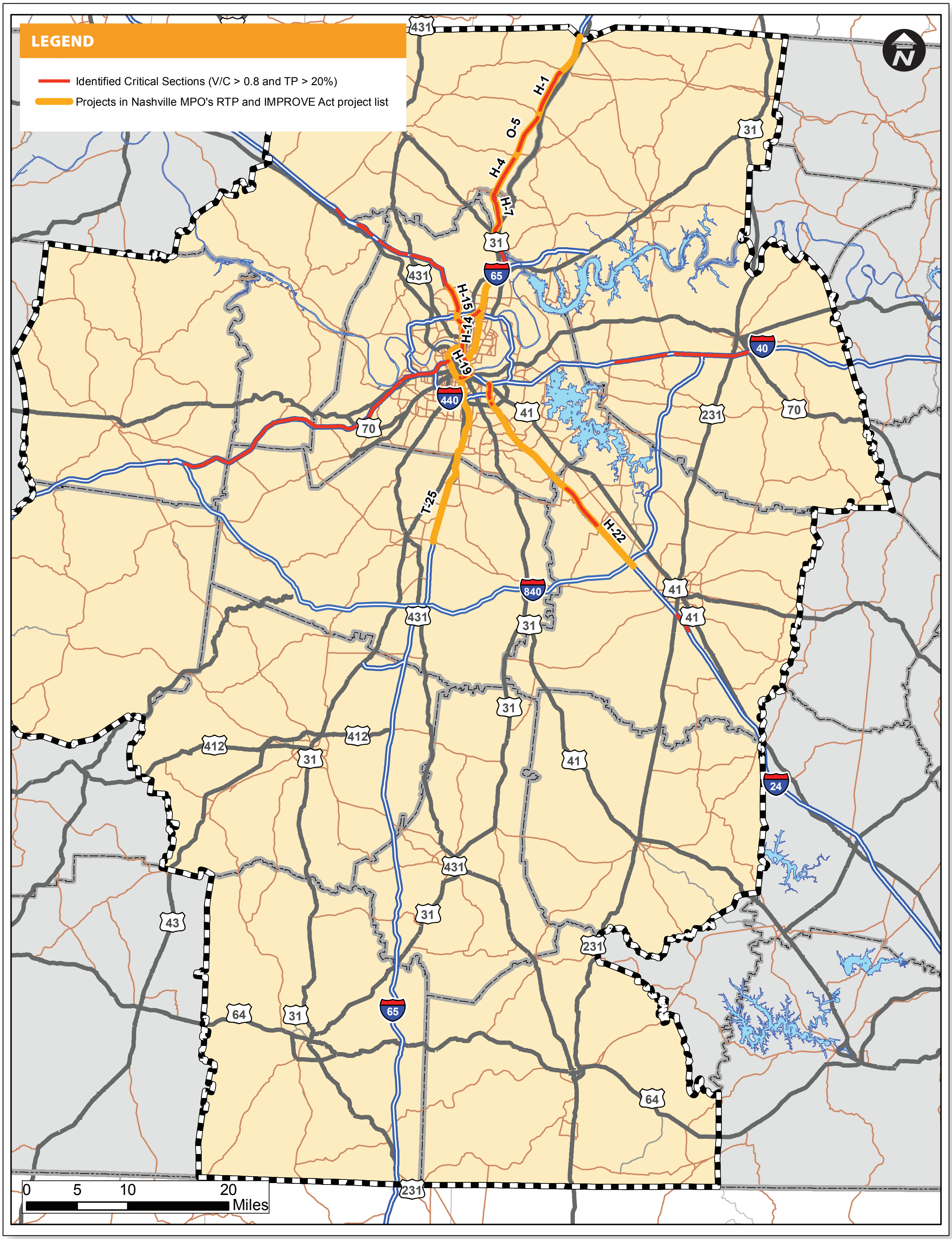
6.2 Interchange Improvements

As part of the interchange analysis (see also Section 4.2), freight operations were evaluated to determine if they are contributing to congestion problems in each of the identified interchanges. Ten interchanges were studied for additional improvements such as ramp widening, revising merging/diverging areas, widening shoulders, and adding dedicated turning lanes.

Table 6-1. Freight Improvements

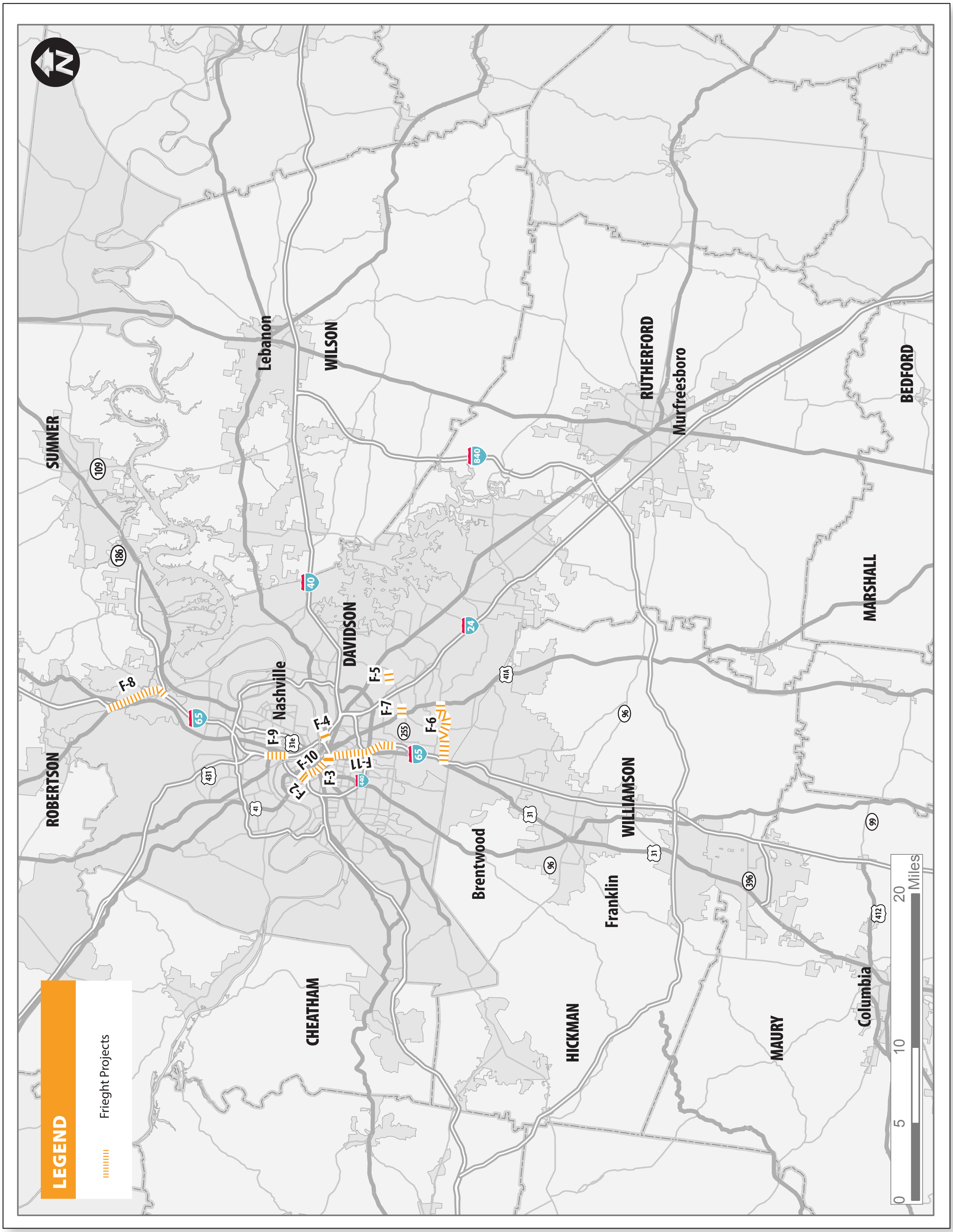
ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
F-1	I-65 Weight Station near TN/KY State Line	N/A	N/A	Roadway Reconstruction and New Weigh Station	0.0	Sumner	North
F-2	I-65	Northbound direction - Diverging area of I-40 and I-65 (West of Nashville Loop)		Diverging area geometry correction - Adding lane(s)	0.2	Davidson	Central
F-3	I-65	Nortbound direction - Merging area of I-40 and I-65 (South of Nashville Loop)		Merge area geometry correction - Adding lane (s)	0.3	Davidson	Central
F-4	Ramp Improvement	Northbound ramp from I-24 to Hermitage Ave		Diverging area geometry correction - Adding lane(s)	0.2	Davidson	Central
F-5	Harding Place (SR-255)	McGavock Pike	Donelson Pike	Widening	0.4	Davidson	Central
F-6	Old Hickory Blvd (SR-254)	I-65	Nolensville Road (US-41A/SR-11)	Widening	4.1	Davidson	Central
F-7	Harding Place (SR-255)	Nolensville Road (US-41A/SR-11)	Jonquil Drive	Widening	0.5	Davidson	Central

Figure 6-1. Projected 2040 Interstate Truck Percentages



Source: Statewide Travel Demand Model, Version 2

Figure 6-2. Freight Improvements



Similar to the mainline improvements, for an interchange to be considered as a bottleneck for freight operations, V/C ratios and truck percentages should be greater than or equal to 0.8 and 20 percent, respectively. The ten interchanges were separately analyzed for the 2010 through 2040 time periods. Based on the analysis, congestion at four interchanges is considerably impacted by truck movements:

- Exit 104/Bethel Road;
- Exit 98/US 31W;
- Exit 96/Rivergate Parkway; and
- Exit 95/Vietnam Veterans Boulevard.

6.3 Managed Lanes

Under the broader umbrella of managed lanes, truck only toll (TOT) lanes are one potential strategy for mitigating truck traffic especially in the peak direction. While not currently used in the United States, TOT lanes are closely related to the larger issue of whether road pricing should be an important tool for consideration in the I-65 corridor. For this study, the impacts of TOT lanes are categorized into two groups: effects on logistics systems and effects on traffic conditions.

Logistics Systems Effects

Impacts of toll lanes on logistics systems are mainly obtained by movement of trucks to less congested roadways which can lead to a reduction in operating costs for the freight operator and in higher driver retention. The effectiveness of toll lanes on logistics decisions are primarily affected by the capability of the carrier to offset the added cost of the tolls (e.g., reduced transport cost and transferability of toll cost to clients), and the extent to which the structure of the logistics system allows implementation of such strategies. Studies have shown that TOT lanes are expected to affect truck utilization, logistics system design, and freight modal choice. In Germany, for example, the tolling scheme increased the cost of moving general cargo by road between five and seven percent. With other conditions remaining the same, it can be expected that a truck tolling scheme will change logistical cost trade-offs made between transport cost and storage, inventory, and administration.

Traffic Condition Effects

The impact of TOT lanes on traffic conditions include changes in truck routing and delivery schedules. In cases where the additional cost cannot be offset, tolling is expected to incentivize utilization of toll free alternative routes which have comparable distance and travel time. The literature, however, offers contradicting findings. In Switzerland, tolling had virtually no impact on vehicle routing which is not surprising considering the fact that all roads are tolled equally. In Germany, only five percent of trucks switched to secondary roads to avoid tolling. In Australia, on the other hand, tolling increased truck traffic volume on secondary roads by about 60 percent.

In addition to truck routing, tolling may affect delivery schedules, especially in cases where tolls vary by time of day. The UK tolling system is the only tolling scheme in Europe in which truck tolls vary by time of day – day and night toll levels. It has been observed that nighttime deliveries in the UK increased from eight-and-a-half percent in 1985 to 20 percent in 2002. However, this change may not be solely attributable to the tolling scheme as day time traffic conditions worsened and warehouses and factories extended their operating hours as well.

In the United States, one study evaluated the impacts of toll level on freight demand diversion on the I-81 corridor in Virginia. The study found that low levels of tolling would not change routing for most commodity types. Coal, however, was sensitive even to low toll levels. The study suggested toll exemption for local freight movement, empty trucks, and special commodity classes. Another study examined the feasibility of implementing truck-only toll lanes (TOT) in Atlanta. TOT lanes are of interest in the Atlanta region because trucks are expected to account for 93 percent of freight movement in the area in 2030. It was found that a TOT facility would reduce total vehicle hours traveled while have little impact on total vehicle miles traveled. Finally, a third study analyzed feasibility of tolling parallel corridors of I-90 and SR 520 in the State of Washington. Results showed that that the introduction of tolling one or both corridors will change truck percentages insignificantly.

TOT lanes may also be introduced to facilities having managed lanes. Currently, there are four managed lane facilities in the US that allow trucks to operate at any time of day: Fort Lauderdale, Florida; Minneapolis–St. Paul, Minnesota; Houston, Texas; and Dallas–Fort Worth, Texas. In the first three examples, truck percentages in the managed lanes are currently less than two percent. Whether or not trucks started to shift to other routes as a result of tolling was confirmed as traffic conditions in regular lanes were also improved. In Fort Lauderdale, evidence indicated that some auto travelers shifted to the managed lane, freeing up capacity for freight operators and incentivizing them to remain in general purpose lanes.

In closing, if the TOT concept is pursued in the I-65 corridor, its potential impacts on logistical decisions and truck routes and schedules hinges upon the preferences of freight operators and the tolling scheme. Toll lanes that focus on commuters may not serve the routes and schedules of freight operators, and consequently, may not meet truck traffic objectives. An in-depth investigation of different aspects of tolling would help clarify potential freight behavior more accurately in the presence of tolls or other demand management pricing mechanisms.

6.4 Parallel Corridors

Identifying parallel routes for freight is another strategy for accommodating increases in truck traffic through and within the I-65 study area. These corridors, all of which bypass downtown Nashville, are shown in Figures 6-3 and 6-4. Truck travel times and average and maximum V/C ratios for each route were also calculated and are shown in Tables 6-2 and 6-3. The results show only minor monthly variability in route travel times. Travel times (Table 6-2) for all routes, except route E and G, are less than three hours in the AM and PM peaks. Average and maximum V/C ratios (Table 6-3) for all routes are also less than those for I-65. Consequently, routes A, B, C, D, F, and H can be considered as acceptable alternatives for I-65. Among these acceptable alternatives, route F, comprised of SR 109 and I-840, is of particular interest with a travel time less than 30 percent greater than the I-65 travel time. Maximum V/C along this route is only 0.82 in 2010 and 1.56 in 2040. Importantly, route F can be considered as a dependable alternative for I-65 not only at the present time but also in the future.

Figure 6-3. Potential Alternative Freight Routes (A-D)

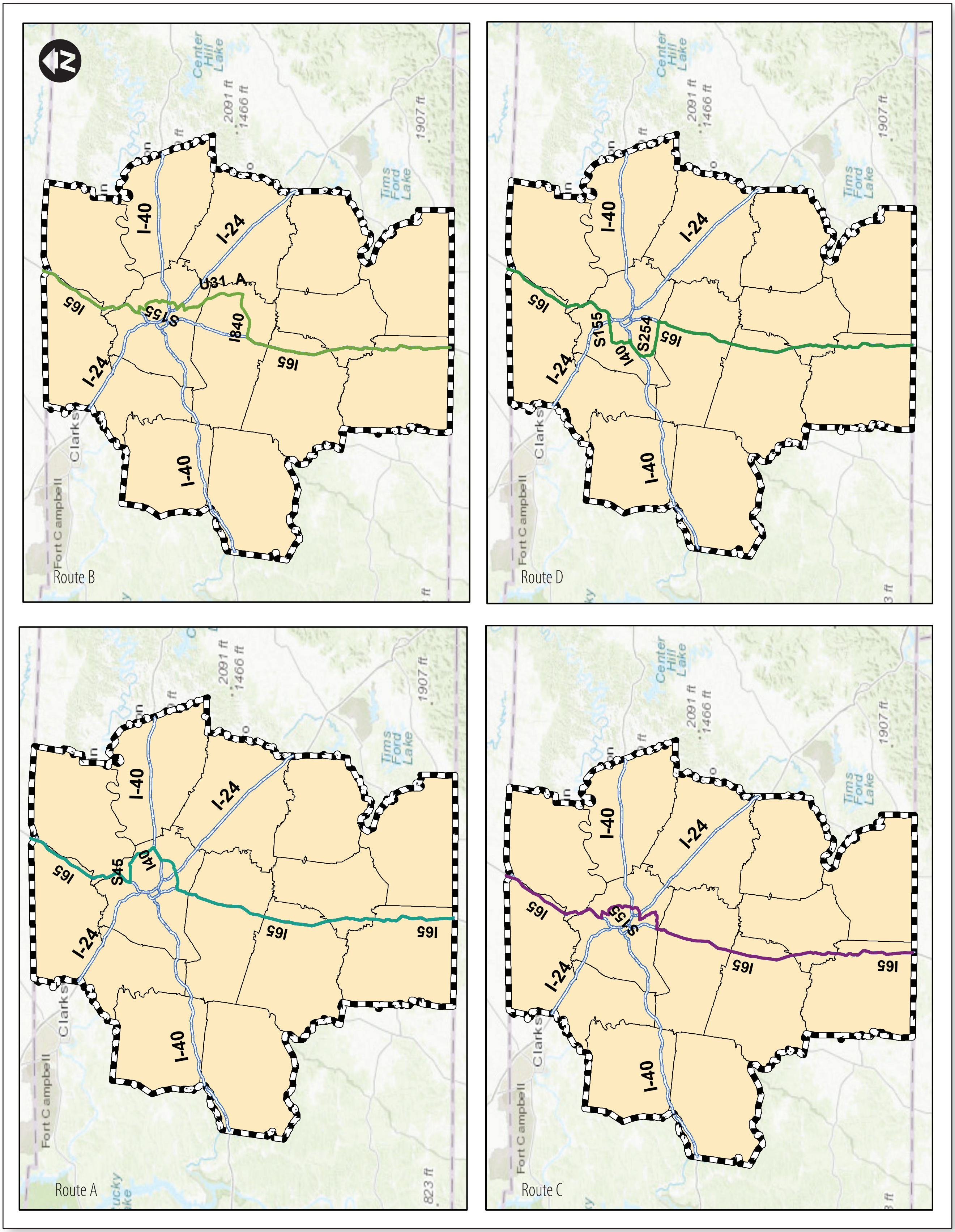


Figure 6-4. Potential Alternative Freight Routes (E-H)

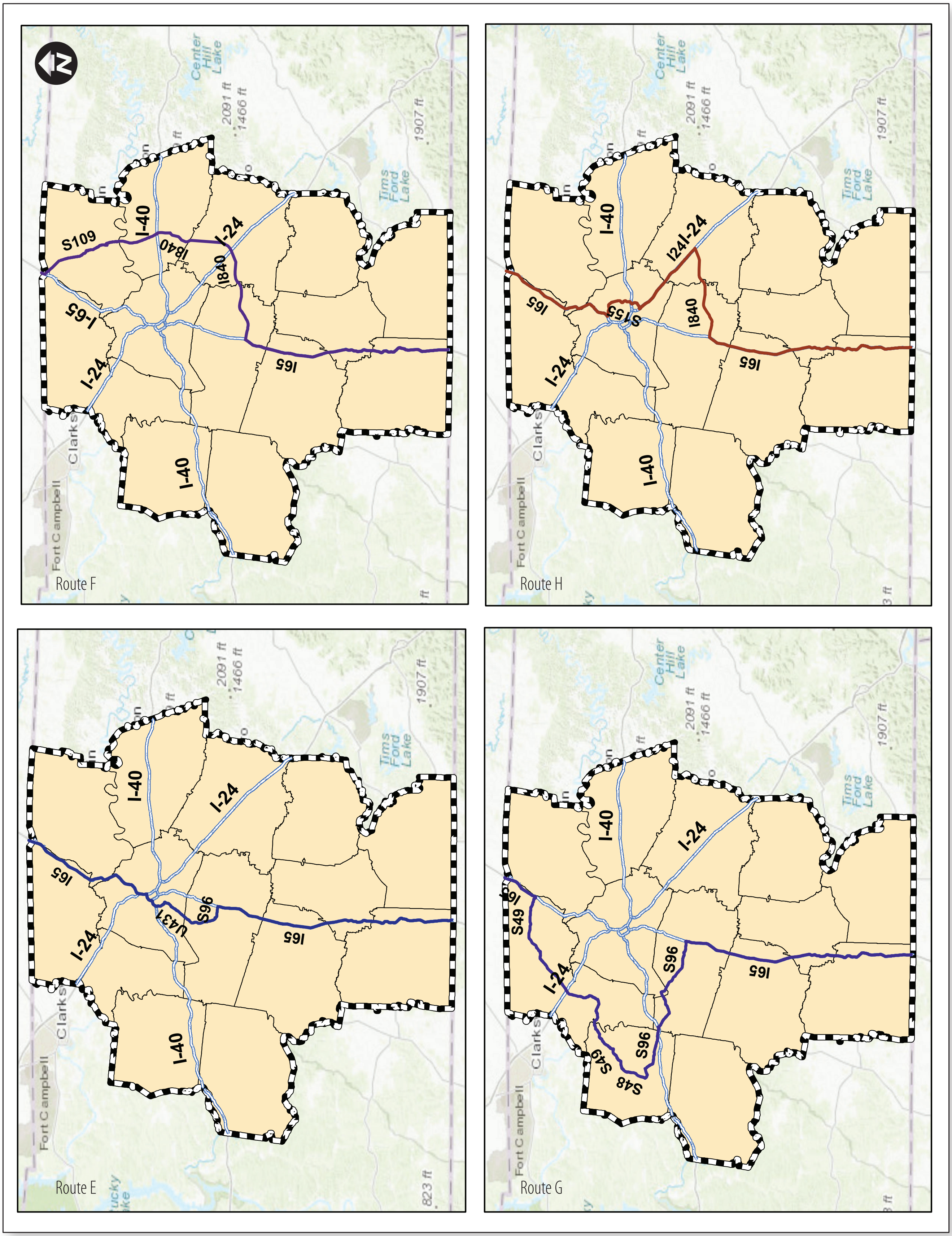


Table 6-2. Potential Alternative Freight Routes: Travel Times

Route	2010		2020		2030		2040	
	AVG V/C	MAX V/C	AVG V/C	MAX V/C	AVG V/C	MAX V/C	AVG V/C	MAX V/C
I-65	0.67	1.65	0.74	1.80	0.81	1.93	0.88	2.05
A	0.51	1.19	0.59	1.36	0.66	1.33	0.73	1.52
B	0.47	1.09	0.57	1.30	0.65	1.50	0.73	1.69
C	0.52	1.38	0.60	1.57	0.68	1.75	0.75	1.91
D	0.54	1.31	0.61	1.55	0.69	1.75	0.76	1.89
E	0.59	1.37	0.66	1.58	0.73	1.71	0.81	1.93
F	0.30	0.82	0.42	1.29	0.51	1.42	0.59	1.56
G	0.29	1.08	0.37	1.39	0.45	1.65	0.53	1.85
H	0.53	1.09	0.63	1.30	0.72	1.50	0.80	1.69

Table 6-3. Potential Alternative Freight Routes: Volume to Capacity

Route	AM		MD		OP		PM	
	TT-NB	TT-SB	TT-NB	TT-SB	TT-NB	TT-SB	TT-NB	TT-SB
I-65	2.26	2.23	2.24	2.22	2.22	2.20	2.25	2.21
A	3.08	3.14	3.05	3.14	3.03	3.13	3.04	3.14
B	2.98	2.98	2.96	2.96	2.95	2.96	2.96	2.96
C	2.82	2.83	2.80	2.82	2.79	2.82	2.79	2.83
D	2.81	2.76	2.80	2.78	2.79	2.77	2.80	2.78
E	3.03	2.99	3.05	2.99	3.06	2.98	3.09	2.99
F	2.92	2.82	2.91	2.80	2.92	2.82	2.92	2.82
G	5.53	5.47	5.47	5.47	5.52	5.57	5.50	5.56
H	2.58	2.61	2.58	2.61	2.57	2.59	2.58	2.59

Evaluating the impact on overall traffic performance measures of rerouting peak period truck traffic to the proposed alternative routes requires detailed route choice information from the travel demand model which is not currently available. In the absence of model data, however, there are steps that can be taken to identify elements needed to implement dynamic truck rerouting (DTR) strategies and understand state of the practice factors affecting DTR effectiveness. In general, DTR will be implemented more efficiently if ITS and connectors to traffic management centers exist, and effectiveness will be increased if DTR is implemented with variable speed limits.

Additionally, DTR can be implemented when:

- LOS during peak period is E or F;
- There are incidents related to severe traffic congestion;
- There exists an alternative route(s) to accommodate rerouted traffic no further than a few miles away;
- There is available capacity on the parallel routes; and
- There is available right-of-way for installation of overhead sign gantries at critical locations.

Some states and cities have already established rerouting plans. The State of Connecticut, for example, developed emergency diversion plans for major expressways in the Department of Emergency Management and Homeland Security (DEMHS) Region 5, a 1,400-square mile area with a population of nearly 600,000. The project's goal was to equip local and state emergency responders with tools to direct vehicles to alternative routes during and after emergency situations and ultimately reduce response time to incidents and improve speed, safety, and efficiency. Alternative routes were developed based on:

- Availability of capacity;
- Appropriateness of geometry (e.g., curve radius and grade standards) for trucks and cars;
- Bridge clearance to accommodate trucks;
- Direction and turn prohibitions; and
- Weight restrictions on bridges.

A set of guidelines was also developed to allow emergency responders to effectively perform rerouting during an incident. Such guidelines should be precise and clear, and should promote interagency cooperation and coordination.

In 2011, the South Alabama Regional Planning Commission studied incidents along Interstates 10, 65, and 165 in Mobile County to identify potential routes for diverging traffic during incidents. Traffic simulation was conducted using Synchro to evaluate the effect of traffic diversion. Routes were chosen based on the following criteria:

- Road type;
- Roadway infrastructure (number of lanes, traffic signals, turn lanes at intersections, etc.);
- Operational constraints (bridge weight restrictions, vertical clearance, traffic geometry, etc.);
- Current traffic demands; and
- Land use served by roadway

Routes were also checked to assure that they "make sense" to typical users. The study acknowledged that rerouting mixed traffic could be challenging because weight, clearance, and geometric restrictions may not allow trucks to follow automobiles. Furthermore, trucks carrying hazardous materials may not be allowed to use some routes. Finally, Seattle, Washington, developed a freight mobility improvement plan in which online information about bridges with weight restrictions and alternative truck routes are provided to users. The rerouting process is expected to diminish recurring congestion. Alternative routes, however, are not responsive to closures caused by incidents.

Although the state of practice is mostly focused on traffic rerouting during incidents or other non-recurring events, there are takeaways for truck rerouting in peak periods. First, availability to hazmat carriers, capacity, road geometry, and weight and clearance restrictions should be meticulously investigated when studying rerouting truck traffic. Second, implementing truck traffic rerouting strategies not only requires appropriate infrastructure, ITS, and traffic management systems but also a clear plan to facilitate interagency communication. Evaluation of alternative routes requires a traffic assignment model to extract route choice information, and a comprehensive study to develop and evaluate truck rerouting strategies for the I-65 corridor should be considered. An ex-post study is also recommended.

6.5 Freight Arterial Bottlenecks

To identify arterial bottlenecks from a freight operations perspective, four special freight generators were analyzed within the study area: Cherokee Marine Terminal, Tennessee Commercial Warehouse, Nashville International Airport, and CSX Radnor Yard. Consistent with previous analysis, sections in which V/C and TP are greater than 0.8 and 20 percent respectively are identified as sections potentially requiring improvement. Results for the 2040 model highlight several bottlenecks, many related to arterials with constrained right-of-way as well as I-24 in the downtown Nashville loop.

- Cherokee Marine Terminal: Jefferson Street between Rosa Park Boulevard and I-65;
- Tennessee Commercial Warehouse: Northbound ramp from I-24 to Hermitage Avenue;
- Nashville International Airport: Harding Place (SR-255) between McGavock Pike and Donelson Pike; and
- CSX Radnor Yard: Old Hickory Blvd (between I-65 and US 41A) and Harding Place (between US-41A and Jonquil Drive).

6.6 Dedicated Freight Corridors

By and large, dedicated truck lanes improve freight movement and promote economic productivity. The latter is expected as truck lanes lower delay cost imposed to freight shipments and reduce wasted fuel cost. Dedicated truck lanes are of particular interest in areas with steep grades. From a design perspective, the rightmost lane is usually dedicated to trucks. There are also some instances in which truck-only lanes are physically separated from the main roadway (e.g., I-5 north of Los Angeles). Truck lanes may also be tolled in order to incentivize carriers to increase efficiency and move more freight payload per unit of fuel and driver cost. Increased efficiency also reduces the adverse environmental effects of diesel engines. Truck safety can be improved too in truck-only lanes as slow, less maneuverable trucks are separated from passenger cars.

Truck-only lanes, however, can be budget intensive due to the high cost of pavement and special geometry requirements. In general, truck volumes rarely justify implementation of truck-only facilities. Conditions justifying implementation of truck-only lanes include:

- Truck volume percentage greater than 30 percent;
- One-way, peak traffic volumes greater than 1,800 vehicles per lane-hour; and
- Off peak volumes in each direction greater than 1,200 vehicles per lane-hour.

Additionally, the National Highway Freight Program (NHFP) calls for states, in consultation with MPOs, to designate Critical Urban Freight Corridors (CUFC) within urbanized areas. Outside urbanized areas, a public road may meet criteria to be designated as a Critical Rural Freight Corridor (CRFC). In the event that routes which parallel I-65 are designated as a CUFC or CRFC, these routes may become competitive for federal funding to improve the efficiency of freight movement along the corridor.

6.7 Speed Modifications

To address growing safety concerns, states have introduced speed limit policies that can be broadly classified into two categories: uniform speed limits (USL) and differential speed limits (DSL). A uniform speed policy involves setting the same maximum speed limit for all vehicles, while a differential speed limit policy sets a lower limit for heavy trucks and buses.

Differential speed limits were introduced as a result of the 1987 Surface Transportation and Uniform Relocation Assistance Act, which allowed individual states to raise the speed limits from the previous mandated national speed limit of 55 mph to 65 mph. Since 2001, differential speed limits have received mixed reviews from a safety perspective. One study examined safety implications of three speed control strategies: uniform speed limits (USL), differential speed limits (DSL), and differential speed controls with truck speed limiters (MSL). The model was applied to a 3.7 mile stretch of a two-lane highway. The authors concluded that differential speed strategies increased the number and rate of car-truck overtakes which in turn resulted in negative effects on safety. On the other hand, DSL and MSL strategies reduced the number of car-car overtakes at different volumes, and increased safety. A second study evaluated impacts of differential speed limits on rural interstate highways in Idaho by reducing truck speed limit from 75 to 65 mph. The study reported that truck mean speeds reduced to 65.6 mph. Reduction in speed variance and violation rate was also observed and crashes decreased by more than eight percent, but the results were not significant at 95-percent confidence level.

A third study investigated safety impacts of uniform and differential speed limits on urban and rural interstates using nationwide fatal crash data from 1999 through 2011. It was found that total rural interstate fatalities were not significantly different among states with uniform and differential speed limits, but truck- and bus-involved rural interstate crashes were observed to be 25 percent higher in states with uniform speed limits than those with differential speed limits. Over the last decade, US states have modified their speed limit policies. The maximum speed limits have significantly increased for rural interstates and specified segments of roads in the western states. As of April 2017, however, differential speed limit use has declined to seven states.

6.8 Freight Traffic Diversion Strategies

Ongoing improvements in developing a truck route network that can be used in future freight planning projects and analysis will be critical in determining how well the developed network is integrated with freight facilities within the study area. To develop the truck route network, five roadway functional classes in the study area were selected:

- Rural Principal Arterial – Interstate;
- Rural Principal Arterial – Other;
- Urban Principal Arterial – Interstate;
- Urban Principal Arterial – Other Freeways and Expressways; and

- Urban Principal Arterial –Other.

The network was then visually inspected and manually adjusted to ensure that it is well connected with urban areas encompassing major freight generators. The proposed network allows for long haul freight movements with a trip end in the study area as well as truck trips passing through the area. The developed network provides very good access to the regions generating the highest volumes of truck traffic (Figure 6-5). In the most freight intensive areas, the network is also dense which indicates that alternative routes will be available to/from freight generators. For example, the intersection area of I-840 and Horton Highway (US-41A, south of I-840) is an area that will experience significant growth in truck trip generation. The area has access to I-65 via both I-840 and Murfreesboro Rd (SR-96).

Given truck trip concentrations, determining the feasibility of freight villages in the Nashville area would be beneficial. A freight village is defined as an area of land that is devoted to a number of transport and logistics facilities, activities, and services that are not just co-located but also coordinated to encourage maximum synergy and efficiency. Freight villages can especially improve freight productivity in areas where the number of warehouse and distribution facilities are likely to increase. Freight village integration in freight intensive areas can be beneficial by providing sufficient infrastructure to facilitate efficient movement of freight, promoting economic development and reducing total traveled truck miles.

6.9 Traffic Management Strategies

Managing freight movement in metropolitan regions has become increasingly important as central cities and surrounding counties continue to grow. New technologies and logistic networks are also remaking how freight and goods flow in and out of urban areas.

Urban Freight Solutions

Last mile delivery and first mile pickup have become critical parts of the supply chain, as the cost of moving goods from transportation hubs to final destinations in urban areas has reached upwards to 30 percent of the total cost of moving goods. As urban freight planning has gained increased attention, different strategies and programs have been proposed to address the last mile challenge including off-hour delivery, time slotting of pickups, and new innovations.

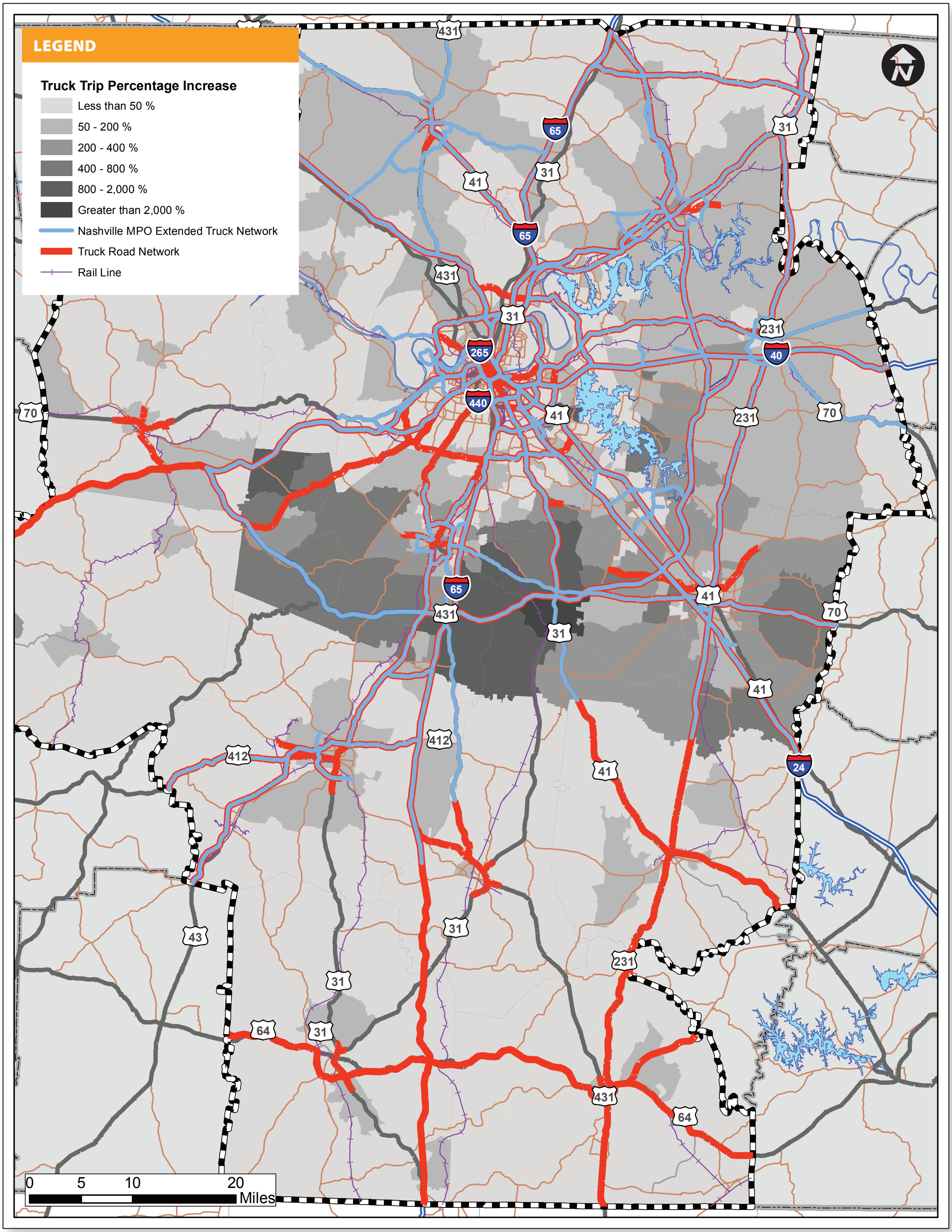
Off-peak hour deliveries (OHD): OHD programs, if implemented correctly, can promote sustainability, quality of life, economic efficiency, and environmental justice. A successful implementation of an OHD program requires a comprehensive knowledge of market and public policies as well as close collaboration with stakeholders. Freight services benefit from OHD programs as the number of routes needed to deliver all shipments can be reduced. In the New York City metropolitan area, receivers were asked about their interest in a Vendor Certification Program where they would accept unassisted off-hour deliveries. Survey results indicated that large establishments and headquarters are not good candidates for this program while the food and beverage sector seems the most likely sector to adopt this program.

Time-slotting: Time-slotting of pick-ups and deliveries is another last-mile delivery solution which can reduce the negative impacts of pick-ups and deliveries to large traffic generators such as government offices, colleges, hospitals, and large commercial establishments.

Driver training: Driver training programs reduce the cost of last mile delivery by changing driver behaviors and enhancing driver competencies to improve delivery efficiency, energy consumption, environmental impacts, and the safety of all road users. Drivers can be trained to drive in eco-friendly ways that save fuel and reduce emissions. Drivers may also be trained to handle deliveries in a quieter manner so that night deliveries do not disturb neighbors. The literature suggests that driver training programs are a cost-effective approach to improve delivery efficiency. Training programs, however, require close collaboration between the public and private sectors which can be challenging.

Loading and unloading management: Loading and unloading can be difficult in dense urban areas and truck operators may resort to shifting operations to traffic lanes and sidewalks. Such operations can be hazardous, but can also be avoided by implementing dedicated loading/unloading spaces, known as delivery bays. Such areas should be designed properly to incentivize operators to use them. Off-street loading/unloading zones can have similar impact.

Figure 6-5. I-65 Study Area Truck Trip Percentage Increase between 2010 and 2040



Source: Statewide Travel Demand Model, Version 2

Urban logistics spaces: Small terminals located in dense urban areas can provide service to local businesses and residents. While these terminals are budget-intensive, require land of 5,000 to 20,000 square feet, they can substantially improve freight operations. Underground parking lots at city centers can be used to provide such services. Local consolidation centers (e.g., FedEx offices) can also play a similar role.

Data analytics: Technological advancements have helped overcome the extraction and analysis of data in real time. Advanced analytic methods (e.g., optimization) can now be implemented for large-scale problems to effectively reduce the cost of last-mile deliveries by rerouting transport vehicles and resequencing stops based on real-time congestion information, pickup requests as they come in, and pickup requests that are anticipated. Another application of data analytics could be in right-sizing delivery vehicles, where mathematical modeling can help determine the appropriate size of vehicles depending on demand and the type of streets to which the deliveries will be made.

Innovative solutions: A number of innovative solutions can address last mile issues and are discussed below:

- **Trunk delivery:** The ability to access the trunk of one's car is a new innovation. Delivering to the trunk of a customer's car leads to a fundamentally different variant of the vehicle routing problem. Similarly, deliveries can be made to lockers versus to residents. Amazon Locker service is a prominent example of the latter solution which has been already implemented in many cities throughout the United States. In Washington D.C., Giant, a supermarket chain, delivers groceries to locker boxes at Metrorail stations. Customers can order online and pick up their items on their commute.
- **Consolidated deliveries and pickups:** Receivers can use technology to coordinate with multiple shippers to consolidate deliveries. On the other end, multiple pickups can also be consolidated.
- **Unmanned aerial vehicles:** Unmanned aerial vehicles will also significantly enhance supply chains and logistic operations by delivering smaller items within the last mile of transportation system.
- **Non-motorized delivery:** Utilizing non-motorized options for the last leg of delivery and first leg of pick up not only reduces vehicle congestion on streets but also lowers the negative environmental impacts of urban freight activities. Using an online bidding system, pedestrians and cyclists will be able to coordinate with a truck carrier and take care of local delivery and pickup activities. In this system, trucks and crowdsource form a hub and spoke, and the system can operate in a very efficient manner. Mathematical modeling shows that a truck carrier is never worse off by implementing such systems due to the reduction of maintenance, insurance, and fuel costs. Non-motorized freight services have been tested in New York City and Portland, Oregon.

Estimating the practicability, ease of implementation, and the level of effectiveness of these solutions in the I-65 corridor will require significant additional analysis and collaboration between local governmental agencies and private stakeholders.

Truck-Friendly Transportation System

Designing and redesigning the transportation system in a way that meets the preferences of truck drivers ultimately results in lower delays to trucks and greater economic productivity. Truck friendly transportation system strategies are grouped into two categories: infrastructure-related strategies and management solutions. Focusing on infrastructure design, first, the following infrastructure related strategies all have potential application in the I-65 corridor:

- Increasing truck parking capacity, allowing truck operators to make deliveries optimally in urban areas;
- Increasing the lengths of acceleration/deceleration lane;
- Establishing a number of terminals on the urban fringe in order to facilitate transferring shipments to delivery vehicles;
- Expanding bridge anti-icing systems;
- Constructing overnight parking facilities in the core of the urban area to reduce the number of inbound truck trips in the morning peak hours; and
- Integrating the urban, suburban, and county traffic signal control systems to enhance inter-jurisdictional traffic management.

Dedicating one or multiple lanes to trucks, reconfiguring truck lanes, and expanding traffic management are relatively inexpensive solutions that can make the transportation system more truck friendly. Merging and diverging areas can be particularly frustrating to truck drivers. A survey of 500 truck drivers in the Knoxville area revealed that most truck drivers support moving truck lanes to the inside travel lanes to avoid lane changing cars. The survey also showed that truck drivers are willing to pay about two dollars to avoid ten minutes of congestion.

Currently, there are six public parking facilities with a total capacity of 54 trucks, and 36 private parking facilities with a total capacity of 1,110 trucks. Disaggregate parking demand data is required to understand truck parking needs. In lieu of detailed data, this study proposes a surrogate truck parking supply performance measure: the ratio of the average truck volume on interstate highway sections to the total parking capacity. Data on truck volumes for the years 2010, 2020, 2030, and 2040 was obtained from the statewide travel demand model and the results are presented in Table 6-4. On average, there is one public parking spot for every 125 trucks moving in the study area in 2010. This number almost doubles by 2040 raising concerns about public truck parking capacity in the area. Due to the greater number of private parking spots, however, there is one private spot available for every 3.6 trucks in 2010 and every 10.5 trucks in 2040, an 83 percent increase. Developing truck parking expansion factors to be used with truck GPS probe data to accurately estimate parking demand will be an important consideration over time, as will an automated monitoring system using truck GPS probe data of parking utilization.

Table 6-4. Truck Volume to Parking Capacity Ratio in 2010-2014

	2010	2020	2030	2040
Public	124.6	154.9	188.6	227.4
Private	6.1	7.5	9.2	11.1
Total	**5.8**	**7.2**	**8.8**	**10.5**

7. Transit

While automobile travel will likely remain the predominant mode of travel in the region, it is important to ensure that residents and visitors in the region have meaningful transportation choices as the region continues to grow and develop. Both existing and emerging activity centers will benefit from a comprehensive multimodal transportation system. This section discusses the transit recommendations from the study, as well as how local jurisdictions can aide in the implementation of these recommendations through local plans and policies, such as zoning ordinances and land development regulations.

7.1 Transit

In December of 2016, the Nashville Metropolitan Transit Authority and the Regional Transportation Authority of Middle Tennessee (MTA/RTA) released nMotion, a plan to improve regional transit. The I-65 Multimodal Corridor Study was coordinated with the nMotion plan, and the recommendations from nMotion have been carried forward in this study. The plan lays out seven primary recommendations to improve and expand the region's transit system and, ultimately, improve mobility in Middle Tennessee.

1. Make Service Easier to Use
   - Evaluate existing routes to determine areas where service can be simplified or improved.
   - Rebrand under a single system to consolidate passenger information, provide a unified fare system, and better connect local and regional services.
   - Provide more and better passenger information on a variety of platforms.
   - Simplify fare payment.
   - Develop a Smart Technology Platform to provide a single point of information for public transit, parking, ride-sharing services, and new or improved mobility options.
2. Improve Existing Services
   - Increase service frequency on both local and regional routes.
   - Improve AccessRide services by partnering with ride-sharing services and local charitable organizations.
   - Improve mobility in downtown Nashville by constructing a second transit center, identifying transit emphasis corridors, and incorporating transit priority measures in key locations.
   - Develop crosstown and through-city routes to complement the current hub-and-spoke network.
3. Improve Access to Transit
   - Improve access to the transit network by improving bicycle and pedestrian connections, establishing private and/or community shuttles, work with local service providers to streamline transfers and fare payments, and provide more conveniently located park-and-ride lots.
4. Make Service More Comfortable
   - Upgrade stations and stops and provide service with more comfortable vehicles.
5. Develop a Network of Regional Transit Centers
   - Develop numerous transit centers throughout the region designed to act as regional and local mobility hubs that provide connections between local services and between local and regional services.
6. Expand Service to New Areas
   - Within Davidson County, expand service to fill gaps in service coverage and extend service to new areas as demand develops.
   - Within the larger Middle Tennessee region, assist local service providers in expansion of their respective services, and extend or improve service to key growth areas, including Springfield, Sumner County, Lebanon, Smyrna and LaVergne, Spring Hill, and Dickson.
7. Build High Capacity/Rapid Transit Network
   - Improve existing commuter rail service on the Music City Star and extend new commuter rail service on the Northwest Corridor to Clarksville.
   - Construct light rail along key high capacity corridors in Davidson County.
   - Develop Bus Rapid Transit (BRT) in key corridors in Davidson County.
   - Upgrade nine existing regional bus services to Rapid Bus Service, and provide new Rapid Bus Service along for regional corridors.

- Provide Freeway BRT along I-24 East, I-65 South, and Ellington Parkway/SR-386 corridors.
- Provide Bus-on-Shoulder service along I-24 West, I-65 North, I-40 East, and I-40 West corridors.
- Improve existing service to Nashville International Airport (BNA).

The recommended transit projects in the I-65 are captured in Table 7-1 and Figure 7-1. In addition to the numerous capital improvements and strategies identified in nMotion, one additional route improvement was identified as part of the I-65 Multimodal Corridor Study. nMotion recommends new regional bus service to the Town of Nolensville. It is recommended that this route extend all the way to SR 96 in the Triune area, which has high population and employment projections through 2040. This extension will provide a north-south transit corridor through eastern Williamson County and, ultimately, a direct link to Nashville and Davidson County.

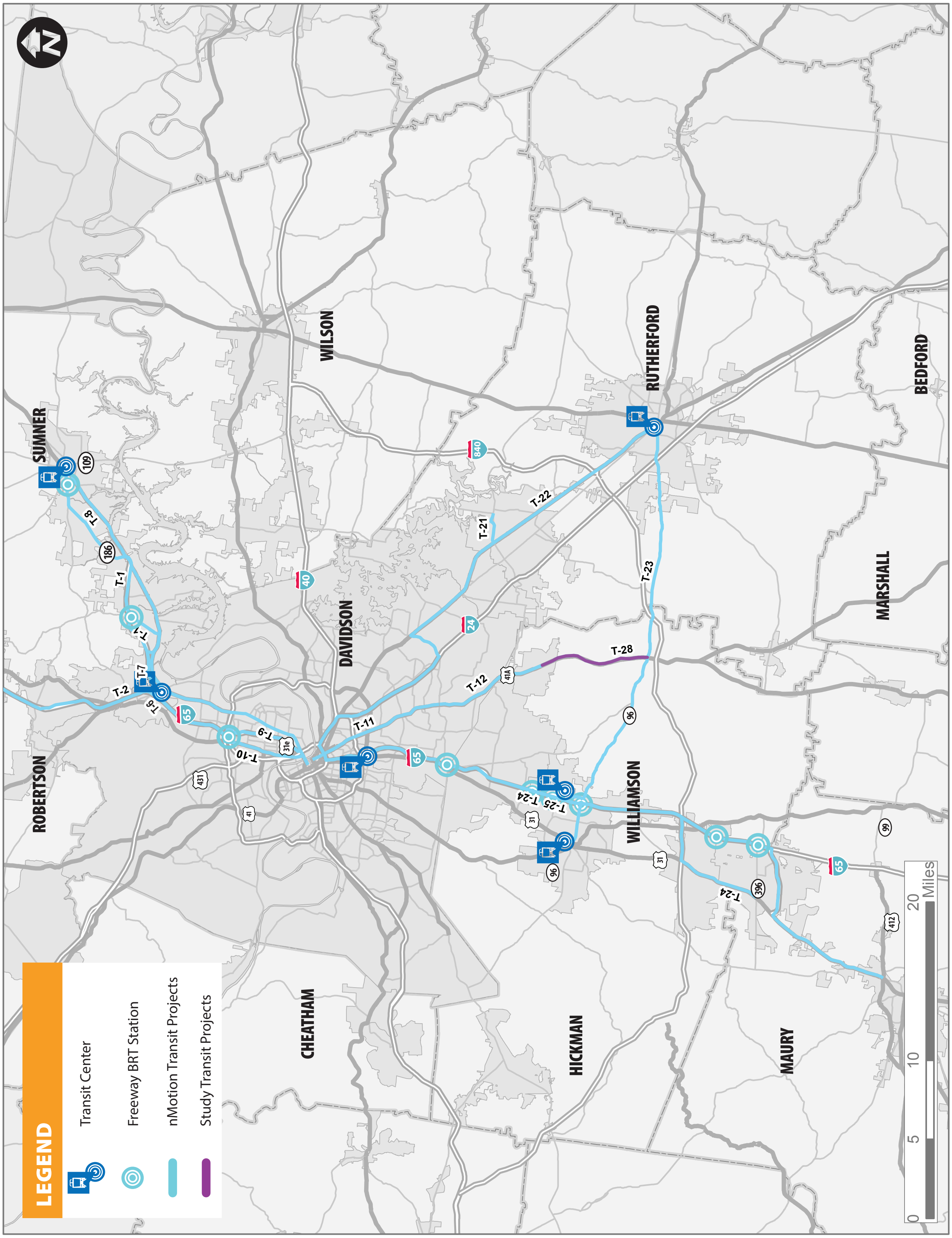
Table 7-1. Transit Improvements

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
T-1	NET Corridor Regional Express Bus Service	Several routes between Nashville and Gallatin		Provide new and expanded service to Sumner County, including additional express trips, additional service hours, and new park-and-ride opportunities	29.0	Davidson and Sumner	North
T-2	White House Express Service	SR-76	SR-386	Widening and strengthening of shoulders to 12-ft for bus on shoulder service. Further study of ramp metering for SR-174 (Long Hollow Pike), US-31W, and SR-257 (Bethel Road) to determine if necessary for safe routing	12.4	Robertson	North
T-3-5	I-65 North Freeway BRT Stations (3)	Goodlettesville	Gallatin	Construction of freeway BRT transit stop and park-and-ride lot	0.0	Davidson and Sumner	North
T-6	NET Corridor Interchange 2	Vietnam Veterans Pkwy (SR-386) at Conference Drive		Interchange modification for Traffic NB onto Conference Drive	0.0	Davidson	Central
T-7	NET Corridor Interchange 1	Vietnam Veterans Pkwy (SR-386) at I-65		Interchange modification WB to NB and SB to EB Traffic	0.0	Davidson	Central
T-8	Rapid Bus Service - Route 80R Gallatin	Outer end of Gallatin Pike LRT	Gallatin	Provide new rapid bus service to Gallatin	15.6	Davidson/ Sumner	Central
T-9	US-31E (Gallatin Pike) LRT	Downtown Nashville	Conference Drive	Construction of light-rail transit along US-31E (Gallatin Pike)	12.0	Davidson	Central
T-10	Dickerson Pike (US-31W) BRT	Hunters Lane	Downtown Nashville	Construction of bus rapid transit amenities along US-31W (Dickerson Pike). Project include dedicated bus lanes and improved pedestrian facilities.	7.2	Davidson	Central
T-11	Nolensville Pike (US-31A) LRT	Downtown Nashville	Lenox Village Drive	Construction of light rail transit along US-31A (Nolensville Pike)	8.8	Davidson	Central
T-12	Rapid Bus Service - Route 81R Nolensville	Outer end of Nolensville Pike LRT	Nolensville	Provide new rapid bus service to Nolensville	7.2	Davidson/ Williamson	Central
T-13-18	I-65 South Freeway BRT Stations (6)	Downtown Nashville	Franklin	Construction of freeway BRT transit stop and park-and-ride lot	0.0	Davidson and Williamson	Central/ South
T-19	Transit-Pedestrian Network Improvements	Various Locations		Construction of transit-supportive pedestrian amenities, including sidewalks, landscaping, lighting, crosswalks, and ADA ramps	0.0	Davidson and Williamson	Central

Table 7-1. (continued)

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
T-20	Rapid Bus Service - Route 81R Nolensville	Nolensville	Murfreesboro Road (SR-96)	Provide new rapid bus service to Triune	7.0	Williamson	Central
T-21	Rapid Bus Service - Route 86R Smyrna/ LaVergne	Downtown Nashville	Smyrna/ LaVergne	Provide new rapid bus service to Smyrna and LaVergne	24.7	Davidson/ Rutherford	Central
T-22	Rapid Bus Service - Route 96R Murfreesboro	Downtown Nashville	Murfreesboro	Provide new rapid bus service to Murfreesboro	35.7	Davidson/ Rutherford	Central
T-23	Franklin to Mufreesboro Express Bus Service	Routes between Franklin and Mufressboro		Provide new service express service to from Franklin (Cool Springs) to Murfreesboro	26.0	Williamson and Rutherford	Central
T-24	South Corridor Regional Express Bus Service	Several routes between Nashville, Franklin, Spring Hill, and Columbia		Provide new and expanded service to Williamson and Maury County, including additional express trips, reverse commute trips, additional service hours, and new Park-and-Ride opportunities	43.0	Maury and Williamson	Central and South
T-25	Rapid Transit/ Managed Lanes between Nashville and Franklin	Downtown Nashville	Murfreesboro Road (SR-96)	Construction of managed lanes for freeway Bus Rapid Transit along I-65 from Nashville to Murfreesboro Road (SR-96)	18.6	Davidson and Williamson	Central/ South

Figure 7-1. Transit Improvements



Additionally, as a follow up the to the recommendations in nMotion, the Greater Nashville Regional Council will begin the South Corridor Transit Study in 2018. This study will identify a locally-preferred alternative for transit investment between Metropolitan Nashville-Davidson County and Maury County. The results of this study will refine some of the recommendations presented here.

7.2 Station Area Development and Access

Transit's success in the I-65 corridor will rely in part on the form and density of development near station areas, particularly those that service high-capacity or regional transit services. Transit-oriented development (TOD) generally describes development that includes a mixture of housing, office, retail and/or other amenities integrated into a walkable neighborhood and located within a half-mile of high-capacity or regional transit service.

For the I-65 Multimodal Corridor Study, the regional transit centers identified in the nMotion plan were assigned a typology based on their location and surrounding uses: urban center, urban neighborhood, or suburban center. Existing population and employment totals were analyzed to determine the density of people and jobs for the base year of the study (2010). Future projections were developed to illustrate what the density around these stations would be in the study's horizon year (2040) if existing development patterns remain the same (Trend) or if zoning regulations were adjusted to support transit-oriented development densities (Build).

As Table 7-2 shows, an additional 75,000 people and jobs could be located within a half-mile of the nMotion station areas by 2040 if local zoning ordinances plan for TOD. This represents, moreover, an increase of approximately 60,000 people and jobs relative to the current trend. These densities would increase ridership on high-capacity and regional transit routes, as well as provide economic development opportunities for the communities in which they are located. Ultimately, enabling these types of densities is the responsibility of local jurisdictions.

Table 7-2. Regional Transit Station Area Development Densities

	2010 Base Year			
Station Areas	Total Population	Total Employment	Total People + Jobs	People + Jobs Density (per acre)
Urban Center	818	13,013	13,831	16
Urban Neighborhood	2,267	4,321	6,588	10
Suburban Center	1,917	2,633	4,550	4
Total	5,002	19,967	24,968	9

	2040 Trend			
Station Areas	Total Population	Total Employment	Total People + Jobs	People + Jobs Density (per acre)
Urban Center	3,284	17,928	21,212	24
Urban Neighborhood	3,183	5,937	9,120	15
Suburban Center	4,050	7,675	11,725	9
Total	10,517	31,540	42,057	15

	2040 Build			
Station Areas	Total Population	Total Employment	Total People + Jobs	People + Jobs Density (per acre)
Urban Center	26,400	26,400	52,800	60
Urban Neighborhood	17,584	7,536	25,120	40
Suburban Center	13,560	9,040	22,600	20
Total	57,544	42,976	100,520	38

Another opportunity associated with regional transit investments is the ability of the surrounding community to access transit services. Currently, regional transit access relies on park-and-ride facilities. While these facilities are often conveniently located for automobiles in existing surface lots, the regional transit centers proposed in nMotion are more centrally-located within communities, with park-and-ride lots reserved for the very ends of regional routes.

While the regional transit centers will likely still provide park-and-ride access for automobile users, nMotion stresses the need to include safe, comfortable, and convenient bicycle and pedestrian networks. Table 7-3 shows the number of people within a five-minute walk or bicycle ride to a transit station, based on the population figures shown in Table 7-2. In the base year, these values are quite low with transit services relying on the existing park-and-ride lot network. The Trend and Build figures are based on the recommended regional transit centers. These figures will increase substantially, even under the Trend scenario. In the Build scenario, approximately 25,000 more will be within a five-minute walking and bicycling distance to regional transit.

Table 7-3. Walking and Bicycling Access to Transit Stations

Unit	Base (2010)	Trend (2040)	Build (2040)
Total People	Walk: 7,329	Walk: 31,880	Walk: 57,544
	Bike: 61,154	Bike: 228,969	Bike: 254,633

8. Walking and Bicycling

Bicycle and pedestrian networks provide critical linkages throughout the corridor, providing important connections for people of all ages and abilities to local destinations and regional transit services. The bicycle and pedestrian facility recommendations for the study were identified using a three-pronged methodology.

- Previously-Planned Facilities – Local bicycle and pedestrian plans were reviewed for the various jurisdictions along the I-65 corridor. Projects planned on existing state routes were identified and included as recommendations in the study. At build-out, these recommendations would provide a base network around which local jurisdictions could construct a more fine-grained network.
- Inter-Community Links – Gaps between or among local networks were identified. Opportunities where a bikeway could link two communities, providing a seamless means of travel between them, were recommended as part of the study.
- Safety – Bicycle and pedestrian crash data for the latest four-year period was reviewed to identify areas with high incidences of bicycle and pedestrian crashes. Improvements to address these safety-deficient areas are recommended.

The recommendations are shown in Table 8-1 and Figure 8-1. By filling in gaps in local networks, providing inter-community linkages, and addressing safety hot spots, these projects can serve as a foundation for expanded multimodal transportation choice in the I-65 corridor.

Table 8-1. Recommended Bicycle and Pedestrian Projects

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
B-1	New Shackle Island Road (SR-258)	Johnny Case Parkway (US-31E)	Long Hollow Pike (SR-174)	Construction of Buffered Bike Lanes	5.2	Sumner	North
B-2	Johnny Cash Parkway/East Main Street (US-31E)	Big Station Camp Road	Center Point Road South	Construction of Paved Shoulders	8.8	Sumner	North
B-3	US-41 (Dickerson Pike)	US-431 (Trinity Lane)	Hart Lane	Safety - Construction of sidewalks along US-41. Project includes landscaping, crosswalks, and pedestrian amenities.	2.0	Davidson	Central
B-4	US-431 (Trinity Lane)	US-431 (Whites Creek Pike)	US-41 (Dickerson Pike)	Safety - Reconstruction of sidewalks along US-431 (Trinity Lane). Project includes landscaping, lighting, crosswalks, in-roadway warning lights at on-ramps, and pedestrian amenities.	1.3	Davidson	Central
B-5	Clarksville Pike (SR-12)	Ashland City Highway (SR-12)	Rosa Parks Boulevard (US-41 Alt)	Construction of Bike Lanes	1.1	Davidson	Central
B-6	Rosa Parks Boulevard (SR-12)	Buchanan Street	James Robertson Parkway (US-31)	Construction of Separated Bike Lanes	1.2	Davidson	Central
B-7	James Robertson Parkway (US-31)	Rosa Parks Boulevard (SR-12)	Church Street	Construction of Separated Bike Lanes	0.5	Davidson	Central
B-8	US-70 (Charlotte Pike)	14th Avenue North	George L. Davis Blvd.	Safety - Pedestrian improvements at interchange of US-70 and I-40/I-65. Project includes landscaping, lighting, crosswalks, in-roadway warning lights at ramps, and pedestrian amenities.	0.1	Davidson	Central
B-9	Rosa Parks Boulevard/8th Ave S. (US-31)	Church Street	Korean Veterans Boulevard	Construction of Separated Bike Lanes	0.5	Davidson	Central

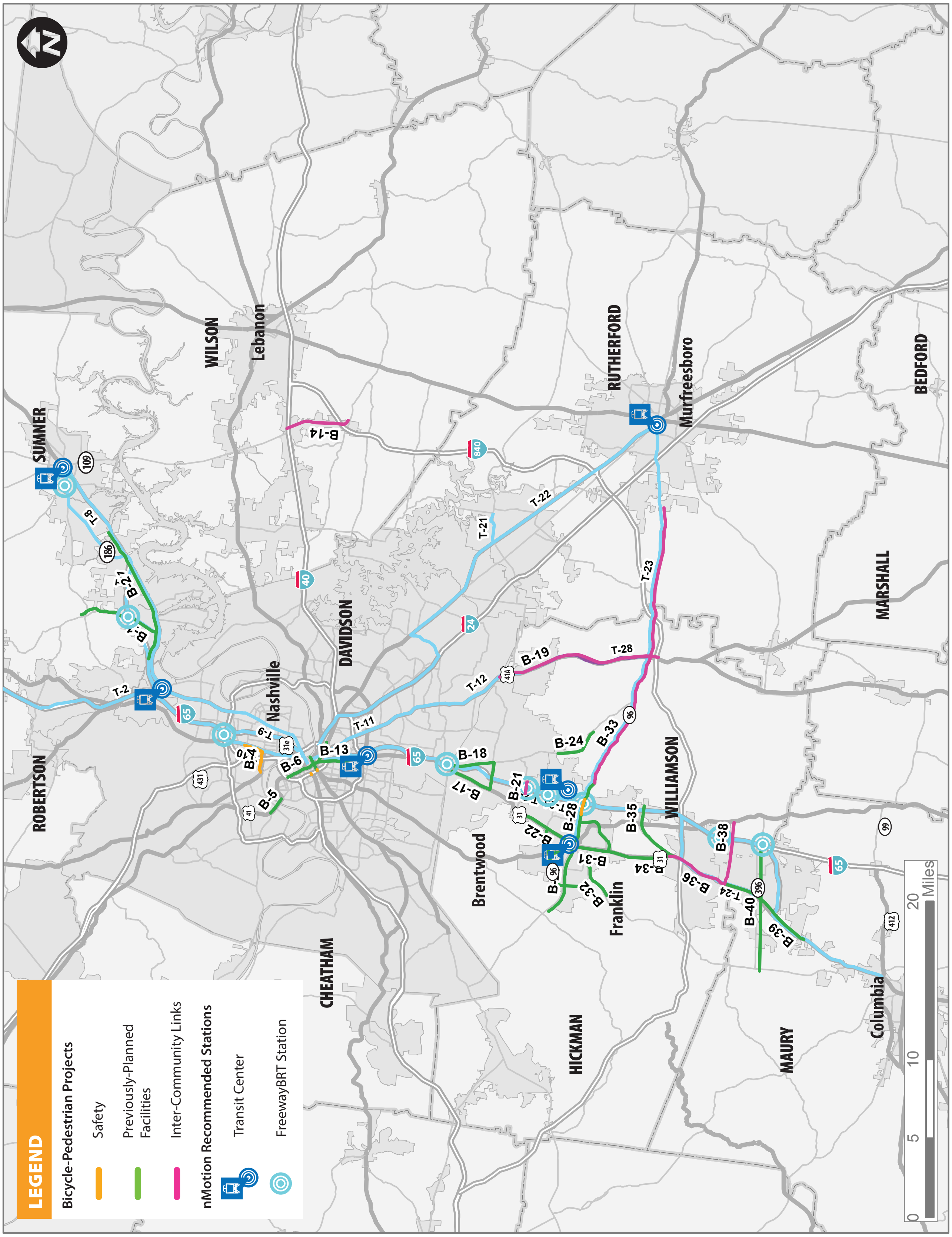
Table 8-1. (continued)

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
B-10	Broadway (US-70)	1st Avenue	14th Avenue North	Construction of Separated Bike Lanes	1.0	Davidson	Central
B-11	US-431 (Broadway)	George L. Davis Blvd.	14th Avenue South	Reconstruction of sidewalks along US-431 (Broadway). Project includes landscaping, lighting, crosswalks, in-roadway warning lights at on-ramps, and pedestrian amenities.	0.1	Davidson	Central
B-12	Lafayette Street (US-31)	8th Avenue S (US-31)	Fairfield Avenue	Construction of Separated Bike Lanes	1.3	Davidson	Central
B-13	8th Avenue South (US-31)	Korean Veterans Boulevard	Bradford Avenue	Construction of Separated Bike Lanes	1.8	Davidson	Central
B-14	SR-109	I-40	I-840	Network - Construction of shared roadway facility	4.0	Wilson	Central
B-15	US-41 (Lafayette Street)	US-31 Alt/SR-11	1st Avenue South	Safety - Reconstruction of sidewalks along US-41 (Lafayette Street). Project includes landscaping, lighting, crosswalks, in-roadway warning lights at on-ramps, and pedestrian amenities.	0.3	Davidson	Central
B-16	SR-254 (Old Hickory Blvd)	Franklin Pike Circle	Franklin Pike	Safety - Reconstruction of sidewalks along SR-254 (Old Hickory Blvd). Project includes landscaping, lighting, crosswalks, in-roadway warning lights at on-ramps, and pedestrian amenities.	0.5	Davidson	Central
B-17	Main Street/Carters Creek Pike (SR-246)	Southall Road	Natchez Street	Construction of Multi-Use Path	3.1	Williamson	Central
B-18	Concord Road (SR-253)	Franklin Road (US31/SR 6)	Wilson Pike (SR-252)	Construction of Multi-Use Path	1.7	Williamson	Central
B-19	Nolensville Road (SR-11)	Burkitt Road	I-840	Network - Construction of on-road or off-road bicycle facilities	10.6	Williamson	Central
B-20	Franklin Road (US31/SR 6)	Concord Road (SR-253)	Maryland Way	Construction of Multi-Use Path	2.6	Williamson	Central
B-21	SR-441 (Moore's Lane)	Mallory Lane	Carrothers Parkway	Network - Construction of on-road facility or multi-use trail	0.8	Williamson	Central
B-22	Franklin Road (US31/SR 6)	SR-441 (Moore's Lane)	Harpeth River Bridge	Construction of Multi-Use Path; Can be constructed in concert with H-37	3.7	Williamson	Central
B-23	Mack Hatcher Pkwy (SR-397)	Hillsboro Road (SR-106/US-431)	Franklin Road (Sr-6/US-31)	Construction of Multi-Use Path	1.5	Williamson	Central
B-24	Wilson Pike (SR-252)	McEwan Drive	Trinity Lane	Network - Construction of Multi-Use Path	2.9	Williamson	Central
B-25	Mack Hatcher Pkwy (SR-397)	South of SR-96	US-431 (SR-106)	Construction of Multi-Use Path; Can be constructed with in concert with H-28	3.3	Williamson	Central
B-26	Hillsboro Road (SR-106/US-431)	Mack Hatcher Pkwy (SR-397)	Del Rio Pike	Construction of Bike Lanes with Sidewalks	1.0	Williamson	Central
B-27	SR-96	7th Ave North	Old Charlotte Pike	Construction of Multi-Use Path	4.4	Williamson	Central
B-28	SR-96	Harpeth River Bridge	Arno Road	Construction of Multi-Use Path; Portion could be constructed in concert with B-5	3.9	Williamson	Central

Table 8-1. (continued)

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
B-29	SR-96 (Murfreesboro Road)	Southwinds Drive	Carothers Parkway	Safety - Construction of sidewalks or multi-use path along SR-96. Project includes landscaping, crosswalks, and pedestrian amenities.	1.0	Williamson	Central
B-30	Mack Hatcher Pkwy (SR-397)	SR-96 east of Franklin	Columbia Pike (US-31/SR-6) south of Franklin	Network - Construction of Multi-Use Path; Can be constructed with in concert with H-30	3.2	Williamson	Central
B-31	Columbia Pike (US-31/SR-6)	Fowlkes Street	Mack Hatcher Pkwy (SR-397)	Construction of Bike Lanes; Can be constructed in concert with H-31	1.9	Williamson	Central
B-32	Wilson Pike (SR-252)	Concord Road (SR-253)	Church Street East	Construction of Multi-Use Path	2.6	Williamson	Central
B-33	SR-96 (Murfreesboro Road)	East of Arno Road	Veterans Pkwy	Network - Construction of on-road or off-road bicycle facilities	18.3	Williamson/ Rutherford	Central
B-34	Columbia Pike (US-31/SR-6)	Goose Creek Bypass	Mack Hatcher Parkway (SR-397)	Construction of Multi-Use Path	3.9	Williamson	Central
B-35	Goose Creek Bypass (SR-248)	Columbia Pike (US-31/SR-6)	Long Lane	Construction of Bike Lanes with Sidewalks	4.1	Williamson	Central
B-36	US-31	SR-248 (Goose Creek Bypass)	North of Buckner Lane	Network - Construction of bike lane(s) or multi-use path	3.8	Williamson	Central
B-37	Buckner Road	Columbia Pike (SR-6/US-31)	Buckner Lane	Network - Construction of bike lane(s) or multi-use trail; can be constructed in concert with H-24	1.9	Williamson	Central
B-38	Buckner Road	Buckner Road/I-65 Interhchange	Lewisburg Pike (SR-106/US-431)	Network - Construction of bike lane(s) or multi-use trail; can be constructed in concert with H-22	2.1	Williamson	Central
B-39	US 31	Buckner Road	Carters Creek Station Road	Construction of Bike Lanes	6.2	Maury/ Williamson	Central/ South
B-40	SR-247 (Duplex Road/ Beechcroft Rd.)	I-65	SR-246 (Carters Creek Rd.)	Construction of Multi-Use Path	7.8	Williamson	Central

Figure 8-1. Recommended Bicycle and Pedestrian Projects



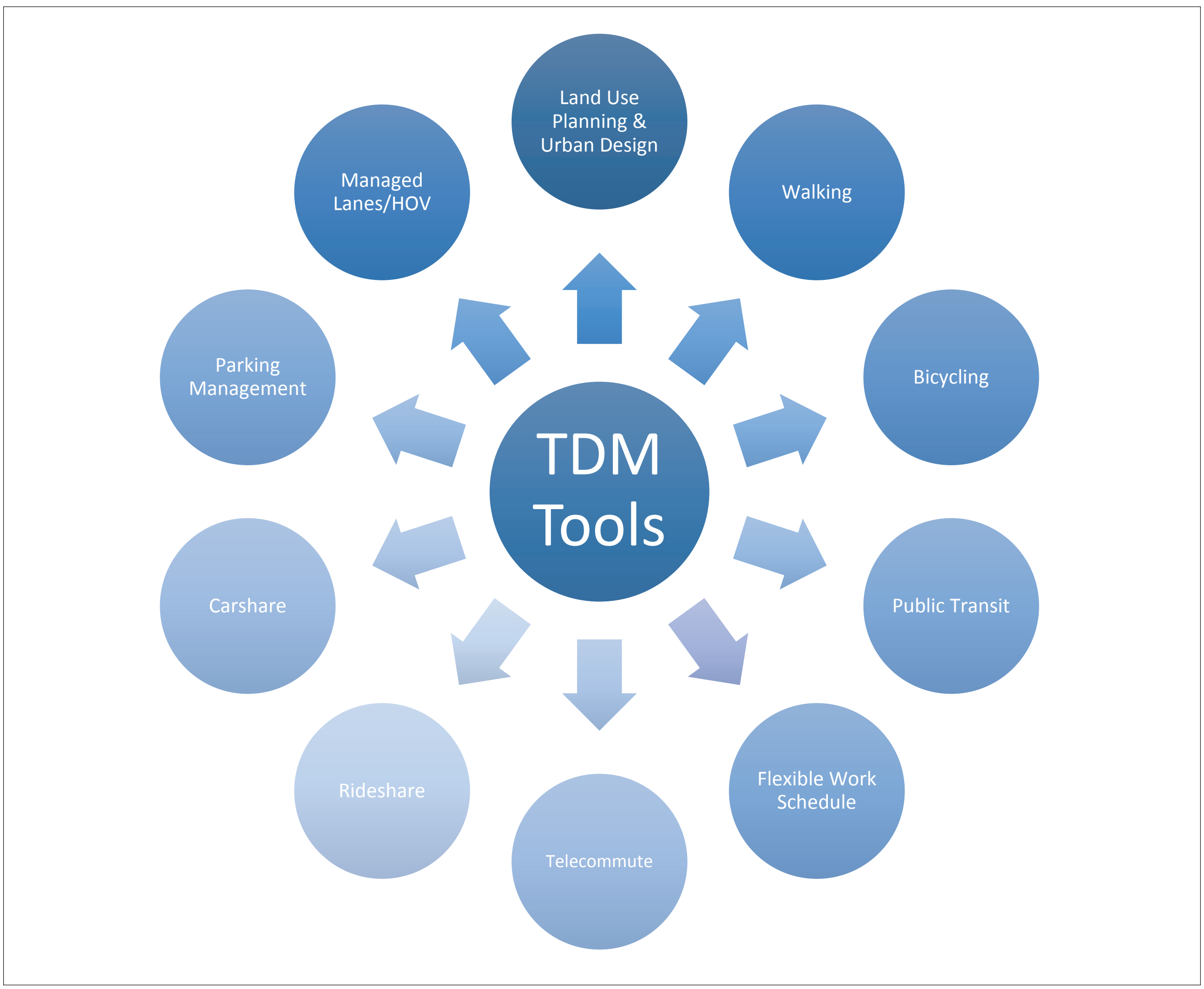
9. Transportation Demand Management

Conventionally, Transportation Demand Management (TDM) has been viewed largely as a congestion relief strategy, attempting to reduce travel and shift trips across modes and across time periods. More strategically, TDM is focused on expanding transportation options for people of all ages and abilities and improving transportation system efficiency. In either case, commuting mode shares offers a valuable measure of how well TDM programs are performing in a community, corridor, or region.

Throughout the I-65 corridor, commuting mode shares are dominated by single occupancy vehicles, representing between 85 and 90 percent of total work trips in many key travel markets. Importantly and notably, ridesharing accounts for much of the remaining trips in the same key travel markets with 10 to 15 percent of the commuting mode share. Walking, bicycling, and, in particular, transit commuting shares are well below national averages in the I-65 corridor.

As walking, bicycling, and transit facilities and services improve in tandem with land use planning and urban design strategies (Sections 7.0 and 8.0) in the I-65 corridor, TDM tools (Figure 9-1) will increasingly focus on employer-based strategies and ridesharing systems. According to a 2016 Tennessee Department of Transportation (TDOT) survey of employers, approximately half of the respondents in the Nashville region indicate that they already offer telecommuting, flexible work schedules, and carsharing programs to employees, and would consider providing emergency

Figure 9-1. Transportation Demand Management Tools



ride home, discounted transit passes, and incentives for not driving alone to work in the future.

While ridesharing is still unfolding with the advent of new technologies and new private service providers, it is clear that ridesharing will continue to play an important role filling the gap between fixed-route transit and single occupancy vehicles. To reinforce and expand existing employer-based programs, ridesharing systems, and TDM services more generally, below is a series of recommended TDM strategies for implementation in the I-65 corridor:

- Integrate TDM programs regionally and across the public and private sectors;
- Establish comprehensive marketing and information programs;
- Improve information and communication technologies that support real-time information and individual choice;
- Strengthen the ridesharing system of park-and-ride lots, High Occupancy Vehicle (HOV) lanes, and public and private ridesharing services; and
- Measure and report performance.

9.1 Regional TDM Program

In order for TDM programs to help reduce congestion and provide travel choices, they need to be cross sector, regionally comprehensive, and network oriented. If TDM programs are limited in scale and disconnected, they effectively mimic the "triple convergence" challenge posed by individual highway projects. Standalone TDM programs may result in reducing transportation demand for a period of time, but as an area experiences operational improvement, other people will shift their travel routes, times, and modes in response and absorb any short-term gains in system efficiency and supply.

Building on existing TDM programs provided by TDOT, the Regional Transit Authority of Middle Tennessee (RTA), the Transportation Management Association Group (TMA Group), and Metro Nashville, formal steps should be taken to organize services regionally, including:

- Establish a regional TDM advisory committee to strengthen partnerships between state and local governments and the private sector and to define regional TDM goals;
- Reposition existing TDM programs as regional services and consolidate service delivery; and
- Designate employment and activity centers as TDM districts and target programs and services in those areas.

9.2 TDM Marketing and Information Programs

Successful TDM programs clearly articulate that a safe and reliable transportation system is everyone's responsibility and in everyone's interest. Rather than viewing traffic congestion and limited transportation choices as someone else's problem to solve, TDM programs proactively bring different stakeholders to the table to develop plans and strategies collaboratively. In turn, upfront stakeholder outreach lays the groundwork for subsequent TDM customer marketing and information programs.

- Identify TDM coordinators throughout the region who can work with employers, school districts, chambers of commerce, and other organizations to build local support for and investment in TDM programs;
- Develop a regional outreach and engagement strategy that communicates and reports TDM benefits and results to elected officials, employers, and the general public on a regular basis; and
- Develop marketing material that program sponsors can use to promote TDM services, including travel options, financial and time incentives, and information resources.

9.3 Information and Communication Technologies

New information and communication technologies are reshaping TDM programs and services, and technologies that support real-time information and individual choice can provide a greater number of travel options throughout the day for a wider variety of people. Regional TDM stakeholders should partner to:

- Establish data collection and storage systems that support public and private sector providers of pre-trip and in route travel information (e.g., road conditions, optimal departure times, routing, travel choices, and comparative real-time information);
- Ensure that open data policies and protocols for publicly collected data incorporate TDM programs and services; and

- Coordinate ITS system improvements with TDM programs and services (e.g., managed lanes, transit technologies, and first/last mile).

9.4 Ridesharing System

For trips beyond walking and bicycling distances, ridesharing will assume a greater role as the I-65 corridor's population increases and autonomous vehicles expand the total number of vehicle trips. While there are certainly a number of contributing factors, including the current lack of transit services, it is important to underscore that rideshare commuting shares match or exceed statewide and national averages in the I-65 corridor despite high HOV violation rates. Recommendations to strengthen the ridesharing system include:

- Link park-and-ride lot planning and design to the designation of TDM districts in the corridor and ensure that a comprehensive set of TDM services (e.g., transit station amenities, carsharing, and bikesharing) are available at park-and-ride lots;
- Improve HOV lane enforcement and operations by adopting best practices in violation laws and policies and upgrading HOV facilities in conjunction with high capacity transit investments (e.g., complete HOV networks, direct access, and managed lanes); and
- Develop regional policies and programs for public ridesharing services that bridge fixed-route transit and private ridesharing services.

Table 9-1. Hierarchy of Efficient Commuting Strategies

Location Efficient	Work at home
	Telecommute
	Walk and bike
Technology Efficient	Transit
	Ridesharing
Resource Inefficient	Drive alone

9.5 TDM Performance Measures

Comprehensive, regionally based TDM programs shift the focus of performance measures from individuals and individual employers to a network of centers, corridors and communities. Regional TDM performance measures could include:

- Reductions in congestion;
- Reductions in energy consumption and air pollution;
- Annual commuting savings;
- Private sector TDM spending per dollar of public funding; and
- Commuting mode share.

10. Performance Evaluation

A key analytical component of the I-65 Multimodal Corridor Study is the evaluation framework for the proposed projects. To evaluate system performance in the I-65 corridor, the framework was developed to compare performance of base year conditions (2010); trend conditions (2040), and build conditions (2040). Table 10-1 summarizes the results of the performance evaluation. Generally, the Build scenario performed similarly to the Trend scenario on many of the aggregate metrics. The Build scenario did realize modest improvements in several traditional measures, such as auto travel times and vehicle hours of delay. More significant performance improvements were realized with respect to land use development patterns near the proposed station areas. Additional benefits are likely to be realized at a more local level for many of the projects recommended. The system-level metrics presented here typically do not reflect the travel time, safety, and traveler comfort benefits of individual projects at smaller scales.

10.1 Additional Outreach and Analysis

Prior to finalizing the recommended multimodal solutions for the study, additional outreach and analysis activities were conducted to obtain input on the final recommendations, as well as ensure that no major constraints are currently present in the study area with respect to project feasibility.

Table 10-1. Performance Summary

Goal	Performance Measure	Unit	Base (2010)	Trend (2040)	Build (2040)	Percent Change Trend v. Base	Percent Change Build v. Base
Moving Autos and Trucks	Auto Travel Times	Minutes	See Table 4-3			n/a	n/a
	Auto Vehicle Miles Traveled (VMT)	Miles (1,000s)	173,652	279,757	279,885	61%	61%
	Auto Vehicle Hours of Travel (VHT)	Hours (1,000s)	3,836	6,456	6,442	68%	68%
	Auto Vehicle Hours of Delay (VHD)	Hours	101,746	431,384	391,309	324%	285%
	Truck Vehicles Miles Traveled (VMT)	Miles (1,000s)	6,524	12,030	12,090	84%	85%
	Truck Vehicle Hours of Travel (VHT)	Hours	123,726	327,961	319,196	165%	158%
	Truck Vehicle Hours of Delay (VHD)	Hours	16,204	27,147	27,103	68%	67%
Moving People	Person Throughput	Persons per Day - North	177,569	252,815	259,888	42%	46%
		Persons per Day - South	205,076	275,077	290,187	34%	42%
Safety	Presence of Countermeasures at Safety Hotspots	High, Medium, or Low	See "Safety Recommendations"			n/a	n/a
Land Use Coordination	Presence of TOD at Stations	Total People and Jobs	24,968	38,456	100,520	54%	303%
Equity and Accessibility	People within a 5-Minute Walk or Bike Ride to a Station	Total People - Walk	7,329	31,880	57,544	335%	685%
		Total People - Bike	61,154	228,969	254,633	274%	316%
Air Quality/ Emissions	Carbon Intensity	Pounds per Day per Person	99.07	96.35	96.47	-3%	-3%

10.2 Public and Stakeholder Outreach

TDOT conducted a second round of public workshops for the study on the following dates and in the following locations:

- Goodlettsville: Delmas Long Community Center – June 12, 2017;
- Brentwood: Brentwood Public Library – June 20, 2017; and
- Spring Hill: Spring Hill City Hall – June 22, 2017.

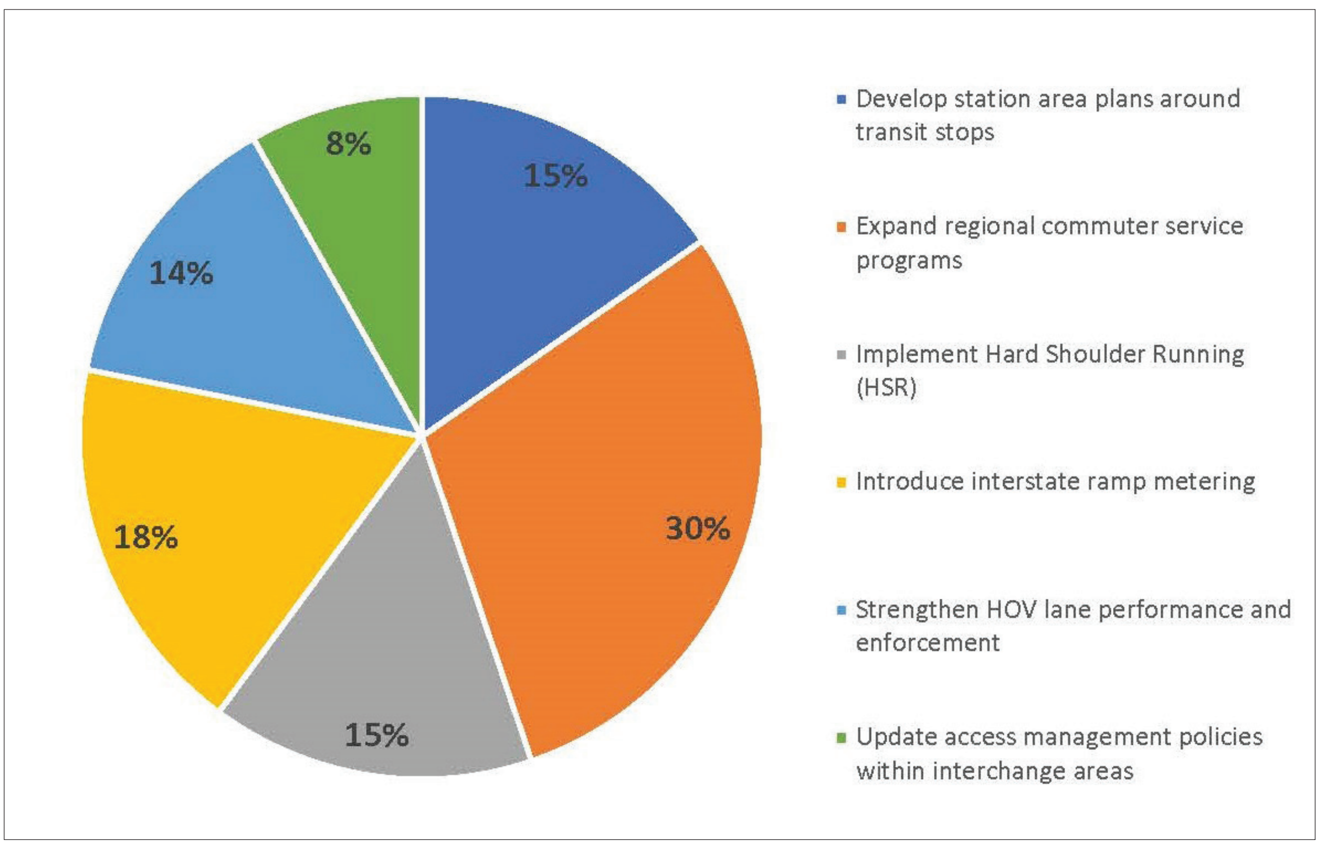
The goal of the second round of workshops was to give the public and key stakeholders a summary of the major deficiencies and needs that were identified in the corridor, as well as present the Phase 1 suite of recommended projects, programs, and policies. At the workshops, attendees identified additional deficiencies and needs, additional project recommendations, and additional non-construction policies, programs, and strategies that could be used to improve travel conditions in the project area.

Additional Policies, Programs, and Strategies

Among the meeting materials, attendees were specifically asked to express preferences for six non-construction related policies, programs, and strategies. Respondents were given six dot stickers to invest across the six categories. Dots could be allocated in any way the respondents chose; for example, all of the dots could be used on one category, spread equally, or distributed in any other combination. The policies, programs, and strategies are listed below in the order they appeared at the workshop, along with the number of dots each received. Figure 10-1 shows the percentage breakdown of all responses received.

- Develop station area plans around existing and future transit stations/stops – Emphasizing transit-oriented, mixed-use, and pedestrian/bicycle-friendly development. (28)
- Expand regional commuter service programs – Providing additional trip planning information, ridesharing resources, and transit incentives or benefits. (54)

Figure 10-1. Percentage Breakdown of Responses



- Implement Hard Shoulder Running (HSR) – Opening interstate shoulders in selected areas for general traffic use during peak hours. (28)
- Introduce interstate ramp metering – Managing the flow of vehicles entering the interstate in congested areas using a traffic signal on the ramp. (33)
- Strengthen High Occupancy Vehicle (HOV) lane performance and enforcement – Improving access points and separation, expanding violation detection strategies, and increasing penalties. (25)
- Update access management policies within interchange areas – Controlling the frequency and location of street intersections and driveways on interchange area crossroads. (15)

Additional Project Recommendations

Attendees were provided with maps that depicted the entire I-65 corridor from the Kentucky state line to the Alabama state line. The maps depicted all the Phase 1 projects discussed in the presentation. Attendees were asked to suggest additional projects, programs, or strategies they would like to see examined in Phase 2 of the analysis. All responses received were analyzed against previously identified deficiencies and needs and for project feasibility. Several additional project recommendations received from the public and key stakeholders were ultimately included in the final recommended multimodal solutions for the study.

10.3 Environmental Constraints and Fatal Flaws

A high-level analysis of environmental constraints within the corridor was conducted to determine whether "fatal flaws" were present with respect to the recommended multimodal solutions. Fatal flaws are major constraints that might render a project infeasible or unable to be constructed as proposed.

The fatal flaws considered as part of this analysis included the following:

- Environmental features, including wetlands and major river crossings; and
- Cultural resources, including National Register of Historic Places sites and districts.

No projects were found to be infeasible or unable to be constructed as a result of the analysis. All projects receiving federal funding will undergo an intensive preliminary review consistent with the requirements of the National Environmental Policy Act of 1969 (NEPA). During the NEPA review, the project will undergo consultation with the U.S. Army Corps of Engineers, the Tennessee State Historic Preservation Office (SHPO), and all state and federal agencies with regulatory authority over threatened and endangered species.

Traditionally-Underserved Populations

The project recommendations were also reviewed to ensure that equitable investments, consistent with anticipated growth patterns, traffic conditions, and safety needs, were made throughout the corridor, including to areas with high minority and low-income populations. Urban and rural equity issues, as described in Technical Memorandum 2 of this study, were considered during the development of the projects, programs, and strategies recommended as part of this study. Additionally, the TDOT Office of Community Transportation (OCT) conducted small-group stakeholder outreach to key partners throughout the study area.

A detailed Environmental Justice (EJ) impact analysis, consistent with the requirements of NEPA, will be conducted for all projects advanced by TDOT on a project-by-project basis. This analysis will ensure that no project will disproportionately impact any low-income or minority communities within the project impact area.

11. Recommended Multimodal Solutions

The final recommended multimodal solutions for the I-65 Multimodal Corridor Study are depicted in Figures 11-1, 11-2, and 11-3 and Table 11-1 through Table 11-6, with the exception of the ITS improvements which are illustrated in Figures 5-1, 5-2, and 5-3. The recommend improvements reflect the results of the technical analysis, input received from the public and key stakeholders, and coordination with TDOT.

Table 11-1. Mainline Improvements: Highway Capacity

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
H-1*	I-65	SR-25	Kentucky State Line	Widening, 4 to 6 lanes	8.8	Robertson	North
H-2	I-65/SR-109 Prop/ SR-41	N/A	N/A	Relocation of SR-109, new interchange at I-65, and widening of I-65 from south of new interchange to Kentucky state line	0.6	Sumner	North
H-3*	SR 109 Portland Bypass	SR-109 south of SR-76	SR-109 near Kirby Drive	Construct new 4 lane divided roadway	6.8	Sumner	North
H-4*	I-65	Bethel Road (SR-257)	SR-25	Widening, 4 to 6 lanes	8.7	Robertson	North
H-5*	SR-76	Charles Drive	New Hall Road	Widening, 2 to 4 lanes	2.1	Robertson	North
H-6	I-65	New interchange at New Hall Road in White House		New Interchange	N/A	Robertson	North
H-7	I-65 (SB only)	Blue Star Road (US-31)	Bethel Road (SR-257)	Widening, 2 to 3 lanes	5.2	Robertson	North
H-8*	NET Corridor Section 2 - Vietnam Veterans Pkwy (SR-386)	US-31E/ Saundersville Road	SR-109 Bypass	Transit Capital Expansion - Widening, 4 to 6 lanes for freeway Bus Rapid Transit service from Nashville to Gallatin (Project currently under study by TDOT)	6.9	Sumner	North
H-9	SR-109	North of the Cumberland River Bridge	SR-109 Portland Bypass south of Gallatin	Widen from 2 lanes to 4/5 lanes	1.3	Sumner	North
H-10#	I-65	Long Hollow Pike (SR-174)	Blue Star Road (US-31)	Widening, 4 to 6 lanes	1.8	Sumner	North
H-11*	Vietnam Veterans Pkwy (SR-386) at Forest Retreat Road	N/A	N/A	New Interchange (Project currently under study by TDOT)	0.0	Sumner	North
H-12	I-65 at Springfield Highway (SR-11/US-41)	N/A	N/A	New Interchange	N/A	Davidson	Central
H-13*#	NET Corridor Section 1 - Vietnam Veterans Pkwy (SR-386)	I-65	US-31E/ Saundersville Road	Transit Capital Expansion - Widening, 4 to 6 lanes for freeway Bus Rapid Transit service from Nashville to Gallatin	8.9	Sumner	North

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
H-14	NET Corridor Transit - Ellington Pkwy (US 31E/SR-6) and I-65	Ellington Pkwy (SR-6) southern terminus	SR-386	Construction of managed Lanes along Ellington Pkwy (SR-6) and I-65 for freeway Bus Rapid Transit service from Nashville to Gallatin	10.0	Davidson	Central
H-15*	I-24	I-65	Old Hickory Blvd (SR-45)	Widening, 4 to 6 lanes	4.3	Davidson	Central
H-16	I-65	Briley Parkway	Nashville Core	Extend HOV lanes	4.2	Davidson	Central
H-17	Dickerson Pike (US 41)	SR-155 (Briley Pkwy)	Spring St	Widening, 4 to 6 lanes	4.7	Davidson	Central
H-18*	Clarksville Hwy (US-41A/SR-112)	SR-12 (Ashland City Hwy)	SR-155 (Briley Pkwy)	Widening, 2 to 5 lanes, with Multi-Use Trail	2.4	Davidson	Central
H-19*	Downtown Nashville Loop	N/A	N/A	Roadway/Junctions Reconstruction	12.2	Davidson	Central
H-20	I-65	I-40 (Exit 210)	I-40 (Exit 208)	Weaving Patterns	2.0	Davidson	Central
H-21	I-65	Armory Drive	Nashville Core	Extend HOV lanes	3.4	Davidson	Central
H-22*	I-24	I-40	I-840	Widening, I-40 to Haywood Lane - 8 to 10 lanes; Haywood Lane to I-840 - 6 to 8 lanes	23.2	Davidson and Rutherford	Central
H-23	Battery Lane/ Harding Place at Franklin Rd/ Improvements	SR-6 (Franklin Rd.) at SR-255 (Harding Pl.) and Battery Lane		Capacity improvements for intersection approaches	0.7	Davidson	Central
H-24	Nolensville Pike	South of Old Hickory Blvd (SR-245)	South of Burkitt Road	Reconstruction and widening, 2 to 5 lanes	4.5	Davidson and Williamson	Central
H-25	I-65	Old Hickory Blvd (SR-254)	Concord Road (SR-253)	New Interchange	0.0	Williamson	Central
H-26	Franklin Road (US-31/SR-6)	Concord Road (SR-253)	Moores Lane (SR-441)	Widening, 2 to 5 lanes	2.3	Williamson	Central
H-27	Franklin Road (US-31/SR-6)	SR-441 (Moore's Lane)	Harpeth River Bridge	Widening, 2 to 5 lanes	3.7	Williamson	Central
H-28	Nolensville Road (SR-11)	Burkitt Road	I-840	Widening with realignment from south of Clovercroft Road to north of Sunset Road in Nolensville	10.6	Williamson	Central
H-29*#	Mack Hatcher Pkwy (SR-397)	South of SR-96	US-431 (SR-106)	New construction, 4 lanes	3.3	Williamson	Central
H-30	East McEwen Drive	Near Cool Springs Blvd	Wilson Pike (SR-252)	Widening, 2 to 4 lanes	1.6	Williamson	Central
H-31	Smyrna/Williamson County Connector	I-24 at Rocky Fork Road	McEwen Drive Extension	New Roadway	12.0	Williamson and Rutherford	Central
H-32*	Mack Hatcher Pkwy (SR-397)	SR-96 east of Franklin	Columbia Pike (US-31/SR-6) south of Franklin	Widening, 2 to 4 lanes	3.2	Williamson	Central

Table 11-1. (continued)

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
H-33*	Columbia Pike (US-31/SR-6)	Fowlkes Street	Mack Hatcher Pkwy (SR-397)	Widening, 2 to 4 lanes	1.9	Williamson	Central
H-34*#	Murfreesboro Road (SR-96)	East of Arno Road	Wilson Pike (SR-252)	Widening, 2 to 5 lanes	5.8	Williamson	Central
H-35	Lewisburg Pike (SR-106/US-431)	Mack Hatcher Pkwy (SR-397)	Donelson Creek Pkwy	Widening, 2 to 4 lanes	0.8	Williamson	Central
H-36	Peytonsville Road/ Goose Creek Bypass (SR-248)	SR-106 (Lewisburg Pike)	West of I-65	Widen existing 2 lane road to 4/5 lane	0.8	Williamson	Central
H-37*#	Murfreesboro Road (SR-96)	East of Wilson Pike (SR-252)	I-840	Widening, 2 to 5 lanes	5.5	Williamson	Central
H-38*	Columbia Pike (US-31/SR-6)	I-840	Mack Hatcher Pkwy (SR-397)	Widening, 2 to 4 lanes	5.0	Williamson	Central
H-39*	Murfreesboro Road (SR-96)	I-840	Veterans Pkwy	Widening, 2 to 5 lanes	6.9	Williamson and Rutherford	Central
H-40	I-65	I-840	SR-396 (Saturn Parkway)	Widening, 4 to 6 lanes	5.8	Williamson	Central
H-41	Buckner Road Widening	Columbia Pike (SR-6/US-31)	Buckner Lane	Widening	1.9	Williamson	Central
H-42	Buckner Road Extension	Buckner Road	Lewisburg Pike (SR-106/US-431)	New Roadway with New Interchange at I-65	2.1	Williamson	Central
H-43	Saturn Pkwy (SR-396) Extension	US-31	Carters Creek Pike (SR-246) at I-840	New Roadway	6.0	Maury and Williamson	Central
H-44	Duplex Road (SR-247)	SR-6/US-31	0.1 mile west of I-65	Widen Duplex Rd. from 2 to 3 lanes with add'l improvements	3.1	Maury and Williamson	Central
H-45	I-65	Saturn Parkway (SR-396)	Bear Creek Pike (SR-99/US-412)	Widening, 4 to 6 lanes	6.9	Maury	South
H-46	Bear Creek Pike (SR-99/US-412)	Nashville Highway (US-31)	US-431	Widening, 2 to 4 lanes	11.1	Maury	South

** Project included on IMPROVE Act project list*
 # Project included in 2018-2020 Comprehensive Multimodal Program

Table 11-2. Mainline Improvements: Safety

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
S-1	I-65 at SR-257 (Exit 104)	I-65 at SR-257 (Exit 104)		NB/Off Ramp Queuing	0.0	Robertson	North
S-2	I-65 at Bethel Road (SR-257) Interchange Lighting Improvements	I-65 at SR-257 (Exit 104)		Install interchange lightning	0.0	Sumner	North
S-3	Bethel Road (SR-257)	Lake Road	I-65	Widen shoulders and correct substandard horizontal geometries	2.3	Robertson	North
S-4	I-65 at US 31W Louisville Hwy (Exit 98)	I-65 at US 31W Louisville Hwy (Exit 98)		NB/Off Turn Lanes, SB/On Auxiliary Lane, NB/SB Signal Timing	0.0	Sumner	North
S-5	I-65 at US-31W (Exit 98)	I-65 at US-31W (Exit 98)		NB to WB Flyover	0.0	Sumner	North
S-6	I-65 Interchange Lighting at Rivergate Pkwy, Long Hollow Pk, US-31W	N/A	N/A	Interchange Lighting	N/A	Davidson	Central
S-7	I-65 at SR 174 Long Hollow Pike (Exit 97)	I-65 at SR 174 Long Hollow Pike (Exit 97)		SB/Off Turn Lanes, NB/SB Signal Timing	0.0	Davidson	North
S-8	I-65 at Trinity Lane (Exit 87)	I-65 at Trinity Lane (Exit 87)		NB/Off Ramp Auxiliary Lane Length	0.0	Davidson	Central
S-9	I-65 at Rosa L Parks Blvd (Exit 85)	I-65 at Rosa L Parks Blvd (Exit 85)		NB/Off Turn Lanes, SB/Off Turn Lanes, SB/On Turn Lanes	0.0	Davidson	Central
S-10	I-65 at Wedgewood Ave (Exit 81)"	I-65 at Wedgewood Ave (Exit 81)		SB/On Auxiliary Lane, NB/SB Signal Timing	0.0	Davidson	Central
S-11	I-65 at SR 254 Old Hickory Blvd (Exit 74)	I-65 at SR 254 Old Hickory Blvd (Exit 74)		Convert to to Diverging Diamond Interchange	0.0	Davidson	Central
S-12	I-65 at SR 253 Concord Rd (Exit 71)	I-65 at SR 253 Concord Rd (Exit 71)		NB/On Auxiliary Lane, SB/On Auxiliary Lane, NB/SB Signal Timing	0.0	Williamson	Central
S-13*	I-65 at Moores Lane	I-65 at Moores Lane		Interchange Modification	0.0	Williamson	Central
S-14	I-65 at SR 96 Murfreesboro Rd (Exit 65)	I-65 at SR 96 Murfreesboro Rd (Exit 65)		NB/Off Turn Lanes, SB/Off Turn Lanes, NB/SB Signal Timing	0.0	Williamson	Central
S-15	SR-96	Intersection with US-41A		Intersection Improvements	0.0	Williamson	Central
S-16	I-65 at SR 396 Saturn Parkway (Exit 53)	I-65 at SR 396 Saturn Parkway (Exit 53)		NB to WB Flyover	0.0	Maury	South
S-17	I-65 at US 412/SR 99 (Exit 46)	I-65 at US 412/SR 99 (Exit 46)		NB/SB Signalized Intersection	0.0	Maury	South
S-18	I-65 at SR 129 Lynnville Highway (Exit 27)	I-65 at SR 129 Lynnville Highway (Exit 27)		NB/On Turn Lane, SB/On Turn Lane	0.0	Marshall	South
S-19*	SR-99 (US-412) Interchange Modification	I-65 at SR 99 (US-412)		Interchange Modification	0.0	Maury	South
S-20	I-65 at SR 11/US 31A (Exit 22)	I-65 at SR 11/US 31A (Exit 22)		NB/SB Signalized Intersection	0.0	Giles	South
S-21	I-65 at SR 15/US 64 (Exit 14)	I-65 at SR 15/US 64 (Exit 14)		NB/SB Signalized Intersection	0.0	Giles	South
S-22*	Main Street (SR-7)	Union Hill Road (Ardmore)	Morrow Road (Ardmore)	Safety Improvements	0.9	Giles	South

** Project included on IMPROVE Act project list*

Table 11-3. ITS Improvements

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
0-1	Rapid Incident Scene Clearance (RISC)	Kentucky	Alabama	Contractual incentive-based program and operational policy to support open roads initiative related to truck crashes; North and South options	122.0	All	North, Central, and South
0-2	Conversion to Virtual Weigh Stations	Kentucky	Alabama	Portland weigh station	122.0	All	North, Central, and South
0-3	Smart Truck Parking	Kentucky	Alabama	Location TBD; Potential sites include the existing rest areas near Exit 22, Exit 46, and the Kentucky state line	122.0	All	North, Central, and South
0-4	I-65 Traffic Incident Management (TIM) Team	Kentucky	Alabama	North and South options	122.0	All	North, Central, and South
0-5	I-65 North ITS	Exit 108	Kentucky border	Install CCTV, DMS, and detection devices including fiber optic connections on I-65; Suggested DMS locations: SR-25/Main St (Exit 112) NB and SB, and SR-52 (Exit 117) SB.	13.0	Sumner	North
0-6	Connected Vehicle Technology Deployment	I-840	SR-76 (Exit 108)	Install DSRC radios	49.0	Davidson, Robertson, Sumner, and Williamson	North and Central
0-7	Adaptive Ramp Metering (ARM)	Exit 108 (SR-76)	Exit 90 (SR-155)	Install adaptive ramp metering devices and additional detection at 6 ramp locations in each direction	18.0	Davidson, Robertson, and Sumner Counties	North and Central
0-8	Adaptive Ramp Metering (ARM)	Exit 88 (I-24)	Exit 80 (US-440)	Install adaptive ramp metering devices and additional detection at 6 ramp locations in each direction	8.0	Davidson	Central
0-9	Dynamic on-ramp assignment - Southbound	Charlotte Ave	I-40/I-65 Split	Add arterial DMS along 14th Ave, add interstate shields or use gantries for junction pre-positioning on on-ramps and interstate facilities	1.0	Davidson	Central
0-10	Dynamic on-ramp assignment - Northbound	Broadway (US-70A)	I-40/I-65 Split	Add arterial DMS along 14th Ave, add interstate shields and deploy lane control gantries for junction pre-positioning on on-ramps and interstate facilities	1.0	Davidson	Central
0-11	Adaptive Ramp Metering (ARM)	Exit 80 (US-440)	Exit 53 (SR-396)	Install adaptive ramp metering devices and additional detection at 9 ramp locations in each direction	27.0	Davidson and Williamson	Central and South
0-12	Active Arterial Management US-31 E/Gallatin Pike	Rivergate Pkwy	Spring Street	Last mile connectivity between intersections, install detection for all intersections, MOUs, and Consultant Operations to optimize signal timing and detect incidents along corridor	10.0	Davidson	North and Central
0-13	Active Arterial Management (AAM) Dickerson Pike	US-31 W/ Louisville Hwy	US-431/ Trinity Ln	Last mile connectivity between intersections, install detection for all intersections, MOUs, and Consultant Operations to optimize signal timing and detect incidents along corridor	10.0	Davidson and Sumner	North and Central
0-14	Active Arterial Management (AAM) Franklin Rd	Demonbreun	Mack Hatcher	Last mile connectivity between intersections, install detection for all intersections, MOUs, and Consultant Operations to optimize signal timing and detect incidents along corridor	18.0	Davidson and Williamson	Central
0-15	Active Arterial Management (AAM) Nolesville Pike (US-41)	Korean Veterans Blvd	Old Hickory Blvd	Last mile connectivity between intersections, install detection for all intersections, MOUs, and Consultant Operations to optimize signal timing and detect incidents along corridor	9.0	Davidson	Central
0-16	Active Arterial Management (AAM) Old Hickory Blvd	Hillsboro Rd (US-431)	US-41	Last mile connectivity between intersections, install detection for all intersections, MOUs, and Consultant Operations to optimize signal timing and detect incidents along corridor	15.0	Davidson	Central

Table 11-3. (continued)

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
O-17	Active Arterial Management (AAM) Hillsboro Rd (US 431)	Broadway (US-70A)	Mack Hatcher	Last mile connectivity between intersections, install detection for all intersections, MOUs, and Consultant Operations to optimize signal timing and detect incidents along corridor	16.0	Davidson and Williamson	Central
O-18	Active Arterial Management (AAM) Nolensville Pike (US-41)	I-840	US-231/ Colloredo Blvd/Lane Pkwy	Last mile connectivity between intersections, install detection for all intersections, MOUs, and Consultant Operations to optimize signal timing and detect incidents along corridor	28.0	Williamson, Rutherford, and Bedford	South
O-19	I-65 South ITS	MM 57.6	Alabama border	Install CCTV, DMS, and detection devices including fiber optic connections on I-65; Suggested DMS locations: SR-396/ Saturn Pkwy (Exit 53) NB and SB, SR-50/New Lewisburg Hwy (Exit 37) NB and SB, and SR-11/ Alt US-31/Sam Davis Hwy (Exit 22) NB.	67.0	Maury and Giles	South

Table 11-4. Freight Improvements

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
F-1	I-65 Weight Station near TN/KY State Line	N/A	N/A	Roadway Reconstruction and New Weigh Station	0.0	Sumner	North
F-2	I-65	Northbound direction - Diverging area of I-40 and I 65 (West of Nashville Loop)		Diverging area geometry correction - Adding lane(s)	0.2	Davidson	Central
F-3	I-65	Nortbound direction - Merging area of I-40 and I-65 (South of Nashville Loop)		Merge area geometry correction - Adding lane (s)	0.3	Davidson	Central
F-4	Ramp Improvement	Northbound ramp from I-24 to Hermitage Ave		Diverging area geometry correction - Adding lane(s)	0.2	Davidson	Central
F-5	Harding Place (SR-255)	McGavock Pike	Donelson Pike	Widening	0.4	Davidson	Central
F-6	Old Hickory Blvd (SR-254)	I-65	Nolensville Road (US-41A/SR-11)	Widening	4.1	Davidson	Central
F-7	Harding Place (SR-255)	Nolensville Road (US-41A/SR-11)	Jonquil Drive	Widening	0.5	Davidson	Central

Table 11-5. Transit Improvements

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
T-1	NET Corridor Regional Express Bus Service	Several routes between Nashville and Gallatin		Provide new and expanded service to Sumner County, including additional express trips, additional service hours, and new park-and-ride opportunities	29.0	Davidson and Sumner	North
T-2	White House Express Service	SR-76	SR-386	Widening and strengthening of shoulders to 12-ft for bus on shoulder service. Further study of ramp metering for SR-174 (Long Hollow Pike), US-31W, and SR-257 (Bethel Road) to determine if necessary for safe routing	12.4	Robertson	North
T-3-5	I-65 North Freeway BRT Stations (3)	Goodlettesville	Gallatin	Construction of freeway BRT transit stop and park-and-ride lot	0.0	Davidson and Sumner	North
T-6	NET Corridor Interchange 2	Vietnam Veterans Pkwy (SR-386) at Conference Drive		Interchange modification for Traffic NB onto Conference Drive	0.0	Davidson	Central
T-7	NET Corridor Interchange 1	Vietnam Veterans Pkwy (SR-386) at I-65		Interchange modification WB to NB and SB to EB Traffic	0.0	Davidson	Central
T-8	Rapid Bus Service - Route 80R Gallatin	Outer end of Gallatin Pike LRT	Gallatin	Provide new rapid bus service to Gallatin	15.6	Davidson/ Sumner	Central
T-9	US-31E (Gallatin Pike) LRT	Downtown Nashville	Conference Drive	Construction of light-rail transit along US-31E (Gallatin Pike)	12.0	Davidson	Central
T-10	Dickerson Pike (US-31W) BRT	Hunters Lane	Downtown Nashville	Construction of bus rapid transit amenities along US-31W (Dickerson Pike). Project include dedicated bus lanes and improved pedestrian facilities.	7.2	Davidson	Central
T-11	Nolensville Pike (US-31A) LRT	Downtown Nashville	Lenox Village Drive	Construction of light rail transit along US-31A (Nolensville Pike)	8.8	Davidson	Central
T-12	Rapid Bus Service - Route 81R Nolensville	Outer end of Nolensville Pike LRT	Nolensville	Provide new rapid bus service to Nolensville	7.2	Davidson/ Williamson	Central
T-13-18	I-65 South Freeway BRT Stations (6)	Downtown Nashville	Franklin	Construction of freeway BRT transit stop and park-and-ride lot	0.0	Davidson and Williamson	Central/ South
T-19	Transit-Pedestrian Network Improvements	Various Locations		Construction of transit-supportive pedestrian amenities, including sidewalks, landscaping, lighting, crosswalks, and ADA ramps	0.0	Davidson and Williamson	Central
T-20	Rapid Bus Service - Route 81R Nolensville	Nolensville	Murfreesboro Road (SR-96)	Provide new rapid bus service to Triune		Williamson	Central
T-21	Rapid Bus Service - Route 86R Smyrna/ LaVergne	Downtown Nashville	Smyrna/ LaVergne	Provide new rapid bus service to Smyrna and LaVergne	24.7	Davidson/ Rutherford	Central
T-22	Rapid Bus Service - Route 96R Murfreesboro	Downtown Nashville	Murfreesboro	Provide new rapid bus service to Murfreesboro	35.7	Davidson/ Rutherford	Central
T-23	Franklin to Mufreesboro Express Bus Service	Routes between Franklin and Mufressboro		Provide new service express service to from Franklin (Cool Springs) to Murfreesboro	26.0	Williamson and Rutherford	Central

Table 11-5. (continued)

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
T-24	South Corridor Regional Express Bus Service	Several routes between Nashville, Franklin, Spring Hill, and Columbia		Provide new and expanded service to Williamson and Maury County, including additional express trips, reverse commute trips, additional service hours, and new Park-and-Ride opportunities	43.0	Maury and Williamson	Central and South
T-25	Rapid Transit/Managed Lanes between Nashville and Franklin	Downtown Nashville	Murfreesboro Road (SR-96)	Construction of managed lanes for freeway Bus Rapid Transit along I-65 from Nashville to Murfreesboro Road (SR-96)	18.6	Davidson and Williamson	Central/ South

Table 11-6. Recommended Bicycle and Pedestrian Projects

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
B-1	New Shackle Island Road (SR-258)	Johnny Case Parkway (US-31E)	Long Hollow Pike (SR-174)	Construction of Paved Shoulders	5.2	Sumner	North
B-2	Johnny Cash Parkway/ East Main Street (US-31E)	Big Station Camp Road	Center Point Road South	Construction of Buffered Bike Lanes	8.8	Sumner	North
B-3	US-41 (Dickerson Pike)	US-431 (Trinity Lane)	Hart Lane	Safety - Construction of sidewalks along US-41. Project includes landscaping, crosswalks, and pedestrian amenities.	2.0	Davidson	Central
B-4	US-431 (Trinity Lane)	US-431 (Whites Creek Pike)	US-41 (Dickerson Pike)	Safety - Reconstruction of sidewalks along US-431 (Trinity Lane). Project includes landscaping, lighting, crosswalks, in-roadway warning lights at on-ramps, and pedestrian amenities.	1.3	Davidson	Central
B-5	Clarksville Pike (SR-12)	Ashland City Highway (SR-12)	Rosa Parks Boulevard (US-41 Alt)	Construction of Bike Lanes	1.1	Davidson	Central
B-6	Rosa Parks Boulevard (SR-12)	Buchanan Street	James Robertson Parkway (US-31)	Construction of Separated Bike Lanes	1.2	Davidson	Central
B-7	James Robertson Parkway (US-31)	Rosa Parks Boulevard (SR-12)	Church Street	Construction of Separated Bike Lanes	0.5	Davidson	Central
B-8	US-70 (Charlotte Pike)	14th Avenue North	George L. Davis Blvd.	Safety - Pedestrian improvements at interchange of US-70 and I-40/I-65. Project includes landscaping, lighting, crosswalks, in-roadway warning lights at ramps, and pedestrian amenities.	0.1	Davidson	Central
B-9	Rosa Parks Boulevard/8th Ave S. (US-31)	Church Street	Korean Veterans Boulevard	Construction of Separated Bike Lanes	0.5	Davidson	Central
B-10	Broadway (US-70)	1st Avenue	14th Avenue North	Construction of Separated Bike Lanes	1.0	Davidson	Central

Table 11-6. (continued)

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
B-11	US-431 (Broadway)	George L. Davis Blvd.	14th Avenue South	Reconstruction of sidewalks along US-431 (Broadway). Project includes landscaping, lighting, crosswalks, in-roadway warning lights at on-ramps, and pedestrian amenities.	0.1	Davidson	Central
B-12	Lafayette Street (US-31)	8th Avenue S (US-31)	Fairfield Avenue	Construction of Separated Bike Lanes	1.3	Davidson	Central
B-13	8th Avenue South (US-31)	Korean Veterans Boulevard	Bradford Avenue	Construction of Separated Bike Lanes	1.8	Davidson	Central
B-14	SR-109	I-40	I-840	Network - Construction of shared roadway facility	4.0	Wilson	Central
B-15	US-41 (Lafayette Street)	US-31 Alt/SR-11	1st Avenue South	Safety - Reconstruction of sidewalks along US-41 (Lafayette Street). Project includes landscaping, lighting, crosswalks, in-roadway warning lights at on-ramps, and pedestrian amenities.	0.3	Davidson	Central
B-16	SR-254 (Old Hickory Blvd)	Franklin Pike Circle	Franklin Pike	Safety - Reconstruction of sidewalks along SR-254 (Old Hickory Blvd). Project includes landscaping, lighting, crosswalks, in-roadway warning lights at on-ramps, and pedestrian amenities.	0.5	Davidson	Central
B-17	Main Street/Carters Creek Pike (SR-246)	Southall Road	Natchez Street	Construction of Multi-Use Path	3.1	Williamson	Central
B-18	Concord Road (SR-253)	Franklin Road (US31/SR 6)	Wilson Pike (SR-252)	Construction of Multi-Use Path	1.7	Williamson	Central
B-19	Nolensville Road (SR-11)	Burkitt Road	I-840	Network - Construction of on-road or off-road bicycle facilities	10.6	Williamson	Central
B-20	Franklin Road (US-31/SR-6)	Concord Road (SR-253)	Maryland Way	Construction of Multi-Use Path	2.6	Williamson	Central
B-21	SR-441 (Moore's Lane)	Mallory Lane	Carrothers Parkway	Network - Construction of on-road facility or multi-use trail	0.8	Williamson	Central
B-22	Franklin Road (US-31/SR-6)	SR-441 (Moore's Lane)	Harpeth River Bridge	Construction of Multi-Use Path; Can be constructed in concert with H-37	3.7	Williamson	Central
B-23	Mack Hatcher Pkwy (SR-397)	Hillsboro Road (SR-106/US-431)	Franklin Road (SR-6/US-31)	Construction of Multi-Use Path	1.5	Williamson	Central
B-24	Wilson Pike (SR-252)	McEwan Drive	Trinity Lane	Network - Construction of Multi-Use Path	2.9	Williamson	Central
B-25	Mack Hatcher Pkwy (SR-397)	South of SR-96	US-431 (SR-106)	Construction of Multi-Use Path; Can be constructed with in concert with H-28	3.3	Williamson	Central
B-26	Hillsboro Road (SR-106/US-431)	Mack Hatcher Pkwy (SR-397)	Del Rio Pike	Construction of Bike Lanes with Sidewalks	1.0	Williamson	Central
B-27	SR-96	7th Ave North	Old Charlotte Pike	Construction of Multi-Use Path	4.4	Williamson	Central
B-28	SR-96	Harpeth River Bridge	Arno Road	Construction of Multi-Use Path; Portion could be constructed in concert with B-5	3.9	Williamson	Central
B-29	SR-96 (Murfreesboro Road)	Southwinds Drive	Carothers Parkway	Safety - Construction of sidewalks or multi-use path along SR-96. Project includes landscaping, crosswalks, and pedestrian amenities.	1.0	Williamson	Central

Table 11-6. (continued)

ID	Project Name	Termini (From)	Termini (To)	Description	Length of Project (miles)	County	Sub-Area
B-30	Mack Hatcher Pkwy (SR-397)	SR-96 east of Franklin	Columbia Pike (US-31/SR-6) south of Franklin	Network - Construction of Multi-Use Path; Can be constructed with in concert with H-30	3.2	Williamson	Central
B-31	Columbia Pike (US-31/SR-6)	Fowlkes Street	Mack Hatcher Pkwy (SR-397)	Construction of Bike Lanes; Can be constructed in concert with H-31	1.9	Williamson	Central
B-32	Wilson Pike (SR-252)	Concord Road (SR-253)	Church Street East	Construction of Multi-Use Path	2.6	Williamson	Central
B-33	SR-96 (Murfreesboro Road)	East of Arno Road	Veterans Pkwy	Network - Construction of on-road or off-road bicycle facilities	18.3	Williamson/ Rutherford	Central
B-34	Columbia Pike (US-31/SR-6)	Goose Creek Bypass	Mack Hatcher Parkway (SR-397)	Construction of Multi-Use Path	3.9	Williamson	Central
B-35	Goose Creek Bypass (SR-248)	Columbia Pike (US-31/SR-6)	Long Lane	Construction of Bike Lanes with Sidewalks	4.1	Williamson	Central
B-36	US-31	SR-248 (Goose Creek Bypass)	North of Buckner Lane	Network - Construction of bike lane(s) or multi-use path	3.8	Williamson	Central
B-37	Buckner Road	Columbia Pike (SR-6/US-31)	Buckner Lane	Network - Construction of bike lane(s) or multi-use trail; can be constructed in concert with H-24	1.9	Williamson	Central
B-38	Buckner Road	Buckner Road/I-65 Interhchange	Lewisburg Pike (SR-106/US-431)	Network - Construction of bike lane(s) or multi-use trail; can be constructed in concert with H-22	2.1	Williamson	Central
B-39	US-31	Buckner Road	Carters Creek Station Road	Construction of Bike Lanes	6.2	Maury/ Williamson	Central/ South
B-40	SR-247 (Duplex Road/ Beechcroft Rd.)	I-65	SR-246 (Carters Creek Rd.)	Construction of Multi-Use Path	7.8	Williamson	Central

Figure 11-1. Recommended Multimodal Solutions: North Sub-Area

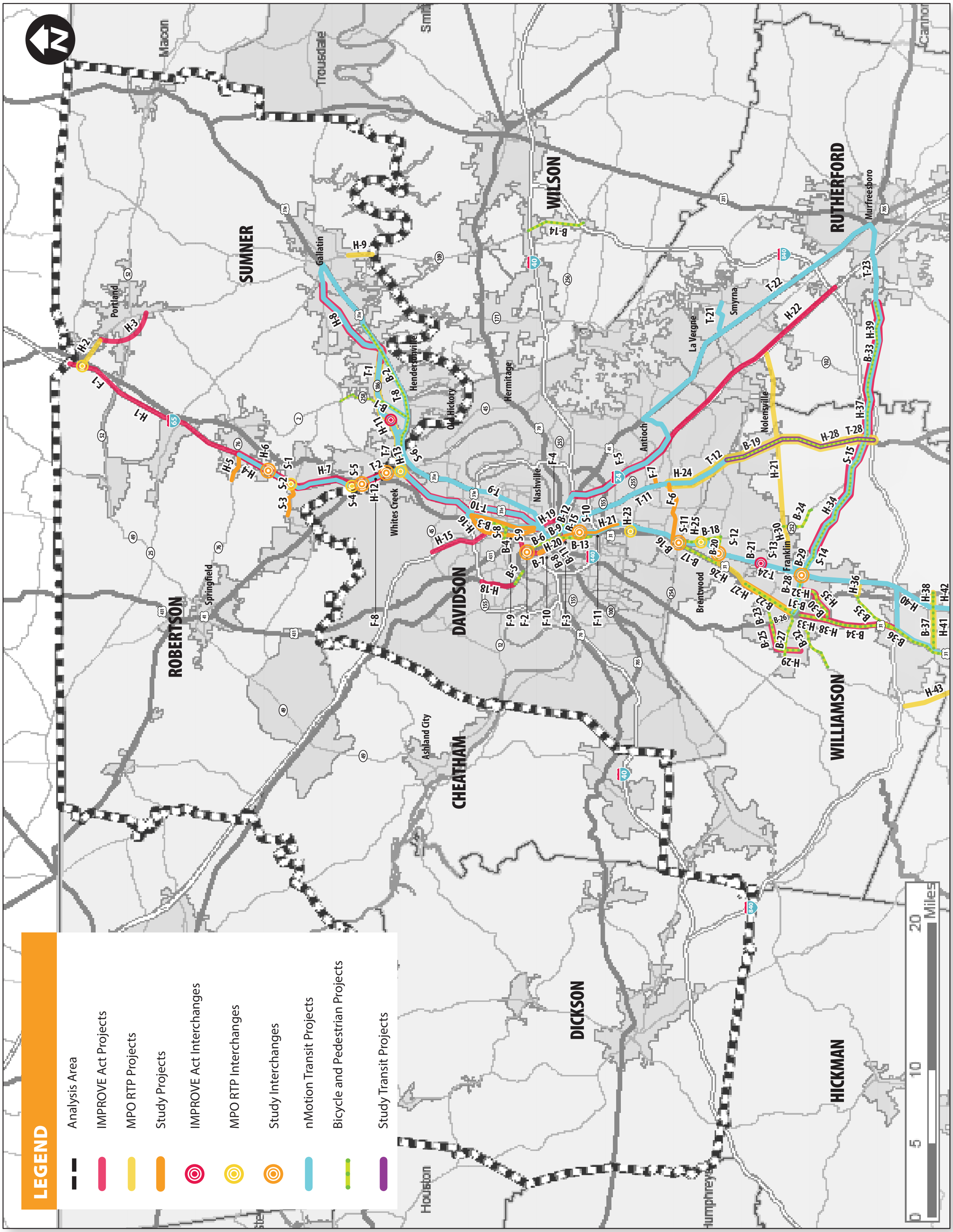


Figure 11-2. Recommended Multimodal Solutions: Central Sub-Area

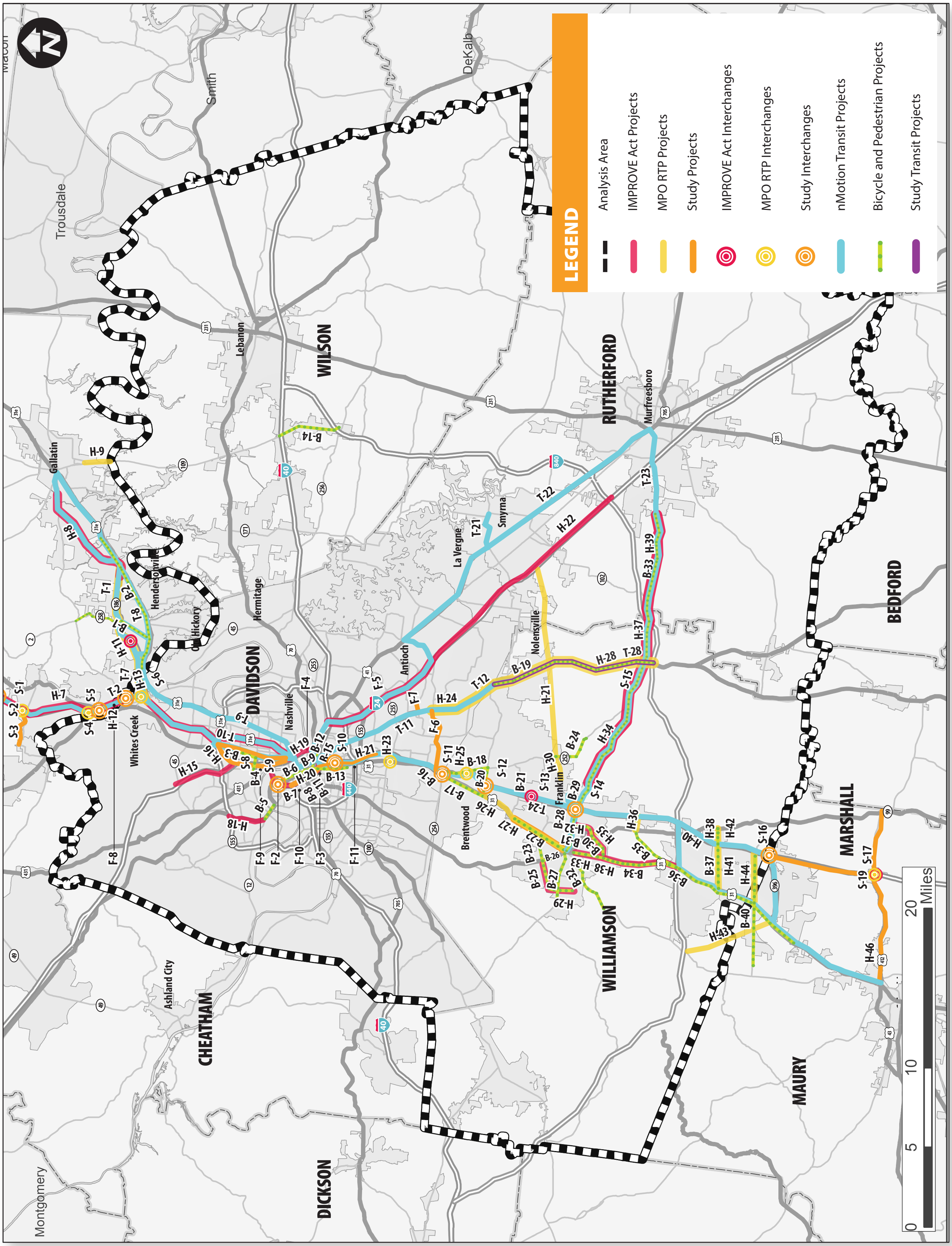


Figure 11-3. Recommended Multimodal Solutions: South Sub-Area